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# NATURE

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*" To the solid ground*
*Of Nature trusts the mind which builds for aye."*—WORDSWORTH

THURSDAY, MAY 6, 1875


## GEIKIE'S "LIFE OF MURCHISON"

*Life of Sir Roderick I. Murchison, Bart., F.R.S. etc. Based on his Journals and Letters. With Notices of his Scientific Contemporaries and a Sketch of the Rise and Growth of Palæozoic Geology in Britain.* By Archibald Geikie, LL.D., F.R.S., Director of H.M. Geological Survey of Scotland, and Murchison Professor of Geology and Mineralogy in the University of Edinburgh. 2 vols. Illustrated with Portraits and Woodcuts. (London: John Murray, 1875.)

TO have before us in detail, and reflected as in a mirror of his own notes and correspondence, the story of the life of one who has taken a foremost place in the ranks of science, is a matter of no little interest. We want to know as much as we can of the kind of qualities that go to make a successful man of science, and of the circumstances which have enabled him to be useful to the world. Such information may be obtained either by categorical questions addressed to such men during life, after the manner of Mr. Francis Galton's work lately reviewed in these columns,* in which we have the advantage of numbers for comparison; or by the more detailed story of the life of individuals, from which we can gather for ourselves the answers to our questions, with all the additional light thrown upon them by surrounding circumstances.

Such a story is that presented to us by Prof. Geikie of the life of Sir Roderick Murchison, whom no one will deny to have occupied a foremost place, and to have contributed valuable and lasting materials to the sciences to which he devoted himself. Many, indeed, and fruitful are the teachings of such a life as this, and some of them are well pointed out by the author in his concluding lines.

Nor is the interest of the work confined to this. Not only was Murchison eminent in science, but he ranks among the founders of one of its most recent branches—Geology; and hence, though in later years his name has been more prominently connected in the public mind with Geography, it is as a geologist alone that he will be known to posterity; and the study of his life is an examination of the way in which some of the chief corner-stones of Geology were laid.

Prof. Geikie has performed his promised task in an admirable manner. It must be remembered that he was asked by the subject himself to undertake the work, and the materials out of which he was to develop it were placed in his hands; and under these circumstances he must necessarily be guided partly by the probable wishes of the subject, and partly by the nature of his material; and if it be a biographer's duty to "hold a mirror up to nature," there can be no doubt that Prof. Geikie has admirably done so. The scenes and circumstances that formed so large a part of the acted life may well occupy an equally large share in the written life, however much geologists or students of human nature might wish for different matter.

We have no doubt that Prof. Geikie would have preferred to write such a life as we have indicated, and he has done his best to escape from a "narrative devoted merely to the personal events of Sir Roderick Murchison's life;" but in loyalty to his friend he felt bound, no doubt, to follow his desires rather than his own. Those who are acquainted with Prof. Geikie's other writings need not be told that this is written with admirable perspicuity, and his candour and ingenuousness are above all praise. There is no false colouring here; we see Murchison as he was; what was good not exaggerated, but duly brought forward; what was bad (and who has not faults?) by no means palliated, though, where possible, accounted for. These are undoubtedly the great merits of the work, and ought to inspire thorough confidence where it touches on matters of controversy.

The Life before us gives admirable means of perceiving the exact relation of Sir Roderick Murchison to the science of Geology, and the qualities and circumstances which enabled him to stand in that relation. There are times in the history of a Science, as in the history of a Nation, when some definite work has to be done, and it is

* NATURE, vol. xi. p. 161.

done, as we may say, through some power of natural selection, by one whose qualities are adapted for that purpose and for that alone, and whose greatness consists in being exactly fitted in that respect to the time in which he lives, and it may be in nothing besides. Before we consider the relation which Murchison held in this way to Geology, we may pass in review the chief incidents of his life as detailed for us in these volumes.

Sir Roderick was descended from a sturdy Highland stock, whose courage and perseverance he inherited, but who contributed no further to his fortune. His father was a surgeon, who, after making a fortune in India, returned to his native land and bought the estate of Tarradale, in the eastern part of the county of Ross, where Roderick was born on Feb. 19, 1792. When the boy was only three years old the family removed to Bath, where the father died in 1796. Three years after, Roderick's mother married a second time, and the boy, at the age of seven years, was sent to the grammar school of Durham. Here he seems to have learnt little but mischief; but educational requirements were not great in those days, and he probably knew at the end of his six years as much as most of his contemporaries. Certainly his education here had no manner of influence, as far as we can see, on his future career; and the absence of scientific culture in youth, if it did not prevent him from rising to greatness and doing good work, would most decidedly have done so had he been thrown into other circumstances and lived in days like our own, and it certainly confined him to the limits of a geological worker instead of allowing him to become a geological philosopher.

After leaving Durham, and visiting his uncle, General Mackenzie, who persuaded him he would make a good soldier, he was sent to the military college at Great Marlow. The two years he spent here cannot be said to have been without use to him, for if he learnt but little from books, he was forced to undergo the more special training for a soldier's career, which in after life had a solidifying effect on his character. At this time his uncle wrote of him: "He is a charming boy, manly, sensible, generous, warm-hearted. I think he has talents to make a figure in any profession." At the age of fifteen he was gazetted Ensign in the 36th Regiment, which, after picking up some scraps of knowledge in Edinburgh, he joined in Ireland. He had not long to wait for work, for in the following year (1808) his regiment was ordered to the Peninsula, and he received his "baptism of fire" at the battle of Vimieira. We need scarcely say of any English soldier that he behaved with bravery in battle, and fortitude under trying circumstances: but, after a short display of these qualities, a retreat was ordered from Corunna, and Murchison returned home, being nearly wrecked in the transport. Though he joined his uncle Mackenzie as aide-de-camp in the following year, he never again succeeded in getting into active service, and this induced him, after eight years' career, to retire from the army.

Murchison was evidently a keen soldier, and it seems probable that, had he found adequate scope for the irrepressible energy of his character in this direction, Geology would have lost his services. At the age of twenty-three on August 29, 1815, he married Miss Charlotte Hugonin, daughter of General Hugonin, of Nursted House, Hampshire; an event which had a more than usual influence on his future career. In the first place, her fortune, combined with his own, enabled him to devote himself to any pursuit he might take up, without having the distractions of bread-winning routine duties, and in later years to keep up that state and hospitality which made him the representative of science in the upper circles of society. But also, and to her honour, she exercised a most salutary personal influence over him, almost imperceptible, but always in the right direction. Prof. Geikie says, "to his wife he owed his fame;" but a perusal of his life assures us that this must be taken in a very qualified sense. Such a steady attachment to science as he showed for more than forty years argues a natural bent that way that would sooner or later have been developed under any circumstances; yet at one time certainly she was his "*better* half," and her influence deserves all admiration. It was soon after his marriage that he retired from the army, chiefly to avoid introducing his wife to the monotony of barrack life. What pursuit was he to follow now? Something it must be that, while it would not engross too much time and effort, would leave him plenty of scope for the satisfaction of that muscular energy which was continually craving for some adequate outlet. Should he become a country parson, trudging for miles over the wild country side to visit some outlying houses, varying his duties occasionally by a fox-hunt or a day's shooting? He actually thought of this; but his creed, as given in his own words by his biographer, shows that this was really an impossible solution of the question. So he tried travel; and for two years roamed over Italy and examined the treasures of art with a quickly ripening critical eye. His enthusiasm in this pursuit, which was quite new to him, proved how vast was his energy, and that it only required guidance into a suitable channel to accomplish valuable work. But he found out in time that art was not his calling; and, tired of continental travel, he brought back his wife to England. Then there was nothing but fox-hunting that he could think of to employ his energies; so he spent five of the best years of his life, from twenty-six to thirty-one, in this important occupation, and succeeded in gaining the glorious distinction of being the best rider in his neighbourhood.

But the wild oats were sown at last, and partly from *ennui*, partly from meeting with Sir Humphry Davy, and greatly from the influence of his wife, he once more looked the question in the face—Was there no employment that would be worthy of a man of energy, that would require and repay his enthusiasm?

At that time (1825) Geology was in need of such a man as he. Some few years before the Geological Society had been started, and its principle was this: "In the present state of geological science, facts are more wanted than theories." Now, while the facts of most other sciences are obtained in the closet, many of those of geology are to be gathered in the field. Prof. Geikie gives in this connection a pleasant outline of the state of theoretical geology of the time, on some details of which there may possibly be difference of opinion, but it is certain that no sound progress could be made on account of the backwardness of stratigraphical geology; almost the only good work as yet done in this direction being that of Wm. Smith—a man considerably like Murchison in character, though in a lower walk of life, and who had mapped and arranged most of what we now call secondary rocks. Much remained yet to be done both among these and above them, but below them was a perfect blank. No one had yet attempted to attack the monster "Grauwacke" in his fastnesses. It was not, however, to be conquered by a tyro, and it was only after minor attempts elsewhere that Murchison made the assault upon it from above, while Sedgwick undermined it from below.

Murchison's life hitherto has not been such as to lead us to expect much of him; but a study of his biography and a knowledge of his works prove that we must from this time see him in a different light; without indeed the advantages of early training, yet earnestly doing his best under the circumstances to advance the cause of science in that way in which alone he could hope to do so. He was one of those who

> "rise
> On stepping-stones of their dead selves
> To higher things;"

and we next hear of him as a diligent student of Brande, Buckland, Webster, and Wollaston, and very shortly following out, at the suggestion of others, some new lines of inquiry, where information was wanted. The discussion of these works we will postpone for the present, and pass on to the sketch of his life henceforth as detailed for us so clearly by Prof. Geikie.

His first excursion was in the summer of 1825, when he was accompanied by his wife, and made a tour of nine weeks on the south coast, from the Isle of Wight into Devon and Cornwall. "Driving, boating, walking, or scrambling, the enthusiastic pair signalised their first geological tour by a formidable amount of bodily toil."

Murchison associated himself early in his geological career with Sedgwick, with whom he had many a happy and profitable tour, the first of which took place in 1827, when they went together to the Island of Arran. Murchison's summers for many years now were spent in the field, while his winters in London were given to society, and to the work of the Secretary of the Geological Society, which he voluntarily undertook. It was not till 1831 that he first broke ground in "Siluria," the results of which appeared after many delays, in 1838, in the well-known "Silurian System." He was not content with work in England only, but quite as often traversed the Continent, bringing home results, and enjoying the society of the chiefs of geology abroad. No sooner was his first work well off his hands than he began to contemplate an excursion to Russia to trace the same rocks there, and having been partially successful in 1840, the next year he surveyed the whole of the Ural Mountains under the auspices of the Emperor, and with the assistance of Count Keyserling and De Verneuil, the results of which survey appeared in 1845 in the magnificent work entitled "Geology of Russia and the Ural Mountains."

From this time Murchison's position in the ranks of geologists was secure. How did he use it? To this there can be but one answer. He used all the influence his position gave him for the advancement of science. His personal energies never flagged; no summer passed but he did good work, which now forms part of the common property of geologists. Each autumn saw him enthusiastically engaged in the work of the British Association, of which he was president in 1846, and in which he ever continued to take a genuine interest. During these years his devotion to the Geographical Society increased, and, as our readers know, he was in the end regarded as so indispensable to its prosperity, that for the last ten years of his life he was president.

This Society was almost of his own making, for it was a very different thing when he joined it to what it was when he died; and perhaps some little feeling of jealousy may be entertained by geologists at the apparent transference of his affections. But it should be remembered that throughout his career Murchison was a pioneer. His works are all masterly outlines of fresh fields; and when by the time that infirmities in any case would prevent him from doing much field-work, he found a large band of geologists working at details throughout Europe. No room was left for such preliminary investigations as his, unless he went by proxy, so to speak, to countries far away; and in the end he was strictly serving Geology, by encouraging Physical Geography; for the former is impossible without the foundation of the latter being laid.

As Director-General of the Geological Survey, a post which he held from the death of Sir H. De la Beche in 1855 until his own decease in 1871, he earned the gratitude of geologists by the enlarged scope he persuaded the Government to give to it, and its consequent rapid and invaluable work; while in this and in other ways he was always ready and anxious to help forward any rising worker in the field.

Into further details of his life—how honours were poured on him from all sides, which he received with avidity; how he never failed to enjoy the delights of society; how he obtained a Geographical Section at the British Association; how he endowed a professorship of Geology—into these we cannot enter more fully, but must refer the reader to the book itself, where they are all admirably set forth.

The last words of Prof. Geikie on the character of Sir Roderick Murchison are very good. He traces the success of his career and the value of his life to three main sources. "Foremost we would place his vigorous energy, his unwearied and almost reckless activity. He never seemed to be without a definite and well-planned task." "Another leading feature in his character was shrewd common sense and knowledge of the world;" and "there was still another characteristic which secured to Murchison the esteem as well as the respect of his fellow-men—his thorough kindliness and goodness of heart." Every one of these features is amply illustrated in the details of his life; and though other features, perhaps not quite so imitable, may strike us on its perusal, yet these stand out in the foreground, and teach the ever-required lesson that industry and energy are the invariable forerunners of success. *(To be continued.)*

## *THE FLORA OF BRITISH INDIA*

*The Flora of British India.* By Dr. J. D. Hooker, C.B., assisted by various Botanists. Vol. I. Ranunculaceæ to Sapindaceæ. (London: Reeve and Co.)

THE completion of the first volume of the Flora of India is an event of no small importance in descriptive botany. That India should be almost the last of our possessions whose vegetable wealth botanists have undertaken to describe in a systematic order, is due to various causes, not the least of which is the enormous labour of collecting and sifting the scattered literature bearing on this subject. The books and short papers on the botany of various parts of India are exceedingly numerous, and several works have been commenced never to be completed. Dr. Hooker himself, in conjunction with Dr. T. Thomson, published some years ago the first volume of a Flora of India based upon a more elaborate plan than that of the work now in progress, which departs from that of the other Colonial Floras, Hooker's "Student's Flora of the British Islands" having served as a model.

In addition to British India proper, this work embraces the territories of the Malayan Peninsula, Kashmir, and Western Thibet; but Afghanistan and Baluchistan, having been taken up by Boissier in his "Flora Orientalis," are not included. The total area under investigation exceeds a million square miles, exhibiting every variety of climate, soil, and other conditions, and ranging from the sea-level to an altitude of 19,000 feet, which is about the upper limit of flowering plants. Dr. Hooker computes the total number of species growing within this area at 12 to 14,000, which is doubtless not very wide of the mark, judging from the number reached up to the end of the *Sapindaceæ*.

In the first place we will give a glance at the contents of the present volume, which forms about a sixth part of the whole work. Exclusive of an index of forty pages, it extends to about 700 pages, and includes descriptions of 2,250 species under 442 genera, belonging to forty-four natural orders. These figures do not take in introduced plants incidentally mentioned or fully described. Contrasting these numbers with those afforded by the flora of tropical Africa up to the end of the *Sapindaceæ*, we obtain some idea of the relative richness of the vegetation of tropical Asia, especially if we bear in mind that the area of tropical Africa is more than six times the extent of India. True, African vegetation is not so well known, but future discoveries in the respective countries will probably not materially alter the proportions. The numbers for tropical Africa, which we have added up in Oliver's "Flora of Tropical Africa," are 945 species in 250 genera, and forty-five natural orders. It will be seen that the number of natural orders is almost the same, one more being represented in Africa than in India. A very large proportion of the species enumerated in the volume before us are exclusively Asiatic; we have not made an exact calculation, but should estimate it at ninety per cent. Of the 442 genera, 164 are, so far as our present knowledge goes, peculiar to Asia. The greater part of the peculiar genera are tropical, and many of these, doubtless, still remain to be discovered in New Guinea and tropical Australia. The mountains of Northern India have furnished our parks and gardens with many useful and ornamental trees, &c.; e.g., *Cedrus Deodara* and *Pinus excelsa*; and many others might be introduced with a view to profit or pleasure. In most cases, where possible, Dr. Hooker gives the altitudes at which the species are known to occur; but of course this part must still be imperfect. We have made a list of those species reported as growing *above* 10,000 feet, and it includes nearly 250 species, or about a tenth part of the whole number. These belong chiefly to the *Ranunculaceæ*, *Cruciferæ*, and *Caryophylleæ*, and contain a large number of endemic species; the remainder being chiefly common either to Siberia or the Alps of Southern and plains of Northern Europe, including many common British plants. We will not trouble the reader with many more figures, but we may select a few more to give a general idea of the vegetation up to the point reached in this volume. Taking two or three examples of those orders consisting mainly of herbaceous plants or climbing shrubs, we have *Ranunculaceæ*, 115 species, or 5·2 per cent; *Cruciferæ*, 137 species, or about 6 per cent.; *Caryophylleæ*, 104 species, or 4·6 per cent.; and *Geraniaceæ*, 165 species, or 7·3 per cent. Turning to the woody orders which characterise the tropical and sub-tropical regions, we have *Anonaceæ*, 190 species, or about 8·5 per cent.; *Dipterocarpeæ* (an almost exclusively Asiatic family), 92 species, or about 4 per cent.; *Guttiferæ* 61, *Tiliaceæ* 109, *Meliaceæ* 83, *Olacineæ* 66, *Celastrineæ* 105, and *Sapindaceæ* 70 species. Among genera numerous in species we may mention *Capparis*, *Garcinia*, *Grewia*, *Impatiens*, and *Vitis*. Considerably more than a hundred species of *Impatiens* are described, and about 75 of *Vitis*; seven of the former genus ascend above 10,000 feet, and nearly all of them are very restricted in their geographical area. In tropical Africa there is about the same number of species of *Vitis*, but only one or two are common to both regions, the others being endemic.

So far we have confined ourselves to an attempt to indicate the interest of the work as a contribution to phytogeography; its usefulness in applied botany cannot be over-estimated. It would not be difficult, it is true, to point out a great many little defects and inequalities in elaborating the materials at their disposal by the different contributors. But those whose experience is least in this branch of botany are aware of the difficulties encountered at every step. In the first place, the limitation of species must be more or less arbitrary, and it is by no means an easy task to settle the limits, in this case especially, on account of the large number of forms described as species by botanists of all nations in innumerable books and journals. The view here taken of species is a broad one; hence we find that there is an average of two synonyms to each species, and in some instances the array of names is something quite formidable. Of course many of these synonyms result from individual views respecting generic limits. As to genera, there is little deviation from Hooker and Bentham's "Genera Plantarum," though an examination of a large number of specimens has frequently necessitated a modification of the diagnoses of certain genera. As to "polymorphous species," the forms readily distinguished are briefly characterised as varieties; but it is assumed that the extreme forms collected under one species are united by every intermediate gradation, so that it is not possible in practice to say to which variety some forms should be referred. We have already mentioned that Hooker's "Students' Flora" has been followed mainly in the style of arranging the matter, and this no doubt is an improvement in some respects on the Colonial Floras; but the absence of keys to the species of each genus, in our opinion, is not compensated for by the change. In the "Students' Flora" the synonyms are given in italics, and readily catch the eye; but in the "Flora of India" they are printed in the same type as the descriptions, and are difficult to find, especially as one is so unaccustomed to this method. Under each genus and species the geographical area is given, and in most cases pretty fully; but most of the numerous discoveries in tropical Australia since the publication of the "Genera Plantarum" have been overlooked: we allude to those already published in the "Flora Australiensis." Other little slips of this sort occur. For instance, there is a species of *Berberis* in Abyssinia.

Dr. Hooker has contributed largely to this volume, and the following botanists have assisted:—Dr. M. T. Masters, *Malvaceæ*, &c.; Mr. W. P. Hiern, *Sapindaceæ*, &c.; Prof. W. T. T. Dyer, *Dipterocarpeæ*, &c.; Prof. Lawson, *Ampelideæ*, &c.; Mr. A. W Bennett, *Polygaleæ;* Dr. Anderson, *Guttiferæ;* and Dr. T. Thomson and Mr. M. P. Edgeworth were also associated with Dr. Hooker in the elaboration of certain orders. A comparison of the work of the different contributors brings out the defects of some rather strongly, but it would obviously be unfair to single them out, because they have not done quite so well as the best.

This is a good solid instalment towards a portable flora of India; and with so numerous a staff of botanists, well qualified for the task, we may confidently hope that the work will proceed with tolerable rapidity. True, the first part of this volume appeared in 1872, but we anticipate a better rate of progress for future volumes.

## OUR BOOK SHELF

*Proceedings of the London Mathematical Society.* Vol. V 150 pp. (London: Hodgson, Gough Square, 1875.)

FORMER volumes of these Proceedings have embraced the Transactions of two and even of three sessions; this contains the Transactions of one session only; hence the smallness of the volume. The longest paper in it is a valuable geometrical memoir, by Dr. Hirst, "On the correlation of two planes." When the points and right lines of two planes are so associated that to each point in one of the planes and to each line passing through that point, respectively correspond, in the other plane, *one* line and *one* point in that line, then a correlation is said to be established between the two planes. The author indicates in a note how his results are also all applicable to the case of two homographic planes.

Prof. Cayley contributes papers on Steiner's Surface and on certain constructions for bicircular quartics. Lord Rayleigh has a note "On the numerical calculation of the roots of fluctuating functions." Mr. J. W. L. Glaisher writes "On the transformation of continued products into continued fractions." Mr. C. J. Monro has a note "On the inversion of Bernoulli's theorem in probabilities." Mr. Samuel Roberts also contributes a note "On the expression of the length of the arc of a Cartesian by elliptic functions," and "The parallel surfaces of developables and curves of double curvature;" Mr. Spottiswoode has a paper "On the contact of quartics with other surfaces;" and Mr. H. M. Taylor "On inversion with special reference to the inversion of an anchor-ring or torus." Interesting papers of a more elementary character are contributed by Mr. J. Griffiths "On the Cartesian equation of the circle which cuts three given circles at given angles," and "On a remarkable relation between the difference of two Fagnanian arcs of an ellipse of eccentricity $e$, and that of two corresponding arcs of a hyperbola of eccentricity $\frac{1}{e}$;" and by Prof. Wolstenholme "On another system of Poristic Equations."

So far we have cited those memoirs only which treat of pure mathematics. There are, besides, papers by Mr. Röhrs, "On spherical and cylindric motion in viscous fluid;" by Mr. Routh, "On stability of a dynamical system with two independent motions," and "On small oscillations to any degree of approximation;" by Prof. Clifford, "On graphic representation of the harmonic components of a periodic motion;" by Prof. Crofton, "A method of treating the kinematical question of the most general displacement of a solid in space;" by Mr. Merrifield, "On the determination of the form of the dome of uniform stress."

Here is, as usual, sufficient variety for differing tastes dished up by the most advanced mathematicians in this country; other names also occur as contributories of communications, though their communications do not appear in this volume, notably those of Professors Sylvester, H. J. S. Smith, and J. Clerk-Maxwell. Further, a communication by Mr. A. J. Ellis, we are informed, took the shape of a separate pamphlet, entitled "Algebra identified with Geometry." This pamphlet arose out of Mr. Ellis's connection with the Association for the Improvement of Geometrical Teaching, and copies were kindly presented by him to the members of the two societies. It is procurable at the above-named publishers of the Mathematical Society's Proceedings.

*Fiji our New Province in the South Seas.* By J. H. De Ricci, F.R.G.S. With two Maps. (London: Stanford, 1875.)

MR. DE RICCI'S book has the appearance of having been put together hastily, to catch the mild and short-lived excitement connected with the annexation of Fiji. A large proportion of it consists of extracts from other works thrown together without much attempt at systematic arrangement; the result is a somewhat undigested mass of facts and figures about Fiji. Still, the book does contain a great deal of useful and interesting information, and will give its readers a very fair idea of the history and the physical and social condition of our most recent annexation. The information given may be regarded as trustworthy, as it is taken from the works of Wilkes and Seemann, and from various official documents. Appended are lists of the native names of timber-trees and of the fauna; but very much more valuable is the long systematic list of all the Fijian plants at present known, compiled partly from previous writers and partly from the author's own observations. The two maps add to the value of the work—one of the Fiji Archipelago, and the other showing the position of the colony in reference to America, Asia, and Australia.

## 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.*]

### Geology in America

I AM somewhat chagrined to find that I appear to you (vol. xi. p. 381) to say that the Geological Survey of Great Britain is especially to blame for the diminution of interest in geology in the country that has done the most for its advancement. My remarks were taken down by a reporter, and I have not seen them in print. The point I sought to make was to the effect that in all matters relating to geology, Massachusetts could not do better than to follow the lead of the British Survey. The only question to be considered was whether it was not open to criticism from an educational point of view. On this matter I expressed no individual opinion, but only restated doubts that I had heard expressed by more than one of your own masters in the science. I feel that geological science owes so much to your noble Survey, that none of its students should subject it to hasty criticism. If it is to have its methods questioned, it should be done by some one far better acquainted with its ways than any person from another country is likely to be. It seems to me, however, that the diminution in the number of geologists, compared with the students of other sciences, if not in absolute number, is clear on simple inspection of the field. It is true not only of Great Britain, but of France and America as well. Of mining engineers there is, I believe, a great plenty; but of men who are trained in field work, who can be trusted to unravel a set of rocks, or who care for the science as a science, and not as a means of winning a living, there are far too few.

A year ago I had to organise a geological survey in the State of Kentucky. I needed three topographers and three assistant geologists who could stand alone. I picked my topographers from over a hundred competent applicants; I should have searched in vain for months for two of my geologists, had it not been that the suspension of the Missouri Survey gave me trained men. But for this I should have been driven to Germany, that inexhaustible reservoir of trained men, for my helpers. In our schools it is still worse: geology is taught in the air, not on the earth. The student never gets into the field for practical work, and the science remains for him a thing of names and shadows. With the hope of doing something to remedy these evils, there is to be a Summer School of Geology, intended for teachers of geology and those who propose to make special workers in the science, taught in connection with the work of the Kentucky Geological Survey; it will be, in fact, though taught in Kentucky for the present, the Harvard Summer Term in Geology, all the instructors in that department from this University taking a part in its work. Eight or more of the assistants of the Kentucky Survey will also be employed as instructors. Already over one hundred persons have applied for admission to the school, but the number will be limited to thirty: this list now includes twenty-five teachers of schools of academic grade, and five graduates of colleges who propose to become geologists. As the school will be placed in a camp, it will be possible, if it succeeds, to establish it in a new region each year, so that teachers attending for, say, three years in succession, may get a fair notion of our rocks, and, what is better, learn how to do field work. I believe that the novelty of the life, the freedom and fresh air, will make it possible for teachers to use their vacation time in study without damage. I am not without hope that in this way teachers may be trained to their work, and beginners provided with that practical introduction to geology which it is now so hard to obtain. N. S. SHALER

Harvard University, April 18

[We append the programme of the Summer School of Geology referred to by Prof. Shaler, in the hope that something similar may be inaugurated here.]

HARVARD UNIVERSITY.

*Summer Instruction in Geology*, 1875

In order to furnish an opportunity for teachers in natural science and special students in Geology to become acquainted with the methods of practical work in that science, a Summer School of Geology will be established, during the months of July and August, at a camp near Cumberland Gap, in the State of Kentucky. This place has been chosen on account of the eminent advantages it offers for the study of a great section of the American Palæozoic rocks, and of the structure of the Appalachian Mountains, and on account of the co-operation of the Kentucky Geological Survey which is promised in a letter from the Governor of that State to the President of the University. It is also a very healthy region.

The special object of this school will be to teach students to observe, but instruction will be provided in Physical Geology, Historical Geology and Palæontology, Chemical Geology, and Topographical Engineering, as far as these subjects are connected with geological work. The instruction will be necessarily incomplete, and will be expressly directed to the elucidation of the problems furnished by the area to be explored. The co-operation of six well-qualified instructors has already been secured, and a number of other able geologists have promised their presence and their aid in teaching. Some instruction in the zoology and botany of the neighbouring region will probably be given to those who desire to receive it. Certificates of attendance will be given at the end of the time. The number of students will be limited to thirty, and men only will be accepted. No previous knowledge of the science is required, but only graduates of colleges, teachers, or other persons who can give evidence of maturity and some training can be admitted.

Persons wishing to join the school should at once address J. W. Harris, Secretary of Harvard College, Cambridge, Mass. Before their enrolment they will be required to pay the fee of fifty dollars for tuition, use of tents and camp equipage, and transportation about camp. In case anyone is prevented from joining the school by illness this fee will be remitted, provided the notice thereof is given before June 15. They will also be required to pay weekly in advance the estimate for subsistence and camp servants (which is not expected to exceed three dollars per person).

Persons joining the school from the west will report themselves on June 24 and June 30, at the terminal station on the Lebanon Branch of the Louisville and Nashville Railroad. Those joining from the east will be met at a station hereafter to be designated on the East Tennessee Railroad, on June 26 or July 1. Persons unable to join on these days should notify the chief of camp, Mr. John R. Proctor, Lexington, Ky., who will arrange for their transportation to camp.

All students are expected to provide themselves with the following articles:—Two blankets, a pocket magnifying-glass, a pocket compass; Dana's "Manual of Geology," revised edition (1874), and Lyell's "Principles of Geology." Suitable notebooks will be provided at cost. Students should also provide themselves with two suits of old clothes, flannel shirts, and stout boots. The total amount of baggage should not exceed seventy-five pounds for each person. An effort will be made to secure a reduction of fares on the railroads leading to the camp.

## The Attraction and Repulsion caused by the Radiation of Heat

WILL you allow me to say a few words in reference to the report of Mr. Crookes's paper which appeared in NATURE, vol. xi. p. 494. Apparently Mr. Crookes does not understand the nature of the forces which I have shown to result from the communication of heat between a gas and a surface; otherwise he would not bring forward as conclusive against the supposition that the phenomena which he has discovered are due to these forces, experiments which show entirely the other way. As I have previously explained, it follows as a direct result of the kinetic theory of gas, that if such forces as I have supposed exist for a certain tension of the gas surrounding the surface, they will not be diminished by diminishing the tension of the gas; and consequently no amount of pumping would destroy such forces where they once existed. Whereas the smaller the tension of the gas the freer the surface will be to move, and the less its motion would be opposed by convection currents; hence, on the supposition that the motion is due to these forces, the only effect of improving the vacuum would be to intensify the action. An this being the case, it is clear that Mr. Crookes's experiments, in which he finds that the action still remains in the most perfect vacuum which he has obtained, tend to support and not to upset my conclusion that the actions are due to these forces. The fact that Mr. Crookes finds it impossible to conceive this only shows, as I have said, that he does not comprehend the nature of the forces; for it certainly presents no greater difficulty than the fact that the velocity of sound is independent of the tension of the gas through which it is transmitted.

Mr. Crookes still appears to think that I attribute these forces solely to the presence of condensable vapour. It is true that the title of my first paper might have led him into this error had he read no further; but both in that paper and in a letter to the *Philosophical Magazine* for November 1874 it is clearly shown that this is not the case.

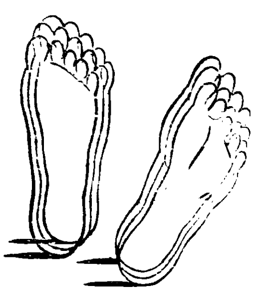
I am in hopes that ere long we may hear something on this subject from Prof. Maxwell, who probably knows more about the kinetic theory of gases than anyone else. If I am right, these experiments afford a direct proof of the truth of this theory; and as far as I know, this is the only direct proof that has ever been obtained. I do not mean to say that this is the most conclusive proof, but the most direct, or, to quote a remark of Dr. Balfour Stewart, "These experiments stand in much the same relation to the kinetic theory of gases that Foucault's pendulum occupied with regard to the rotation of the earth." No one can admire more than I do the experimental skill with which Mr. Crookes has brought the phenomena to light; nor can I see, should it turn out as I maintain, that they have led to the discovery of a law of nature, that this will detract from their importance, even if they lose somewhat in general interest from the breaking up of the halo of mystery with which they have hitherto been surrounded. OSBORNE REYNOLDS

Owens College, Manchester

### The Rôle of Feet in the Struggle for Existence

MAY not the "set" of the feet in various races of men have played a not unimportant part in the struggle for existence? In thinking over the subject the following points have occurred to me, and perhaps some of your readers may be able to throw some further light on the question.

In the case of the North American Indian, for example, except that he wears soft mocassins instead of stiff boots, he is less in a state of nature as regards his feet than we are. For we, and all the Teutonic tribes for countless generations, have paid little regard to our feet except as instruments of unconscious progression or as pedestals on which to stand firm. The North American Indian, on the contrary, is obliged by his habits of life, and has been obliged for hundreds, perhaps thousands of years, to direct his particular attention in no small degree to the position of his feet. For in hunting it is of the greatest importance that he shall not tread on any rotten stick which may snap with a loud noise and alarm the game of which he is in pursuit. On the war track it is of equal importance that he shall deceive his enemies as to the number of his party, and so each man carefully steps in the footprint of the warrior who had preceded him. This, I should think, would be decidedly easier if the foot were kept pointing straight fore and aft than if it were held obliquely. This may be more evident from the three rough outlines I have drawn of footprints in each position, in which I have made the difference in the length of the stride much the same. Indeed, the difference is greater in the fore and aft one, and yet the impression made by the three footprints will not be so large as when the foot is oblique. In walking in snow-shoes, too, the feet must be held as nearly as possible parallel, as otherwise the shoes are apt to catch in each other and trip their wearer up. It seems quite possible that long-continued attention to the position of the feet for many generations, together with the advantage which a parallel position of the feet may have conferred in the struggle for existence, may have led to its becoming a permanent characteristic of the Red Indian; while the advantage which the outward direction of the feet may have given the old Saxon, by affording a firmer support in a hand-to-hand struggle, may have led to its permanence in the successors of those who possessed this peculiarity, and by its means enabled them to overcome their opponents.



I cannot be quite sure about the ancient Egyptians. If I remember rightly, the Farnese Hercules has toes pointing considerably outwards, while Mercury generally has his feet more or less parallel. This would indicate that the Greeks associated the former position with strength and firmness, and the latter with fleetness. As fleetness will also aid the North American Indian in the struggle for existence, it is possible that its association with a parallel foot may have something to do with the peculiar formation of his ankle-joint. This, however, leads us to the question which I do not think has ever yet been taken up: In what way does the possession of a certain kind of weapon and the use of particular methods of warfare influence the conformation of the body? Have the descendants of the Teuton tribes toes which point outwards because their forefathers used clubs, axes, and targets, and have the Red Indians of the present day parallel feet because their forefathers used arrows and keen tomahawks, and trusted to agility rather than to brazen studs and thick bull-hide for escape from the blows of their adversaries? X.

### Destruction of Flowers by Birds

A WELL-OBSERVED case of the destruction of primrose flowers by birds will perhaps be of interest to some of your readers.

The flowers of two plants of primrose at a short distance from a window have during the last few days been almost entirely destroyed; and this having drawn attention to the subject, they have been watched. The result is that a number of the common house-sparrows have been seen to peck off the flowers by cutting them through at the base of the tube of the corolla, so as to remove the ovarium. In some cases the flower has not been completely detached from its stalk, a ragged hole being left where the ovarium originally was placed, but the flower has never been subject [to any further dismemberment. The few flowers which have been left on the plants, when chewed in the mouth, do not seem to have any sweetness about them, and one would therefore suppose that they do not contain any appreciable quantity of nectar.

The inference from these observations seems to be that the sole object of the destruction of the flowers is to obtain the ovaria. It is also to be observed that the primrose is not indigenous to this part of the country, and the only plants within a radius of at least two miles are those cultivated in gardens. The cowslip is, however, very abundant, but I have never noticed any similar destruction of it. I shall, now the cowslips are coming into flower, watch them with the object of finding out whether they are attacked or not.

H. GEORGE FORDHAM

### Note on the Common Sole

IN looking over Mr. Buckland's last work on "British Fishes," I did not find any account of the power the Sole has of fixing itself against the glass of an aquarium by means of a sucker placed close to the mouth, on the lower side; and as I find it is one of the "things not generally known," I think it may be worth your notice, particularly as I have not remarked it at the Brighton Aquarium. I first observed the fact at the Havre Aquarium, where I pointed it out to many persons hitherto unacquainted with it, but I have been disappointed at not seeing it at Brighton during any of my visits. The only way I can account for this difference in the habits of the same fish is that the Brighton Soles being, during my visits, always in the light, lay quietly at the bottom, whereas those at Havre, being almost excluded from the light, were seen to much greater advantage, swimming about freely and attaching themselves to the glass when they came in contact with it, or sliding down to the ground. The sucker of a Sole nine inches long would be about ¾ inch by ½ inch, placed diagonally to the long diameter of the fish, and exhibiting fine radiating lines. Though I watched other flat-fish carefully, I never could detect any attempt in them to fix themselves against the glass when they struck it, and therefore I am quite unable to explain why the Sole alone should have this power. As I make no pretension to be an ichthyologist, it is very probable that I may be telling a thrice-told tale. I must therefore leave it to your judgment to decide whether it is worth your notice in NATURE. T. OGIER WARD

Eastbourne

### Colour in Goldfinches

LAST July I took a goldfinch's (*Carduelis elegans*) nest with five young birds in it out of a tree in my garden and brought them up. Four turned out to be properly marked specimens, but the fifth is almost black, only having a few red feathers on its head. I see in Bechstein's "Cage Birds" (third edition), p. 147, that "four young ones of this variety were found in the same nest." Now, why were not all my five specimens black, and what is the cause of the fifth's blackness? Can any of your readers say?

Manley, May 1 LUCIE WOODRUFFE

## OUR ASTRONOMICAL COLUMN

VARIABLE STARS.—The two following stars require further examination, as affording signs of fluctuating brightness. (1) Lalande 23228-9, estimated 7th magnitude, 1795 May 8, and 5½, 1798 March 14. It is 6·7 in Lamont (No. 1149), and in Steinheil's Chart, one of the series published by the Berlin Academy, it is only 8th mag. Neither Bessel nor Santini has observed it. (2) The star Lalande 27095, in Boötes, 7th mag., observed 1795 May 25, and missed by Olbers, 1804 March 22, during his observations of the comet of that year: it is the star which passed the centre wire at 14h. 42m. 10s. (Histoire Céleste, p. 164), and Olbers distinctly says of it "ist nicht mehr am Himmel zu finden." It was, however, observed by Bessel in his Zone 415, 1828 May 24, as a 9th magnitude; it is 9·0 in the "Durchmusterung," and is called 9·1, 1866 June 5, in the Bonn Observations, vol. vi. The positions of these stars for 1875·0 are:—

| | | | | | | |
|---|---|---|---|---|---|---|
| (1) R.A. | 12h. | 18m. | 45s. | N.P.D. | 100° | 54'·9 |
| (2) ,, | 14 | 45 | 54 | ,, | 52 | 0·3 |

THE BINARY STAR Σ 2107.—This undoubted binary, first measured by Struve in the year 1828, well merits attention, and it may soon be possible to gain an idea of the form of the orbit. The recent measures of Dembowski and Barclay prove the angular velocity to be still increasing, the accompanying diminution of distance requiring pretty large telescopes to be brought into requisition for satisfactory observations. Dembowski calls the principal component a 7th magnitude, bright yellow; the smaller one a 9th and dusky. This star is Herculis 197 (Bode), and its place for 1875·0 is in R.A., 16h. 46m.54s.; N.P.D., 61° 7′

HIGH-LATITUDE PHENOMENA.—Our correspondent "H. F. C.," who writes from San Francisco, California, with regard to a statement in the recently-published narrative of the "German Arctic Expedition," that "the moon shone without setting for several days" in November, refers to a phenomenon which must necessarily occur in circumpolar latitudes. As an illustration: In lat. 82° N. and long. 60° W., near which position a part of the expedition about to leave our shores is expected to winter, the moon in December next will rise on the 8th, and will not set until the 18th, attaining her greatest altitude above the horizon at meridian passage on the 13th. The sun during this interval is, of course, invisible in lat. 82° N., but there is continuous moonlight for between nine and ten days, and similarly for other months during the Arctic winter.

THE SOLAR ECLIPSE, 1876, MARCH 25.—This eclipse will be a very similar one to that of March 1858, which created so much interest in its passage across this country: it will be annular, but in those parts of the track of central line, where the augmentation of the moon's geocentric semi-diameter is greatest, the eclipse, though still annular (as in England in 1858), approaches very near a total one. Vancouver Island is situate in this track, which runs about centrally over it, as the following points will show:—

| | | | |
|---|---|---|---|
| Longitude | 127° 6′ W | Latitude, | 48° 42′ N. |
| „ | 126 4 | „ | 49 30 |
| „ | 125 51 | „ | 49 40 |
| „ | 125 15 | „ | 50 6 |
| „ | 122 46 | „ | 51 50 |

A direct calculation for the third of the above points, in Vancouver Island, gives for the duration of the *annulus* only 7·5 seconds, the middle at 0h. 25m. 29s. local mean time with the sun at an altitude of 44°: the apparent semi-diameter of the moon is 1″·5 less than that of the sun. The central line subsequently traverses the Lesser Slave Lake and Lake Athabasca, with slightly longer duration of *annulus*. The eclipse will be visible in its partial phase in the position of the winter quarters at which the British Arctic Expedition aims.

THE MINOR PLANET "LYDIA."—M. Leverrier's *Bulletin International* of April 29 contained a telegraphic notice of the discovery of a supposed new member of the minor planet group, at the Observatory of Toulouse, by M. Perrotin, on the same morning, which in the following *Bulletin* is recognised as No. 110, Lydia, detected by M. Borrelly at Marseilles on April 19, 1870; the ephemeris (*Berliner Jahrbuch*) being much in error. The elements of No. 110, calculated by Dr. Oppenheim of Königsberg, and brought up with perturbations to 1874 (*Astron. Nach.*, No. 1,971), give a position for April 28, differing considerably from that assigned by the observation at Toulouse; but if we apply a correction to the mean anomaly of +1° 21′ 57″, the observed and computed longitudes agree, and the latitudes differ only one minute, and the diurnal motions also accord, so that there can be little doubt that the identification of M. Perrotin's object with No. 110 is correct. With the above correction the mean anomaly, April 28·5 Greenwich mean time, is 262° 8′ 27″, and thus with the other elements given by Dr. Oppenheim we have the following positions, which will be pretty near the true ones. At 12h. Greenwich mean time:—

| | | R.A. h. m. s. | | N.P.D. ° ′ | | Log. distance. |
|---|---|---|---|---|---|---|
| May 3 | ... | 15 4 17 | ... | 105 29·5 | ... | 0·2498 |
| „ 5 | ... | 2 27 | ... | „ 25·8 | ... | |
| „ 7 | ... | 15 0 36 | ... | „ 22·2 | ... | 0·2481 |
| „ 9 | ... | 14 58 45 | ... | „ 18·5 | ... | |
| „ 11 | ... | „ 56 54 | ... | „ 14·9 | ... | 0·2476 |
| „ 13 | ... | „ 55 4 | ... | „ 11·3 | ... | |
| „ 15 | ... | „ 53 15 | ... | „ 7·8 | ... | 0·2482 |
| „ 17 | ... | „ 51 28 | ... | „ 4·4 | ... | |
| „ 19 | ... | 14 49 42 | ... | 105 1·2 | ... | 0·2499 |

## LECTURES AT THE ZOOLOGICAL GARDENS*

### Mr. J. W Clarke on Sea Lions and Seals

II.

THE Sea Lion that is best known is the Northern Sea Bear (*O. ursina*), which is almost entirely confined to the Pribylov Islands. These islands were discovered in 1787 by a Russian sailor of that name. The slaughter of the animals is under the regulations of the United States Government. There are two islands, that of St. Paul and that of St. George, and the number of seals that have been calculated to exist in a given year upon one of them—namely, 1,152,000—will give a good notion of the multitudes of these animals to be met with at one of their favourite haunts. There is about half that number on St. George, making nearly 2,000,000 on the two islands. Out of this vast number, 100,000 are annually killed, principally young males. In South Shetland the "take" of fur seals was 320,000 in 1821 and 1822, and as all that arrived were killed, the speedy extinction of the colony was the result. The same happened in New Zealand.

A full-grown male *Otaria ursina* is between seven and eight feet long, the female not being more than four feet. The males reach their maximum size at about the sixth year, the females at the fourth. The hairy coat consists of an outer covering of long, flattened, coarse hair, beneath which is a dense coating of long, fine, silky fur.

The next species is Steller's Sea Lion (*O. stelleri*), named in honour of its discoverer. It is much larger than the other species, the males being as much as sixteen feet long. The ears are short and pointed, much broader than those of the Fur Seal. It is found on the island of St. Paul, extending down the coasts of Kamschatka and California. At San Francisco it inhabits an island in the harbour where Mr. Woodford has built a large hotel, to which parties resort to dine and look at the Sea Lions play. The under-fur of this species is so short as to be useless for clothing purposes.

There is another Otaria on the Californian coast, found in Japan also. It was first described by Schlegel from specimens collected by Siebold. It has been named *O. gilliespii*, but it would be far better to adopt the name since suggested by its original describer, and call it *O. japonica*. It is much smaller than the species named after Steller, and the skull presents an exceptionally large crest.

The next species to be mentioned is the one which extends round South America, from Peru to the River Plate—*Otaria jubata*—of which a specimen is living in the Gardens, having been obtained by its keeper, François Lecomte, from the Falkland Islands, when a mere pup. A full-grown male may reach nine feet in length, the females being much smaller. The fur is of no use for sealskin, as the undercoat is very scanty. The male has a mane, and is therefore called "Lion."

Inhabiting precisely the same localities, round Cape Horn and the Falkland Islands, is the Fur Seal of commerce—*Otaria falklandica*. It is much smaller than the

* Continued from vol. xi. p. 514.

other species, a full-grown male being hardly more than four feet long. It is probable that it is identical with one of the New Zealand Fur Seals, described by Dr. Gray as *Otaria cinerea*. If this should turn out to be the case, it will have a wider range than any of the others of the group.

There is certainly another species of Sea Lion on the coast of New Zealand, called Hooker's Sea Bear—*Otaria hookeri*. Its only certain habitat is the Aucklands. It is a large species, the males about six feet long, the females proportionately smaller. Though these New Zealand coasts and islands, together with the coasts of the mainland of Australia, have been visited and surveyed in every direction by English expeditions, no one has ever thought of preserving specimens for museums, so that we really know less about the seals of our colonies than we do about those of foreign coasts. Thus there is certainly a large species on the west coast of Australia, at the group of islands called Houtman's Abrolhos, described by Dr. Gray as *Neophoca lobata*. We are almost equally ignorant about the Sea L ons of the Cape of Good Hope. The species from that locality living in the Gardens—*Otaria pusilla*—is a very small one with an excellent fur. The Antarctic Sea Lion—*Otaria antarctica* (Gray)—is also from the Cape. This completes the number of species of Otarias, which may be thus tabulated :—

OTARIA

| | |
|---|---|
| *Pusilla*<br>*Antarctica* | from South Africa and the adjacent islands. |
| *Jubata*<br>*Falklan lica* | from Cape Horn and the adjacent islands. |
| *Japonica*<br>*Stelleri*<br>*Ursina* | from the North Pacific. |
| *Hookeri*<br>*Lobata* | from Australia and New Zealand. |

In some respects intermediate between the Sea Lions and true Seals, is the Walrus, an animal with the head flattened in front, the upper lips with long stiff whiskers, the two enormous tusks, the short bull-like neck, and the vast carcase. Stuffed specimens err in being too distended and smooth, all the natural wrinkles being removed. The hair is thin and short. The attitude resembles in the main that of the Sea Bear, as do the limbs, the thumb being the longest digit, and the hind feet directed forward. There are no external ears, but a fold of skin above the auditory opening. The eyes, destitute of lashes, are deeply set. The tusks, developed in the female as well as in the male, never exceed twenty-six inches in length, including the imbedded root of six inches. The creature is omnivorous. It is becoming very scarce in its favourite haunts, on account of the indiscriminate way in which it is slaughtered. Upwards of 1,000 are still taken annually in the neighbourhood of Spitzbergen. Formerly it was found at Bear Island and on the coast of Finmark. It is still found on the east coast of Greenland, on the west shore of Davis' Straits, about Pond's, Scott's, and Howe Bays. In 1775 they resorted, to the number of over 7,000 a year, to the Magdalen Islands, at the mouth of the St. Lawrence, and the English once had a fishery at Cape Breton. It can be mentioned only as a straggler to our coasts.

Every part of the animal is of value—the tusks, the hide, and the flesh. The word *Walrus* means "Whale Horse," *Ross* being the Danish for a steed. *Morse* is Russian. The Greenlanders call it *Awŭk*, a name derived, it is said, from the cry of the young animal.

Seals are in a state of far less confusion than Sea Lions. The species are numerous, Dr. Gray recognising fourteen species and thirteen genera. As a basis for classification, the number of incisor teeth, together with the shape of the hands, leads to a very natural arrangement of the family. Following this, we find that four incisors above and four below unite the four Seals of the Southern Ocean with the Mediterranean Seal. The six northern species, again, have all six incisors above, and four below, their hands being like those of the "Bearded" and "Common" Seals. Lastly, four incisors above and two below separate off those very remarkable forms, the "Bladder Seal" of the north and the mighty "Sea Elephant" of the south, which have the further point in common of a remarkable development of the nasal passages. The Sea Leopard—or Leopards, if there are really two—together with the Crab-eating Seal, which ought most probably to be united in the same genus with them, inhabit the Antarctic Ocean. In the last-named species the molar teeth are remarkably modified.

The fourth Antarctic Seal is that called *Ommatophoca rossi*—Ross's Large-eyed Seal, known only from specimens procured from Sir J. Ross's Antarctic Expedition. The next species we come to is the Monk Seal (*Monachus albiventer*), which inhabits the Mediterranean and the Island of Madeira.

Of the "Hooded Seal," or "Bladder Nose," till a few days ago a fi re male specimen was living in the Society's Gardens. The length attained ranges between seven and twelve feet. Though a true seal, it has the power of using the fore-feet to walk on land to a certain degree. The nose is broad and flat, and in the male the upper wall of the nostril is so loose that it can be blown up at will into a hood. The use of this curious appendage is not known. Its habits are migratory. It is found in South Greenland, rarely in Iceland and Norway, never now at Spitzbergen. The nearest ally to this seal is the "Sea Elephant," described by Anson in 1742, from Juan Fernandez. It has been recorded to be thirty feet long. The nostrils of the male are prolonged into the remarkable appendage which has been the origin of its name, "Proboscis Seal," the tubular proboscis being, when inflated, a foot in length.

Round the English coast there are two species of seals that are tolerably common, the Common Seal (*Phoca vitulina*) and the Great Grey Seal (*Phoca gryphus*). The former frequents both sides of the North Atlantic, Spitzbergen, Greenland, and Davis' Straits. The latter species is far rarer in this country. It is not found in Polar waters nor in the Mediterranean Sea, where the former exists. Further north we come to three other seals, the Bearded Seal (*P. barbata*), the Greenland Seal (*P. grœnlandica*), and the Ringed Seal (*P. hispida*); the two latter sometimes appear on our coasts as stragglers.

The lecturer concluded by remarking on the necessity for some international agreement to prevent the destructive effects of the short-sighted policy now adopted in seal-hunting.

(*To be continued.*)

## *ON LIGHTNING FIGURES*

THE letter headed "Struck by Lightning," and signed "D. Pidgeon," contained in NATURE, vol. xi. p. 405, is valuable, and the more so because it is unaccompanied by any theory. Formerly, when ramified marks appeared on the persons of men or animals, they were always referred to some near or distant tree, of which the marks formed "an exact portrait." Thus, in the *Times* of September 10, 1866, is an account of a boy who had taken refuge under a tree during a thunderstorm, having been struck by lightning, and on his body was found "a perfect image of the tree, the fibres, leaves, and branches being represented with photographic accuracy."

In a paper read by me before the British Association at Manchester in 1861, I attempted to show that such ramified figures are not derived from any tree whatever, but represent the fiery hand of the lightning itself. Very instructive tree-like figures may be produced on sheets of crown glass by passing over them the contents of a Leyden jar. For this purpose the plates (those I used were four inches square) should be put into a strong solution of soap, and wiped dry with a duster. If a plate be then held by the corner against the knob of a small charged jar, and, with one knob of the discharging rod resting against the outer coating, the other be brought up to the knob of the jar with the glass between, the spark will pass over the surface of the pane, turn over its edge, and thus arrive at the knob of the rod. Nothing is visible on the plate until it is breathed on, and then the condensed breath settles in the form of minute dew on those parts of the soapy film that have not been burnt off by the electricity, while on the lines that have been burnt off or made chemically clean the moisture condenses in watery lines, bringing out the trunk, branches, and minute spray of the dendritic figure in a very perfect manner. In the discussion that followed the reading of my paper, the president of the section remarked that the figures exhibited would pass for trees all over the world. The discharge sometimes exhibits bifurcations and even trifurcations. The main trunk is evidently a hollow tube, as in the vitrified masses known as fulgurites, where lightning

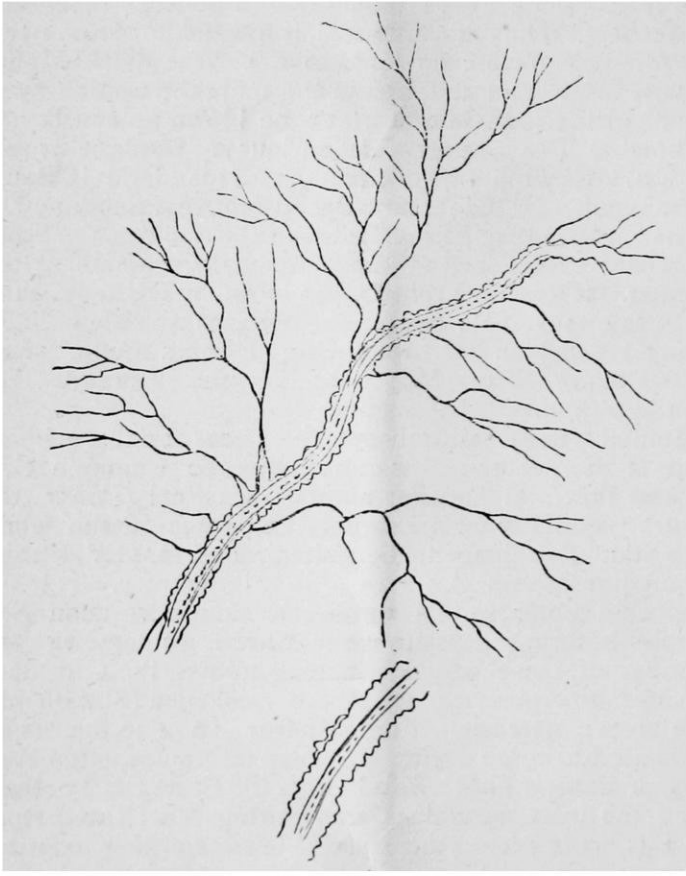


FIG. 1.—Breath Figure of Electric Discharge (also called *Roric Figure*, from *Ros-roris*, "dew.")

ploughs through a sandy soil. Should the plate be too thick, the main discharge may not pass, in which case the plate represents spray only. Hence I infer that the spray precedes the discharge and acts as a feeler for the line of least resistance. Indeed, it is an old observation of sailors, that before the ship was struck everyone on board felt as if cobwebs were being drawn over his face.

The accompanying (Fig. 1) is one of the figures produced as above described, the separate figure being an enlarged portion of the stem or trunk which represents the main discharge. Other examples may be found in the "English Cyclopædia" (Arts and Sciences division), article "Breath Figures," and in the *Edinburgh New Philosophical Journal* for October 1861.

After the reading of my paper I was anxious to see some examples that had been undoubtedly produced by lightning of these ramified figures. I was gratified by the receipt of a letter from Dr. Pooley, of Weston-super-Mare, informing me that he had actually seen a tree struck by lightning, that the inner surfaces of the detached bark contained ramified figures such as I had described, and that he had sent specimens to Dr. Faraday. I accordingly applied for permission to examine them. The figures on the bark had become very faint, but the following engraving (Fig. 2) represents their character.

In the *Lancet* of July 30, 1864, Dr. D. Mackintosh describes a case in which a straw stack was struck by lightning and set on fire, while a man who had sought its shelter was killed, and two boys injured. One of the boys, aged ten, said he felt "dizzy all over;" his legs would not carry him, and he felt pain in the lower part of the abdomen. On taking off his clothes a peculiar sulphurous singed odour was perceptible, and also several irregular but distinct red streaks, of about a finger's breadth, running obliquely downwards and inwards on either side of the chest to a middle line in front of the

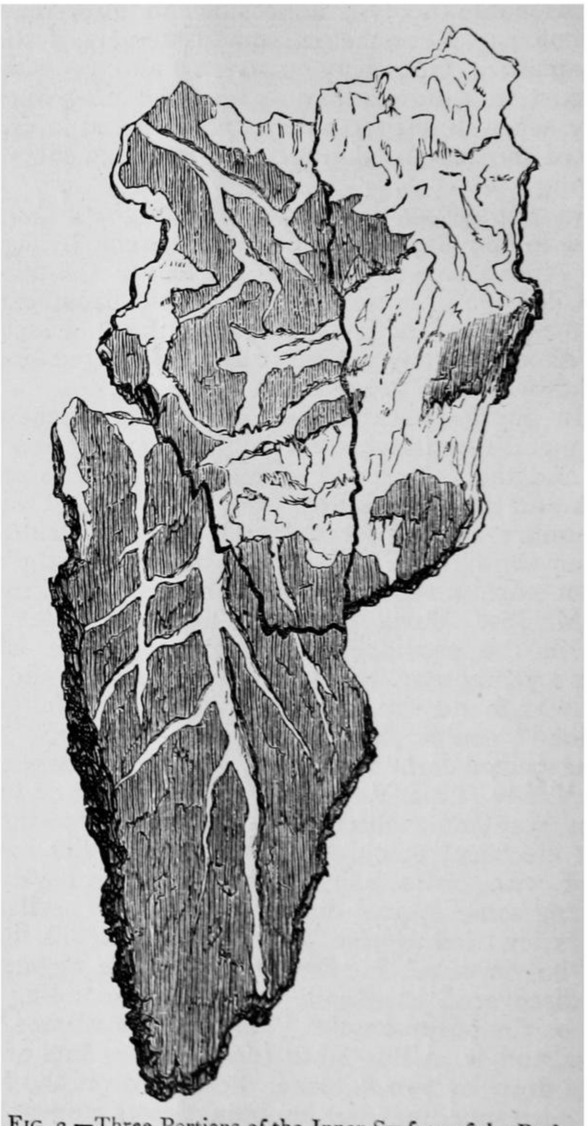


FIG. 2.—Three Portions of the Inner Surface of the Bark.

abdomen, whence they converged; from this point they diverged again till they were lost in the perineum. The streaks were of a brighter red on the more vascular parts of the body; they disappeared in about four days, and the lad recovered.

In the second case, that of a boy aged eleven, "the figures on either hip were so exceedingly alike and so striking, that an observer could not but be impressed with the idea that they were formed in obedience to some prevailing law."

In the third case, that of a man of forty-six, the discharge passed through the head, and seems to have produced instant death.

The phenomena in the case of the two boys agree very well with those described in Mr. Pidgeon's letter.

But there are various other figures produced by lightning sufficiently numerous to have led M. Baudin, in his

"Treatise on Medical Geography," to apply to them the term *Keraunography* (to write with thunder). Mr. Poey, in 1861, published a small volume in which twenty-four illustrative cases are cited. The author starts with the popular notion that the dendritic figures referred to are derived from some near or distant tree, and then proceeds to account for them by means of a photo-electric action in which the surface of the animal is the sensitive plate; the tree, &c., the object; and the lightning the force that impresses it.

But in connection with our subject are other facts, startling, it is true, but recurring from time to time in different parts of the world, and reported by sailors and others, who possess the invaluable art of recording their observations without attempting to explain them. The desire of explaining everything often amounts to a kind of rabies, when the sane course seems to be to wait; for if a reasonable theory is impossible, an unreasonable one is ridiculous. Nevertheless, some observers, if they cannot explain a fact, deny its truth; and yet such facts may exist in nature, and only wait the progress of discovery, when in due time they are gathered in under the sickle of the appointed reaper. Three such facts are the following:—

1. In September 1825, the brig *Il Buon Servo*, anchored in the Bay of Armiro, was struck by lightning, and a sailor who was sitting at the foot of the mizenmast was killed. Marks were found on his back, extending from the neck to the loins, including the impression of a horse-shoe, perfectly distinct, and of the same size as the one that was fixed to the mast.

2. In another case that occurred at Zante, the number 44 in metal was attached to the fixed rigging between the mast and the cot of one of the sailors. The mast was struck and the sailor killed. On his left breast was found the number 44, well formed and perfectly identical with that on the rigging. The sailors agreed that the number did not exist on the body before the man was struck.

3. M. José Maria Dau, of Havannah, states that in 1828, in the province of Candelaria, in the island of Cuba, a young man was struck by lightning, and on his neck was found the image "d'un fer à cheval qui avait été cloué à peu de distance contre une fenêtre."

Unexpected light was thrown upon such cases by Mr. C. F. Varley (Proc. Roy. Soc., Jan. 12, 1871), in following up an accidental observation during the working of a Holtz electrical machine, the poles of which were furnished with brass balls about an inch in diameter. Noticing some specks on the ball of the positive pole, Mr. Varley tried to wipe them off with a silk handkerchief, but in vain. He then examined the negative pole, and discovered a minute speck corresponding to the spots on the positive pole. This pole sometimes exhibits a glow, and if in this state three or four bits of wax, or even a drop or two of water, be placed on the negative pole, corresponding non-luminous spots appear on the positive pole. Hence it is evident that lines of force exist between the two poles, by means of which we may telegraph through the air from the negative to the positive pole. And in explanation of the above cases in which the lightning-burn on the skin is of the same shape as the object from which the discharge proceeded, all that is necessary is that the object struck be + to the horse-shoe, brass number, &c., the discharge being a negative one.

C. TOMLINSON

## INAUGURATION OF THE ZOOLOGICAL STATION OF NAPLES

AFTER the first working year a formal inauguration of this new institution took place on April 11. Dr. Dohrn had invited the Italian Minister of Public Instruction, Signor Borghi, and the German Ambassador at Rome, Herr von Kendell, to be present as representatives of the two countries which had most assisted in completing the new establishment, the one granting the locality, whilst the other paid a subvention of 3,000*l.* towards the expenses of the construction. Unfortunately both gentlemen were at the last moment prevented from being present, but sent two letters stating their great sympathy and the sympathy of the two Governments which they represent, for the Zoological Station.

The inauguration solemnity consisted chiefly in an inaugural address read by Dr. Dohrn himself to an audience of distinguished gentlemen, and a short answer given by Signor Paureri, the well-known Professor of Anatomy of the Naples University.

Before giving an abstract of the address, it may be permitted to say a few words about the life and work of the Zoological Station during the first year of its existence.

The following naturalists have made use of its laboratories:—From *England*: Mr. Balfour, Mr. Dew Smith, Mr. Marshall, from Cambridge; Mr. E. Ray Lankester, from Oxford. From *Holland*: Mr. Hubrecht (Leyden), Dr. Hoek (Haag), Prof. Hoffmann (Leyden), Dr. Hoorst (Utrecht), Prof. Van Ankum (Groningen). From *Germany*: Prof. Waldeyer (Strassburg), Prof. Wilh. Müller (Jena), Dr. Korsmann (Heidelberg), Prof. Hesslöhl (Constanz), Prof. Greeff (Marburg), Profs. Kollmann and Ranke (Munich), Dr. Steiner (Halle), Prof. Oscar Schmidt (Strassburg), Prof. Langer Lans (Freiburg), Dr. v. Thering (Göttingen), Dr. Götte and Dr. Lorent (Strassburg), Dr. Vetter (Dresden), Prof. Selenka (Erlangen). From *Austria*: Prof. Claus (Vienna) with two students of the Vienna University. From *Russia*: Prof. Salensky (Kazan), Dr. Rajewsky (Moscow), Dr. Bobretzky (Kiew), Dr. Ulianin (Moskau), Dr. Rosenberg (Dorpat), Cand. Isnoskoff (Kazan). From *Italy*: Dr. Cavanna (Florence), Dr. Fanzago (Padua), Dr. Zingone (Naples).

Some of these naturalists have been working a whole year in the Zoological Station; some have come back a second time; the greater number have only stayed the winter, especially from February till May, a period when the Station is likely to be visited more frequently than at any other.

If one compares the number of naturalists coming to Naples in former years to study Marine Zoology with the number of those who are named above, it is at once obvious how great an effect the Zoological Station has had on the increase. Formerly from three to five zoologists used to come during the year to Naples, often even less, or none. From Easter 1874 till Easter 1875, there were thirty-six naturalists, and during March and April of this year alone there have been working contemporaneously in the Zoological Station eighteen zoologists.

This shows how considerable in a quantitative point of view the increase of scientific work done at Naples has become. It is besides obvious that the arrangements in the Zoological Station—the great Aquarium providing almost natural conditions of life to the animals, the daily supply of fresh material, the facility offered by the library for consulting the literature, and the personal intercourse among so many scientific men,—must have also a favourable influence on the quality of the work, by enabling each of the naturalists to concentrate his energy solely on the scientific difficulties of his pursuit, not having at all to deal with any of the tiresome, very trying, and for a single man often almost insurmountable obstacles of a more practical character which are in the way of these studies.

Besides, one must not forget that the Zoological Station is still in its infancy, and has grown to its present state of working order in the midst of difficulties of every kind and character. Granted a greater experience in the line of its actions, especially a greater knowledge of the sea and its localities, currents, temperatures, and other conditions affecting the life and habitat of the animals; granted, further, an increased income to allow a more liberal endowment of its different parts, viz., library, collection, laboratories, and also an increase in its leading and scientific staff; granted, finally, new donations and subventions like those of the English naturalists and of the German Government, and we may be pretty sure that the Zoological Station at Naples will in future be a quite indispensable and very powerful instrument for scientific research.

At present the following Governments and Universities have entered upon contracts with the Zoological Station for one or two tables:—Prussia, Italy, Russia, Austria, each for two tables; Bavaria, Saxony, Baden, Mecklenburg, Holland, and the Universities of Cambridge and Strassburg, each for one table. Negotiations have been entered upon with Würtemberg and Hesse-Darmstadt. Accommodation for twenty-four naturalists will be ready for next winter, and it is hoped to augment the daily arriving quantity of marine animals for investigation by help of a small steam launch, which will be always out on fishing expeditions, weather permitting.

All this together shows a regularly working institution, which, we believe, deserves the full attention of scientific men as a new element, or, to use an expression applied to it once by Prof. Owen, a new dynamic in science.

The following is an abstract of Dr. Dohrn's inaugural address:—

Dr. Dohrn began by referring to the success which has hitherto attended the Naples establishment, to the Andersonian School of Natural History in America, and to the Zoological Station which the Austrian Government proposes to establish at Trieste. He then proceeded to show what may in time be expected from the institution; in what its duties principally consist.

The original purposes of the undertaking was to facilitate the labours of the zoologists who come to Naples from all parts of Europe to study the marine animals of the Bay. For this purpose it is of course necessary to enter into relations with the fishermen in the Bay, in order to obtain the needed supply of fish; but this method is so far from satisfactory that Dr. Dohrn, as soon as the state of funds permits, is resolved to obtain a small steamer, properly fitted up; with such assistance only can the purposes of the institution be satisfactorily carried out.

Dr. Dohrn then referred to the library of the Station, which he is exceedingly anxious to make as complete as possible, and hopes that authors, publishers, and academies will continue to supply the wants of the Station in this respect. He is especially anxious to obtain systematic works, the want of which has already made itself painfully felt. The institution greatly depends upon its pecuniary resources, and he hopes those who are friendly to its purpose will continue to lend it a helping hand.

The Zoological Station will continue to supply foreign universities, laboratories, museums, and private collections with marine animals, carefully preserved according to the directions of the person who orders them.

Besides thus endeavouring to further the work of others, the Station has important scientific tasks of its own. One of the chief of these is an exact determination of the fauna of the Bay. Not only for its own sake is this task one of the first duties of the Station, but it will be of great assistance in facilitating the work of the Station in other directions. It may be objected that the smallness of the means at the disposal of the Station is inadequate to the fulfilment of all these purposes. While the justice of this objection is admitted, there is at the same time no doubt that a great future is in store for Zoological Stations; for the principle on which they are founded will remain, and give rise to ever new realisations.

The decreasing importance which the study of zoology holds in the medical curriculum can hardly be avoided without inordinately lengthening the time required for such a course, medical science itself has become so subdivided and specialised. Still, those who look upon the medical profession as something more than merely a means of livelihood, will not treat zoology with indifference, but will perceive the important bearing it has on the proper understanding of many medical problems.

The importance of the principles of the Development theory on the progress of medicine are then insisted on. In the case of transmission of a hereditary tendency to certain forms of disease, the application of these principles might be made to serve a most important purpose, if thoroughly understood and carefully carried into practice. "How important must it be to ascertain the conditions of such a transmission, to discover the symptoms which, though in the present state of our knowledge they may escape observation, may in the earliest years show a morbid predisposition, and thus warn us to conduct the whole physical and moral education of the child with reference to the hidden enemy. As soon as these truths have become a part of the intellectual possessions of the people, as soon as physicians and teachers bear them constantly in mind and act in accordance with them, how different will education become! For in this the highest significance of the Darwinian theory consists, that its principles embrace the moral as well as the physical nature of man, and that their critical application may bring about intellectual as well as corporal changes.

"As soon as its high practical value is established and recognised, no doubt can be entertained that the progress of zoology, the chief exponent of these laws, is an essential furtherance to the advance of morals and the reasonable adjustment of human life; and it follows that society—and the highest form of society, the State—are not only entitled, but in duty bound, to afford a free opportunity for zoological investigation, and to support it by all the means in their power."

Zoology is now so advanced and subdivided that at the various universities the professorships of Zoology should be at least doubled; no man is able adequately to teach all branches of it. Moreover, laboratories must be established at the seaside, and still more, stations in various parts of the world.

Dr. Dohrn bespoke the utmost toleration for the Darwinian theory from all classes. He hoped that the fact that he had connected the name of the Station with the development and application of the Darwinian theory would not prevent anyone from lending it his support.

"When the fundamental principles of Darwinism are once thoroughly understood, it becomes clear that it is not nearly as revolutionary as some of its disciples seem to suppose. On the contrary, it is the declared enemy of all revolutions. It takes its stand on concrete reality, and teaches, like Hegel, that the real is the reasonable. It sees in all that exists the necessary result of a long process of development, in which innumerable influences have contributed to render the present world what it is, and not something quite different from it. But it sees in the present world only the *present* world; tomorrow it will be changed. What in to-day is the effect of yesterday, must at the same time be the cause of tomorrow. Thus Darwinism is at once extremely tolerant and the prophet of a different future. If at times this should not appear to be the case, the blame is due, not to the theory, but to its advocates, who often seem not to understand the doctrines they so zealously teach, since they are enraged at an opposition which, if they understood how necessary and inevitable it is, they might with ease gradually but certainly remove."

It was shown that the Development theory is applicable to all forms of existence and to all departments of human life. If the law were carefully applied to history as well as to nature, we might hope to be able to reduce the phenomena of both to one great law of development, by means of which we should be enabled better to understand both the past and the future, and to judge more clearly of the present.

The important bearing which the work at the Naples and similar stations had on the elucidation of this law was then pointed out. "Every fish, every crab, every Medusa is the result of a long process of development, which we have to trace, and the determination of which the Zoological Station is intended to facilitate. That is its purpose; it was for that end that I built it, and for that reason I have asked you to lend your support to my efforts."

## THE "VILLE DE CALAIS" BALLOON ASCENT

PARIS, *May* 3.

WE made our ascent yesterday from La Villette gasworks at 1·25 P.M., and landed safely in a field at Creney, a small country place four miles south-east of Troyes, which is about 100 miles south-east from Paris. After having made observations during a little less than six hours, our grapnel was let down at ten minutes past seven. There were three of us in the car—M. Duruof, Mr. Marriott, an English correspondent in Paris, and myself. The maximum altitude reached was about 12,000 feet. The ascent was very gradual, and the above height was reached only at six o'clock. No sensible effect was perceived, although the temperature of the air, which on the ground was about 50° F., was no more than 26° at this altitude. We tried several experiments, with what success it remains to determine on examination of the apparatus. Some of the results, however, I am able to state here.

We had suspended to the net a number of cages containing small birds and guinea-pigs. The current of gas had a decided inclination to flow in a certain direction, and we had not ascended 6,000 feet when one of the birds was found dead by suffocation. It was the only bird exposed to the inhalation of the current of gas, and no other was injured. It was proved by a careful autopsy executed this morning by Dr. Lionville that this bird had perished by intra-osseous hæmorrhage in the cranium. The hæmorrhage had taken place on both sides, and without any lesion appearing to the exterior.

We discovered that not less than four different banks of clouds were being carried over Paris and its vicinity. Before the end of our journey the clouds had considerably diminished in thickness, and the blue sky appeared. I was able to take some thermo-solar observations with a blackened bulb thermometer *in vacuo*.

As the effect on our constitutions of our 12,000 feet trip was very trifling, I am of opinion that the experiment may be scientifically conducted gradually to an immense altitude, independently of previous catastrophes.

W. DE FONVIELLE

## NOTES

As we announced some months ago (Dec. 24, vol. xi. p. 153), Prof. Huxley is to undertake the duties of Prof. Wyville Thomson's chair of Natural History in the University of Edinburgh during the present summer session. Prof. Huxley gave his introductory lecture on Monday afternoon to a large audience. He was accompanied by Principal Sir Alexander Grant, Principal Tulloch, St. Andrews, and the members of the Senatus, and was enthusiastically received. He expressed at the outset a hope that at this time next year Prof. Thomson would be among them again, full of health and vigour, laden with the spoils of the many climes through which he had travelled, and a sort of zoological Ulysses, full of wisdom for their benefit. He then took a general view of his subject, put before the class the considerations which resulted from the careful study of a single animal, the Crocodile; an animal which was worthy of attentive study, as it might be said that a knowledge of its organisation was the key to the understanding of a vast number of extinct reptiles, and the key to the organisation of birds; while it helped them to connect the higher with the lower forms of vertebrate life, and was, in part at any rate, the key to the history of past life upon the globe. There might be asked respecting this animal, as respecting every other living thing—first, what was its structure? second, what did it do? third, where was it found? and fourth, in virtue of what chain of causation had this thing come into being?—this last having only been recently recognised as one of those questions which might legitimately be put. He then proceeded to describe the organisation of the Crocodile—its morphology, physiology, and distribution; and remarked that there were few animals about the palæontological history of which they knew so much, as they could carry back its history through the tertiary and secondary epochs. The answer to the last question constituted Ætiology, or the science of the causes of the phenomena of morphology, physiology, and distribution. Here, as in all cases where they had to deal with causation, they left the region of objective fact and entered that of speculation. With their present imperfect knowledge, the only safe thing they could do in attempting to form even a conception of the cause of this extraordinary complex phenomenon was what a wise historian would do—stick by archæological facts. He pointed out that palæontological facts showed that there had been a succession of forms of that animal to the present day, the oldest being something like the Lizard.

THE Instructions prepared for the use of the officers of the Arctic Expedition in their Scientific work are now nearly complete, and all the courses of instruction, comprising the use of magnetical, astronomical, and meteorological instruments and of spectroscopes, will be concluded next week, many officers from both ships having taken part in them. We believe that the present arrangement as to date of leaving, the 29th instant, may be considered as final. We have already stated that the exploring ships are to be accompanied as far as Disco Island by the *Valorous* for the purpose of enabling them to fill up with stores and coal at the last moment. At the suggestion of the Council of the Royal Society, advantage will be taken of the presence of this ship to make observations in a little explored region, her homeward voyage being employed in carrying out such a physical and biological exploration of the southern part of Baffin's Bay and the North Atlantic between Cape Farewell and the British Isles as may serve to complete the work which is being so successfully prosecuted in other seas by the *Challenger*. Mr. J. Gwyn Jeffreys, the coadjutor of Dr. Carpenter and Prof. Wyville Thomson in the *Porcupine* expeditions, which first demonstrated the feasibility and scientific importance of this kind of exploration, has volunteered for the service, and he will take with him as his assistant Mr. P. Herbert Carpenter, who did good work when accompanying his father in the *Porcupine*, and who will especially take charge of the physical inquiries.

M. CORNU's lecture on the velocity of Light at the Royal Institution to-morrow evening is looked forward to with great interest. We believe he intends to speak in French, though his knowledge of English renders him quite competent to make use of that language if he chose. An account of the results attained by M. Cornu will be found in NATURE, vol. xi. p. 274.

HOFRATH HEINRICH SCHWABE died at Dessau on April 11; he reached a patriarchal age, having been born on Oct. 25, 1789, at Dessau. He retained his faculties to the last, although he had been compelled for many years to relinquish his favourite astronomical studies, which in 1857 had won for him the Royal Astronomical Society's Gold Medal.

CHEMISTRY in Germany and in Austria has to deplore two severe losses. On the 15th of April died Prof. von Schrötter, Master of the Mint in Vienna, and known best through his discovery of amorphous phosphorus and his determination of the atomic weight of phosphorus; he died at the age of seventy-three years. A few days later Prof. Carius died at Marburg after a protracted illness. Although only forty-six years old, he leaves behind him the record of very numerous researches, of which those on the sulpho compounds, corresponding to glycerine and its derivatives, on the oxysulphides of phosphorus, on the action of hypochlorous acid on hydrocarbons, and on the analyses of organic chlorides, iodides, bromides, sulphides, and phosphides are best known.

THE *Times* of the 30th ult. contains a letter from its correspondent with the *Challenger*, dated "Zamboango, Jan. 31." The *Challenger* left Hong Kong on Jan. 6, and proceeded to the middle of the China Sea, where a series of temperature soundings was taken, the temperature at the bottom, 1,200 fathoms, being found to be 36° Fahr. This temperature is accounted for by Capt. Chimmo's statement, that the China Sea is cut off by a barrier, which rises to a height of between 800 and 900 fathoms below the surface of the water, from communication with the Antarctic Ocean. Passing along the west coast of Luzon, the *Challenger* entered a little enclosed sea extending from the north point of the island of Tablas to the strait between the north-east angle of Panay and the south-west point of Masbate. Here another series of interesting temperature soundings was taken, the temperature at bottom, 700 fathoms, being 51·7°. The temperatures generally in this Panay Sea were to a certain extent intermediate between those in the China Sea on the one side and the Zebu Sea on the other, leaving it uncertain whether the cleft in the barrier to the depth of 150 fathoms is between Tablas and Panay or between Romplon and Sabuyan. After visiting Zebu, near which some fine specimens of the beautiful sponge the "Venus' Flower-basket" (*Euplectella*) were trawled, the ship made for the small island of Comiguin, between Mindanao and Bohol, to inspect the active volcano therein. This volcano "was born on May 1, 1871," and now forms an irregular cone of 1,950 feet in height. From Comiguin the *Challenger* proceeded along the west coast of Mindanao to Zamboango, where a party of sportsmen were sent to camp out in the forest within riding distance of the ship. On leaving Zamboango, a run of about 2,000 miles was to be made nearly parallel with the equator, and only a few degrees to the north of Greenwich Island. Thence the expedition was to make one of the most important sections, through the Caroline and Ladrone Islands to Japan, where it was expected to arrive about the second week of April.

THE enterprise of the Scottish Meteorological Society we have had frequent occasion to refer to, and the practical as well as scientific value of the work it undertakes does it the greatest credit, especially when its narrow means is taken into consideration. One of its latest publications is a diagram by Mr. G. Thomson, Fishery Officer, Lybster, Caithness, showing for the months of July, August, and September, 1874, the catch and quality of the herrings, and the varying positions of the herring-ground in the district of Lybster, as also the meteorology of the district. The diagram, which has been revised by the secretary, Mr. Buchan, is ingeniously constructed and quite intelligible. There are two series of conjoined curves and tables, the first showing all details belonging to the meteorology of each day, and the second showing the catch and quality of fish. Underneath are a sketch of the coast and indications of the different fishing grounds occupied. The diagram, we believe, is intended for distribution among the various district fishery officers in Scotland, with the view of inducing some of them to prepare similar diagrams for 1875 for their own districts. With these, and the observations from twenty sea-thermometers which were presented by the Marquis of Tweeddale, as also of the weather during the coming season, results may be hoped for that will throw some light on the important question of the varying localisation of the fishings.

THE Committee of the forthcoming Geographical Congress at Paris have finished the distribution of the space allotted to the various countries in the *Pavillon de Flore* for exhibition; the geographical order has been adopted in locating the several nations. Russia, being the most northern, has been placed first; but magnificent rooms have been allotted to British exhibitors on the ground-floor. Everything has been done to ensure a splendid display of English science and industry, and great things are expected from the nation which, without any boasting, may be said to have done as much as many others put together to open the world to civilisation. The presidents of the English Committee are the Earl of Derby, Sir H. Rawlinson, and Sir Bartle Frere. Great interest is felt by the Society and the Committee in the Polar Expedition, and models of the two ships, of sledges, boats, &c., would be most particularly popular and very thankfully received.

THE Council of the Senate of Cambridge University upon the Grace which proposed to constitute a Syndicate for the purpose of considering what representations should be made to the Government as to the pecuniary and other relations subsisting between the University and the Colleges, are of opinion that it should be withdrawn; they think, however, that it is advisable to obtain the general opinion of the University on the following points:—1. What additional teachers or appliances for teaching are required in the different departments of University study. 2. How these teachers and appliances may be best supplied, whether by the individual Colleges or by the University, or partly by the one and partly by the other. 3. Whether by any improved organisation the systems of professorial and collegiate teaching may be made more efficient and be brought into closer relations with each other. 4. How the teaching in the University may be organised so as to give the greatest encouragement to the advancement of the several branches of learning. They therefore recommend that a Syndicate be appointed to consider these subjects. The Vice-Chancellor invites discussion of this report on Saturday next, at 2 P.M., in the Arts School.

A SYNDICATE has been appointed to consider what steps (if any) should be taken for establishing a Professorship of Mechanism and Engineering in the University of Cambridge.

The late Prof. Willis, by his will, offered to Cambridge University, for 1,200*l*., the collections of models, instruments, and tools used by him as Jacksonian Professor. A Syndicate has been appointed to consider the expediency of purchasing the whole or part of the collections.

FOR some time past negotiations have been in progress between Prof. Charles F. Hartt, of Cornell University, and the Government of Brazil, in regard to a complete geological survey of that empire. It is now stated that the preliminaries have been completed, and that Prof. Hartt has been appointed director of the survey. His preparations for this work are ample, as he has made no less than four successive visits to Brazil with reference to the study of its general geology and ethnology. His salary is said to have been fixed at $10,000 a year. It is also announced that Prof. Caldwell, another member of the faculty of Cornell University, has been appointed to take charge of the agricultural branch of the survey.

IN reference to a note in *Dingler's Polytech. Journal*, mentioned in NATURE, vol. xi. p. 456, there is a second paper in the valuable serial (2nd January part) on the part played by carbonic oxide gas in smoking. This treatise is by Dr. Vohl, and refutes Dr. Krause's opinion. He says: "It is evident from Dr. Krause's account that he is unaware of the experiments made by Dr. H. Eulenberg and myself as far back as 1871, which proved the presence of carbonic oxide in tobacco smoke. I cannot, however, agree with the idea that the physiological effects of smoking are to be in part or wholly attributed to this gas, as it varies greatly in the quantity in which it is present in smoke. This quantity is never considerable, and the effects in question must rather be ascribed to the volatile organic bases, which form while tobacco is burning. Dr. Krause owns himself that his analytical results are not exact, on account of the method he used in obtaining them; these results cannot therefore give any idea as to the quantity of carbonic oxide generally present in tobacco smoke, as neither the temperature nor the barometrical pressure was noted, nor was any account taken of oxygen and marsh gas."

THE Government has taken up the question of the protection of seals in the Greenland seal fishery; and a Bill has been introduced into Parliament by the Board of Trade, authorising the issue of an Order in Council prohibiting the capture or destruction of any kind of seal between such dates as may be specified in such Order, in any part of the area included between the parallels of 67° and 75° N., and the meridians of 5° E. and 17° W. Such Order is to be made whenever it shall appear that the other States whose subjects and vessels are engaged in the seal fishery shall make similar regulations. The great destruction of seals which has taken place of late years has seriously interfered with the success of the important industry. This year many of the vessels have returned "clean."

M. WALLON, the French Minister for Public Instruction, has visited the Lille Academy and Colleges, and was received with a great display of enthusiasm. He is said to contemplate many improvements in educational establishments in large provincial cities; these are to be tried first in the city where he was born, and which he represents in the National Assembly.

THE Council of the lately-established United Services College, Westward Ho, have resolved to introduce Natural Science into the regular school-work; in fact, to place it on an equal footing with Languages and Mathematics as a means of mental training. They have appointed as master Mr. Herbert Green, F.C.S., M.A., of Queen's College, Oxford, who has had some years' experience at Victoria College, Jersey. A laboratory will be at once fitted up under his supervision, and class-rooms will be added as required.

WITH regard to the statement quoted from Dr. Cleland's book on Animal Physiology (NATURE, vol. xi. p. 504), "that the presence of chlorophyll is as necessary for the production of organic matter in organisms as the presence of protoplasm is necessary for growth," a correspondent points out that fungi seem to be an exception to the rule. He has never seen it stated that Torula, for instance, contains chlorophyll, nor has he ever himself seen chlorophyll in Torula. It is generally agreed, he believes, that fungi do not contain chlorophyll or starch.

DR. JOHN CROUMBIE BROWN, F.L.S., author of a work on the Hydrology of South Africa, is preparing for the press a work which he intends to call "Reboisement en France." It will consist of records of the replanting of the Alps, the Cevennes, and the Pyrenees with trees, herbage, and bush, with a view to arresting and preventing the destructive consequences and effects of torrents, and will embody a *résumé* of Alexandre Surell's "Étude sur les Torrents des Hautes Alpes," with copious extracts.

THE Annual Meeting of the Royal Institution was held on Saturday last. Sixty-four new members were elected in 1874. The following gentlemen were unanimously elected as officers for the ensuing year:—President, the Duke of Northumberland, D.C.L.; Treasurer, George Busk, F.R.C.S., F.R.S.; Secretary, William Spottiswoode, M.A., LL.D., Treas. R.S. The Vice-presidents for the year are the Duke of Devonshire, K.G., Dr. Pole, F.R.S., and Dr. C. W. Siemens, F.R.S.

THE Iron and Steel Institute commenced its meetings yesterday; we hope to be able next week to give some account of the work done.

WE believe that Mr. Disraeli has promised to receive a deputation on the subject of the India Museum after the Whitsuntide holidays.

STEPS are being taken to obtain the assent of the Emperor to a proposal for holding an Imperial German Industrial Exhibition in Berlin in 1878.

MR. STANFORD is about to publish Part I. of "Vestiges of the Molten Globe," by Mr. W. L. Green, Minister of Foreign Affairs to the King of the Sandwich Islands. The work will be concluded in three parts, and will, we believe, contain some curious observations as to the formation of minerals, Mr. Green having had many opportunities of watching the process during his twenty-five years' residence beside the Hawaiian volcanoes.

MR. EDWARD B. AVELING, B.Sc. Lond., has been appointed Lecturer on Comparative Anatomy at the London Hospital Medical College.

MR. J. RAND CAPRON has reprinted from the April number of the *Philosophical Magazine* his paper "On the Comparison of some Tubes and other spectra with the Spectrum of the Aurora."

VINE culture in New South Wales is progressing very rapidly, the number of acres occupied for this purpose being 3,183 in 1873, against 2,568 acres in 1872, and the produce 575,985 gallons against 451,450 gallons. These figures relate only to the growth of grapes for wine-producing purposes, but a considerable area is devoted to the cultivation of the vine for other objects. In Western Australia also, where the soil and climate are eminently favourable to the growth of the grape, this pursuit is becoming more general.

MUCH information on the functions, the form, and the habits of the Octopus may be obtained from a small work by Mr. C. Mitchell, recently published by Messrs. Dean and Son. The structure and economy of the animal are, in it, explained in a particularly lucid and interesting manner, which will lead those who have the opportunity of seeing the Octopus in an aquarium for the first time, to form a far better idea of the somewhat shapeless mass presented to their view, than any amount of time spent in simply inspecting it at a distance. Some anatomical illustrations which are added will also be found very useful to any one who has the opportunity of obtaining specimens for dissection.

THE additions to the Zoological Society's Gardens during the past week include two Pig-tailed Monkeys (*Macacus nemestrinus*) from Java, presented by Mr. A. B. Gordon and Miss H. E. Humphreys; a Patagonian Conure (*Conurus patagonus*) from La Plata, presented by Mrs. Cabry; a Ground Hornbill (*Buceros abyssinicus*) from West Africa, a Concave-casqued Hornbill (*Buceros bicornis*) from India, received in exchange; a Hoffmann's Sloth (*Cholopus hoffmanni*) from Panama, purchased; two White-fronted Lemurs (*Lemur albifrons*), a Hairy Armadillo (*Dasypus villosus*), and four Upland Geese (*Chloephaga magellanica*), born in the Gardens.

## METEOROLOGY, ETC., IN MAURITIUS

THE following letter from Mr. C. Meldrum, dated "Observatory, Mauritius, April 2," to a friend in England, gives some interesting data tending to prove a connection between solar activity and the state of the weather. With his new instruments we may hope soon to have some most important results.

"Since December last the colony has been suffering from drought, and there is very little appearance of a favourable change. February has been the driest month since systematic observation commenced in 1852, and the rainfall for January and March has been far below average. If the present state of things continue long, the island will be hard up for water.

"Coincident with this drought there has been, as usual on such occasions, a great falling off in the number and violence of cyclones in the Indian Ocean. We copy here the log-books of all vessels arriving in port from India, Australia, the Cape, England, &c., so that no great storm can take place over the greater part of the ocean without our getting more or less information about it. Well, the hurricane season is nearly over, and we have heard of only two storms, one on the 24th of January away to the northward of us, and one on the 7th of March, away to the eastward of us, and neither of them seems to have been extensive or very violent, only two vessels having been involved in each. The season thus bears a remarkable contrast to the corresponding periods for 1871, '72, and '73, and furnishes another instance of the now oft-observed fact that when Mauritius suffers from drought the Indian Ocean is almost free from hurricanes. The neighbouring island of Réunion has fared as badly as Mauritius, and the log-books furnish evidence that the drought has prevailed over a wide area.

"The S.E. trade-wind has been blowing from S.E. to E. and E.N.E. almost without interruption during the last three months, and the barometer been unusually high and steady for the season, thus showing that from some cause or other the belt of calms and variables between the S.E. trade and the N.W. monsoon has not advanced so far to the south as it did in the years 1871–74.

"It is only now that I am enabled to keep a continuous record of the sun-spots, the photo-heliograph having been put up a fortnight ago, and being at work only for a week; but from observations made directly, as often as possible, it would appear that there has been a great falling off in the number and magnitude of the spots. If this is the case, then we have, as on many other occasions, a decrease of spots, a decrease of cyclones, and a decrease of rain all at or about the same time.

"Our latest telegraphic news, *viâ* India, states that severe cold prevailed throughout Europe. It would be very interesting to know the conditions of weather for the whole habitable globe during the last three months. Comparative meteorology—including the sun's—can alone throw light on the nature of the relations subsisting between weather changes and variations of solar activity.

"Although the sun-spots decreased considerably in January and February, yet one or two pretty large ones appeared towards the end of February, and on the 27th of that month, between 1 and 7 P.M. we had (for this latitude) a remarkable magnetic storm. I fancy next mail will bring us news of auroras and magnetic storms having been observed in different parts of the world at that time. We had no aurora here, but on the 25th, 26th, 27th, and 28th there appeared, shortly after sunset, long beams of light radiating from a point near the horizon at E. by N. (nearly opposite the sun). This of course is easily explained without an aurora or any fitful outburst on the sun, but I have noticed that these radiating beams, which are sometimes very gorgeous, and occasionally radiate from points near the poles, are much more frequent in some years than others—which may arise from different states of the vapour and clouds. Dr. Lyall, who took a series of observations in Madagascar about forty-five years ago, makes mention of them, and describes them under the name of Aurora.

"We have all the instruments at work now, except the thermograph, which has not arrived. I have been so much occupied with the putting up of the instruments and removing into the new Observatory, that I have had very little time for anything else. I wished to send to the Royal Society some papers, but I could not manage to get sufficient leisure to prepare them. In a short time we shall be in train, and I hope to resume the subject of periodicities, &c."

## SCIENTIFIC SERIALS

THE current number of the *Quarterly Journal of Microscopical Science* commences with an account by Mr. Wm. Archer of a new freshwater sarcodic organism, named by the author *Chlamydomyxa labyrinthuloides*, which is illustrated by a superb folio-sized coloured plate, as well as an octavo one. The species is shown to be closely allied to *Labyrinthula* of Cienkowski. The matrix is enclosed in a multilaminate cellulose envelope, which at times appears to burst and give exit to protoplasmic contents, which emerge in an arborescent manner with hyaline prolongations, along which small fusiform protoplasmic masses travel.—Rev. M. J. Berkeley gives a short account of the Thread Blight of Tea, in which he describes the fungus producing it, although he is unable to name it because he has not had an opportunity of examining the fructification.—Mr. P. Kidd draws attention to the occurrence of spontaneous movement in the nucleoli of the epithelium of the frog's mouth.—This paper is followed by an excellent and illustrated account of the structure of the Pacinian corpuscles, considered with reference to the homologies of the several parts composing them, by Mr. Edward Schäfer, in which it is shown—assuming an ordinary nerve fibre to consist of the axis cylinder in the middle, surrounded by, first, the medullary sheath, or white substance; secondly, a delicate layer of protoplasm containing nuclei; thirdly, the primitive sheath (of Schwann); and lastly, the numerous laminæ of the neurilemma, which, however, encloses a layer of finely filamentous connective tissue—that the coats of the Pacinian are the layers of the neurilemma; that the sheath of Schwann surrounds the core, this latter being an expansion of the protoplasmic substance; that the medullary sheath, if not retained as such, disappears, and that the axis-cylinder becomes the central fibre.—Mr. A. W. Bennett gives an account of modern researches into the nature of yeast, specially noticing those of Reess and Cienkowski.—Prof. Lankester has a paper of special theoretical importance, on the Invaginate Planula, or Diplobastic Phase of *Paludina vivipara*; in which, after proposing the name "blastopore" for the orifice of invagination of those Planulæ which exhibit it, he proposes a a classification of Planulæ, which helps to simplify this intricate part of embryonic history. He divides Planulæ into two groups: *Delaminate* Planulæ, in which there is no invagination, but a splitting of the blastosphere to form the endo- and ecto-derm; and *Invaginate* Planulæ, which may be *embolic*, or have no food-yelk; or *epibolic*, possessing a "residual yelk." The Hydrozoa and Calcareous Sponges have delaminate planulæ; Amphioxus, Ascidians, many Mollusca, Sagitta, Echinodermata, and many Vermes have embolic invaginate planulæ; whilst in the third group are included many Mollusca, many Vertebrata, the Ctenophora, certain Vermes, and certain Arthropods.—Mr. H. C. Sorby describes the absorption spectrum of *Bonellia viridis*, and draws attention to a most striking point, namely, that there seems to be a constant ratio between the wave-lengths of the different bands in these spectra.—The number contains its usual excellent quarterly chronicle, notes, &c.

THE *Journal of the Chemical Society* (March 1875) contains the following papers, besides a large number of abstracts from other serials, already noticed in NATURE:—The formulæ of the alums, by S. Lupton. The author briefly states the formulæ given to the alums before they were finally designated as $A' B'''2SO_4.12H_2O$ (where A stands for an alkali metal and B for a metal of the iron group). At present some chemists use this formula, while others double it into $A_2'B_2'''4SO_4.24H_2O$. The cause of this variety of usage rests in the uncertainty attaching to the atomicity of alumium; this metal appears as a tetrad when combined with chlorine, bromine and iodine, but as a triad in its methyl and ethyl compounds. The author tried to obtain certain bodies similar to the alums in constitution, but differing in the number of molecules of water which they contain; the latter have often served to establish the formula of salts. Experiments were made with iron and ammonium alum, aluminium and potassium alum, and alumium and ammonium alum; these experiments are described, and the author arrives at the conclusion that the doubled formula as above is the correct one, as it seems that upon dehydration the residue $R_2'R_2^{iv}4SO_4$ remains unaffected, and exists therefore in the ordinary alums in combination with 24 molecules of water.—On the colour of cupric chloride, by Walter Noel Hartley. This salt is almost invariably described as being of a green colour, but the author has found that the salt is only green as long as there is a trace of moisture about it; as soon as the salt is quite dry its crystals are transparent, brilliant, and of a beautiful pale blue tint. A strong solution of the salt is deep green, a dilute solution blue. When the crystals are moist, they may be considered wetted with the dark green solution, and so their true colour is masked.—On the purification and boiling point of methyl-hexyl carbinol, by E. Neison.—This is followed by a note on the same subject from the pen of Prof. C. Schorlemmer. The two gentlemen agree pretty well with regard to the boiling point, which Mr. Neison finds to be at 181°–182° C., and Prof. Schorlemmer at 179°·5; the difference may probably rest upon the difference of thermometers.—The last paper is on the oxidation of the essential oils, by Chas. T Kingzett.

*Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie*, Feb. 1.—Dr. Julius Ucke, of Samara, contributes an abstract of his work, undertaken chiefly from a medical point of view, on the quantitative proportions of atmospheric oxygen in different climates, in relation to temperature, moisture, and density of air. The public have chosen certain localities as health-resorts long before science pointed them out as eligible, and although we cannot doubt that oxygen is a great healing power in these, the part it really plays remains to be determined by physiologists and pathologists. The present work merely opens the way to inquiry, and does not claim to go beyond the evidence of statistics. Samara is a health-resort remarkable for the rarity of diseases of respiration, but its climate is windy and not mild, and the changes of temperature are great, both daily and seasonal. The conditions of temperature, moisture, pressure, and wind, do not account for its healthiness. Two factors remain: oxygen and ozone. Oxygen only concerns us at present. In order to find the relative quantity of oxygen at any place, thermometric, barometric, and hygrometric data are indispensable. Thirteen European and three Indian towns and one American station were chosen. Data for Nice, Algiers, and Madeira were wanting. Bearing in mind the hygienic object of his task, Dr. Ucke takes as a measure of the quantities of oxygen the number of inspirations of a grown man in the course of a month of 30·42 days. In the absence of a normal standard, the mean of the results for the seventeen stations is used for comparison. He finds that in the whole year most oxygen is inspired at Samara, least at Seringapatam; that, taking all stations, the quantities are largest in winter, least in summer, except at Seringapatam, where spring gives the lowest figure. Also. that generally the quantities decrease from E. to W These differences of course depend on the three factors, temperature, density, and moisture. The first two have by far the most considerable effect. The article is illustrated by various tables.

THE *American Journal of Science and Arts*, March.—The principal papers in this number are: On some phenomena of binocular vision, by Prof. J. Le Conte. The article has reference to the direction of the optic axes in sleep. Arguing from "double sight" in drowsiness, Prof. Le Conti concludes that the axes diverge.—The gigantic cephalopods of the North Atlantic, by A. E. Verrill. This is a continuation of a former article in which he records the dimensions of specimens captured within the last few years.—The trap rocks of the Connecticut Valley, by G. W. Hawes. This contains many analyses of dolerites and diabase.—On the comparison of certain theories of solar structure with observation, by Mr. S. P. Langley. (See following article.)—Notes on Costa Rica Geology, by W. M. Gabb. The area described—the district of Talamanca, consists of granite rocks on which rest beds of Miocene age, the granite being pushed up after the deposition of the Miocene.—Under the head of Scientific Intelligence is a description of a new order of Eocene Mammals, *Tillodontia*, by Prof. O. C. Marsh.—Report of progress of Geological Survey of Pennsylvania for 1874.—Notes on the transit of Venus.

*Memorie della Societa degli Spettroscopisti Italiani*, January 1875.—Mr. S. P. Langley, director of the Alleghany Observatory, contributes a paper on the comparison of certain theories of the structure of sun-spots with observation. He alludes to the so-called "crystalline" forms seen at times in the umbræ of spots, and to their lending confirmation to the views of those who regard the photosphere as a luminous covering of incandescent fluid, and the spots cooling matter in it. The author says that they are at first sight so confirmatory of this view that it was only after long study he had been led to think them assimilable to certain cloud forms in our atmosphere. A beautifully executed steel engraving accompanies the paper, showing the forms alluded to over the umbra of a spot; and they certainly put one in mind of certain forms of cirrus cloud. All the filaments of the penumbra are directed generally towards the centre of the spot; but while all are more or less curved, there is no common direction of curvature. Mr. Langley also remarks that the ends of the filaments are generally the brightest parts, and that it is difficult to resist the impression that they turn upwards at the extremities and appear as though lifting their points through some obscuring medium. One of the crystalline forms appears in great beauty on the spot. It is about 20″ long, and 10″ wide, and has the appearance of a plume or of finely carded wool: and the author asks if we are prepared to admit the existence of a body analogous to a crystal covering ten times the area of Europe. He also refers to sudden and abrupt changes in the direction of the filaments, apparently being due to the passage of one cloud stratum over another, and he remarks this disposition elsewhere in the spot giving a terraced appearance. He says: "It seems difficult to reconcile the bright, sharply-defined inner edge and the regular structure discerned in the umbra, with another view in which this umbra is a sort of stagnant pool formed by cold vapours or clouds which have settled there after depressing the general surface by their weight until the penumbral slope is determined;" and "The theory which regards cyclonic or vertical action as a prominent agent in determining the forms we have studied appears to be in closer accordance with observation than the former."—Father Secchi, in a note on the foregoing paper, remarks that at the edge of the sun, where the spot in question disappeared, there was seen an active prominence, and his further remarks are to be continued in the next number.—P. Tacchini contributes a paper on the condition of Italian and other observatories, giving the staff at each and their salaries. We extract the total payments to the staff and for instruments at the following Observatories:—

| | Lire. | | Lire. |
|---|---|---|---|
| Paris | 54,000 | Rome | 4,920 |
| Greenwich | 75,000 | Padua | 6,200 |
| Pulkowa | 220,000 | Modena | 4,940 |
| Palermo | 7,800 | Turin | 4,700 |
| Naples | 13,248 | Bologna | 4,500 |
| Florence | 6,700 | Parma | 1,300 |
| Milan | 14,802 | | |

## *SOCIETIES AND ACADEMIES*

### LONDON

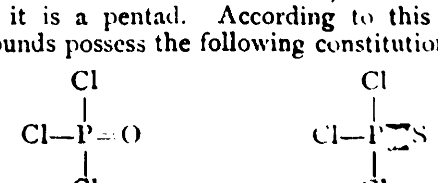
Royal Society, April 15.—"Researches upon the Specific Volumes of Liquids," by T. E. Thorpe. Communicated by Prof. Williamson, For. Sec. R.S.

I. *On the Atomic Value of Phosphorus.*

Hermann Kopp has shown that, as a rule, the specific volume of an element is invariable when in combination. Exceptions to the law occur, however, in the cases of oxygen and sulphur, each of which bodies has two specific volumes dependent upon the manner in which they are held in union. When contained "within the radicle," as in acetyl, $C_2H_3O$, oxygen has the value 12·2, but when existing "within the radicle," as in alcohol, it has the smaller value, 7·8. Sulphur, when "within the radicle," has the specific volume 28·6; when "without the radicle," it has the specific volume 22·6.

The cause of these variations may be thus stated in the language of modern theory:—When dyad sulphur and oxygen are united to an element by both their affinities, their specific volumes becomes respectively 28·6 and 12·2; when they are attached by only one combining unit, their specific volumes are 22·6 and 7·8.

Phosphorus is regarded by certain chemists as invariably a triad; others maintain that it is sometimes a triad, at other times a pentad. In the trichloride it is a triad, in the oxychloride and thiochloride it is a pentad. According to this view the two latter compounds possess the following constitution:—



If, however, phosphorus is invariably trivalent, the oxychloride and thiochloride must possess the following formulæ:—

```
   Cl             Cl
   |              |
   P—O—Cl         P—S—Cl
   |              |
   Cl             Cl
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It is possible to decide between the two modes of representing the constitution of these compounds, if it be granted that the variation in the specific volume of oxygen and sulphur is due to the manner in which these elements are held in union. For if the phosphorus in the oxychloride and thiochloride be quinquivalent, the oxygen and sulphur must possess the greater of the two values, since both their combining units are united to the phosphorus; if, on the other hand, phosphorus be trivalent, the oxygen and sulphur must possess the smaller of the two values.

The author has determined the specific gravity, boiling-point, and rate of expansion of $P\,Cl_3$, $P\,O\,Cl_3$, and $P\,S\,Cl_3$, in order to ascertain the specific volume of the oxygen and snlphur in the two latter compounds, and consequently the chemical value of the phosphorus; and he finds that the specific volumes of the oxygen and sulphur are almost identical with the values given by Kopp for these elements when "without the radicle." It would therefore appear that the oxychloride and thiochloride must possess the constitution—

```
   Cl             Cl
   |              |
   P—O—Cl         P—S—Cl
   |              |
   Cl             Cl
```

and that the phosphorus in these bodies is to be regarded as a triad.

The author concludes by discussing Buff's hypothesis that the specific volume of an element varies with its chemical value; and he shows that in the case of phosphorus there are no reasons for the belief that this element has a variable specific volume.

Geological Society, April 14.—Mr. John Evans, V.P.R.S., president, in the chair.—Descriptions of new corals from the Carboniferous Limestone of Scotland, by Mr. James Thomson. In this paper the author described some forms of corals from the carboniferous limestone of Scotland, which he regards as new species, and as belonging to three new genera allied to *Clisiophyllum*. In the group which he names *Rhodophyllum* the calice is circular and shallow, the epitheca thin and smooth, the septa thin and numerous, and the columellar boss dome-shaped, slightly raised above the inner margin of the primary septa, and clasped by subconvolute ridges. The species referred to this genus are *Rhodophyllum Craigianum*, *R. Slimonianum*, *R. Phillipsianum*, *R. Argylianum*, *R. rcticulatum*, and *R. ellipticum*. *Aspidiophyllum* has the calice generally circular, shallow; the septa forming thin laminæ for about half their length from within, when they become flexuous, and the columellar boss prominent and helmet-shaped. The species are named *A. Koninckianum*, *A. Huxleyanum*, *A. cruciforme*, *A. elegans*, *A. Hennedii*, *A. Danai*, *A. dendrophyllum*, *A. ellipticum*, *A. Pagei*, *A. scoticum*, and *A. laxum*. The third genus, *Kurnatiophyllum*, is most nearly allied to *Rhodophyllum*, but has the columellar space slightly raised above the inner margin of the primary septa, and crowned by bending or wavy lamellæ, some of which pass over the central space in sinuous folds. The species are described under the names of *K. concentricum*, *clavatum*, *Tyleranum*, *intermedium*, *ellipticum*, *Ramsayanum*, *Youngianum*, *Harknessianum*, *lamellifolium*, *bipartitum*, *octolamellosum*, *Haimianum*, *Edwardsianum*, and *Davidsonianum*. In a specimen of *Aspidiophyllum Huxleyanum* the author noticed in the open interseptal space a small tube, four lines long, around the inner margin of which there was a group of oval bodies, which, from their close proximity to the inner margin of the primary septa and their form, he is inclined to think may be ova.—On the probable existence of a considerable fault in the lias near Rugby, and of a new outlier of the oolite, by Mr. J. M. Wilson. The author called attention to what appeared to him to be a great fault in the Lower Lias at the village of Low Morton, near Rugby, where a sandpit is worked against the face of a steep hill to a depth of nearly fifty feet. The sand in the valley, as proved by wells and borings, is of great depth. Above the sand-pit is a clay-pit, and the author stated that the clay is bounded towards the sand by a highly inclined face of clay, against which the sand is thrown. This face of clay can be clearly traced for a distance of more than half a mile, running in a south-easterly and north-westerly direction. If continued to the south-east, it would pass close by Kilsby Tunnel, the difficulties met with in the construction of which may have been due in part to a continuation of the fault; whilst if continued to the north-west it would coincide generally with the valley of the Clifton Brook, the bed of which is also occupied by a great depth of sand. The line of fault thus passes between Rugby and Brownsover, and the author suggests that it is the cause of the presence on the summit of the Brownsover plateau of an extensive oolitic mass of Stonesfield-slate character. The line of fault continued further would connect with the Atherstone and Nuneaton fault, and agree with this in having its downthrow on the north-east side.—On a Labyrinthodont from the Coal-measures, by Mr. J. M. Wilson. The fossil referred to in this paper was from the Leinster Coal-measures, and was regarded as probably belonging to the genus *Keraterpeton* of Prof. Huxley, although the outer posterior angles of the skull do not appear to have been prolonged into cornua.—On *Cruziana semiplicata*, by Mr. J. L. Tupper; communicated by Mr. J. M. Wilson. In this paper the author gave a detailed desciiption of a slab of unknown origin, but said to have been obtained from a workman at Bangor, containing several specimens of the fossil described by Salter under the name of *Cruziana semiplicata*. From his examination of the specimen the author seemed inclined to ascribe to *Cruziana* an animal origin, and to regard it rather as fossilised animal structure than as a cast of the track left by the feet of some animal passing over the surface of the sand.

Geologists' Association, April 2.—Mr. Wm. Carruthers, F.R.S., president, in the chair.—Remarks upon geological boundary lines, by Horace B. Woodward, F.G.S. The author believes a tendency exists to overlook the broad classification of lithological characters, and to adopt lines of a palæontological nature. The identity of organic remains is no absolute proof of contemporaneity. In identifying the age of a formation the test of superposition, as a rule, is decisive; and the main facts of palæontology must first be worked out from the stratigraphical succession of the rocks. Still the value of palæontology cannot be disputed, and if we cannot identify formations far separated as synchronous when the fossils are similar, we may parallel successive faunas. Our formations, when looked at in the large way, must be taken to represent deposits of essentially similar character, and characterised by a particular assemblage of fossils. The more we learn of the history of our own strata and those of foreign countries, the less evidence do we see of breaks in the conformity of succession.—Notes on the probable depth of the Gault sea; or, an endeavour to ascertain the relative depth of the sea during the Gault period, by comparing the representative fossil genera with recent forms, by F. G. H. Price, F.G.S. The author is disposed to consider that the depth of the sea in which the Lower Gault was deposited did not exceed 100 fathoms.

Meteorological Society, April 21.—Dr. R. J. Mann, president, in the chair.—Mr. Scott read a paper, "Notes on sea temperature observations on the coasts of the British Islands." He said that it mainly related to the connection between sea temperature and the take of fish on the coasts, and he noticed the investigations formerly carried on by the Dutch and that now in progress under the direction of the Scottish Meteorological Society. He read a letter from Mr. F. Buckland on the subject, which, however, proposed a scheme of action which would entail heavy expenditure, while at present there was no satisfactory record kept of the take of fish on any of our coasts except those of Scotland. Mr. Scott then said that he had had some observations of sea temperature taken at some stations in the West of England and on the coasts of the Irish Sea, and had received some observations from Mr. W. Dymond and from Mr. N. Whitley, and he submitted some monthly mean temperatures from a few stations. He also stated that both the Trinity House and the Commissioners of Irish Lights had kindly consented to have observations taken at certain lightships, and that instruments had been supplied for the purpose, and the inquiry was in progress. In conclusion, he mentioned the steps taken by the German Government to investigate the temperature, &c., of the sea on their Baltic and North Sea coasts, and expressed a hope that our Government would undertake a similar inquiry.—Mr. Pastorelli read a paper on the errors of low range thermometers. He pointed out some of the difficulties which instrument-makers have to encounter in graduating thermometers from $32°\cdot0$ to $-37°\cdot9$, the freezing point of mercury, as there is no intermediate fixed point. He believed that fairly accurate thermometers could only be obtained by calibration.—

Mons. Louis Redier exhibited his new barograph, which was explained to the meeting by Mr. Symons.—Mr. Scott also exhibited Prof. Wild's pressure anemometer.

**Physical Society**, April 24.—W. Spottiswoode, F.R.S., in the chair.—Mr. J. Barrett exhibited an "auxiliary air-pump;" it is a modification of Poggendorff's arrangement for obtaining a Torricellian vacuum, and is allied in principle to the exhauster used by Geissler in the preparation of vacuum tubes.—Mr. Barrett also showed a hammer break for the instantaneous rupture of the current in the primary wire of an induction coil. It is impossible to explain it clearly without a diagram, but an upright swing hammer is kept constantly vibrating by the alternate action of a spring and the magnetised core.—Dr. W. H. Stone read a paper "On some points connected with wind instruments." He stated that discrepancies might be noted in the behaviour of air issuing from the side orifices of wind instruments. These discrepancies deserve attention, and may be accounted for by the laws of efflux. He showed that the stream of air from the side hole of a clarionet was sufficient to extinguish a candle, though the musical vibration was obviously in the main tube. It is usual to tune such instruments by introducing a resinous cement into the holes so as to diminish their calibre, but after a certain point is reached the rounded surface thus obtained ceases to produce an effect. If a short pipe of the same diameter as the orifice be now inserted, auxiliary vibrations are set up, and a definite note may be produced.. Dr. Stone was led to inquire whether the theorem of D. Bernoulli, or the particular part of it named after Toricelli, could be brought to bear on the question. The *vena contracta*, which in fluids reduces the efflux to 0·62 of the calculated amount, is also to be noticed in gases, and the nature of the effluent column of air is affected by three conditions: 1. The thickness of the wall in which the orifice is made. 2. The shape of the nozzle. 3. Friction in a long pipe. Some mathematical details were then given respecting these conditions, and it was admitted that the vibration in a musical tube must also exercise sensible influence. There are two functions in a side orifice in an instrument; the first is to cut off a portion of the tube, and by this means to raise the pitch; the second establishes a point of non-resistance in the wall of the tube, and thus acts by influencing the longitudinal vibrations. In the organ peculiar qualities of tone are often obtained by these side holes, as in the "Viol di Gamba" and "keraulophon" stops. In flutes, oboes, clarionets, and other instruments, much of the tone comes from the bell, even when the side holes are open. In instruments in which the holes are long, as in the bassoon, the holes themselves became separate vibrating tubes. This was shown by introducing tubes of different and increasing lengths, into an orifice in the side of an organ reed pipe. The friction at last became so great, and the secondary wave so strong, that the organ-pipe returned to its original pitch. A reed was also applied to a cylindrical tube, and it was shown that a sharp-edged orifice opened at the middle point of the tube rendered it impossible to produce any note until a cylindrical nozzle was introduced, when the octave was sounded freely. The general results proved that lateral holes had a double function, the pitch of the notes emitted varying with their size, shape, and length, the actual severing of continuity in the principal tube being a comparatively minor point. Dr. Stone then inserted three tubes varying in length from two to six inches in a cylindrical tube like that of a clarionet, at right angles to its length, the longest being placed at the the centre of the instrument, and the shortest at one-eighth from the mouthpiece. The same note was produced when each tube was used singly and when the three were employed, and Dr. Stone expressed a hope that a series of experiments would render it possible to develop curves in which the co-ordinates would be the lengths of the additional tubes and their position in the instrument. He also considered that a new instrument might be produced in which the side orifices acted purely as nodal points by the assistance of friction and the contracted vein.

**Anthropological Institute**, April 13.—Col. A. Lane Fox, president, in the chair.—A paper, largely illustrated by diagrams, was read by Prof. Rolleston, F.R.S., "On the people of the Long Barrow period." The author discussed at great length the following points:—1. The evidence existing for dividing the Long Barrow period into three epochs. In the earliest one the dead were interred unburnt in chambers, *i.e.* in graves walled with upright flags and communicating with the exterior by a passage or gallery, or at any rate constructed so as to admit of successive interments. In those chambers was found the greatest amount of manganous discoloration. In the second period the dead were still interred unburnt, but in cists, *i.e.* in closed stone receptacles not intended to be reopened, and having no gallery leading to the exterior. The third epoch of the Long Barrow period was distinguished, to the great regret of the craniographer, by the practice of cremation, a practice which, like that of burial in cists, and with even more probability, might be supposed to link the Long and Broad Barrow periods together. 2. The evidence for accepting what might be called the Ossuary theory for explaining the appearances met with in the Long Barrows, rather than the theory of successive interments as put forward by Prof. Nilsson, or the theory of human sacrifices and anthropophagy as suggested by the late Dr. Thurnam. What inclined Prof. Rolleston to the Ossuary theory was the fact that just those bones are found in connection most frequently which would, by virtue of their ligamentous or muscular connections, longest resist the dislocating effects of removal from a provisional to a permanent burial-place. 3. The evidence as to the mode of life prevalent in the Long Barrow period which the cranial and other bones of the persons buried or burnt in them furnished. Mr. Bertram F Hartshorne exhibited and described objects of Pre-Hellenic age from Troy.

BERLIN

**German Chemical Society**, March 22.—F. Gäss and C. Hell have observed a condensation of amylic aldehyde through the agency of carbonate of potash resulting in the formation of a body $C_{10}H_{18}O_2$.—C. Hempel has found amongst the products of oxidation of terpin a new monobasic acid, $C_8H_{12}O_4$, homologous with terebinic acid.—E. Prehn found that hydrochloric acid transforms mesaconic into citraconic acid.—E. Büchner, in distilling paramonobromaniline, has observed its transformation into aniline, dibromaniline, and tribromaniline.—R. Fittig and R. Mayer, continuing their communications on isomerism in the aromatic series, insist upon the transformation of all three bromophenols into mixtures of resorcin and pyrocatechin, a fact singularly affecting theoretical conclusions hitherto drawn from single experiments.—A. Schrohe observed allylene-sulphuric acid to yield not only mesitylene, but also acetone, by the action of water.—W. Lossen sent a short note on the reduction of metallic oxides by hydroxylamine, which is thereby transformed into N and $H_2O$.—C. Gosslich asserts that he has discovered a fourth isomeric bromobenzene-sulphonic acid.—H. Limpricht recommended measures of precaution to be taken in the determination of the solubility of salts.—D. M'Creath described substituted guanidines obtained through the action of anhydrides on guanidines, viz., benzoyl-triphenyl-guanidine, diacetyl-triphenyl-guanidine, and dibenzoyl-diphenyl-guanidine.—T. Jannasch has been able to transform bromomesitylene, $C_6H_2Br(CH_3)_3$, into tetramethylbenzene, a liquid isomeric with durene.—C. Liebermann and H. Troschke have studied the action of ammonia on alizarine. The products are compounds in which OH is replaced by $NH_2$, and 2OH are replaced by NH.—C. Liebermann and F. Palm exhibited crystalline compounds of hydrocarbons with the chloride and with the amide of picric acid.

April 12.—O. Brenken has studied what was generally considered as the melting of terchloride of iodine, and has found it to consist of a dissociation into monochloride and free chlorine.—P. Melikoff determined that at 77° $ICl_3$ is completely decomposed into ICl and $Cl_2$.—A. Michaelis and J. Ananoff, in treating $PCl_2.C_6H_5$ with zinc ethyl, have obtained diethyl-phenyl-phosphine, a liquid base, distilling at 222°, taking up 2HCl and 2Cl. Oxide of silver, exchanging O against $Cl_2$, produces an oxide with the latter body. $PC_6H_5(C_2H_5)_3I$ is a well-crystallised compound. Similar bodies have been obtained by the action of zinc methyl on phosphenyl-chloride.—A. Michaelis, by treating $PCl_2C_6H_5$ with $PH_2$ and water or alcohol, obtained a yellow powder of the formula $C_6H_5 - P = P - OH$, diphosphobenzol corresponding to a diazobenzol.—E. Benzinger, heating phosphenylic acid, $C_6H_5PO(OH)_2$ with nitric acid in sealed tubes, has obtained a crystalline mononitrophosphenylic acid, which with tin and hydrochloric acid yields the corresponding amido-acid.—H. Lange, in passing toluene and $PCl_3$ through a red-hot tube, was unable to produce phosphobenzyl-chloride, but obtained stilbene only.—A. Michaelis, who has lately expressed the constitution of phosphorus acid thus: $HPO(OH)_2$, defends his view against a paper lately published by Zimmermann.—F. Kammerer has fixed the melting-point of perchloride of antimony as −6° C.—H. Kohler and B. Aronheim have treated iodide of isopropyl and chloride of benzyl with sodium, thus obtaining $(CH_3)_2CH.CH_2 C_6H_5$, phenyl-isobutan.—H. Hübner proved that benzoic acid can liberate nitrobenzoic acid from nitrobenzoate of barium, although the latter is the stronger acid of the two. The experiment consisted in heating the solutions to 80°.—H. Hübner and C. Rudolf have obtained an ethenyl-phenylenediamine, $C_6H_4{<}^{NH}_{N}{>}C.CH_3$, by treating orthonitroacetanilide with tin and glacial acetic acid.—O. Billeter has transformed sulphocyanate of phenyl into the sulphide by treating it with sodium-amalgam. Lead allyl sulphydrate and chloride of cyanogen have yielded allyl sulphocyanate to the same chemist; it is converted into the isomeric mustard-oil on distillation.—H. Limpricht communicated researches on derivatives of the three amidosulphobenzolic acids.—W. Weith, by heating chloride of ammonium with methylic alcohol to 280° for ten hours, has transformed it completely into trimethylamine and tetramethylammonium-chloride.

April 26.—Researches were read by A. Burghardt, on bibromobenzoic acid; by H. Glassner, on paraiodosulphotoluene, $C_6H_3\ CH_3\ I.SO_3H$; by T. Ebell, on nitrobenzonaphthylamide, $C_{10}H_6.NO_2.NH\ CO\ C_6H_5$, which was found to combine with iodide of amyl; by F. Meinecke, on derivatives of benzanilide; by E. A. Grete, on derivatives of metabromotoluene.—H. Hübner defended modern chemistry against attacks launched against it by Prof. Kolbe, and showed the insufficiency of the proofs hitherto furnished for the existence of four nitrobenzoic acids, four bihydrobenzene, and four bromobenzene-sulphonic acids. These doubtful cases of isomerism, which, if true, would be opposed to Kekulé's benzene theory, were also vigorously attacked by experiments published by A. Ladenburg, as well as by P. Griess and by E. Nölting. The constitution of benzene derivatives, viz., $C_6H_4Br.CH_3$ and $C_6H_3Br.NO_2.CH_3$, also formed the subject of a communication by E. Wroblewsky.—Mr. P. Siljeström defended his opinion on the density of gases under diminished pressure against that expressed by Mr. Mendelejeff.—A. Stutzer has tried the action of nitric acid on the fibre of grasses, and not finding benzene derivatives amongst the products, concludes that the fibre does not contain aromatic bodies preformed.—Dr. Ewald described an improved method for determining urea with hypobromite of sodium by ordinary volumetric analysis.—V. Mering reported on the action of digestion on sarcosine, arriving at the conclusion that urea and uric acid are *not* diminished in quantity in the urine of individuals fed with sarcosine. This is contrary to the observation published by Schultzen some years ago.—E. Fischer, in reducing a diazo-compound, $C_6H_5-N=N-NO_3$, with bisulphite of sodium, and treating the resulting compound, $C_6H_5-NH-NH.SO_3K$, with chloride of benzoyl, obtained the first of a new class of bodies:

$$C_6H_5-NH-N(CO.C_6H_5)_2$$

that is, an ammonia, $NH_3$, in which one H is replaced by an amido-group, $NH_2$. He calls this class of bodies *hydrazines*; the body whose formula is given above is dibenzoylated phenylhydrazine. By the action of water and hydrochloric acid it yields benzoic acid and a base, phenyl-hydrazine, $C_6H_5-NH-NH_2$, which forms well-defined crystalline salts with HCl, &c.

### Paris

**Academy of Sciences**, April 26.—M. M. Frémy in the chair.—The following papers were read:—On ascents to great heights, by M. Faye. M. Faye advocates strongly that the Academy should forbid any balloon ascent beyond 7,000 metres of elevation; he considers that any observations that might be made beyond that point will not be of any greater value than those up to that limit, and will certainly not outweigh the danger to life. He thinks that all aëronauts will respect the Academy's decision.—On the determination of ordinary alcohol when mixed with methylic alcohol, by M. Berthelot.—A note by M. A. Ledieu, on thermo-dynamical machines.—A note by M. Marès, on the results of the experiments made by the Commission investigating the diseases of vines in the Hérault.—A note by M. Dumas, on the use of alkaline sulphocarbonates against Phylloxera.—A note by M. F. de Lesseps, on the methods to be employed for the maintenance of ports.—A note by M. L. Saltel, on the geometrical principle of correspondence of M. Chasles.—On the curves of the order *n* with a multiple point of the order *n* − 1, by M. B. Niewenglowski.—On the development of the perturbating function according to the multiples of an elliptical integral, by M. H. Gylden.—On binauricular perceptions, by M. F. P. Le Roux.—On the determination of methylic alcohol in the presence of vinic alcohol, by MM. Alf. Riche and Ch. Bardy.—On the spiroscope, an apparatus for the study of auscultation, of the anatomy and physiology of the lungs, by M. Woillez.—A note by MM. G. Hayem and A. Nachet, on a new method of counting the blood-corpuscles.—On the wine-growing districts attacked by Phylloxera in 1874, by M. Duclaux.—M. Dumas then announced to the Academy the loss which science has sustained by the death of M. Anton. Schrötter, secretary to the Academy of Sciences at Vienna.—On the precipitation of silver by protoxide of uranium, by M. Isambert.—On the action of platinum and palladium upon the hydrocarbons of the benzenic series, by M. J. J. Coquillion.—A note by M. Peslin, on the law of diurnal and annual variations in the temperature of the soil.—On the theory of storms, by M. Cousté.—A note by M. U. Gayon in reply to M. Béchamp's paper on the spontaneous alterations in eggs.—On the helminthological fauna of the coasts of Brittany, by M. A. Villot.—On a new intermediary type of worms (*Polygordius?* Schneider), by M. Edm. Perrier.—On the ornamentation of striated wood-fibres and their relation to ordinary spotted fibres in the wood of certain species of Conifera, by M. G. de Saporta.—On the glacier deposits of the inferior valley of the Tech, by M. E. Trutat.—On the differences in the rising and setting of Mercury, Venus, Mars, Jupiter, and Saturn, as stated in the *Journal du Ciel* and in the *Annuaire du Bureau des Longitudes*, by M. J. Vinot.—On a method of re-establishing the concordance of the solar with the civil year, by M. Crampel.

## BOOKS AND PAMPHLETS RECEIVED

British.—A Manual of Diet in Health and Disease: T. King Chambers, M.D., F.R.C.P., &c. (Smith and Elder).—The Journal of the Iron and Steel Institute, 1874 (E. and F. N. Spon).—Electricity; its Theory, Sources, and Applications: John T. Sprague (E. and F. N. Spon).—Researches in Chemical Optics: John H. Jellett, B.D. (Dublin University Press).—Journal of Proceedings of Winchester and Hampshire Scientific and Literary Society. Vol. i. Part iv. 1874 (Winchester, Warren and Son).—Meteorology of West Cornwall and Scilly, 1870 to 1874, and Observations on Sea Temperature, 1872 to 1874: W. P. Dymond, F.M.S. (Falmouth, Wm. Tregaskis).—An Address delivered by the President of the Meteorological Society at the Annual Meeting, January 20, 1875.—Journal of the Quekett Microscopical Club (R. Hardwicke).—Perthshire Society of Natural Science. Sixth Annual Report.—On Protoplasm: James Ross, M.D. (R. Hardwicke).—Commercial Handbook of Chemical Analysis, by A. Normandy; Enlarged and to a great extent re-written by H. M. Noad, Ph.D., F.R.S. (Lockwood and Co.)—Life of Sir Roderick Murchison, Bart., K.C.B., F.R.S.: Archibald Geikie, LL.D., F.R.S. (John Murray).—New Code Progressive Reader. Fifth Standard (Wm. Collins, Sons, and Co.)—Unseen Universe (Macmillan and Co.)—Year Book of Facts in Science and the Arts. Edited by Chas. W. Vincent, F.R.S.C. (Ward, Lock, and Tyler).—Thirteenth Annual Report of the Free Librarians' Committee (Birmingham, Hall and English).—Text-Book of Botany, Morphological and Physiological. By Julius Sachs; translated by Alfred W. Bennett, M.A., B.Sc., F.L.S., assisted by W. T. Thiselton Dyer, M.A., B.Sc., F.L.S. (Oxford, Clarendon Press).—Report of the Permanent Committee of the First International Meteorological Congress at Vienna, 1874 (H.M. Stationery Office).—Climate and Time: James Croll (Daldy, Isbister, and Co.)—Fiji: Our New Province in the South Seas: J. H. de Ricci, F.R.G.S. (E. Stanford).—Journal of the Anthropological Society of Great Britain and Ireland, April to July 1874 (Trübner and Co.)—An Elementary Book on Heat: J. E. Gordon, B.A. (Macmillan and Co.)

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