THURSDAY, SEPTEMBER 12, 1878

OUR NATURAL HISTORY COLLECTIONS

THE question of the government of our Natural History Collections, to which we have more than once called our readers' attention, has been taken up, we are glad to say, by the British Association. It was moved in the Committee of the Biological Section by Dr. Allen Thomson at the Dublin meeting, and carried unanimously, that the attention of the Council of the Association should be called to the fact that in the Act lately passed to enable the Trustees to move the natural history collections to South Kensington, the recommendations made by the Royal Commission on Science as to their future government have been wholly ignored, and that the Council should be requested to take such steps in the matter as they might deem expedient. This resolution having likewise successfully passed the ordeal of the Committee of Recommendations, and having been adopted by the General Committee of the Association, will come in due course before the Council, who will, no doubt, take decided action upon the question. The Royal Commission on Science having been appointed mainly at the instigation of the British Association it is not likely that the Council will suffer some of its most important recommendations to be thrown overboard without remonstrance. Meanwhile we may be allowed to offer a few more observations upon this subject, which, we need hardly say, is of the utmost importance as regards the future progress of biological studies in this country.

The great object to be aimed at is the complete separation of the new museum of natural history, both as to control and as to finances, from the Secretariat of the Trustees in Bloomsbury. If this point can be assured it does not so much matter whether the nominal governorship is vested in the Trustees or in a Minister of State. We may well believe that the main object of the Royal Commission on Science in recommending the latter course was to make sure of a divorce of the new institution from the Secretariat in Bloomsbury, under whose blighting rule the natural history collections have so long languished. It must be recollected that the so-called "Superintendent" of the Natural History Departments in the British Museum has hitherto held merely a titular office, so far as authority goes. He can neither spend a sixpence nor deviate in the slightest degree from existing practice without reference to the "Principal Librarian," who is the sole executive officer of the Trustees, and through whom all communications from the different departments have to pass. What is now necessary in the interests of natural history is that the Trustees should (as a minimum) be required to appoint a different executive officer for the new museum of South Kensington, and to keep its finances altogether separate from those of the British Museum. If this change can be effected there will be no longer any temptation to starve the natural history in order to pamper the library, as is the natural instinct of the "principal librarian," who is always selected from one of the library officials, and is utterly ignorant of the requirements of natural history over which he reigns supreme.

Not only should an independent director be appointed for the new museum at South Kensington, but he should be appointed at once. It may at first sight appear rather extravagant to assign a highly-paid director to a museum before there is anything or any person in it to direct, but in the end this will turn out to be by far the most economical plan. If the appointment of a director be deferred until the fittings of the new building have been finished, and the time has arrived to move the collections, it will be found that there will be all sorts of alterations required which will cost large sums. If the director be appointed at once there will be one person responsible to see that the fittings are such as will be suitable for the arrangements of the new institution, and the architect will have one definite person to consult upon the almost endless details which are necessarily incident upon the conservation and exhibition of such a varied mass of material as composes the National Museum of Natural History. We do not doubt, therefore, that many thousands of pounds would be saved by the immediate appointment of a responsible director. Who that director should be is perhaps a more difficult question. A few years ago the recommendation of the Royal Commission on Science that the present superintendent of the Natural History Departments of the British Museum should become the first director of the New Museum of Natural History, would have been the obvious course to pursue. But time runs apace, and it may be doubted whether the present superintendent would now care to undergo the fatigues and anxieties involved in the arduous task involved in the transfer and re-arrangement of the natural history collections in their new site. But there is another distinguished naturalist less advanced in years and already domiciled in South Kensington, whose appointment to such a post—if he could be persuaded to undertake it—would command universal assent. We need not mention his name—it is in every one's mouth.

One other point in connection with the new museum requires immediate attention. The sapient officials at the British Museum who planned the removal of the natural history collections never appear to have realised the idea that nowadays a library is a necessary appendage to a museum. We are told, indeed, that there has been no space even reserved for a library in the new building at South Kensington. But, as every naturalist knows, the collections would be simply useless in their new site without a scientific library. To execute any scientific work without books would, in these days, be more impossible than the famous, if now somewhat antiquated, task of making bricks without straw. But how is a library to be provided? It is not possible to go into the market and buy such an article off-hand. Many, even of the more modern works on natural history, are out of print, and can only be picked up from second-hand booksellers at long intervals. If, when the trustees determined on the removal of the natural history collections ten years ago, they had set apart 1,000*l*. a year out of the 10,000*l*. which they devote to the purchase of books, to form a special library for the Natural History Departments, the required library would have been now ready. But nothing of the sort was thought of, and as books on natural history are growing scarcer every year in consequence of the increased demand for them, it must be now *many years* before the necessary library can be provided, even if there is an unlimited grant of money provided for the purpose. In the meanwhile, how is the scientific work at South Kensington to be carried on? In the first place the "Banksian Library," as it is called, which originally came to the British Museum along with the natural history collections, should be transferred along with them bodily to South Kensington. This will provide a good set of the older publications on natural history for the new institution. In the second place for the modern publications, which are of still greater importance, we venture on a suggestion—which will, we fear, make the principal librarian's hair stand on end—namely, that all the works and periodicals habitually used in the four departments of natural history should be temporarily sent on loan to the new institution at South Kensington. They should be returned to the British Museum by degrees so soon as duplicates of them can be obtained by purchase out of a fund to be annually devoted to the purpose. In this way the work at South Kensington might be carried on without interruption, and the National Library at Bloomsbury would at the same time suffer no permanent loss. It would be no doubt an occasional inconvenience to the readers at Bloomsbury to find that some of the books they require for reference are at South Kensington. But this inconvenience will diminish year by year, as the new set of books is purchased, and by this plan alone, as far as we can see, can the whole of the important scientific work performed in the natural history departments be prevented from coming to a standstill. In point of economy also there can be no question of this plan being the best, as the attempt to purchase at once all the books required for the new Natural History Museum would raise the value of them twenty-fold. Convenience and economy are therefore alike on the side of our suggestion, although we fear that it will be bitterly opposed by the principal librarian and his satellites, who object strongly to see the Banksian Library being removed from the hallowed precincts of Bloomsbury.

THE FENLAND

The Fenland, Past and Present. By S. H. Miller and S. B. H. Skertchly. (Wisbeach: Leach and Son. London: Longmans, Green, and Co., 1878.)

THIS book is practically the joint production of several, many chapters being contributed by writers whose names do not appear on the title-page, though given at the head of their respective chapters. The work contains about 650 octavo pages and is therefore cumbrous; it is divided into fifteen chapters, very unequal both in length and merit, which embrace a wide range of subject, including, among others, dissertations on History, Geology, Botany, Zoology, Archæology, Biography, Engineering and Sanitary Problems, &c. The printing done at Wisbeach has not been carefully revised, as shown by a long list of corrections, which however call attention to but a very small proportion of the errors. Many of the illustrations are presented by patrons, and these are fairly good, except the chromo-lithographed frontispiece which is very inferior either in workmanship or drawing.

The book, whatever its excellence may be in other respects, is certainly objectionable in its treatment of those subjects on which discussion is far from closed among men of science. A vein of dogmatic infallibility is particularly apparent in dealing with geological problems. The book, including so wide a scope, is evidently intended to pass into the hands of readers the majority of whom are quite unacquainted with geology, and to bid for support in this manner from the general public, instead of appealing to those who from their own experience would be able to estimate its real value for views and claims not yet recognised by fellow-thinkers and workers, seems unworthy of science. When original work is laid before specialists, the theories built upon it may be stated boldly and decidedly; but in a popular book, intended for the general reader, that which is accepted as fact and that which is still under discussion or not yet argued, should be distinctly separated, and in the latter case the relative value of each kind of evidence should be clearly defined. Too frequently of late the result of others' work has been incorporated by writers and set forth as their own and in a positive manner not claimed by the discoverers themselves. In this case we have not an account of the geology of the Fens, but an exposition of the opinions of Mr. Skertchly and others on geological questions, introduced as undisputed fact. It is questionable whether the readers to whom the book appeals care for or expect individual opinion, but would not rather desire an easy "coach" to the ascertained facts of Fen-geology.

To illustrate, we select first the treatment of Prehistoric Man. We are told that the "Old Stone Folk" —the term is preferred in the book to Palæolithic—are concluded to be related to the living Esquimaux, and that Prof. Boyd Dawkins is of opinion that they are lineal descendants. This inference, based as it is on very slender grounds—is the only foundation for the following positive assertion, made a few pages further on:—"The Old Stone Folk, on the other hand, belong to the Mongoloid class of *Leiotrichi*, of whom the Lapps and Eskimos are modern examples; hence we see that even in the Old Stone age there were no signs of the fusion of the crisp-haired *Ulotrichi* and smooth-haired *Leiotrichi;* and it is from such striking facts that we are justified in ascribing to mankind an antiquity far greater than that of the earliest relics at present known." It is needless to point out that so far from there being any reason to suppose that Palæolithic man was differentiated, the sameness of type—differing only where different material is used—of all the oldest stone implements is evidence against it. Where so much is predicated of the "Old Stone Folk," it is not surprising to find the "Newer Stone Folk" are minutely described even to their complexion and eyes as if they were still a living tribe. They are termed Iberian, which, as explained not to mean a people indigenous to or even coming directly from the Iberian peninsula, is a misleading term, and has no advantage over that of Black Kelt. The Basque people may be descendants of Neolithic man, but Neolithic men were not Basques. To say that they were a Turanian people means nothing more than that they were not Aryan.

The third chapter, by Mr. Miller, is devoted to a historic sketch of the Fenland people from the time of the Kelts to the reign of Henry III., and is written on naturally surer ground and the interest is better sustained. The stories of the Saxon and Danish conquests are well told according to the most modern versions, and introduce the newest approved spelling of historical names. We can almost follow the exact steps by which the Normans took possession of the Fenland and how they kept it by building fortress dwellings, simply massive round or square towers, which the more civilised Saxon noble would never have made his home. This chapter is illustrated with engravings of coins and of one of the rare British circular bronze shields.

Chapter IV., on Language, and Chapter V., on the Dissolution of Monasteries, are also by Mr. Miller. Chapter VI., by Mr. Skertchly, treats of the attempts made to drain the fens, a subject well worked out by Sedgwick and his scientific assistants. The author's views, although probably correct, are put very decidedly, and in places plentifully sprinkled with notes of exclamation. The following from p. 158 will serve to illustrate the style :—

"How can it be shown that these districts on the same level, with interweaving watercourses and co-equal desiderata, were so distinct that they should be set at variance like a trio of mongrels over a meat biscuit? Yet such has been the disastrous result."

It appears to be Mr. Skertchly's opinion that the one essential to an engineer who undertakes drainage works is to understand "Mr. Tylor's laws" (Mr. Alfred Tylor, F.G.S.). In Chapter VII., a continuation of the last, the writer goes out of his way to object to the *absurdity* of the use of the time-honoured expression, "lands watered by rivers." Yet the term is right, for a land of many rivers is more moist and watered than a land without, and rivers do literally *water* the lands through which they flow. They do it by percolation, overflow, and mist. For instance, not only does the Nile, but rivers all over the world, the Thames itself among them, water their level lands by flood at certain seasons, by mist at night.

The Wash, a subject on which we naturally looked for a good deal of information, is too briefly disposed of in a chapter of only five pages. The next, on Meteorology, is sixty-seven pages long, and bristles with tables which in a popular work would have found a more appropriate place in the Appendix, since their presence in the middle of the work cuts it in two. The botanical sketch by Mr. W. Marshall would have been more welcome had it been longer, and we should have been glad to have seen more of the Fen rarities illustrated. The history of the spread of Anacharis is likely enough to be the correct one, but why is the name of the plant in the illustration *Elodia canadensis*, and *Anacharis alsinastrum* in the text. The Fungi, although not very numerous, have appropriately a section to themselves. It is strange that the writer should speak doubtingly of the occurrence of any fungi in the Carboniferous, since their presence there is now a well known fact. The eleventh chapter treats of the prehistoric fauna of the Fenland, and is so full of errors that it is to be regretted that, as in other instances, a specialist was not intrusted to write it. Space will only permit to notice a few of the inaccuracies. At p. 326, Hipparion is said to be "a horse-like animal with antlers like a stag," and this is the whole description. The table, p. 327, is not a complete list, and we know on the authority of Prof. Boyd Dawkins, that it contains besides, a number of species which have not hitherto been found in the beds to which they are ascribed; it separates *Ursus ferox* and *priscus* which are synonyms, and persists, which is the case throughout the book, in calling Lemmus, "Lemnus." The table at p. 328 is a marvel of careless spellings, none of which are included in the list of corrections at the beginning of the book, which we are "earnestly requested" to make with pen and ink. In another table *Bos brachyceros* is said to be "a variety" of *B. longifrons,* although these are admittedly synonyms.

The limits of a review, however, compel us to pass on at once to the chapter on Geology, with which especial fault is to be found. In the first place, from the nature of the book it is evident, as already intimated, that it is not intended to be specially consulted by geologists, and the fact that a survey memoir on this district, in which Mr. Skertchly was concerned, had already appeared, renders it quite unlikely that it would be. Mr. Skertchly recognises this by prefacing his subject with a perfectly elementary treatise on the science. Instead of this circumstance inducing him to guard his statements with more than ordinary care, he absolutely revels in the opportunity of airing his infallibility, as if without fear of contradiction. The theories of those whom he mentions as friends are everywhere brought in, those of his opponents mostly ignored. Thus Evans's "Ancient Stone Implements of Great Britain," a work in which implements from the Fenlands have been described, is not even alluded to, although the author appears to have made use of it. General readers should in fairness have been cautioned that Croll's theory is not supported by geological evidence, thousands and thousands of feet of consecutively deposited strata showing no trace of cold periods, much less of glaciation; that Geikie's theory of an ice sheet is not generally accepted by the Geological Society, as even this session's discussions show; that Tylor's Pluvial periods have but few adherents. By the way, the Pluvial period is here ingeniously reduced to local showers produced by the evaporation of melting snow and ice, although Mr. Tylor himself disclaims for it all connection with ice action, and claims on the contrary that it was of great intensity and long duration. Mr. Skertchly is so fully impressed with the correctness of the view he happens to take of things that he announces that his alleged discoveries have made the Brandon Beds of "surpassing interest" (a favourite term with him), "for ever setting at rest the question of whether man did or did not exist during the great cycle of the glacial period." This climax is worked up to by pages of *ex parte* reasoning which non-geological readers are not in a position to follow. Considering that this evidence has not yet been brought forward in any scientific publication, and that his repeated promises to bring it before the Geological Society have not yet been kept; that Professors Hughes and Bonney purposely went over part of the ground with him and have publicly thrown grave doubts on the value of the evidence; that Professors Prestwich, Boyd Dawkins, Mr. Evans and others do not admit its value, and that at the Conference held last summer on the Antiquity of Man, the weight of evidence was rather against his interglacial age in England,—it is little less than wantonness, whether the evidence, only known to himself, is or is not conclusive to him, to introduce it as undisputed fact in this manner in the present publication. After this we have not enough interest to read the remainder of the book, and besides it is so full of mistakes, as Urus for Ursus (p. 505), shorter for longer (p. 511), &c., that it is a wearying effort to understand in places what the author really means.

J. S. G.

AMERICAN GEOLOGICAL SURVEYS

Geological and Geographical Atlas of Colorado and Portions of Adjacent Territory. By F. V. Hayden, U.S., Geologist in Charge. (Washington: Published by the Department of the Interior, 1877.)

In the magnificent Atlas just issued by the Department of the Interior we have the consummation and crown of all the labours which Dr. Hayden and his staff have carried on so triumphantly for the last five years, and of which they have already given us so much interesting and important information in a series of Annual Reports. Before examining the work from a scientific point of view, no reader can refrain from expressing his admiration of the style in which the Atlas has been produced by the United States Government. As a specimen of cartography, typography, and lithography, it is altogether worthy of the highest praise. For beauty and indeed sumptuousness of execution, it may be classed with those *livres de luxe* which from time to time have been issued from the National Imprimerie of France.

The Atlas consists of two series of maps, the one of a general, the other of a detailed kind. The first series, on the scale of twelve miles to one inch, comprises four sheets, each embracing the whole State of Colorado and part of the neighbouring territory. The first of these illustrates the system of triangulation adopted in the survey; the second shows the drainage system of the area; the third by a simple and clear arrangement of colours, exhibits at a glance the economic features of the whole region—the agricultural land, pasturage, forests, and woodlands, sage and bad lands, mineral tracts, and the portions rising above the limit of timber-growth; the fourth contains a condensed and generalised geological map of the same territory. Nothing can surpass the lucidity of expression and artistic finish of these maps.

The second series—twelve in number—is on the scale of four miles to one inch, and consists of six topographical sheets and six identical sheets, coloured geologically. The topographical details, though numerous, are so selected as not to neutralise each other, or mar the broad, clear picture which the maps were designed to be. By means of contour-lines of 200 feet vertical distance, the surface-configuration of the whole region is depicted as in a model. We can follow the lines of the broad valleys, of the deep, narrow cañons, and of the hundreds of minor tributaries which have scarped out their courses on either side. Here we look down upon a vast table-land, deeply trenched by stream-channels; there upon a succession of bold escarpments or mesas which bound the table-land and hem in the neighbouring valley. Huge mountain-ranges rising out of the plateaus are so vividly drawn that they seem to stand out of the paper. Yet no shading is employed. All the effects of inequality are produced by contour-lines, so faithfully set down that a single line may be tracked in its sinuous course along the whole of a mountain front until it comes out upon the table-land beyond. When will our map-makers learn to use this, the only true method for expressing the surface of a country? The best of our atlases are disfigured by strips of shading running across the map like so many caterpillars, to represent mountain-ranges. Even our Ordnance maps, so admirable in most respects, are sometimes so loaded with shading, that a steep hill-side only a few hundred feet high is made as black as our highest mountains, and the topographical names can hardly be read, even with a magnifying-glass.

But, above all, welcome are these six geological maps. In the previously published maps and charts accompanying the Annual Reports, only small detached areas were represented, and even from the careful descriptions of the various geologists of the staff it was hardly possible to frame a satisfactory conception of the geology of Colorado as a whole. Ever since the marvels of its deep gorges and vividly painted cliffs were made known, that region has possessed a high interest to the geologist. He has now the means of gratifying his desire for further knowledge. With the help of these maps and the two accompanying sheets of sections he can realise most satisfactorily every great feature of Colorado geology. The ancient Archæan ridge—the nucleus or back-bone of the American continent—may be traced running north and south nearly along the present hydrographical axis of the country. Flanking that ridge comes a series of palæozoic deposits, the oldest of which have been identified palæontologically with Silurian formations. Rocks, regarded as of Devonian age, overlap the Silurian beds, and repose against the ancient crystalline ridge on the south-west side of the San Juan Mountains. They are soon buried under later accumulations, and they seem to be of but local development, since in most places where the rocks are found in juxtaposition, the Silurian are directly succeeded by Carboniferous strata. These last-named rocks cover large tracts of country, running as bands round the Archæan area, and lying in basins across it. Far to the west where the Grand River has so deeply trenched the Utah plateau, the flat Carboniferous beds appear from under the brilliant red Triassic strata. The difficulty of drawing any line between Triassic and Jurassic formations in that region is again acknowledged on these maps, the lower red series being doubtfully assigned to the older, and the upper variegated deposits to the later system. Cretaceous rocks are abundantly developed, and cover a vast extent of territory. In particular they spread over the wide plateaux between the San Juan and Gunnisen rivers, and form the platform on which the enormous volcanic outbursts have been piled up from the West Elk Mountains southward into New Mexico. It is more easy to trace on these maps, too, the area respectively occupied by the Laramie, Wahsatch, Green River, Bridger, and Uintah formations which represent post-cretaceous and tertiary times. Glacier moraines, lake-deposits, drifts, sand-dunes, and recent alluvia, all find adequate expression on the maps. Especial care, too, seems to have been bestowed upon the eruptive rocks which form so important and interesting a feature of Colorado geology. The more characteristic varieties are represented by distinct shades of crimson or orange, and they have been mapped in such a way as to convey at a glance, and even without the aid of sections, a tolerably clear notion of the volcanic phenomena of the region. On the one hand we see the great lava-sheets capping the mesas and spreading far over the plateaux, on the other we notice the great centres of volcanic activity, with their abundant flows, dykes, and breccias.

Two sheets of sections, drawn across all the more interesting and important portions of the geology, complete the vast fund of information given by the maps; while, that nothing may be wanting to enable readers to realise what has been done by the Survey, and the conditions under which it has been accomplished, two large sheets of sketches are given, which most vividly represent the forms of the mountains, plateaux, mesas, and river-channels, as seen from various commanding heights.

Dr. Hayden, with whose personal supervision this great work has been accomplished, has increased tenfold the obligations under which he has laid geologists all over the world for the number and value of his contributions to geology. He now furnishes us with new light whereby to read his former researches and those of his able colleagues. May we venture to hope that he may find leisure to confer yet one further benefit before the progress of his Survey plunges him into a new whirl of work? If he could be prevailed upon to sketch out a plan for digesting the materials of his published Annual Reports, he could doubtless find among his staff some competent writer who, under his guidance, could produce a well-arranged systematic guide-book or text-book to complete the value of the work of his Survey. Such a book of reference as would give a reader who has never had access to the Annual Reports a clear and comprehensive view of Colorado geology, would be of very great service.

These remarks may be fitly closed with an expression of the warmest admiration of the liberal spirit in which the United States Government has conducted these Surveys of the Territories and has published their results. This costly atlas has been distributed gratuitously all over Europe. That this is a wise policy cannot be doubted. Whether actuated or not by a desire to diffuse scientific information, the authorities at Washington do well to make as widely known as possible the geological structure and economic resources of their country. They cast their bread upon the waters, and the harvest comes to them in the form of eager, active emigrants from all parts of Europe.

ARCH. GEIKIE

OUR BOOK SHELF

Forest Flora of British Burma. By S. Kurz, Curator of the Herbarium, Royal Botanical Gardens, Calcutta. (Calcutta: Office of the Superintendent of Government Printing, 1877.)

BY the completion of the work whose title is given above, we have the third valuable contribution to a knowledge of the rich vegetation of our Indian forests. In all three works, namely, Col. Beddome's "Flora Sylvatica of Southern India," Brandis's and Stewart's "Forest Flora of North-West and Central India," and the book now before us, there is much in common, and the plans of the two latter are very similar. There is, however, one great difference between Beddome's and Brandis's Floras and the present issue; while the first two are most profusely illustrated, the work under consideration is entirely without plates. This, perhaps, is not to be regretted considering that the work in its present form constitutes two good-sized volumes; and further than this, Indian plants have of late been very well represented, notably in the two forest floras just referred to. Another distinction, and perhaps one more affecting foresters generally, for whose benefit these floras are ostensibly prepared, is the meagre information regarding the uses of the plants mentioned. Mr. Kurz excuses himself for reducing this portion of his work to a minimum, and refers to Brandis's "Forest Flora" for information on this head. We regret that Mr. Kurz did not see his way to greater condensation in his descriptions, and, if need be, the use of smaller type, so as to reduce the bulk of the book. At the same time its efficiency would have been much increased had he followed Dr. Brandis in giving extended notes as to the uses, for to no similar work can we point with so much satisfaction in this respect as to that of Dr. Brandis.

Regarding the nomenclature of genera and species, it is a pity that some kind of uniformity should not prevail amongst the different authors. Many forest officers would, to say the least, be somewhat confused as to the use of a proper name when he finds in two books published by authority and appearing within a year or two of each other a different generic distinction for the same plant; thus Brandis keeps up the rubiaceous genus *Adina*, and figures *A. cordifolia* of Hook. fil. and Benth., placing *Nauclea cordifolia*, Roxb., as a synonym. Kurz, on the contrary, retains *Nauclea* as a genus, sinking under it *Adina cordifolia*, which is spelt *Andina*, and attributed to Roxb. On this subject of nomenclature, however, Mr. Kurz says: "I confess myself an admirer of, and adherent to, the botanical laws as laid down by the International Botanical Congress at Paris in the year 1867, and published by Prof. Alph. de Candolle. These are translated into nearly all modern languages, and are now generally adopted in Europe, except at Kew. However, I have deviated in several cases in favour of Hooker's 'Indian Flora,' or kept up old-established names, not because I assent to such irregularities, but simply because I thought it not fair that I, a German, should introduce my individual convictions into a practical work written solely for the use of English people."

Notwithstanding the remarks which we have been obliged to make, Mr. Kurz's Flora is one of very great value, and, taken in conjunction with those we have before referred to, forms a pretty complete forest flora of British India. We are reminded by the passing of this work through our hands of the loss Indian botany has sustained by the lamented death of its author.

LETTERS TO THE EDITOR

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

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

American Storm Warnings

THE author of the papers on the American Storm Warnings (NATURE, vol. xviii. pp. 4, 31, 61) seems well acquainted with the storms and storm-warnings of America, and at least with some of the results arrived at in Europe, and if he had confined himself to what he really knew, and to the description of the means which are used by the *Herald* Office (with which Mr. Collins seems to be connected) to issue storm-warnings from the United States to Europe, no objection could be made against him. But Mr. Collins is more ambitious, and makes some assertions which run against the most authenticated facts known to meteorology, and others which may be true, but ought yet to be proved, while Mr. Collins, without any proof whatever, seems to consider them quite well established.

I must first object to the absence of distinction between the seasons, which is so important a feature in storms, especially in lower latitudes. Mr. Collins seems not to know that the West India hurricanes and other destructive tropical storms are frequent only at certain seasons. This is quite enough to dispose of the author's assertion "that the conditions which combine to develop nearly all areas of low pressure are of equatorial origin." The most violent storms of Europe and the United States happen in the colder months of the year, when there are no storms in the tropical belt north of the equator (very few exceptions are known); besides the use of the word "equatorial" must be objected to as, so far as I know, no cyclone has ever originated between 5° N.L. and 5° S.L., at least,[1] so that we may call the storms of the West Indies, the South Indian Ocean, about the Mascarenes, of the Bay of Bengal, &c., *tropical storms*—because they certainly originate in the tropical belt—but certainly not equatorial. So far as Europe is concerned, there are some few cases in which West India hurricanes have reached it, but this is confined to the months of July to October. At the same time of the year it is not impossible that cyclones originating in the tropical belt of the Pacific may strike the Pacific coast of the United States. As to the storms mentioned by Mr. Collins, which strike the west coast of Mexico, pass over the plateau, and thence into Southern Texas, I very much doubt their existence. In any case no storm of this kind has ever been followed on this route, and so Mr. Collins ought to be rather careful in speaking of them. So far as I know, from books published about Mexico, and from personal information, no storms are experienced on the Mexican plateau.

The same absolute want of facts and general improbability can be urged against the storms which Mr. Collins takes from the Asiatic continent to the Pacific and thence to the American continent. Here the distinction of the seasons is especially necessary, as all Eastern Asia is under the influence of monsoons or periodical winds.[2] In winter, when pressure is so enormously high in the interior of Eastern Siberia,[3] and the winds are north-west and north on the coast, that is, bring the cold dry air of the interior towards the Pacific Ocean, these conditions are favourable neither to local depressions nor to the propagation of European storms, which generally die out in Eastern Russia or Western Siberia. In summer the pressure is low in the interior of Asia, and air is constantly drawn from the Pacific Ocean to supply the deficiency towards the end of the rainy season or summer monsoon—in August to October is the time of the typhoons, that is, of the cyclones of the China Seas; but they do not originate on the Asiatic continent, and only strike it on a very limited area, that is, the coast of Southern China. These typhoons may perhaps reach California, as the West India hurricanes reach Europe, but it is not yet proved that this has ever been the case.

I admit that in autumn, that is, September and October, storms may perhaps pass from the Asiatic continent to the Pacific, and thence to America; but in latitudes far to the north of those visited by the typhoons. At Yakutsk, in North-East Siberia, the prevailing winds of that season are west and south-west, the amount of cloud great, and rains frequent, if not abundant, while the temperature is generally above freezing-point to the middle of October. I consider it possible that Atlantic (European) storms may, at this season, travel over the whole of Northern Siberia and reach the Pacific. In winter this is impossible, on account of the low temperature and high pressure then existing in Siberia.

I resume a few facts either well authenticated or very probable about storm-centres (cyclones) of the northern hemisphere.

1. By far the most of them originate in the middle latitudes (35°–65° N.) in Europe, North America, the Atlantic, and Pacific. As to the three first-named regions it is abundantly proved by the observations we have already. As to the Pacific, we want the direct proof, because observations are too few. But nobody will doubt that, in conditions of climate so analogous to those of the Atlantic cyclones do also originate.

2. Cyclones are of much rarer occurrence in Asia, except the great summer depression, which is of a different nature, and remains the whole summer over the dryest parts of the continent.

3. Tropical cyclones are confined to a few months of the year, and even these seldom reach the latitudes north of 35° N.

Lastly, a few words about Mr. Bennett's storm-warnings. I do not doubt that some storms may reach Europe from America. But it is not at all certain that every storm that has passed from the eastern coast of America should reach Europe. This is the first difficulty in storm-warnings from America. The other is, that neither the path the storm will take nor its rate of progress can be known with certainty. Every one who has examined European and American synoptical maps will have noticed how different the paths of the centres are. So long as the storm can be followed on land, by means of numerous stations, a great approximation to certainty in predicting it is possible, as the durations are caused by certain pre-existing states of pressure, temperature, humidity, &c. But how is this to be done on the ocean?

Meteorologists of great ability, especially Prof. Buys Ballot, have often advocated telegraph lines to the Azores and Iceland, so that these islands might serve as advanced guards to predict storms in Europe. At such a distance as they are from our continent they certainly could serve this purpose, as is clearly shown by the French Atlas Météorologique and Hoffmeyer's synoptical maps. As to American predictions for Europe, I must confess that most European meteorologists are very doubtful about it. It is to be noticed also that, as storms are very frequent in western Europe, and as the rate of progress of storm-centres over the Atlantic is not accurately known, there may be a seeming success in American predictions which the facts, when accurately known, would not justify.

This is not meant to cast a shade on the spirit of enterprise of Mr. Bennett in organising the *Herald* weather predictions. The observations thus collected, or saved from oblivion, will certainly be useful, even if it be proved that storm-warnings from America are not reliable.

A. WOEIKOF

St. Petersburg

[1] It would be too long to state why there are no equatorial cyclones. I would advise Mr. Collins to consult "Études sur les Mouvements de l'Atmosphère," by Guldberg and Mohn.

[2] See "Winds of the Globe," by Coffin.—Smithsonian Contrib. vol. xx.

[3] See *Petermann's Mittheilungen*, July, 1878, p. 259, and the short notice in NATURE, vol. xviii. p. 288.

A White Grouse

WHEN shooting, yesterday, on the moors near Dunrobin, I fired at an ordinary grouse and killed it; just as it fell, another bird rose that seemed to be a ptarmigan, from the complete whiteness of its plumage; a third bird then rose, and was shot. The three were picked up not far from each other, and were all very fine birds. It seemed strange that a ptarmigan should be so low; we were not very high above the sea, and far below the elevation affected by these birds. On examining it, it proved to be a very fine grouse, snowy white, with a few dark feathers in the tail and wings. It was not an albino; I think the eyes were dark. It is a very beautiful bird, has been sent off to Inverness to be stuffed, and will be preserved in the Dunrobin Museum.

No one here had seen a specimen of the white grouse before, and it excited considerable interest. No doubt it is only an accident, and its progeny, if it had any, would have been the ordinary grouse.

It may be less rare than I suppose, but you may deem its occurrence worthy notice in NATURE.

J. FAYRER

Dunrobin Castle, Sutherland, September 8

Brehm's "Thierleben"

IN last week's NATURE you have copied a drawing, "cobra charming," from Brehm's "Thierleben," presumably for its excellence. Permit me, however, to point out a most serious defect in its truthfulness—the relative proportions of the snakes to the charmers.

Take the youth blowing the horn to be 4 feet 6 inches in height (he could not be much less), the hoods of the cobras must be 8 to 9 inches across. Now I will venture to say that a hood of 4½ inches across has never yet been measured, in a live specimen at least.

I cannot now lay my hands on a cobra skin I have, and give exact measurements, which I am sorry for, as the cobra in question measured 6 feet 3 inches in length, a size Col. R. Beddome—no mean authority—assured me is seldom or never surpassed.

In a work such as Dr. Brehm's, exaggerations in illustrations should be as carefully avoided as misstatements in letterpress. A Natural History that depicted horses the size of elephants would be scoffed at, yet, strange to say, equally glaring absurdities, such as "cobra charming," frequently pass muster.

Bath, September 10 E. H. PRINGLE

The Sea-Serpent Explained

IF you have space for the following, it is so confirmatory of Dr. Drew's experience of an opera-glass dispelling "fond deceits" concerning a sea-serpent, that it may be worth recording.

One morning in October, 1869, I was standing amid a small group of passengers on the deck of the ill-fated P. and O. ss. *Rangoon*, then steaming up the Straits of Malacca to Singapore. We were just within sight of the coast of Malacca, and quite out of sight, so far as I remember, of Sumatra. One of the party suddenly pointed out an object on the port bow, perhaps half a mile off, and drew from us the simultaneous exclamation of "The sea-serpent!" And there it was, to the naked eye, a genuine serpent, speeding through the sea, with its head raised on a slender curved neck, now almost buried in the water, and anon reared just above its surface. There was the mane, and there were the well-known undulating coils stretching yards behind.

But for an opera-glass, probably all our party on board the *Rangoon* would have been personal witnesses to the existence of a great sea-serpent, but, alas for romance! one glance through the lenses and the reptile was resolved into a bamboo, root upwards, anchored in some manner to the bottom—a "snag," in fact. Swayed up and down by the rapid current, a series of waves undulated beyond it, bearing on their crests dark-coloured weeds or grass that had been caught by the bamboo stem.

Ignorance of the shallowness of the straits so far from land, and of the swiftness of the current, no doubt led us to our first hasty conclusion, but the story, with Dr. Drew's, shows how prone the human mind is to accept the marvellous, and how careful we should be in forming judgments even on the evidence of our senses. E. H. PRINGLE

Bath, September 10

DR. DREW's letter in NATURE, vol. xviii. p. 489, recalls to my mind a similar phenomenon witnessed by myself and a friend on August 3, while crossing from Grimsby to Rotterdam. It was towards evening, when, looking ahead, we saw, about a mile distant, what appeared to be a long, low, black hull, without masts or funnel, moving through the water at enormous speed. After a minute or two it undulated and rose from the surface, and we saw that it was a flight of birds.

The deception was so complete that I can well believe that at least *many* of the stories of the sea-serpent have so originated, though I doubt whether *all* can be explained in this manner.

Grammar School, Bradford, September 7 C. BIRD

THE communication of Dr. Joseph Drew in your issue of yesterday regarding the serpentine appearance of a flock of shags in the English Channel is extremely interesting even as a mere fact regarding the habits of these birds. Will you kindly permit me, however, to point out that Dr. Drew's statement cannot be regarded as explanatory of the sea-serpent's personality? At the most the incident only explains one of a number of *serpentine appearances* of which porpoises and sunfishes swimming in line, pieces of wood with trains of sea-weed, &c., are also good examples. There have been placed on record numerous incidents of serpentine forms having been closely inspected (as in the well-known case of the *Dædalus*, or later still of H.M.S. *Osborne*) where the hypothesis of the serpentine appearances assumed by flocks of birds or fishes could not be held as explanatory in any sense. It is with the view of showing that the exact personality of the "sea-serpent" cannot be accounted for by such an incident as Dr. Drew relates, that I venture to pen these remarks; and as a firm believer from the standpoint of zoology that the large development of the marine ophidians of warm seas offers the true explanation of the "sea-serpent" mystery, I would also ask your readers to distinguish carefully between cases in which serpentine appearances have been assumed by ordinary animals, and those in which *one* animal form has presented itself in the guise of the "great unknown." I am far from contending that a sea-snake developed in the ratio of a giant "cuttle-fish," presents the only solution of this interesting problem. A long tape-fish, or even a basking shark of huge dimensions, might do duty in the eyes of non-zoological observers for a "sea-serpent." The following cutting from the *Scotsman* of September 6, indeed, seems explicable only on the tape-fish theory which I have advocated with the persistence of firm belief within the past few years. At the same time zoologists cannot but feel indebted to Dr. Drew, and to those who, like that gentleman, note unwonted appearances in ordinary animal life, and communicate such incidents to your columns. ANDREW WILSON

Edinburgh School of Medicine, September 6

The following is the extract alluded to :—

"A BABY SEA-SERPENT.—From Van Diemen's Land comes news of the capture of a queer fish. It is fourteen feet long, fifteen inches deep from the neck to the belly, tapering two inches to the tail, and eight inches in diameter in the thickest place. There are no scales, but the skin is like polished silver, with eighteen dark lines and rows of spots running from the head to the tail each side. There is a mane on the neck twenty inches long, and continues from the head to the tail; small head, no teeth, protrusive mouth, capable of being extended four inches like a sucker; eyes flat about the size of a half-crown, and like silver, with black pupils. There are two feelers under the chin, thirty-two inches long. The fish was alive when captured."

Alpine Flowers

IN the Alps I have found some instances of *different forms of flowers in plants of the same species*, which, as far as I know, have been hitherto undescribed, and of which, therefore, I will give a short notice here.

Geranium sylvaticum is in one locality near the Albula Pass *gynodiœcious*, with large-flowered hermaphrodite, and small-flowered female stems. *Veratrum album*, *Dryas octopetala*, and *Geum reptans*, are in all the localities where I have examined them, *androdiœcious*. *Astrantia minor* offers a quite peculiar sort of androdiœcism, some stems bearing, as in other Umbelliferæ, in the same umbel hermaphrodite flowers and male ones, other stems producing solely male flowers. *Dianthus superbus* seems at first sight to exist in three forms: (1) stems with hermaphrodite flowers, being perfectly proterandrous and producing a moderate quantity of *whitish* pollen; (2) stems with female flowers containing very conspicuous rudiments of stamens but pollenless anthers; (3) stems with pistils remaining imperfectly developed and with anthers containing abundance of a *brown* powder. At first sight I thought their flowers to be male, and the brown powder to be pollen grains, but under the microscope the latter proved to consist of grains, the diameter of which is only about one-eighth of that of the pollen grains of the hermaphrodite flowers. I suppose, therefore, these grains to be the spores of some species of fungus, and *Dianthus superbus* to be *gynodiœcious*.

Berninahaus, August 29 HERMANN MÜLLER

The Microphone

WHILE studying the relation between the battery power and the sounds heard through the microphone, I found, when the latter was included in the circuit *between* two pairs of elements, that the sound first amplified by the microphone underwent further amplification by the action of the second pair of elements, and when heard through the telephone the volume of sound was considerably augmented. This new fact may perhaps open up a fresh avenue of research and lead to further development of Prof. Hughes' beautiful discovery.

Hull THOMAS ROWNEY

A Meteor

WHILE directing a small telescope towards Jupiter, at 9.35 P.M. on the 2nd inst., my attention was attracted by the bright light of what proved to be a large meteor, falling towards the south-western horizon. Its apparent size was two or three times that of Jupiter, its colour being green (very similar to that of burning silver), suddenly changing to a dull red on falling to pieces at the end of its course.

The meteor appeared at about R.A. 18h. 10m., Decl. S. 10°, and travelled slowly till it broke up in R.A. 17h. 0m., Decl. S. 16° (or nearly coinciding with the star *η Ophiuchi*), being visible for about three seconds. SYDNEY EVERSHED

Wonersh, Guildford, September 4

OUR ASTRONOMICAL COLUMN

THE INTRA-MERCURIAL PLANET.—The correction applied by Prof. Watson to his first position of the supposed intra-Mercurial planet from more complete reduction of his observation brings the object somewhat nearer to the ecliptic, the longitude being 124° 46′ and the latitude 0° 51′ S., at 10h. 24m. 49s. G.M.T. on July 29. Close and continued search along the ecliptic with large refractors, provided with long "dew-caps" blackened inside, for 10° or 12° on each side of the sun, may now afford the best chance of recovering the planet previous to the next total solar eclipse, or probably until the eclipse in May, 1882; for it will be seen that in the eclipse of January, 1880, the duration of totality is short, and, which is of still more consequence, the central line runs mainly amongst the Pacific Islands without touching any, where observations would be likely to be very practicable. With respect to the precautions that may be usefully adopted in a search for the planet, the reader may consult the remarks of Prof. Julius Schmidt in *Astron. Nach.*, 878, bearing upon his daylight observations of the great comet of Klinkerfues in 1853.

VARIABLE STARS.—Prof. Schmidt notes the variability of the star Lalande 46090, rated 6m. in the catalogues of Argelander and Heis, but which was invisible without the telescope on July 9 and 10, 1878. It is 7m. in Bessel, and only 8·9 in Lamont. The position for 1880 is in R.A. 23h. 26m. 12s., N.P.D. 101° 39′·6.

The Athens observations, last May and June, establish a material increase in the period of the well-known variable δ Libræ. The error of Schönfeld's ephemeris in May, 1877, was—32m.; in the present year it was—48m., from the naked-eye observations, considered preferable to those made with the comet-seeker. χ Cygni was at a maximum (hardly 5m.) on March 14, 1878, 408·6 days having elapsed since the preceding maximum. Prof. Schmidt refers to a star in the nebula of Orion, No. 822, of Bond, which exhibited marked change of brightness in April last, having been seen as faint as 12 8 and as bright as 9·7. This star follows θ, 34·3s., and is south of it 5″·1. In previous years he had not noticed any sensible difference between No. 822 and No. 784, which precedes 8·5s. and 0″·3 to the north.

Mr. Tebbutt writes from Windsor, N.S.W., with reference to our notice of his newly-discovered variable in Ara, that in his communication to the *Astron. Nach.* the field of view should have been given as about half, instead of three-fourths of a degree. Although Brisbane 6,142, is still visible as a star of the eighth magnitude, 6,183 of the same catalogue cannot now be found; but an error of two minutes in the observed R.A. will identify it with 6,196, exactly on the same declination.—Prof. Bickerton, of Canterbury, N.Z., sends us an outline of a lecture delivered by him at the Philosophical Institute of this place, on the explanation of the phenomena of variable stars. Amateurs in such latitudes may do excellent service, with comparatively little expense of time, and with very small optical means, in furthering our knowledge of the variable stars of the southern heavens, providing themselves for the present with Behrmann's Atlas, the magnitudes in which are recorded from recent observations; while at no distant time it may be expected the charts of the Cordoba *Uranometria*, prepared under much greater advantages, will be available to them. The popular atlases are useless in such investigation. We hope the result of attention being directed to subjects of this nature at the Antipodes may be to greatly increase the number of observers in departments of practical astronomy, peculiarly within the scope of the amateur, as, compared with what is now to be effected with limited means and appliances in the northern hemisphere, a promising field is open to them.

SWIFT'S COMET OF JULY 7.—Elements of the comet discovered by Mr. Lewis Swift, of Rochester, N.Y., on the morning of July 7, have been calculated by Dr. Holetschek, from observations to July 23, made at Clinton by Prof. Peters; they do not resemble those of any comet previously computed. The failure to observe this object in Europe, though it was closely sought after at several observatories, appears to have arisen from an error in the telegram, which stated its motion to be slow, whereas it was pretty rapid towards the south-west horizon. It might have been well observed during June, the position at the beginning of the month being in the vicinity of ψ Cygni, and on June 21 just south of 13 Lyræ. The elements are in *Astron. Nach.*, No. 2,213.

THE SATURNIAN SATELLITE MIMAS.—The series of observations of the satellites of Saturn, in 1877, made with the great refractor at Washington, includes but few of the closest satellite *Mimas*, which, indeed, has not been frequently observed of late years. A combination of the later Washington measures, with observations made by Mr. Lassell in 1847, and a few intermediate ones, indicates, on the assumption of a circular orbit in the plane of the ring, a period of 22h. 37m. 6·82s., but there appear grounds for suspecting a very slow increase in the length of the period. Mädler, from his reduction of the observations of Sir W. Herschel, considered a very sensible eccentricity was shown by them, which more recent observations support. In the case of *Hyperion*, the perturbations as indicated by the measures must be very large, but we believe Mr. Marth has found the same result some time since from his investigations on the theory of the satellites, the chief disturber being, of course, *Titan*.

GEOGRAPHICAL NOTES

WE have received three new maps of Cyprus. The first, to which we have already briefly referred, is by the well-known German geographer, Dr. Kiepert, and is a valuable original compilation based upon the English Admiralty chart, but containing many more names of villages, &c., than any other modern map. A noticeable point of this map is the hill-work, which has been very artistically rendered. Stanford's Cyprus is also an original work, with some useful features not found in Kiepert's. The Kaimakamliks and Kazas are all distinctly bounded and named, and although there are not so many names as in Kiepert's map, yet those that find a place appear to have been judiciously selected. The spaces around the map are utilised by the insertion of supplementary maps presenting the agricultural and geological conditions, a section showing the interdependence of these conditions and plans of the chief coast towns and roadsteads. Wyld's Cyprus is on exactly the same scale as Mas Latrie and the Admiralty chart, and appears to be a combination of these two. We notice in one or two places where the positions of villages do not agree in these two authorities, that both positions are inserted on Wyld's map, as though there were two places of the same name. The hills on this map are inferior to Kiepert's; there are few English lithographers that can equal the German in this art. This map, like Stanford's, introduces agricultural and geological insets, and plans of the chief roadsteads and coast towns. We need not be surprised at the alleged unhealthiness of Cyprus, when Mr. Wyld tells us that the average temperature in February is 52·8° *Centigrade*, and that of July and August 82° of the same scale!

LIEUT. KITCHENER, R.E., has handed over to the Committee of the Palestine Exploration Fund the whole of the memoirs, special plans, and lists connected with the great map of Western Palestine. These materials, now in the hands of the Committee, consist of a map in twenty-six sheets, on the scale of one inch to a mile; a map in three sheets, on the scale of three-eighths of the large map; and an immense collection of memoirs from the note-books of Lieut. Conder and himself. The Committee have already taken steps for the publication of the maps, and will at once proceed to consider that of the memoirs, a part of the work as important as the map. Lieut. Kitchener exchanges the work of the Palestine Fund for the important charge of the survey of Cyprus, to which he has been appointed by the Foreign Office. He achieved in Palestine what may be called the unparalleled feat in survey work of surveying 1,000 square miles for 1,000*l.*, and in eight months.

WE learn from Washington that Capt. Tyson is expected in America with the *Florence* in which last year he made a preliminary trip, with the view of establishing a polar colony at Lady Franklin's Sound. The scheme, which has been devised by Capt. Howgate, of the Signal Service, has not been given up, but postponed for one year, Congress having terminated its session without any resolution having been taken on the necessary grant of credit. It will be proposed again when the Congress meets in 1879, and the report drawn up this year by the special commission will receive an additional force from observations taken by Capt. Tyson and his able scientific staff.

THE *Geographical Magazine* for September describes the equipment of two expeditions from the United States for the survey of the Amazon. One of these is in the *Enterprise*, under Commander Selfridge, of the U.S. Navy, which will survey the river as far as Manaos, and the Madeira as far as San Antonio, the point of departure of the line of railway around the Falls of Madeira. The other expedition is sent out by Messrs. Mackie and Scott, of Philadelphia, its object being to arrange a route by way of the large rivers which connect Bolivia and Brazil, over which trade can be carried on. As a preliminary measure a surveying party will go to Bolivia to study the country, and will be accompanied by a naturalist, Mr. Ernest Morris, who has already done good work on the Lower Amazon.

THE just published June number of the *Bulletin* of the French Geographical Society contains M. de Ujfalvy's account of his official journey to Zarafshan, Ferganah, and Kuldja, which contains a good many original ethnological observations. Dr. Hamy has a paper on Manoel Godinho de Eredia, the Portuguese whom Mr. Major and others had accepted as the earliest discoverer of Australia; fuller evidence, however, convinced Mr. Major that Godinho had no claim to this honour, and Dr. Hamy endeavours to show what were the real services rendered by this "Descobrider" to geography. The number contains the letter from Savorgnan De Brazza, describing his journey on the Ogové, to which we alluded some time since.

FROM the *Bollettino* of the Italian Geographical Society we learn that Romola Gessi had been furnished with a formidable equipment for the exploration of the Sobat, by Gordon Pasha, who, at the last moment, was compelled to stop the expedition, on account of a formidable rebellion in Darfur.

M. PAUL SOLEILLET, who, it will be remembered, was to cross Africa from Senegambia to Algeria, reached Kuniakaro on June 23 by way of Bakel. This was 1,250 kilometres beyond St. Louis, and thitherto M. Soleillet had few difficulties. After Kuniakaro, however, the real work of the expedition will commence, and not a few dangers will have to be faced. His next point was Yamina, a small town on the banks of the Joliba, about 50 kilometres from Segou.

LETTERS have been received in Holland from the members of the Dutch North Polar Expedition, and their contents are said to be highly interesting. The expedition, after leaving Bergen, had proceeded to Jan Mayen, where they arrived on May 9. On June 27 they reached Amsterdam Island, where a simple monument was erected in memory of the Dutch sailors buried there. The expedition then visited the other principal points of Spitzbergen, and eventually sailed for Vardö, on the north coast of Norway. It was then their intention to cross the Barentz Sea in order to reach Novaya Zemlya in the middle of August. The letters state further that numerous scientific observations have been made.

DR. GERHARD ROHLFS, after finding that his efforts to form a large society with a view of organising an exploring expedition to Africa upon a grand scale, have not met with the success he anticipated, has now resolved to start alone as on former occasions.

AT the meeting of the French Geographical Societies in Paris a number of resolutions were adopted, bearing principally on the teaching of geography and topography in the public schools, the creation of regional geographical museums and congresses, the means of multiplying the number of geographical societies, and fostering intercourse between members of the several European societies. It was decided that all the members of the different French and Algerian societies should have the right to be admitted to each others meetings. It was proposed to advise foreign societies to do the same, and to adopt an universal geographical society's ticket. The next national geographical exhibition will take place at Montpellier in 1879, on the occasion of the meeting of the French Association. A conference of all French societies will also be held at the same time.

THE gold medal for English maps, charts, &c., at the Paris Exhibition, has been awarded to Mr. Stanford.

BREWING IN JAPAN

AT the present time, when the history of the origin and development of the lower forms of life is occupying a great deal of attention, any facts which increase our knowledge of the growth of such bodies should be welcomed. In our breweries the growth of the yeast-ferment is tolerably well understood, or, at least, has been well observed and described. Under ordinary conditions the yeast-fungus exists only in the aquatic form, as it may be termed; and only under special circumstances, and with considerable difficulty in preventing putrefaction, is it enabled to produce spores. The internal substance of the cell becomes differentiated; granulations form and collect round certain points, and these ultimately become invested with a membrane, upon which the spores are ripe. The production of spores is thus unattended with the formation of a mycelium, or, if formed, it is so minute as to have been overlooked. This, however, is not a normal process of reproduction: the principal one, and indeed under the usual conditions, the only mode, is by budding.

Those living in Japan, however, have the opportunity of seeing a mode of fermentation which differs in many particulars from that employed in Europe. The subject is now under investigation, and at present I am not able to explain accurately what takes place; but as the process followed is interesting from its novelty, as it appears to consist in the previous practical use of a discovery made by De Bary, and afterwards confirmed by Rees and by Fitz, that alcoholic fermentation can be effected by the growth of a species of *Mucor*, I am induced to give an account of a visit made, in company with some scientific friends, to the saké breweries situated about thirty miles away from Tokiô, the capital of Japan.

Saké is the general name given to the alcoholic liquid prepared by the fermentation of rice. There are many varieties of it prepared in different parts of Japan, each receiving some special name, either derived from the district in which it is prepared, or from some fancy of the manufacturer. It is a clear liquid, of a colour varying from the palest yellow to that of the darkest sherry, and containing from twelve to fifteen per cent. by weight of alcohol. There are some special kinds which contain much less alcohol—from four to five per cent—but they do not form the usual drink of the Japanese. It is almost always served hot, being placed in porcelain bottles, which are immersed in hot water and left there until the whole has attained the proper temperature.

This liquid is prepared on the large scale only in certain parts of the country, the most famous district being that near Ôzaka, one of the Treaty Ports. It is, however, often prepared on the small scale in private houses. The winter is the only season during which brewing operations are conducted, but this is not because the fermentation temperature is to be kept low as in the Bavarian method, but, I believe, in order to prevent the action becoming too tumultuous, for the temperature of fermentation is, in reality, even higher than that adopted in England. But, from the fact that the largest breweries are situated nearly 400 miles from Tôkiô, and the operations being carried on during a period when the University session is at its height, I have been compelled to confine my inquiries to the smaller breweries at Hachiôji, near this city.

The main room consists of a large wooden building about 120 feet long by 50 feet broad, and 25 to 30 feet high, running along the middle of which, in the direction of its length, is a platform about 12 feet from the ground, upon which some of the preliminary operations are carried out. Upon this a number of wooden tubs are placed, which serve for the preparation of the ferment, an operation which requires to be repeated several times during the brewing season. On the ground, ranged along the two long sides of the building are large tuns used for the storing of the saké when made, and some of which are also used for the actual processes of fermentation.

The brewing commences with the preparation of the ferment. For this purpose at the end of the previous brewing season a quantity of a green mould is produced upon rice by exposing steamed rice mixed with a certain proportion of the ash of some tree, and over which the spores of this fungus have been scattered in a well-closed chamber, which I may term the "fungus-chamber." This is a small room about 7 ft. high by 6 ft. broad, and 8 ft. long, well lined and covered with straw and matting, so that its high temperature may be kept up for a considerable time. In this chamber the rice and spores are left for about ten days, the atmosphere being kept quite moist by the vapour given off from the steamed rice, and at the end of that time the grains are found to be covered with a green fungus full of spores, and apparently the same kind as is found growing upon putrefying organic substances. The temperature of the chamber when examined was 25° C., that of the external atmosphere being 13° C. This product is called, in Japanese, *tane* or seed.

When prepared at the end of the season it is preserved until the next by being placed in bags, and inclosed in wooden boxes between layers of a mixture of equal parts of lime and wood-ashes.

When it is required to commence operations, a similar method is adopted to that just described, that is, a quantity of steamed rice is placed on wooden trays in the "fungus-chamber," but not mixed with any wood-ashes, and then *tăné* (spores) is scattered over it, and the chamber kept closed for a period varying from two to four days. At the end of this time the rice-grains are found to be covered with large quantities of fine hair-like threads, the mycelium of the fungus added. In this state it is called "kōji."

If this were left for a longer period in the fungus-chamber, it would produce spores, and the brewer calls it "the friend of tane," but in order to carry on the development of the mycelium most vigorously, it is necessary to use wood-ash in addition, which thus seems to act as a fertiliser.

Having thus obtained the "kōji," or mycelium, the brewer uses it for effecting the preparation of his yeast. For this purpose he mixes steamed rice with 30 per cent. of its weight of "kōji" and a sufficient quantity of water to make a thick mud, in small shallow wooden tubs, which are kept on the platform previously mentioned. In these it is frequently stirred and rubbed round with wooden tools, during a period of about ten days, in the course of which the grains of rice appear to be broken down, and the whole assumes a much thinner consistence, while at the same time the liquor becomes decidedly sweet. This is a change which is anything but clear; it would seem that it is connected with the development of an organism derived from the "kōji;" as on the small scale, I have noticed the production of minute cells, apparently budding, but whether they have any connection with the air-fungus, the mycelium of which covers the rice in "kōji;" or whether they have been developed from germs accidentally present in the "kōji," I am not able to say, though I hope that further experiments will make this point clear.

After the end of the ten days this product is mixed with fresh-steamed rice, water, and "kōji," and introduced into larger wooden vessels, in which the mixture is heated by means of closed wooden tubs, containing hot water, and in order to prevent too rapid radiation, the whole is covered with matting. The hot-water tubs are replaced day by day, so that the temperature is kept up for a period varying from eight to thirteen days. The average temperature seems to be about 35° C. (95° F.). During this time there is a continuous development of gas, and a scum gradually forms upon the surface until it has a thickness of a little more than one inch, and, when examined under the microscope, presents the usual appearance of brewer's ferment—saccharomyces. At the end of this stage, if the operation has been well conducted, five tastes are to be distinguished: sweet, bitter, astringent, alcoholic, and sour; but of these five, all of which are quite distinct, the bitter, astringent, and sour tastes are most marked. The product of this operation is called "moto," which means "source" or "origin," referring to the fact that it is from this ferment that the saké is subsequently formed. All the previous part of the brewing process has thus had for its object merely the preparation of the yeast, but it is certainly the most interesting, from the obscurity which surrounds it.

The actual fermentation is divided into three stages, called respectively *beginning*, *middle*, and *end*, the proportions of steamed rice and ferment varying slightly in each stage, but giving a final result of 100 parts of steamed rice to 30 parts of ferment. This mixture, together with the proper quantity of water, is placed in one of the large tuns before mentioned, and allowed to remain for about fifteen days in all, during which time fermentation actively proceeds, and the liquid becomes strongly alcoholic, at the end of which time it is drawn off from the grains of rice which have subsided, and introduced into other tuns, where it is allowed to remain to permit the remainder of the rice to be separated. The residue is placed in bags and subjected to pressure in a lever press, the clear liquid which is expressed being added to that which has been clarified. It is now placed in boilers and heated up to about 60° C., after which it is kept in the store vats, carefully sealed up.

The residue left in the press is subjected to a process of distillation in a current of steam, by which a spirit containing about 42 per cent. of alcohol is obtained.

The saké in the store vats contains about 15 per cent. of alcohol, and this fact shows that the fermentation is different to that effected by the *Mucor racemosus*, as described by Fitz. In his experiments he found that the presence of $4\frac{1}{2}$ to $5\frac{1}{2}$ per cent. of alcohol killed the ferment, whilst in the process above described, we find the ferment acting in such a way as to produce 15 per cent. There is, however, nothing improbable in the supposition that different species may possess different degrees of sensitiveness to alcohol, and that the species used here may be less easily affected than the one employed by Fitz.

There are, however, many points about the process which are obscure, and about which I cannot say anything at present, but further experiment will, it is hoped, throw light upon the obscurity now enveloping the subject. The above account has been given in the hope that it may prove of some interest to those engaged in the study of fermentation, and that it may lead to a more extended examination of the action of various species of fungus upon amylaceous substances.

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THE ORIGIN AND DISTRIBUTION OF ORGANIC COLOUR

COLOUR, throughout the realms of organic nature, is a factor hitherto held to be the most capricious in its distribution and the least amenable to any finite law. So uncertain and variable indeed are its manifestations that its claims for the purposes even of specific diagnosis have long since been ignored by the comparative anatomist. Nevertheless, when examined more attentively, an amount of evidence may be adduced sufficient to warrant further inquiry as to whether there is not existent beneath the superficial stratum of apparent disorder, a harmonious under-current indicative of a derivation in the abstract from one of nature's simplest physical laws, namely, that of polarisation.

Directing brief attention first to the subject of colour as distributed among the animal world, it will at once be recognised that, with few exceptions, it is only amongst the classes lower in the scale than the mammalia that this element either attains or retains its full exuberance. Even within such limits it will be further found that the beautiful and recently-discovered law of natural selection, for the purposes of concealment or protection, has in many instances so influenced and subordinated all pre-existing characters as to have entirely masked or eliminated them. The lepidopterous order of the class Insecta most prominently illustrates this latter case; the brilliant and varied hues of many members of this tribe being, as has been ably demonstrated, more especially by Mr. Alfred R. Wallace, in accord either with the flowers they most frequent, the objects upon or adjacent to which they rest in repose, or, still more remarkably, mimetically identical with those of other perfectly distinct species which owe their immunity from the attacks of birds to their peculiar acrid flavour.

The types among which have been first observed those peculiar colour-characteristics now to be submitted, are more particularly associated with aquatic life, and from these latter it has been found possible to extend and institute comparisons amongst almost every terrestrial group. Reference is here made to the dominance among the animal types in question of those so-called "complementary colours" familiar to all acquainted with the working of the polariscope. Of these colours in question, the combinations red and green, and blue and yellow are the most important, and it is surprising to find how frequently these reproduce themselves in nature.

Enumerating on this occasion merely a few instances, reference may be first made to those forms in which blue with its complementary hue, yellow, are found associated. Blue, as a rule, enters but to a comparatively trifling extent into the coloration of our indigenous fish fauna, but a remarkable and very gorgeous exception is afforded by the male of the Cuckoo Wrass (*Labrus mixtus*), which in its adult condition is resplendent with equally-distributed tints of the purest azure and most brilliant orange. These same complementary hues of blue and yellow obtain again in the male of another British fish, known as the Gemmeous Dragonet (*Callionymus lyra*). A conspicuous exotic example of the same colour-combination is presented by the Tesselated Parrot Fish of Ceylon (*Scarus hariæ*), characterised by its groundwork of azure blue decorated with an hexagonal network of golden yellow. Among the invertebrate division of the animal kingdom, the class of the Crustacea affords several interesting instances of a similar combination. Two of these belonging to the Decapodous order, *Galathea strigosa* and *Scyllarus arctus*, are of considerable size, having the deep orange hue of the general surface of their carapace variegated with bands and markings of brilliant blue. The Common Lobster (*Homarus vulgaris*), again, often "sports" into a bright blue variety, variously spotted and mottled with yellow. The legs of the Common Prawn (*Pandalus annulicornis*) are also most usually decorated with alternating rings of blue and orange. The marine copepods, more especially those of tropical seas, abound with instances of the association of these same two complementary hues. The class of the Mollusca is one among which blue as a pure colour but very rarely presents itself. There are, however, two Nudibranchs (*Goniodoris cœlestis*, Desh., and *G. elegans*, Cantraine) conspicuous for their ground colour of azure, accompanied in each instance by spots or lines of yellow. The last-named and finer of these two species, attaining a length of $2\frac{1}{2}$ inches, and usually classed as a Mediterranean type, was collected by the writer on the rocky shore of the Cies Islands, Vigo Bay, in association with the dredging expedition of Mr. Marshall Hall's yacht *Norna*, during the spring of the year 1871.

Pursuing the investigation among terrestrial types, the bird tribe—although it is necessary here to cite almost entirely tropical forms—produces abundant instances of the association of the same blue and yellow tints. The large Blue and Yellow Macaw (*Ara ararauna*) of South America forms a most conspicuous illustration, and the same two complementary hues will be found coupled together among innumerable other representatives of the parrot tribe, and likewise among the toucans. The most exquisitely beautiful blue bird yet known to science, the Azure Cæreba (*Cæreba cyanea*), is not altogether deficient of the complementary tint of yellow, several feathers of this colour appearing in the wings. One of the Cassowaries (*Casuarius kaupi*, Sclater), as figured in the Zoological Society's *Proceedings* for the year 1872, is represented as having the skin of the upper and front portion of the throat coloured azure-blue, while immediately behind and adjacent to this succeeds a patch of bright yellow. A still later and highly characteristic example is likewise afforded by the newly named *Euphonia insignis* of Messrs. Sclater and Salvin, figured at Pl. lii. Fig. 1 of the third part of the same *Proceedings* for this current year. Although our indigenous avifauna produces very few species in which the colour blue occupies a prominent position, the little Blue Tomtit (*Parus cœruleus*) is an exception which at the same time altogether conforms to that law of polarity here brought forward. Thus while the feathers on the head and back of this familiar species are of a bright cerulean blue, those of the breast and under-surface are mostly yellow. Higher than the birds it seems useless to seek for the association of the two complementary tints under notice, though singularly enough one of these, the blue, turns up where it might be least anticipated, namely, amongst certain of the baboons, or Simiadæ, whose cheeks and remarkable posterior callosities are not unfrequently coloured bright cobalt. So late as the commencement of historic times our noble ancestors are reported to have supplied what nature had denied them in this department by the adorning of their persons with the juice of woad.

Turning now to the second complementary combination, that of red and green, it will be found to be far more extensively distributed even than that just discussed, birds, reptiles, fishes, and almost every class of the invertebrate kingdom supplying an important quota in which these colours are placed in juxtaposition. From among the first-named, the parrot tribe, woodpeckers, certain pigeons (*Ptilonopus*), trogans, and humming-birds, furnish abundant examples. Among lizards may be mentioned the Indian genus *Calotes;* while the ballan and corkwing wrasses, the Connemara sucker, and even the common stickleback in its breeding-dress, illustrate familiar examples of our indigenous species of fish in which green and red constitute the two dominant hues. To this last-named list of fishes might be added innumerable exotic types. With the crustacean class green and red appears to be a scarce combination, but one marine Isopod (*Spheroma*), remarkable for the variation in colour of different individuals, supply an exceptional illustration, I having by me alive at the present moment two examples, one of which is pale green, and the other scarlet. A spider, with whose technical name I am not familiar, but which often occurs on laurel bushes, has its body apple-green, supplemented with a bright red spot in the posterior region. Aphides, whose bodies are usually green, have frequently associated with the same scarlet or crimson eyes, and the same two colours will be found to be the prevalent tints of the larvæ of many lepidopterous insects. Green and red ascidians, worms, and zoophytes might likewise be enumerated, and the same combination is further traceable down to the Protozoa, and within the precincts of that debatable ground from whence both plants and animals take common origin.

Here, indeed, the subject assumes its most interesting and important phase, it being evidently at this initial point that the key and origin of the whole attendant phenomena are to be sought. Among a number of these humble unicellular organisms, including apparently as undoubted animals the Euglenæ or Astasiæ, and as true plants the Thecomonads and Volvocinæ, it will be found that the brilliant green hue of the general cell-substance is supplemented at one point by a brilliant scarlet speck, with which, in the case of animal organisms, the properties of a visual organ have been frequently associated. Though this interpretation does not meet with general support, it is remarkable how persistent is the presence of scarlet eyes among the more minute representatives of several invertebrate classes, including Insecta, Crustacea (some of these *monocular*), Annelids, and even Echinoderms, as typified by the starfish tribe. Advancing further on the vegetable side, the complementary colours of red and green, as first foreshadowed in unicellular Phytozoa, become still more conspicuously associated. Altogether apart from the floral elements the colour red constantly accompanies the more general green cellular structure of the stems, petioles, and leaf venation of ordinary plants. One remarkable Mexican species, indeed, *Pointsettia pulcherrima*, affords an instance in which the whole foliage forming a rosette at the terminal portion of the plant is the most brilliant scarlet, while that of the lower part is simply green. *Calladiums*, *Begonias*, and many other types might be quoted, in which the same two colours are equally blended in the leaves. Among the flowerless cryptogams, again, the group of the Bryaceæ, or moss tribe, yields further analogous and corroborative data. The peculiar fimbriated structure or peristome, which upon the dehiscence of the operculum guards the aperture of the spore capsules in this group, being in the majority of instances bright scarlet or crimson. The brilliant floral elements of the phanerogamic class are not so easily subordinated to that law of polarity, which appears to have left its impress on the simpler vegetative parts. Cross-fertilisation and numerous other external conditions and surroundings have no doubt exercised their influence in this case to an extent parallel to, though not identical with, what obtains among the Lepidopterous group of the animal series. Even here, however, it is a matter of question whether red is not the colour most extensively distributed. Certain forest trees, for example, such as the larch, poplar, and hazel (female flower), form interesting exceptions among a group more usually altogether wanting in brilliant floral decoration, and in all of which instances red is the characteristic hue of the flowers they bear.

How, or in what manner, the varied colours of nature were first called into existence is a problem that yet remains to be solved. Without presuming to put forward or propose any arbitrary interpretation of this primeval derivation, the following data may be tentatively submitted. The initial term of the series, as represented amongst the lowest animals and lowest plants, and in the latter instance continued throughout the higher forms, is evidently the colour green. Associated with vegetable life it takes the form of chlorophyll, and as such is altogether dependent for its origin and existence upon the influence of solar light. Shut off from such influence, this element fails to produce itself, and vegetable tissues remain white, as instanced in the artificial cultivation of seakale and other culinary herbs. Prolonged isolation from such light, however, results in the arrest of the vital functions, and this circumstance fully explains the absence of chlorophyll producing vegetation below that depth in the ocean to which solar rays have access.[1] Green again, is not a simple colour, but a combination of two others—blue and yellow. May not therefore its origin be remotely related to the effect of the solar rays, technically white and colourless, but yellow to the external senses as represented by ordinary sunshine and upon the artist's canvas, acting in concert with the blue ether of which our outer atmosphere is composed?

Given this initial colour green, the three primary hues of nature follow as a necessary consequence:—Blue and yellow by the resolution of the initial factor into its constituent parts, and red as its direct or reflex product in abeyance to the law of polarity. That this latter law exerts a considerable influence in the origin and distribution of those glorious tints of nature which may be said to constitute its most potent charm, will scarcely fail to recommend itself to the attention of those specially conversant with the physics of colour, and in whose hands this subject may prove susceptible of important development.

W. SAVILLE KENT

[1] Reference may be appropriately made here to the predominant colour of fixed deep-sea organisms, such as sponges and corals. In the hexactinellid sponge-form *Phæronema* (*Holtenia*) characteristic of abyssal depths, the colour, as observed by the writer in association with examples procured from a depth of from five to six hundred fathoms off the coast of Portugal, and in connection with the dredging expedition of Mr. Marshall Hall's yacht the *Norna* recently referred to, was the most brilliant orange. This hue was likewise observed to be characteristic of the soft parts of the large deep-water branching coral *Dendrophyllia ramea* obtained in the same expedition. It will at once occur that this colour, orange, is directly complementary or polar to that of the superincumbent mass of water, always distinguished when overlying such profundities by its deep cerulean hue.

ELECTRIC DISCHARGE IN GASES

I.

In a paper read some time since at the Royal Society,[1] Drs. Warren De La Rue and Hugo W. Müller gave the first part of an account of their researches on the electric discharge in gases. This part, of which we shall at present give some account, consists mainly of a discription of the apparatus employed in this research, and of the results of their experiments with gases at atmospheric pressure and pressures down to 141 millimetres. They have since communicated to the Royal Society a second part, which treats of the discharge in highly rarefied gases (vacuum tubes).

The source of electrification used by Messrs. De La Rue and Müller was a battery of chloride of silver elements; commencing with 1,000, the authors have from time to time increased the number of cells to 11,000 joined in series (11,330 volts). In spite of its containing a somewhat costly material, this element, when compared with the many other forms of voltaic cell at present in use, possesses points of advantage such as render its general adoption extremely probable; we therefore transcribe in considerable detail the authors' description of it in its present improved form.

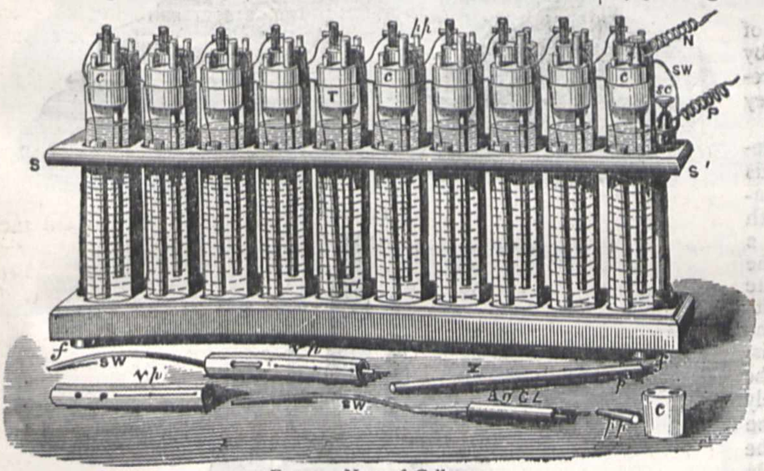

FIG. 1.—Nest of Cells.

Fig. 1 shows a nest of twenty cells of the most recent construction; the several components of the cells are given separately at the base of the stand. The glass tube T is $5\frac{1}{2}$ inches high, and $1\frac{1}{8}$ inch in diameter: it has a flat bottom. The stopper *c* is of paraffin, and is perforated with two holes, one for the zinc rod (*z*) to pass through, the other for letting in the liquid; the latter is ultimately closed with a paraffin plug (*pp*). Cork and india-rubber stoppers were tried and abandoned. The zinc is obtained of the Belgian Vieille Montagne Company. When it is intended to keep a battery more than a year in action the zincs should not be amalgamated, as the silver wires in contact with them would gradually be rotted through. Platinum, which would not become amalgamated, might have been substituted for the silver wires; but it would have cost 55*l.* extra per 1,000 cells. The zinc rods are 15 cm. long, 0·56 cm. in diameter, and perforated at the top with a hole 0·25 cm. in diameter. The chloride of silver (AgCl) is cast in the form of a rod on a flattened silver wire S W; the rods are 5·4 cm. long, 0·762 cm. in diameter, and weigh 12·97 grms. The silver wires are 20 cm. long, 0·127 cm. wide, and 0·0229 cm. thick, weighing 0·88 gms. each; they protrude slightly beyond the bottom of the rod of chloride, as will be seen from the figure. The wires and rods were obtained from Messrs. Johnson and Matthey, of Hatton Garden; the cost, including labour of casting, amounted to 2*s.* per cell. *v p* is a cylinder of three folds of vegetable parchment; at its lower end the folds are stitched together with thread, and at the upper part they are interlaced with the silver wire, and thus prevented from unfurling. The object of the parchment cylinder is to prevent the reduction of the chloride of silver rod, which would result from its accidental contact with the zinc. By giving proper bends to the silver wire before making up the cell it is easy to cause the chloride rod to lie vertically and press gently against the glass wall.

The liquid used for the cells is a solution of chloride of ammonium, 23 gms. to 1 litre of distilled water; by making use of a glass siphon with a long arm of india-rubber tubing, provided with a pinch cock, and terminating in a glass tube drawn down to enter freely into the hole in the paraffin stopper, it was found that 2,400 cells could be charged by one person in ten hours.

In making up a battery the glass cells are first arranged in their nests; next the paraffin stoppers are fitted with zincs; then the chloride rods are inserted and the cell closed with the stopper, the thin silver wire passing between the glass and the paraffin. When these operations have been performed for all, the cells are joined up by passing the silver wire of each cell through the hole in the zinc rod of its neighbour, and securing it there by pressing in a taper brass plug *p* with a pair of pliers. Ultimately, the cells having been charged with fluid, as already described, and closed by the insertion of *p p*, a hot iron is run round the outside of the stopper and round the zinc rod to secure the latter in its place, and make tight the joints by the melting and re-setting of a little paraffin.

Thus set up, the battery has an electromotive force of about 1·03 volt and internal resistance of not more than 5 ohms per cell: the former remains remarkably constant, but the latter increases, especially in cells that are left long idle. This rise in internal resistance is caused by a skin of oxychloride of zinc, which gradually forms on the zincs in all batteries where the zincs are immersed in a neutral chlorine compound. The battery may be restored to its original resistance by removing and scraping the zinc rods, but a more expeditious mode is to withdraw the small paraffin plug used to close the hole in the stopper through which the cells are charged, and to introduce into each cell, containing 50 c.c., 1 c.c. of pure hydrochloric acid, sp. gr. 1·16, containing 31·8 per cent. HCl gas, equivalent to 0·3689 gm. acid. Before introducing it into the cells, as is conveniently done by means of a graduated pipette furnished with a stop-cock, it is better to dilute the acid with an equal volume of distilled water. An effervescence takes place, and it is therefore necessary to allow the tubes to remain open twenty-four hours before the small paraffin plug is replaced, in order to permit the hydrogen, which is generated, to escape. It required two days for one person to perform this operation on a battery of 1,200 cells. The acid dissolves 0·3295 gm. of zinc or its equivalent of oxide.

After having been in almost daily use on circuits comparable with those occurring in overland telegraphy, it was found that in two batteries the amount of AgCl reduced in sixteen months averaged 4·57 gms. per cell, while in two other batteries which had been worked for ten months the reduction amounted to 3·57 gms. per cell.

An accident enabled the authors to give precise information as to the loss in working up the reduced silver; 600 cells having been accidentally allowed to run

[1] *Phil. Trans.*, clxix. pp. 55-122.

down, the loss in extracting and fusing the silver was 1·38 per cent.

Chloride of silver is charged at three-quarters of the price of silver; and the allowance made by Messrs. Johnson and Matthey for returned silver is about 6 per cent. less than the price at which they sell it. The charge for fusing and casting the chloride is 1*d*. per rod. Hence it appears that though the prime outlay is considerable, the cost of renewal is small, and a battery of these elements represents a certain amount of capital which might be realised at any moment. The labour required for setting up this battery is comparatively very little, and, this done, the element, from the insolubility of one of its electrolytes, is capable of standing idle for any length of time without other detriment than increase of internal resistance; this increase, too, occurs but slowly, many months elapsing before it rises from, say, 5 to 20 or 30 ohms per cell. Moreover, the element is notably clean and compact—a case 141 cms. high, 107 cms. wide, and 43 cms. deep, will hold 1,200. The details carefully given by Messrs. De La Rue and Müller of their very great experience of this valuable cell will probably be hailed as a boon by the many who have occasion to make use of voltaic batteries.

The accompanying diagrams show some of the apparatus which were specially devised by the authors to meet the insulation requirements of the high electromotive force they employed.

For instance, the ordinary form of double-reversing-key could not be used with this great battery, in consequence of the formation of an arc when the key is raised with the object of breaking the circuit. Figs. 2 and 3 show the new form devised by the authors. H is the handle fixed to the ebonite axis, which has metallic collars A Z at its extremities; these are connected to the springs S S′ by wires inserted in the axis. The battery wires are led to A and Z. The standards B and B, B′ and B′, are respectively connected by *diagonal* wires between the ebonite plates E and E′. Fig. 3 shows the open circuit position. In Fig. 2 the zinc pole is connected through S to B′ and the leading wire N′; the silver pole being similarly connected to P′. If now the handle H be thrown over to the right-hand side of the Fig. 2, Z will be connected to B on the right side, thence through the diagonal wire to B on the left side of the figure, and to P′, while A*g* will be similarly connected to N′. In this key, on breaking contact, the arms S S′ can be removed from the standards B B′ by a distance greater than that to which the arc can be drawn out.

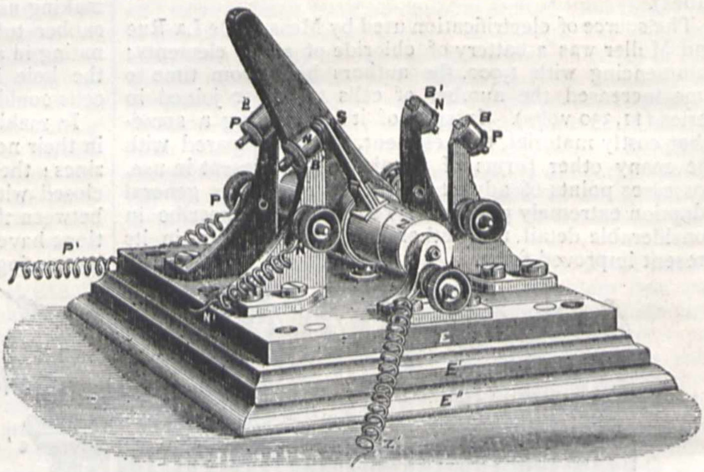

Fig. 2.

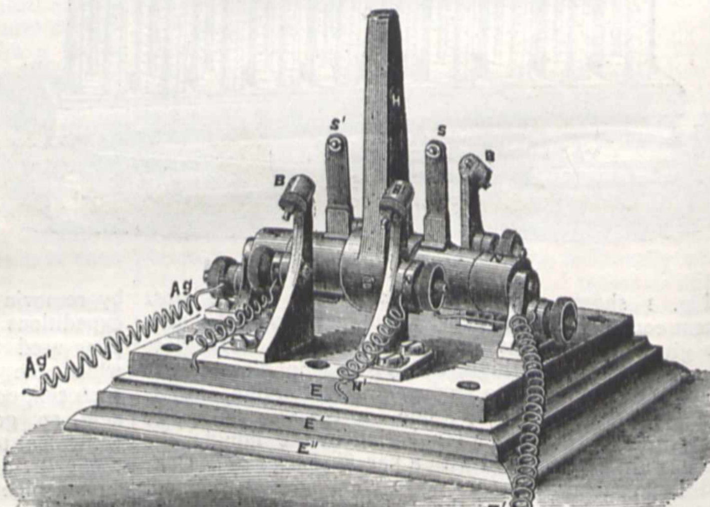

Fig. 3.

Figs. 2 and 3.—Double Reversing Key.

Fig. 4 shows the micrometer discharger, by means of which the authors are able to measure the length of the spark to within $\frac{1}{10000}$ of an inch. Its construction is sufficiently obvious; it need only be remarked that the nut fixed in the cross-head at the top of the frame through which the screw works is in metallic communication with the clamp C, and is divided horizontally into two parts, which are pressed asunder by three spiral springs in order to prevent shake or play of the micrometer screw.

For special experiments it was necessary to design and have constructed a commutator capable of reversing the current many times in a second; that shown in Fig. 5 represents the most convenient form; it is capable of reversing the current 352 times in a second when the handle is turned 240 times in a minute. It will be seen that each revolution of A, B, C, D reverses twice. The figure is so distinct as scarcely to require any description; B and D are of one piece of metal, and also A and C of another, the spring conductors making contact at 90° distance from each other; each of the uprights supporting the axis of the revolving disc is in metallic connection with its respective insulated clamp. In the position shown in the figure the positive current passes from A*g* to the upright supporting the axis of the revolving disc, and through the right hand spring to the wire plate A*g*′; the negative current from Z to the upright on the other side of the revolving disc, only partly seen, thence through the upper spring to Z′.

Besides this, the authors had a contact breaker very similar in appearance, and shown *in situ* in Fig. 7 on the top of the dwarf cabinet of battery No. 1, containing 1,080 powder-cells; this cabinet top is of ebonite, and forms their ordinary working bench. M M′ represents a revolving mirror, which has a multiplying wheel, and in which the reflection of the discharge in a vacuum tube can be seen. In the circuit was a set of coil-resistances from 1 to 1,000,000 ohms, specially insulated, the wires running in grooves on insulating cylinders made of paraffined cardboard, in order that they may be kept at a distance; besides this set of resistances there were four tubes of liquid having a maximum resistance of about 2, 4, 6, and 33 megohms respectively; all but one were furnished with adjustable wires by which their resistance could be diminished; two are charged with equal parts of water and glycerine, two with distilled water; each has a plug to throw the resistance out of circuit.

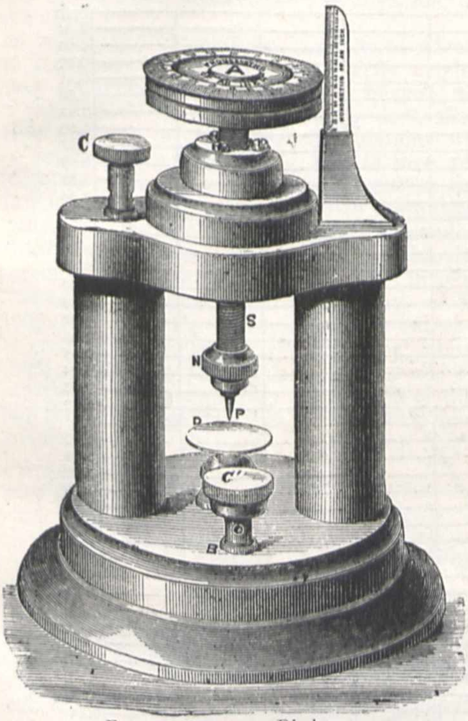

Fig. 4.—Micrometer Discharger.

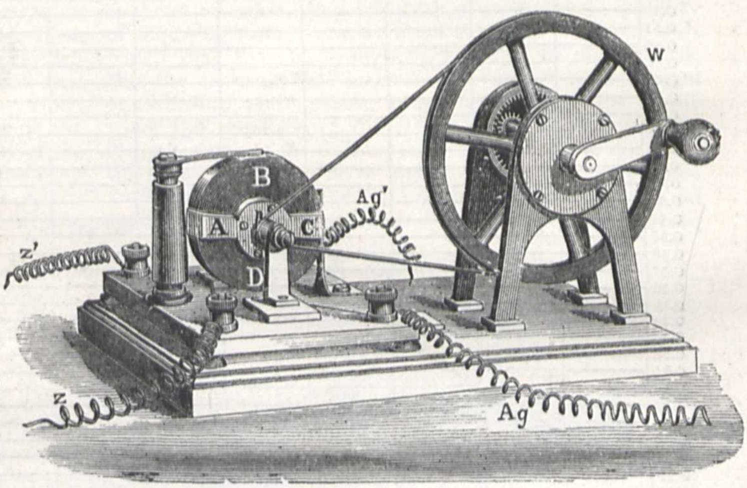

Fig. 5.—Rotating Commutator.

These resistances gradually diminish by the absorption of ammoniacal salts from the atmosphere, and this necessitates occasionally the entire renewal of the fluid.

As has been already stated, the paper deals principally with the discharge in gases at atmospheric pressure. Very elaborate series of measurements were made of the

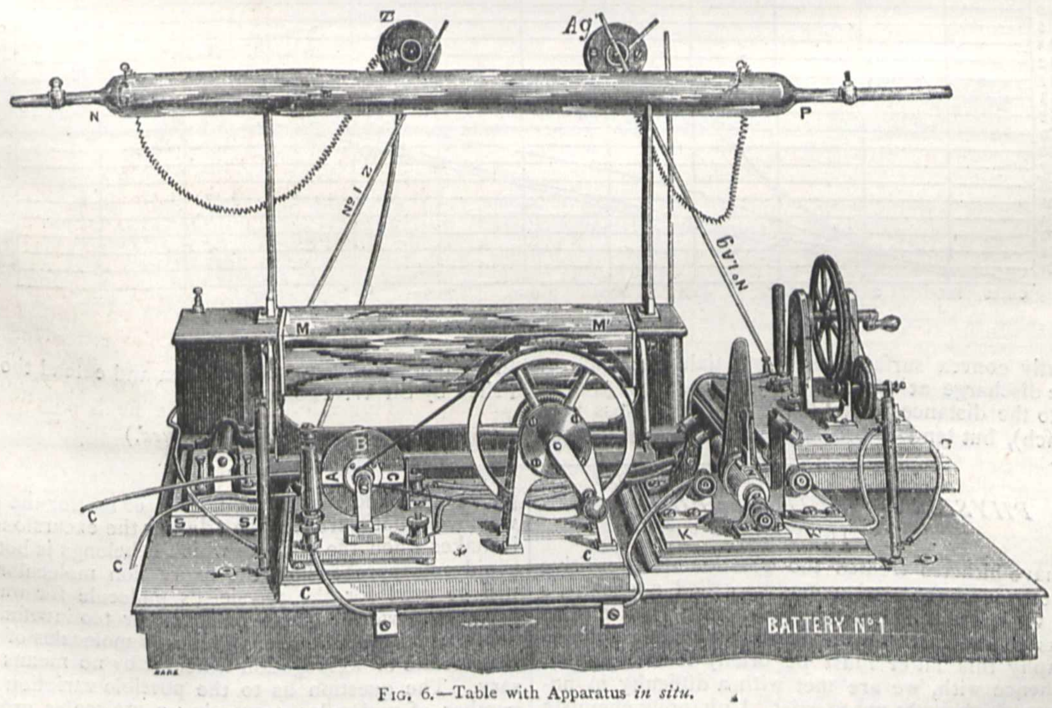

Fig. 6.—Table with Apparatus *in situ*.

potentials (*i.e.*, differences of potential) requisite to produce discharge at various distances between (1) plane surfaces, (2) spherical surfaces of 3-inch radius of curvature, (3) concentric cylinders, the diameter of the outer being constantly 0·4895 inch, that of the inner being varied from 0·4733 inch to 0·2865 inch, (4) a paraboloidal point and a disc, (5) paraboloidal points. The results of each series are clearly set forth in the tables and plates which accompany the original memoir; here we have only space for a diagram (Fig. 7) giving a comparative view of the mean curves of all the measurements.

An inspection of the diagram will show that with plane

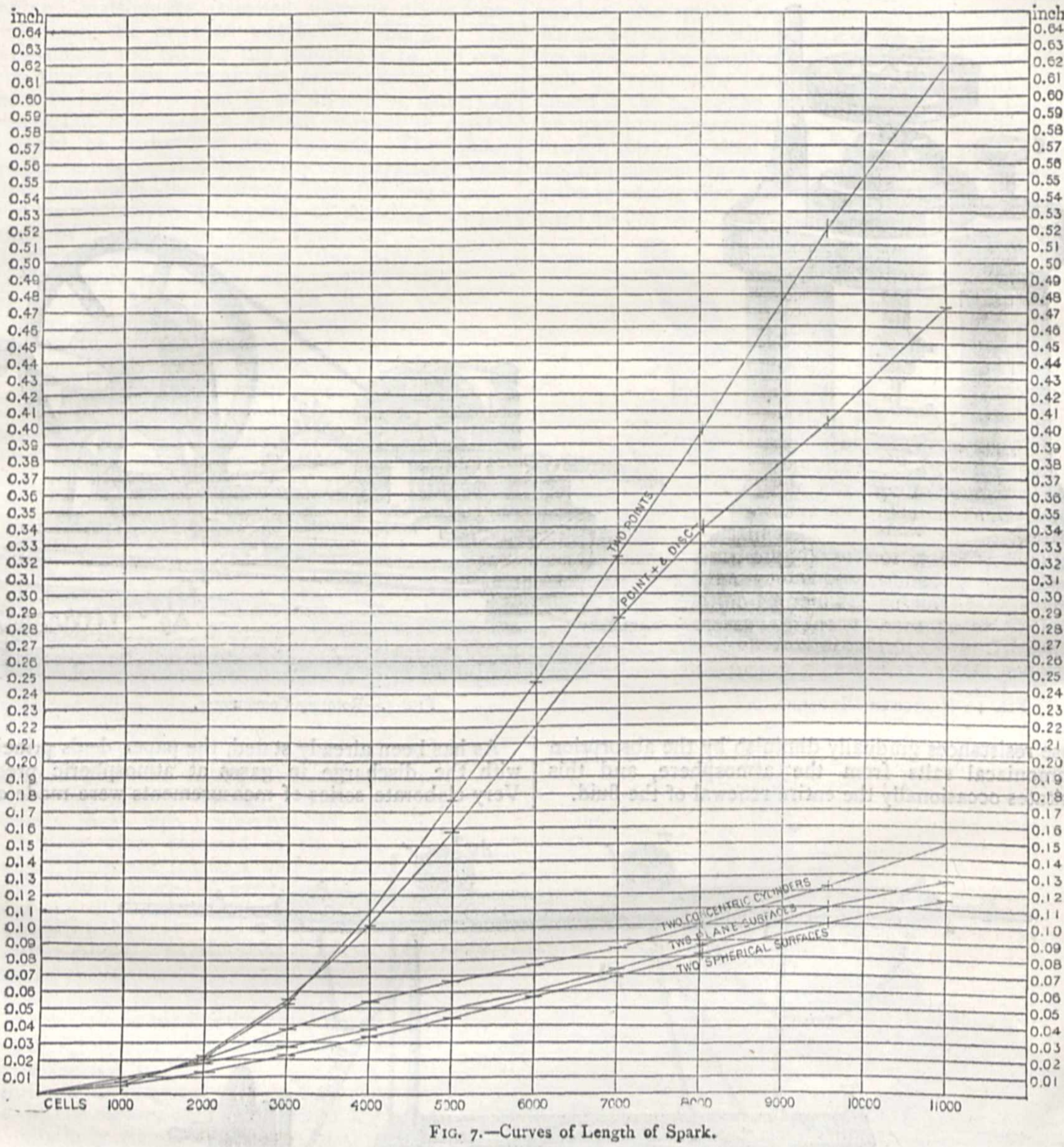

FIG. 7.—Curves of Length of Spark.

or slightly convex surfaces the potentials necessary to produce discharge at various distances are not proportional to the distances when these are small (less than 0·025 inch), but tend to become so as the distances are increased. These results confirm and extend those published by Sir W. Thomson.[1]

(To be continued.)

PHYSICS IN PHOTOGRAPHY[1]

II.

We have hitherto treated the question of a sensitive compound from what may be called a chemist's point of view, but it has also its physical aspect, and to enable us to understand what has recently been done in photography this latter must be briefly touched upon. To commence with, we are met with a difficulty in nomenclature which ought not to exist. Unhappily chemists and physicists employ the term molecule in a different sense. The physicist's molecule, for instance, in one place is defined[2] as "a small mass of matter the parts of which do not part company during the excursions which it makes when the body to which it belongs is hot." To avoid misapprehension the expression molecular group will be used for the physicist's molecule for want of a better, the word particle being rather too indefinite, and being usually applied to a group of molecules of visible size, a state of aggregation which is by no means necessary. The question as to the possible variation of the number of molecules composing a molecular group has not been entered into, as it would be trenching on ground

[1] Continued from p. 491.

[1] *Proc.* Roy. Soc., vol. x. pp. 326-338.

[2] "Theory of Heat," Maxwell.

which has been explored by others in relation to a different subject; but this may be stated as a matter of observation that some compounds of silver which are sensitive to light are capable of forming two molecular groups, one of which absorbs the blue rays, and the other the red rays.

The iodide and bromide are the salts of silver which, either separately or together, are chiefly employed for securing a developable photographic image; and it is these with which we shall principally deal, though the chloride and one or two other combinations will come under review when considering certain new phases in photography. The point to which attention must now be directed are the radiations to which these compounds are sensitive; and these are evidently dependent upon the absorption that takes place in them individually. If we take precipitated silver bromide and fuse it into a crystalline mass, and examine it spectroscopically, we find that it energetically absorbs all rays from the extreme violet to the green, and also less markedly in the yellow of the spectrum; whilst if we place a slab of it before the slit of the spectroscope, and photograph the spectrum of white light passing through it, we find that it completely cuts off the ultra-violet rays; so that we may say that the red and perhaps the ultra-red rays are the parts of the spectrum in which but slight absorption takes place. Now, since absorption means work done in the absorbing body, it is evident that we may expect some action to take place in the silver bromide when exposed to these rays; and the action may be a chemical change, or a rise in temperature, it being remembered that the latter may co-exist with the former, since it may be produced by the result of chemical action as well as by the absorption of the radiation. The question then arises, On what does the possibility of a chemical change in a compound depend? This is a question which is very easily asked but not so easily answered. It must evidently depend amongst other things on the capability of the molecules of the compound to throw off some atom or atoms; or on their capability of acquiring some vibrating atom or atoms of a body with which they may be brought in contact; in other words, that the molecule shall be in a state verging on indifferent equilibrium, and seeking rearrangement of the atoms when the impulses of the waves forming the radiations impinge against it. Taking for granted that the chemical theory of the formation of the photographic image holds good, we know that the atom of the halogen is thrown off from the molecule of the silver compound, leaving

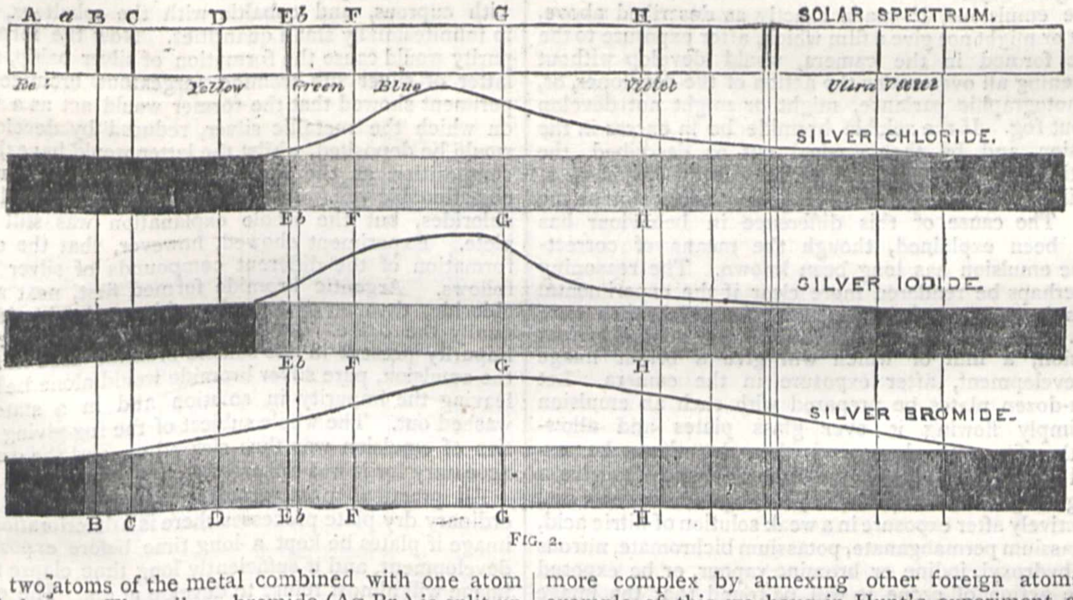

Fig. 2.

behind two atoms of the metal combined with one atom of the halogen. Thus silver bromide (Ag_2Br_2) is split up into argentous bromide (Ag_2Br) and bromine. If a film of the yellow sensitive salt be exposed to the spectrum an image is developed on all the parts which it absorbs, in other words, absorption in this case means chemical action. Similarly with the iodide where the absorption of radiation is most energetic there we have a chemical change. With the chloride we have a different phenomenon; crystalline chloride is nearly colourless, and the absorption of every part (though not necessarily of the invisible regions) of the spectrum must be nearly equal, but we find that this salt is sensitive only to about the same radiations, under ordinary conditions, as the iodide. An explanation of this will be offered at a more advanced stage of these articles, but it may be as well to note the fact now. In the accompanying diagram the ordinary results of the exposure of the three chief silver compounds to the spectrum are shown (Fig. 2).

When we obtain a molecular grouping in which the red is absorbed, we may expect that the same chemical change may take place as when in the former state. This is not a necessity, since, instead of a reduction to a less complex form of molecule, the new compound, formed by the aid of light, might be rendered more complex by annexing other foreign atoms. An example of this we have in Hunt's experiment, already quoted; where it is evident that the violet subchloride would be sensitive to light if it were proved that light alone caused the absorption of oxygen. Again, in the combination of chlorine and hydrogen, when exposed to light, we probably have a greater complexity of molecular structure introduced.

In the ordinary state in which silver bromide is formed in a collodion film (we will take this compound as it is this one which has been principally examined), we have it in the state in which the blue is absorbed and the red transmitted; but there are means by which it may be made to absorb the red. We may obtain the bromide in either state by what is known as the "*emulsion process.*" Briefly, this process may be described as one in which an emulsion of silver bromide is formed in a viscous liquid, such as collodion or a solution of gelatine, by first dissolving a soluble bromide in it and then adding to it a solution of silver nitrate. The particles of solid bromide thus formed remain suspended in the fluid. In the emulsion with collodion we can get the silver bromide in various states according to the rapidity with which we add the silver nitrate. Thus if we add it rapidly, we get a mass of silver bromide which is coarse and has a tendency to subside, and which, when poured upon a glass plate and dried, gives a film transmitting white light; whilst if we add it drop by drop and shake it up between each addition, we find that the bromide remains suspended for days, and that a film of it transmits orange light. If we take the emulsion, however, as first described, and place it in a still, and bring it to a state of ebullition, distilling over the ether and alcohol solvents of the collodion, thus breaking up the heavy particles of the suspended bromide, and then wash the contents of the flask in water to get rid of all soluble salts (which must necessarily exist owing to the double decomposition of the soluble bromide and the silver nitrate), we shall find, on redissolving the mass, after washing with alcohol, that the film will transmit lavender or a sky-blue light. On the other hand if the solvents from the emulsion which transmits the orange light be allowed to evaporate spontaneously and the solid residue be then washed and redissolved, the film will still transmit red light. It will thus be seen that silver bromide may be secured in two states *in one of which it principally absorbs the blue and in the other the red.* The chances are that the former is sensitive to the less refrangible rays of the spectrum, whilst the other is only sensitive to the more refrangible rays.

The emulsions, if made exactly as described above, might or might not give a film which, after exposure to the image formed in the camera, would develop without blackening all over under the action of the developer, or, in photographic parlance, might or might not develop without fog. If the soluble bromide be in excess in the emulsion, and be then washed out as described, the sensitive films would be free from this evil, whereas if the silver nitrate were in excess, this would not be the case. The cause of this difference in behaviour has lately been explained, though the means of correcting the emulsion has long been known. The reasoning will perhaps be rendered more clear if the experimental proofs be recounted in the order in which they were made. We must suppose that we have at hand a perfect emulsion, a film of which will give a bright image on development, after exposure in the camera. Let half-a-dozen plates be prepared with such an emulsion by simply flowing it over glass plates and allowing the films to dry; and then let these be exposed in the camera for the time necessary to give a strong image on development. Let the plates be immersed respectively after exposure in a weak solution of nitric acid, of potassium permanganate, potassium bichromate, nitrous acid, hydroxyl, iodine or bromine vapour, or be exposed to the action of ozone, it will be found that the image impressed by light will steadily refuse to develop, however much it may be coaxed; or again, if another half-dozen plates be prepared and be exposed to light external to the camera, we know if exposed to the lenticular image after such treatment, that we might obtain an image on development, but that it would be obliterated by the veil induced by the preliminary exposure. If between the preliminary exposure and exposure in the camera the plates be treated with any of the above solutions or vapours, and be then washed, we should find the impressions of light in the camera would yield images perfectly free from the veil. In other words the treatment of the film with any of these solutions will destroy the effect of the action of light. Now as we have already shown, the image is formed of silver sub-bromide; hence we may say that the treatment has changed the sub-bromide to an undevelopable compound. When exposed to iodine or bromine the sub-salt will naturally become converted into the primitive salt, but when we look at the nature of the other destructives, we cannot but be struck with the fact that they are either solvents of metallic silver or oxidising agents. In the first case we may presume that the loose atom of the silver of the sub-bromide (Ag_2Br) is dissolved away and converted into some other form of silver, leaving behind the half molecule of bromide, and in the other we may presume that the sub-bromide is oxidised to form an oxy-bromide of silver.

With this fact as a starting-point, it appeared probable that the elimination of a veil due to an emulsion ought to be effected by the same agents as if the veil occurred through the action of light. It was well known that in order to get an emulsion perfectly free from this enemy that chlorine, bromine, iodine, or some diad chloride or bromide were necessary to be added to the washed emulsion if the silver nitrate were in excess at first, and that nitric acid had the same effect if added to the emulsion with the silver nitrate. Here, then, seemed to be the proof of what was wanted, but another link was still required to make the reasoning complete. In making an emulsion if the soluble bromide was in excess none of these agencies were required. The question then arose as to why this was the case. To clear this up a fair hypothesis was taken, viz., that no soluble bromide was absolutely free from contamination. If the bromide were of the alkalis or some of the metals such as zinc, it was probably contaminated with the oxide, whilst with other diad metals it was probably of the lower form of bromide. Thus cupric bromide was probably contaminated with cuprous, and cobaltic with the cobaltous, though in infinitesimally small quantities. Now the former impurity would cause the formation of silver oxide, and the latter of silver sub-bromide (argentous bromide). Experiment showed that the former would act as a nucleus on which the metallic silver, reduced by development, would be deposited, whilst the latter would have the same composition as the latent image and thus induce the objectionable veil. The same reasoning applied to the chlorides, but the whole explanation was still incomplete. Experiment showed, however, that the order of formation of the different compounds of silver was as follows. Argentic bromide formed first, next argentic chloride, then argentous bromide and chloride, and finally the oxide. If, then, there was but little of the impurity present in the soluble bromide used in forming the emulsion, pure silver bromide would alone be formed, leaving the impurity in solution and in a state to be washed out. The whole subject of the fog-giving properties of emulsion was thus cleared up, and the correction necessary for it was apparent.

All practical photographers are aware that in the ordinary dry plate processes there is a deterioration of the image if plates be kept a long time before exposure and development, and if sufficiently long time elapse that the image will almost refuse to develop at all. The question arises why this obliteration of a developable photographic image takes place? We have seen how an image can be destroyed artificially by the use of oxidising agents, and we might naturally infer that the same destructive agency might obliterate the image even when the oxidising agent is merely ordinary air, and after considerable experimental proof we are compelled to come to the conclusion that this is the case, more especially when it is found that any readily oxidisible matter, such as gallic acid, if applied in solution and dried in contact with the sensitive film, preserves the image for a longer period than if this precaution be omitted. The oxidisable matter has to be oxidised before the image itself is attacked, for we may assume that the image itself is not as readily oxidisable as such bodies as that mentioned, and many others. The fact that the image can be oxidised and thus destroyed, seems to disprove the once held opinion that the undeveloped image was formed of metallic silver, a body which will tarnish but not oxidise, the pure oxides being unstable.

As a sequence to the destruction of the photographic image by oxidation, the hitherto unexplained results which Draper obtained when photographing the spectrum were examined. Briefly it may be stated he found that if a spectrum was allowed to fall on a sensitised daguerrotype plate, which had received a preliminary exposure to white light, a remarkable phenomenon took place—a phenomenon which was also observable if weak white light were allowed to fall on the plate during its exposure to the solar spectrum. In developing such an image with mercury vapour, the blue, or most refrangible end of the spectrum was impressed in the usual way, that is to say, the Fraunhofer lines showed as dark lines on a lighter back-ground; at the red or least refrangible end of the spectrum, however, the Fraunhofer lines were seen as light on a darker back-ground; in other words, the photographic action was reversed, the neutral point of no action lying somewhere in the yellow. On studying a picture taken by this means, it was observed that in all cases the darkest Fraunhofer lines had the same tint, and that effect of light lines upon dark background, or dark lines upon the light background, were caused by alteration in tint of the background itself. Could this effect have anything to do with the oxidation? if it had it would indicate that the rays in the least refrangible end of the spectrum must *accelerate oxidation*; for it must be remembered that the plates had received an exposure to white light, either before, or during, exposure to the spectrum, and that the red rays prevented the development of the effect of the white light.

Now Draper had failed to get the same result on films of collodion containing the sensitive silver compounds, though he had obtained the reversal of the least refrangible end of the spectrum on such plates. If the theory

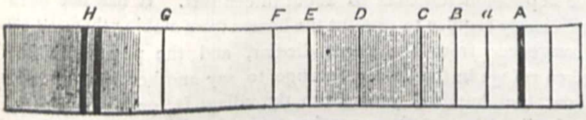

FIG. 3.

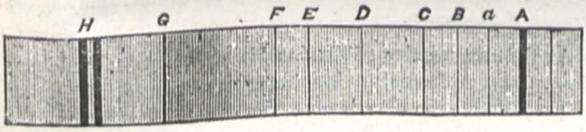

FIG. 4.

of oxidation held good for daguerrotype plates it ought also to hold good for the collodion films, and experiment decided once again in favour of the theory. Collodion films, which held *in situ* the blue form of silver bromide already alluded to, and which had been proved to be sensitive to the red end of the spectrum in the ordinary sense of the word (*i.e.*, that a proper negative picture of it could be obtained as it could of the blue end), were the subjects of experiment. It is evident, if the red rays were accelerators of oxidation, that in order to get a positive picture of the red end (*i.e.*, one answering to the reversal of the Fraunhofer lines in Draper's daguerrotype plates) the films should be exposed to the spectrum whilst in some oxidising medium, weak enough by itself, not totally to obliterate during the time of exposure to the spectrum any preliminary exposure which should be given to them, and yet strong enough to do so and to destroy the reducing action of the red rays, if these latter possessed a power of accelerating oxidation. Ozone, hydroxyl, nitric acid, and other oxidising agents, completely corroborated the idea that all the red rays had the power of accelerating oxidation, as the positive pictures of the red end here obtained, and in some case of the blue end, with negative pictures of the yellow and ultra-violet. The strength of the oxidising solutions was very small; thus, when nitric acid was used, four drops to a couple of ounces of water was found sufficient to cause this remarkable action to take place, whilst if the nitric acid were reduced in quantity, or omitted altogether, the effect of the ordinary negative picture was obtained in that part of the spectrum (Figs. 3 and 4). On the other hand, when the strength was increased, the image disappeared altogether. Figs. 3 and 4 show the results indicated above; the shaded portions show where the spectrum was photographed in the usual way, the white portions indicate where the reversed action took place.

We are not sure but we believe that Draper used silver iodide as his sensitive salt in the experiments with collodion, in which he failed to obtain these phenomena. The iodide is insensitive to the red end of the spectrum under ordinary conditions of exposure, being usually exposed in the presence of a solution of silver nitrate which clings to it after taking it out of the bath. It was found, however, if this free silver nitrate were washed away and if the exposure to the spectrum took place in the oxidising medium, after a preliminary exposure to white light, that this reversing action, as it is called, of the red end of the spectrum was obtained; and under certain conditions if the silver nitrate were removed, that the same results could be obtained even when the plate was not exposed in this oxidising medium.

Now regarding the reversal in the blue indicated above how can it be accounted for? By the very same theory, only an abandonment of the hypothesis that the least refrangible end of the spectrum *alone* is an accelerator of oxidation becomes necessary. In all comparative experiments made with the daguerreotype plate and the collodion film the difference of these conditions must be remembered. In the former the halogen liberated by the action of the light on the iodide combines immediately with the metallic plate forming fresh sensitive compound; in the latter the thickness of the sensitive compound has a limit, and much of it is altogether inoperative, the outside of the particles alone being available for the reducing action of light, and the halogen has to escape or be absorbed as best it may. In a collodion film it is manifest that the reduction of all the sensitive compound available must take place after a time, and when this is the case, if the same rays which effect reduction likewise accelerate oxidation, that the latter effect of the rays will have unimpeded action. So much for the theory, does experiment prove or disprove it? It is evident if the hypothesis be correct, that a film which is exposed to the action of light in a medium free from oxygen, or in one which is an absorbent of oxygen, should be incapable, on development, of showing this reversal of the ordinary action of light.

The results again showed that the theory was borne out, for it was found impossible to obtain a reversal of the image when so exposed. Here, then, we have a probable explanation of the phenomenon known as solarisation, to which allusion has already been made; it seems to be an oxidation of the undeveloped image.

W. DE WIVELESLIE ABNEY

(*To be continued.*)

NOTES

DR. O. FINSCH has resigned his appointment as Custos of the Museum of Bremen, and, as soon as the publication of his work on the results of the German Siberian Expedition of 1877 is completed, will leave Europe on a scientific mission to the Pacific and Australia. Dr. Ludwig, late Assistant in the Zoological Museum of Göttingen, has been appointed Dr. Finsch's successor.

WE notice the death at Cuenca, in Ecuador, on June 20, of Gustav Wallis, the botanist. He was born at Luneberg, in Detmold, May 1, 1830. In 1860 he was commissioned by the Lindens, the great horticulturists of Brussels, to gather new varieties of plants in South America, and during eight years, almost without cessation, he traversed Brazil, Peru, Ecuador, Bolivia, Columbia, Panama, and Costa Rica, making everywhere enormous botanical collections. A similar journey to the Philippine Islands under the auspices of Veitch and Co., of London, followed in 1868, but in 1871 he was back again in his favourite field, the north-western portion of South America. Here he met his death in a hospital, reduced to poverty, and fairly worn out in the cause of science. Wallis stood fairly first among the travelling botanists of our day, possessing a rare combination of courage, energy, and scientific training. Not only were his contributions to botany of great value, but he actually introduced into European horticulture no less than 1,000 new varieties from across the ocean, and no small portion of the brilliant treasures of our modern conservatories are due to his unwearied zeal.

THE American Association met, under the presidency of Prof. O. C. Marsh, at St. Louis on August 21 and following days, and, judging from the reports that have reached us, the attendance was not quite up to the average, St. Louis having a bad reputation on account of its heat, this year aggravated by the dread lest the yellow fever might extend up the Mississippi Valley to the meeting-place of the Association. Vice-president Thurston gave the introductory address "On the Philosophic Method of the Advancement of Science," in which he traced the history of scientific research from early times, and advocated the establishment of a systematic method for discovering competent scientific writers, and endowing them adequately for the pursuit of research. Mr. A. R. Grote gave an address entitled "Education, a Succession of Experiences." Mr. Edison was present at the meeting for a short time and met with an enthusiastic reception; he read a paper on some of his inventions. A committee was appointed to arrange for a eulogy on the late Prof. Henry. We see from the neatly got-up *Daily Programme* of the Association that upwards of 100 papers were down to be read. We hope to give an account of the principal papers in an early number. The Association meets next year at Saratoga, on the last Wednesday of August, Mr. G. F. Barker of Philadelphia, president.

AT the recent International Congress of Anthropology several interesting reports were read by specially appointed reporters. M. Thulié gave a report on anthropological societies and education in anthropology. In tracing the history of anthropological societies in France and England, he showed the gradual progress which had been made in the objects and method of the science. M. Topinard's report was on astronomical, biographical, and pathological anatomy. He divided anthropology into general and special—the former embracing the human group as a whole and in its relation with the lower animals, the latter department being entitled "Zoological Anthropology;" special anthropology or ethnology investigates natural divisions, primitive or secondary, called *races*. Another division was into anatomical, biological, and pathological anthropology. Ethnographical reports were given by M. Girard de Rialle on Europe, Central and Western Asia, and America, and by M. Bordier on Africa, Eastern Asia, and Oceania. M. de Rialle called attention to the magnificent museums in the northern European countries, Sweden, Finland, and Russia, as contrasted with France, and still more markedly, we might say, with England. These reports were illustrated by reference to the fine collections shown at the Paris Exhibition. There were two reports in the department of prehistoric archæology, one by M. de Mortillet on geological times, and the other by M. Cartailhac on the neolithic period. In the report on demography (a sort of statistical anthropology), by M. Chervin, he gave a beautiful example of a statistical study by Dr. Berg, of the Swedish Statistical Bureau, who traces the influences of the Swedish wars between 1795 and 1810, generation after generation down almost to the present day. Dr. Lebon read an instructive paper on the results of his experimental researches on the variation of volume of the cranium in their relations to intelligence. He showed that intelligence was proportionate to the volume of the cranium, and that among the higher races the difference between the size of individual crania is less than among inferior races. A curious result is that among the women of the inferior races the cranium is generally larger than among those of the superior races; this result he ascribes to the insignificant part allotted to females in the active work of civilised society.

AMONG the resolutions passed by the International Congress on weights, measures, and coins, at Paris, was the following:—"The Congress learns with pleasure the progress of the metric system; it deplores that England, Russia, and the United States have not yet entered into the same path; and it is of opinion that the Governments of those countries should be solicited to give effect as early as possible to an act of progress so eminently useful to science, commerce, and international relations." The British and American members had a separate meeting, and resolved to petition their respective Governments to appoint a mixed Commission to consider the adoption of the metric system by both countries, and to make all necessary recommendations for the proper legislation to secure the desired end.

THE *Gazetta d'Italia* recounts a somewhat remarkable change in the surface of the earth at the village of Ortagli, a short distance south-east of Florence. In the course of a few days the tract on which the village stands has gradually sunk, until the depression amounts to about fifteen feet. It has not been sufficiently regular to prevent the houses from making threatening divergences from the perpendicular, and the population has taken refuge in the field. Strange to say another tract of land about two hundred yards from the village is, on the contrary, gradually rising, at times nearly rapid enough to be noticed with the eye. Several Italian *savants* are on the ground studying the strange phenomenon.

AT the next meeting of Russian Naturalists at St. Petersburg the question of chronology is again to be ventilated, with a view of proposing to the Government the change of date from the old style, now in use in Russia, to the new style used everywhere else in Europe and abroad.

ADMIRAL MOUCHEZ appointed two days every month when the Paris Observatory might be visited by the public, but the number of requests increase so much that he has been obliged to establish supplementary visits. On Saturday, September 7, the number of visitors exceeded a thousand. Admiral Mouchez intends giving a great *soirée* at the Observatory, on which occasion all the celestial objects drawn from nature by a clever artist will be shown with a magic lantern. He has asked from the Ministry of Public Instruction the loan of a portrait of Louis XIV., the founder of the Observatory. This portrait will be placed in the large saloon and surrounded by the portraits of Lalande, Laplace, Arago, Leverrier, and other great astronomers whose names have been associated with the establishment.

A COMMISSION was some time since appointed to report on the great reflector which Leverrier discovered to be imperfectly polished. The Commission has examined the instrument carefully, but unfortunately drawn up an ambiguous report, so that Admiral Mouchez is said to be left in a most perplexing position. The report does not say clearly that the instrument is good, but at the same time it gives no authority to reject it and to have it polished again. The perplexity is enlarged by the incertitude on the results of works in course of execution. The polishing of the glasses of the large refractor has been placed in the same hands in pursuance of a contract signed by Leverrier long ago. It is expected that at the next meeting the Council of the

Observatory will give to the director the means of protecting efficiently the interests of Government and science.

MOUNT VESUVIUS is showing visible signs of agitation. An overflow of lava is considered probable on the side towards the Observatory.

AT a meeting of the Sunday Society a report was read from Mr. W. E. A. Axon, hon. secretary of the Manchester and Salford branch, announcing that, after a debate which had extended over three meetings, the City Council had, by a majority of 28 against 20, acceded to the memorial from the Sunday Society, and decided to open the several free libraries of the City on Sunday afternoons. Much satisfaction was expressed with Mr. Axon's report, and on the motion of Mr. Mark H. Judge, seconded by Mr. Frederick Long, a resolution was unanimously passed thanking the branch for the energy they have exhibited, and congratulating them upon the success they have achieved. The libraries were opened last Sunday for the first time.

ONE of the large monkeys at the Alexandra Palace had been for some time suffering from the decay of the right lower canine, and an abscess, forming a large protuberance on the jaw, had resulted. The pain seemed so great it was decided to consult a dentist as to what should be done, and, as the poor creature was at times very savage, it was thought that, if the tooth had to be extracted, the gas should be used, for the safety of the operator. Preparations were made accordingly, but the behaviour of the monkey was quite a surprise to all who were concerned. He showed great fight on being taken out of his cage, and not only struggled against being put into a sack prepared, with a hole cut for his head, but forced one of his hands out, and snapped and screamed, and gave promise of being very troublesome. Directly, however, Mr. Lewin Mosely, who had undertaken the operation, managed to get his hand on the abscess and gave relief, the monkey's demeanour changed entirely. He laid his head down quietly for examination, and, without the use of the gas, submitted to the removal of a stump and a tooth as quietly as possible.

THE *Daily News* Roman correspondent writes that from his villegiatura at Rocca di Papa, the archæologist Prof. Michael Stephen de Rossi, sends to the *Voce della Verità* an account of the earthquake that occurred there on the 3rd inst. At 11.13 P.M. of that day the inhabitants of the village were aroused by the very distinct shock of an earthquake, which was at first jerking, then undulatory in its movement, in a north-west south-east direction. The jerking lasted three seconds, but the undulatory stage occupied a considerable interval of time. In the seismographs the jerking stage of the phenomena was very strongly registered. What merits attention is that this shock coincided with a rise of the barometer,—at the close, that is to say, of an atmospheric storm. It happened when the temperature had barely reached its maximum for the season, thereby coinciding with the phenomena that took place on August 24 of last year. This earthquake was not unforeseen, although it was the first very perceptible one of which they have had experience this season. Already from August 24 there happened slight shocks, and sometimes they were felt even in Rocca di Papa. The instruments, particularly the tronometer, were continually agitated. On September 3 between 11.30 A.M. and 12.30 P.M., Prof. de Rossi counted eleven slight shocks, the most perceptible of them being that which occurred at 12.10 P.M. It was jerking on the 4th, the instruments being agitated in the most extraordinary manner, principally at 11.40 A.M. and between 2 and 5 P.M., at which time he also noticed two very tiny shocks. In the interval between August 24 and September 6 there were also felt some subterranean murmurs, for the study of which Prof. de Rossi did not, he regrets to say, put the microphone in operation. This wonderful instrument was scarcely dreamt of when he published his opinion that it could be applied to the observation of even the microphonic sounds which may accompany not only earthquakes but also microseismic movements. In fact, Count G. Mocenico, of Vicenza, tried for the first time to apply it for this purpose, with the result of hearing the most mysterious sounds which are produced under our feet in the depths of the earth. Prof. de Rossi ventures on no speculation as to the continuance and close of the actual seismic period. It is certain, however, he states, that it is found in strict relation with the extraordinary drought, of which, perhaps, as in the past year, it is the result.

WE have received a neat and well-illustrated guide-book to the new aquarium which has been opened in Princes Street, Edinburgh, under the direction of Dr. Andrew Wilson. The institution is intended to be utilised for instruction as well as for amusement, and in winter it is Dr. Wilson's intention to deliver occasional lectures of a popular kind adapted especially for school-children, who will thus, it is hoped, be incited to study natural history practically, or at least to take some interest in their living surroundings. When the arrangements are thoroughly completed it is hoped that a naturalist's table and small laboratory may be instituted. The directors, we are informed, appear to encourage as far as possible the educational features of the institution. We trust the institution will prove a success, and turn out an important addition to the educational resources of Edinburgh.

WE understand that Messrs. Chatto and Windus have in the press a volume of Essays and Lectures on Biological Subjects, by Dr. Andrew Wilson, of the Edinburgh Medical School. The work, under the title of "Leisure Time Studies," will be fully illustrated; some of the more prominent essays dealing with the relations of science teaching to ordinary education.

MR. W. S. SONNENSCHEIN will publish this year an English translation of Naegeli and Schwendener's well-known work, "Das Mikroskop. Theorie und Anwendung desselben," made by Mr. Frank Crisp, LL.B., B.A., Hon. Sec. to the Microscopic Society, and the publisher himself. The translation will be made from the last German edition, and will be supervised in part by Prof. Schwendener himself. The last chapter of the original (on Morphology) will be omitted, as having no reference to the microscope.

A GENEVA correspondent sends us a photograph showing the effects of lightning on an aspen (*Populus tremula*), situated in a wood near the Château of Crans on the shore of the Lake of Geneva. It was struck on August 9 last, in circumstances confirmatory of the views of Prof. Colladon (NATURE, vol. xvi. p. 568). The lightning chooses by preference the poplar as a conductor to reach the ground, and the case is striking here, where the tree is surrounded by other kinds, particularly firs, taller than it. Two great branches, of forty-five and fifty centimetres in diameter, which surmounted it, were struck by the lightning, and led it to the ground without having received the least apparent injury, while the trunk below them is absolutely shattered. This is a fresh proof that the upper part of trees, especially of poplars, is an excellent conductor of electricity, which only rends or shatters the wood when it finds a passage in the trunk. Other recent observations prove the preference of lightning for trees situated near streams or reservoirs of water, so that the best conductor for a house is a lofty tree, a poplar especially, situated between the house and a well, a pond, or a neighbouring stream.

AN interesting establishment was opened in the Champ de Mars, Paris, close to the École Militaire (within the precincts of the Exhibition), a few weeks ago, and deserves notice. It is a technical library for French authors which now numbers more than 3,000 volumes. This library will be made permanent, and established somewhere in Paris when the Exhibition is over. It was originated by M. Tresca, the sub-director of the Conservatoire des Arts et Métiers.

THE weather being magnificent in Paris, the Giffard captive balloon takes up daily 500 passengers, paying twenty francs each, exclusive of a large number of *invités*, two aeronauts, and meteorological observers. M. Giffard has received propositions from the New York *Daily Graphic* for the purchase of his balloon, but he has declined; it will probably become a permanent institution in Paris.

THE Russian Technical Society at St. Petersburg has commenced the publication of polyglot technical dictionaries. The French-Russian-German-English part has just appeared.

THE rage for exhibitions has now spread even to Central Asia. The latest news from Tashkent states than an agricultural and industrial exhibition is about to be held there. Great preparations are being made for it at Samarcand, and the Government has promised gold and silver medals to the exhibitors as well as —honorary Kaftans!

WE recommend to all who have anything to do with the management of schools, two lectures by Dr. Liebreich, which have been published by Messrs. Churchill under the title of "School Life in its Influence on Sight and Figure."

THE botanist Fournier finds in Mexico 638 varieties of grasses, of which 376 occur in no other land. Of the remainder 82 are found in the United States, 30 on this side of the Atlantic, and the rest in the West Indies, South and Central America.

DR. AHLBERG describes, in Neubert's *Deutsches Magazin*, the Japanese flora as being at the height of its beauty in May. None of the great families is without its representatives, although as usual the Cruciferæ, Compositæ, Papilionaceæ, Ranunculaceæ, and Umbelliferæ predominate. The forests are marked by a variety of maples, numerous representatives of the oak, and a large number of varieties of ilex.

UNDER the title of "African Poisons" the *Journal of Applied Science* for the current month has some notes on the poisonous properties of a species of *Strychnos* and on the Inée poison (*Strophanthus hispidus*). Regarding the former it seems to be employed as an ordeal by the natives in Gaboon under the names of "Cusa" or "Icaja," and at Cape Lopez by that of "M'boundou." The plant producing it is described as growing in swampy or inundated situations, and attaining a height of only from four to six feet. The root is long and tapering, and is covered with a red bark, and it is from this bark that the active principle is obtained. The root-bark is scraped off and steeped in about a quart of water. When the water has acquired a reddish colour the poison is ready. According to the recent investigations of Messrs. G. Picholier and C. Saint Pierre the toxical principle of M'boundou is soluble in water and alcohol, and has a mode of action analogous to nux vomica, that is to say, acting on the sensitive nervous system. It only in a secondary degree affects the active nervous system. It is suggested in the article from whence the above information is obtained that it would be interesting to compare the M'boundou with the hoang-nan (*Strychnos gautheriana*) of Cochin China, which is employed in cases of leprosy and hydrophobia.

IN the British Section of the Paris Exhibition, amongst scientific instrument makers, the gold medal has been awarded to Messrs. A. Légé and Co., for their exhibit of instruments of precision and for the improvement of navigation.

WE learn that Parts I. and II. of Mr. Buchanan's work on "The Grasses of New Zealand," which is being published in the colony is on the eve of publication if it has not already appeared. These two parts contain twenty-one plates. The volume is large quarto and when completed will consist of five parts, and will contain fifty-five plates all native printed. It is said that Dr. Hector intends to bring out a reduced edition in octavo with the plates reduced by photo-lithography, and tinted. In this form it will be more handy and convenient than the original bulky volume.

THE Paris mint has published statistics on the value of pieces struck in the establishment from 1795, the date of its foundation, to 1878:—In gold, about 8,500,000,000 francs; in silver, about 5,510,000,000 francs; in copper, about 62,702,785 francs. Total value, 14,072,702,785 francs.

PROGRESS OF THE "CHALLENGER" REPORT[1]

AS a period of more than two years has now elapsed since the return of the *Challenger* expedition, I may very properly be expected to give some account to my scientific brethren of the progress which has been made up to the present time in the reduction and classification of the multitude of observations which were made in different departments, in the description and illustration of the natural history collections, and in the preparation of the official record of the voyage, which has been called for by government.

Before doing so, however, it may be well for me to sketch briefly the circumstances which led to the adoption of the plan now in operation for working up the results of the expedition, and putting them in a permanent form.

The voyage of the *Challenger* was undertaken for a very definite purpose, the determination of the physical and biological conditions of the ocean, and as the period of three years and a half occupied by our cruise round the world was quite too short even to draw the first outline sketch of general deep-sea conditions, our time was entirely devoted while the ship was at sea to registering observations, and cataloguing, and labelling, and storing specimens. Owing to the great liberality of the government in supplying abundantly all the necessary materials and appliances, an enormous collection of marine animals was sent home from time to time in wonderfully good condition. It was a matter of distinct understanding when I undertook the scientific direction of the expedition, that the responsibility not only of the conduct of the scientific work during its progress, but of the working out of its results at its close rested with me, and before the end of this cruise I was called upon by the Lords Commissioners of the Admiralty for a statement for their consideration of the course which I proposed to pursue both with regard to the publication of the results, and the ultimate destination of the specimens and other materials. Of course I had given this matter much careful thought, and I was in a position to submit to their lordships a general plan which commended itself to their approval, and which is now in process of being carried out unaltered. I proposed that for the time the collection should be placed in rooms which were given to us for the purpose in the University of Edinburgh, and that for the first year our attention should be chiefly directed to the preparation of an outline of the general report, and to the examination of the collection and its rough classification in zoological sequence; and that during this period the services of the gentlemen who had been associated with me on the scientific staff on board should be retained. I proposed that as soon as possible arrangements should be made to invite gentlemen who were recognised as authorities in different departments, and who had sufficient leisure at their disposal, to undertake the description of the zoological series, group by group, and that a sufficient sum should be granted to defray the expense of complete illustration and to compensate them to a certain extent for their expenditure of time.

With regard to the destination of the collection, I proposed that in the first place each specialist who undertook the description of a group should be requested to set aside all unique specimens

[1] "On the Progress which has been made in the Preparation of the Official Report of the *Challenger* Expedition." Paper read at the Dublin meeting of the British Association by Prof. Sir C. Wyville Thomson. Revised by the Author.

and the most complete series possible of all species of which there were duplicates to be sent at once to the British Museum, and that afterwards duplicates should be arranged in sets, and distributed to museums at home and abroad, according to a scheme to be sanctioned by their lordships.

Many considerations entered into the selection of the experts, into whose hands this vast collection of new material was to be placed. As I was solely responsible to Government for the general result, I was of course obliged to undertake this duty; but I rarely trusted my own judgment, acting in most cases with the advice and sanction of one or other, the weight of whose opinion on the special question at issue would be universally recognised. My sole object was to carry out the task intrusted to me to the best of my ability, and to prepare and to submit to Government the most complete report possible, and I asked the co-operation of men who, in my judgment, were the most likely to insure this result. I have to acknowledge, with profound gratitude, the frank readiness with which almost every appeal for assistance was responded to, and it is a matter of great satisfaction to me that the plan of work, which is the result of these arrangements, has elicited an expression of general approval from nearly all of those to whose opinion on such a question I attach the highest value.

From what I see at present the official account of the voyage of H.M.S. *Challenger* may be expected to extend to from fourteen to sixteen quarto volumes of 500 or 600 pages, the whole illustrated by about 1,200 lithographed plates, and many charts, woodcuts, and photographs. The MSS. of the first volume, which will contain a general account of the voyage, the hydrographic details contributed by Staff-Commander Tizard, the head of the Naval Surveying Staff on board, is nearly completed, and the charts of the ship's course and the sections showing the vertical distribution of ocean temperature which illustrate this volume, are in course of preparation. The second volume will consist chiefly of tables, and will include a report on the magnetic observations made during the voyage, drawn up under the superintendence of the Hydrographer to the Navy; and a detailed report on the meteorology, prepared by Capt. Tizard. The greater part of this volume is already in print, and I place before you a copy of the Magnetic Report, which will give an idea of the general appearance of the book.

Another volume will contain the discussion of the nature and composition and source of the deposits forming at the bottom of the sea, the composition and specific gravity of the sea-water, and the proportions of its contained gases, and sundry other questions, chemical and physical; and the remainder of the work will be occupied by a series of memoirs by different authors on the various groups of animals which constitute the deep-sea fauna. A large number of these monographs are in progress, and I hold in my hand a series of about 150 plates of natural objects which are now on the stone.

Only one department is finished; and I have here to record my special obligation to my friend Mr. Thomas Davidson for a most complete and thorough memoir on the *Brachiopoda* of the expedition. Mr. Davidson has not only figured all the species himself with the utmost care, but he has added to his descriptions of the *Challenger* forms a discussion of the relations which they bear, in structure and distribution, to all other known living forms, which greatly enhances the value of his monograph.

The illustration of the *Foraminifera* has been undertaken by Mr. Henry Brady, and a rapidly-thickening pile of plates testifies to the diligence of his artist, Mr. Hollick.

This plate represents several forms of a remarkable little group of Rhizopods in some ways intermediate between the Foraminifera and the Radiolaria, to which we have given the name *Challengerida*, as the twenty or thirty species of which the group is composed seem hitherto to have escaped observation.

A splendid memoir by Prof. Haeckel, on the *Radiolaria*, is in progress, and will be illustrated by upwards of a hundred plates. Everyone acquainted with Haeckel's classical work, "Die Radiolarien," will appreciate our good fortune in having secured his co-operation.

The next series of plates prepared under the direction of Mr. Moseley represent the deep-sea corals, and the next series, also by Mr. Moseley, illustrate a most remarkable series of coralloid forms of *Hydrozoa*, on whose structure and relations Mr. Moseley's careful work during the voyage and since our return has thrown quite unexpected light. The normal *Hydrozoa* are in the hands of Prof. Allman, but owing to our having already secured for other departments the services of nearly all the available British artists experienced in natural-history drawing, he has not been able as yet to make much progress. Prof. Haeckel will describe the deep-water *Medusæ*, few in number, but of the highest interest.

Echinodermata are very abundant in the abyssal region. I have undertaken to describe a portion of the first class of this type, the Stalked Crinoids, and upwards of twenty plates are on the stone, illustrating their structure. The drawings are by Mr. William Black, one of the most successful students in the Edinburgh School of Art under the Science and Art Department, and now an accomplished natural-history draughtsman. And Mr. Herbert Carpenter takes up the *Comatulidæ*, a group rich in undescribed species, which he is studying, along with the valuable collection procured by Prof. Semper in the Philippines.

Prof. Alexander Agassiz is progressing rapidly with the *Echinidea*, and his monograph, exquisitely illustrated as all these American memoirs are, will probably be among those first finished. Mr. Lyman is working at the *Ophiuridea*, which he says are very numerous and almost all new, and I expect Mr. Théel, of Upsala, to come over shortly to examine the *Holothuridea*, which he is going to describe under the general superintendence of Prof. Lovén. The Swedish Arctic Expeditions have already yielded some of the most characteristic abyssal forms of this group, and these we know through the excellent memoirs of Mr. Théel.

This bundle of beautiful plates drawn under the eye of Mr. Busk, illustrate the *Polyzoa*, a group which descends to the greatest depths, represented by many undescribed and characteristic genera.

Dr. McIntosh is working out the *Annelida*, and will require a volume to himself, while several hands are occupied with the *Crustacea*, Mr. Spence Bate taking the heaviest part of the work in the *Macroura*, Prof. George Brady describing the *Copepoda* and *Ostracoda* with many beautiful plates, some drawn by himself and others with the assistance of artists; and Prof. Huxley dealing with the *Anomoura*, which some of his recent investigations have given for him a special interest. Mr. R. Boog Watson undertakes the lower *Mollusca*, a heavy task involving the steady work of a year or two, and a ponderous volume, in which he receives the friendly assistance of our colleague, Dr. Gwyn Jeffreys, Mr. Edgar Smith, and other conchologists here and elsewhere; and Prof. Huxley closes the Invertebrates with a monograph of the *Cephalopoda*, culminating in a gem of a memoir on the structure of *Spirula*, the drawings done by his own hand from the careful dissection of the single specimen which we procured.

Brief descriptions of the deep-sea fishes have already been published by Dr. Günther, and the final memoir is in preparation; the birds in which group rhere are a comparatively small number, are in the charge of Dr. Sclater; and some anatomical details involving important additions to our knowledge of the structure of the *Cetacea*, the *Marsupialia*, and the Penguins have been worked out by Prof. Turner, Prof. Morrison Watson, and Dr. Cunningham.

It will be seen that in the foregoing notes many important groups of marine invertebrates are still unaccounted for. These are cases in which it has not yet been found possible to commence work from want of artists or some other cause, or in which the naturalists engaged have not yet reported progress. I have every hope that all will be under way in the course of another year.

Perhaps I have said enough to show that a report is in progress of preparation, which may be expected to register in a suitable form the results of a great scientific expedition. Some causes of delay have occurred, and there has been the regulation amount of friction inseparable from the working of a complicated piece of machinery, but my feeling is that on the whole things are going on wonderfully well, and the utmost I anticipate is the necessity for a little extension of time for the appearance of the later volumes.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

DR. MANSFIELD MERRIMAN, author of the "Elements of the Method of Least Squares," and for several years past an instructor in the Sheffield Scientific School of Yale College, has accepted the Professorship of Civil and Mechanical Engineering in Lehigh University, Bethlehem, Penn., and enters upon his duties there at the beginning of the September term.

We noticed recently the death of Prof. Behn, president of the Kaiserliche Leopoldina-Carolina Deutsche Akademie der Naturforscher. The Academy has chosen as his successor for a term of ten years, Prof. H. Knoblauch, of Halle, well known by his researches on light. With this new election, the head-quarters of the Academy are changed from Dresden to Halle.

SCIENTIFIC SERIALS

American Journal of Science and Arts, July.—In his ninth paper of "Contributions to Meteorology" (based chiefly on observations of the U.S. signal service), Prof. Loomis shows, *inter alia*, that barometric waves often travel from the Pacific Coast across the Rocky Mountains (10,000 feet) and reach the Mississippi valley with but little modification. Areas of unusually high pressure in their course eastwards are generally accompanied by areas of low pressure both on the east and west sides, and at an average distance of about 1,200 miles. When a centre of low pressure has passed the wind sets in with force from the north, and being deflected westwards by the earth produces condensation there. Again, it is shown that an area of low barometer in Ireland is usually accompanied by one of high barometer in Southern or South-eastern Europe, and that during the colder months Vienna is generally near the centre of this high area, which is replenished by air rising from the area of low pressure.—Mr. Goldmark finds, from experiment, that a rise in temperature produces a slight but constant increase in the electric potential of the air.—A new and remarkable mineral locality (for manganesian phosphates) in Fairfield County, Connecticut, is described by Messrs. Brush and Ed. Dana. No less than six new and well-defined species have been got from it, besides many other known but rare species. All the minerals are obtained from veins of albitic granite.—Prof. Mayer claims independent invention of the sound-mill (lately described by M. Drorak); Mr. Chester describes some artificial crystals of gold and gold amalgam, and Prof. Rood suggests a form of telephonic relay.

August.—This opens with the first portion of an interesting lecture by Prof. Asa Gray on "Forest Geography and Archæology." The forest production of America is sketched and considered in its relation to climatic conditions.—Prof. Leconte gives an account of the structure and origin of mountains, and answers some recent objections to the "contractional theory."—The presence of a solid hydrocarbon in the trap-rocks of New Jersey Mr. Russell accounts for by infiltration of petroleum into cavities and subsequent evaporation and (to some extent) oxidation.—Prof. Trouvelot gives an account of his observations of the recent transit of Mercury at Cambridge, Mass. Among other points noted are the luminous ring round Mercury observed distinctly for more than two hours, and the rounding off of the angles formed by the sun's limb with Mercury after internal contact, a phenomenon of the same nature as the black drop (which was not seen).—Prof. Peters indicates the position of the new planet he discovered lately.

SOCIETIES AND ACADEMIES

GENEVA

Physical and Natural History Society, June 6.—Prof. F. A. Forel, wishing to explain the action of the seiches of the Lake of Geneva, seeks to establish the effects of storms, which often coincide with marked oscillation of the fluid mass. He is still continuing his investigations.—Prof. Schift described his researches on the alterations which the blood undergoes in consequence of a momentary arrest of the circulation.—M. Phil. Plantamour has studied periodical displacements in the air-bulb of improved levels manufactured at Geneva and placed in the cellar of his house. At certain times there is shown a slow change towards the east, without sensible return towards the west; at other times the immobility is complete. The maximum of eastern elevation takes place sometimes towards 5 P.M., at other times sooner, towards mid-day, with oscillations the amplitude of which does not exceed seventeen seconds.

July 4.—M. Eug. Demole presented phenomena of oxidation produced by the free oxygen of the air. Thus the case was presented of dibromic ethylene.—Prof. Forel, by increasing the rate of the unrolling of the paper of his limnograph, has attained interesting traces corresponding to the perpetual oscillations of the level of the Lake of Geneva. These oscillations vary from half a minute to two or three minutes in maximum, corresponding neither with the duration of the waves nor with those of the seiches. They vary notably in intensity with the agitation of the lake by the wind or by a steamer, but their cause is yet totally unknown.

VIENNA

Imperial Academy of Sciences, July 11.—The following among other papers were read:—On the nature of galvanic polarisation, by Dr. Exner.—Optical investigation of spark-waves, by Prof. Mach and Dr. Gruss.—On the optical properties of soot, by Dr. Rosicky.—Researches on the origination of chlorophyll-granules, by Dr. Mikosch.—On two new isomeric cyanide acids, by Herr Herzig.—On the elastic reaction in glass, by Herr Klemencic.—On the composition of cinchonin, and on its oxidation-products, by Dr. Strauss.—Action of oxidising agents on some hydrocarbons, by Herrn Othman and Zeidler.—On camphor chlorides, by Dr. Spitzer.—On a camphene derived from camphor, and the synthesis of its homologues, by the same.

PARIS

Academy of Sciences, September 2.—M. Fizeau, president, in the chair.—The following papers were read:—Formation of a cylinder out of a circular disc, by M. Tresca.—Litter manure, by M. Ch. Brame.—On the influence of the quantity of blood contained in the muscles on their irritability, by M. J. Schmoulewitsch. The author has proved that the muscles, on becoming anæmic, do not lose their irritability at once; on the contrary, it increases for some time, and having attained a certain degree, begins to decrease.—On the existence of an intra-Mercurial planet observed during the solar eclipse of July 29, by Prof. Watson. M. Gaillot is investigating the results of Prof. Watson's observations.—On the diffusion of cerium, lanthanum, and didymium, by M. Cossa.—On the causes of the humming of insects, by M. J. Pérez. The author finds that among hymenoptera and diptera, humming is due to two distinct causes; one, the vibrations of which the articulation of the wing is the seat, and which constitute the true hum; the other, the friction of the wings against the air, an effect which more or less modifies the former. Among the powerful-winged lepidoptera, such as the Sphinxes, the sweet and mellow hum of these insects is due only to the rustling of the wings by the air. This sound, always grave, is the only one produced; it is not accompanied by basilary beatings, on account of a peculiar organisation, and especially on account of the presence of scales. Among the Libellula, the base of whose wings is provided with soft and fleshy parts, there does not exist true humming, but a simple noise due to the rustling of the organs of flight.—Application of borax to researches in vegetable physiology, by M. Schnetzler.

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