THURSDAY, OCTOBER 23, 1879

THE INTRA-MERCURIAL PLANET QUESTION

IN No. 2253-54 of the *Astronomische Nachrichten*, Dr. C. H. F. Peters, the discoverer of so many minor planets, has "Some critical remarks on so-called intra-Mercurial planet observations," including the observations reported by Prof. Watson during the totality of the eclipse of July 29, 1878. Replies to these remarks have since appeared from Prof. Watson and also from Mr. Lewis Swift, of Rochester, New York, who, it will be remembered, also considered he had seen an object which could be no known star or planet. Prof. Peters enters upon other cases where intra-Mercurial bodies have been suspected, but we shall confine ourselves mainly here to his criticism of Prof. Watson's observations during the last eclipse. His object is to adduce evidence disproving Watson's conclusion that he had seen one, probably two unknown planets, and he grounds his argument chiefly upon the small size of the circles to which Watson trusted, and the fact that nearly on the parallel of his two objects *a* and *b*, and at an almost equal distance, a small one, in right ascension, were the stars θ and ζ Cancri. He states that the circles of wood with paper scales pasted on them, were only 5 and $4\frac{3}{4}$ inches respectively in diameter, and as Prof. Watson estimated the probable error of a position given by them at only five minutes, the space would measure on the circles only $\frac{1}{25}$ of an inch, and further he states that the wires which served as pointers "were so elastic as easily to give way several degrees under the touch by a pencil." So far, therefore, from accepting Watson's estimate of the precision of his readings, Prof. Peters thinks he does him no injustice in supposing that they were made "at the utmost to $\frac{1}{10}$ inch, corresponding to twenty minutes of arc upon his circles;" and in this case, the differences of *a* from θ Cancri, and of *b* from ζ Cancri, or + 2m. 55s. and + 3m. 23s. respectively, he believes may be explained by the errors in the markings or readings. It is also urged that the markings for the sun were made under circumstances less hurried than those for the suspected planets. Watson estimated the objects at the time of 4 and $4\frac{1}{2}$ magnitude, and, remarking that absolute magnitude must be quite uncertain under such conditions, Peters points out that the difference of brightness corresponds pretty nearly with that given by Argelander, Heis, and others between ζ and θ Cancri; and he adds, "it is, therefore, quite apparent to every unbiassed mind that Watson observed θ and ζ Cancri, nothing else." It should be added that Prof. Peters attempts to explain the ruddiness of the object near θ,—"If the sand ledge, under the lee of which the telescope was standing had nothing to do with it;" the observation, perhaps, teaches that the corona possesses the property of less absorbing the red rays, and may, therefore, be of some value. It seems also, in his view, that the corona gives a disk to the stars, or calms down the radiations to a kind of spurious disk, as a slight fog does; and as he does not admit that the power employed would show a real disk, we are to assume this was the case during Prof. Watson's observations. With regard to Mr. Swift's observations, it is represented that his successive publications offer so singular a gradation in the statements as to unfit them to be the subject of a scientific discussion.

As we have stated, Prof. Watson has replied to the criticisms which the Clinton astronomer has published to "make evident beyond cavil how erroneous the conclusion too rashly rushed at by the observers." He protests against mis-statement of the facts connected with his observations, remarking that it appears to him "the grossest of unfairness to attempt to discredit an observation made by an experienced observer by deliberately misrepresenting the circumstances of the observations." So far from the pointers of his circles bending under the touch by a pencil, they were made of unannealed brass wire one-eighth of an inch in thickness, not filed to a point, but to a *knife-edge*, placed vertical to the plane of the circle; they were quite rigid, and could not be disturbed in the least by the pencil when marking. The probable errors attributed to his readings Watson declares to be absurd, and says that any one interested may, by a few trials ascertain that by the method he adopted it is possible to measure without a greater probable error than 2′; the limit of 5′ which he gave was an outside one. Peters had urged that a practised observer would have compared the object *a* directly with θ Cancri, as the two would have been in the field together with the telescope employed, to which Prof. Watson replies, and with justice, that besides the want of time for such direct comparison, the method he was applying was different. If he had known that a new star would present itself near θ Cancri, he could have prepared himself for direct comparison; under the circumstances his plan of securing rapid indication of the position of any object that might be visible seems to have been as effective a one as could have been devised, and, as Dr. Draper termed it when it was explained to him the night before the eclipse, "a good dodge." Further, Watson observes that the assertion that his circles "were of wood, with paper scales pasted on to them, and wires serving as pointers," shows conclusively that Peters either did not yet understand his method, or that he was "purposely mis-stating the circumstances of his observations."

Finally, he makes what he terms these emphatic declarations:—"1. I observed, during the total eclipse of July 29, 1878, a new star between θ Cancri and the sun, and south of the sun, whose position and magnitude were as already published by me. 2. I observed another star, which I believe to be a new star, whose magnitude and position were as already published by me." Whether or not these objects were intra-Mercurial planets he does not positively assert, but he had the right to express the hones belief that they were. Watson adds that he "hopes ere long to give good reason for the faith that is in him," by which we understand him to imply that he has the intention to enter further upon the subject.

We will venture to say that the general feeling amongst astronomers when first reading Prof. Watson's announcement of his observations during the totality of the eclipse of 1878, of one, if not two, unknown objects, would be that a man of such known ability and experience as an observer, and so good a practical astronomer, as shown, amongst other proofs, by his able treatise on practical astronomy, would not risk his whole scientific reputation by putting forth such a statement to the world, unless he

was firmly convinced of its truth and felt able to substantiate it; otherwise the fact that there were two known stars, on the parallel or nearly so, and less than one degree west of the objects supposed to be new, would probably have been felt to be an almost fatal objection to the reality of the discovery. It must be remembered that Watson asserts he did see θ Cancri as well as the neighbouring object a; Peters objects—"not at the same time though"—an objection which Watson does not notice in his reply, but which will be easily removed by him; it might perhaps be rather gathered, that if the objects were not in the field together, he satisfied himself of their distinctness.

Throughout Prof. Peters's criticisms, not only as regards the American astronomer's observations during the eclipse, but other reported observations of unknown bodies in transit over the sun's disk, there is evinced a certain *animus*, which might have been as well avoided, and there is a flippancy in his reference to Leverrier's labours on the theory of Mercury, which he hopes "will be investigated anew by a hand very favourably known in this field of research, and we may expect then to have the intra-Mercurial spectre put to rest definitively." Most astronomical readers will feel more respect for the opinion of our great physical astronomer, Prof. J. C. Adams, who, on presenting the gold medal of the Royal Astronomical Society to Leverrier in 1876, thus expresses himself as to the existence of intra-Mercurial matter, as indicated by the French astronomer's researches—"The theory of the planet has been established with so much care, and the transits of the planet across the sun's disk furnish such accurate observations, as to leave no doubt of the reality of the phenomenon in question; and the only way of accounting for it appears to be to suppose, with M. Leverrier, the existence of several minute planets, or of a certain quantity of diffused matter circulating about the sun within the orbit of Mercury."

It has been mentioned that Mr. Swift has also addressed a communication to the *Astronomische Nachrichten*, in consequence of Peters's criticism of the observations made during the eclipse. Mr. Swift notified, soon after the occurrence of that phenomenon that he had seen two reddish objects with sensible disks about 3° distant from the sun; their mutual distance he first stated to be twelve minutes of arc, subsequently correcting this estimate to seven or eight minutes, as it is given in a letter which he addressed to NATURE, vol. xviii. p. 539, but in the same letter, referring the position of one object to that of the other, which he believed to be θ Cancri, by means of the place of the star given by the Astronomer-Royal in a communication to this journal, he assigned a position which, as we pointed out (vol. xviii. p. 569), would locate the supposed planet at a distance of thirty minutes from the star, instead of seven or eight minutes. He now writes that the difference of declination (? right ascension) shown by his own and Watson's observations, had been "a source of solicitude," as he could see no way to harmonise them "till NATURE pointed out the error of reducing the eight minutes of arc to time, saying it was but 32s. instead of 2m. This changed the whole complexion of the matter. The scales immediately fell from my eyes, and for the first time I was able to see my way clearly through the difficulty with which it had so long been enshrouded." We should have been glad if we could explain in what manner the sudden illumination consequent upon our remarks reconciles the distances in question, and so clear the way for accepting Mr. Swift's observation as confirmatory of that of Prof. Watson. He tells us that he has been an observer of the heavens for twenty-two years, and we know that he has been the first discoverer of several comets, and have no intention to depreciate his claim to credence on any astronomical question, but it has naturally happened that the different statements and the hesitation felt as to the distance of the objects he observed has detracted from the importance which would otherwise have attached to his experiences during the eclipse.

AUSTRALASIA

Australasia. Edited and Extended by A. R. Wallace. With Ethnological Appendix by A. H. Keane, M.A. (London: Stanford, 1879.)

THIS stout octavo volume is one of the series entitled "Stanford's Compendium of Geography and Travel," based on Hellwald's "Die Erde und ihre Völker." Mr. Wallace tells us, however, in the preface that he has been able to utilise comparatively little of the translation of Hellwald's work, so that it forms little more than one-tenth part of the present volume.

The term Australasia is taken in a very wide sense to include the entire East Indies and the Philippines, New Guinea and Australia, and all the islands of the Pacific, even to Easter Island. The region extends thus around much more than one-third the circumference of the globe.

The book commences with a short general account of the main geographical and biological features of the area and then treats of its various subdivisions separately. The author divides his Australasia into six principal regions, viz., Australia, Malaysia, Melanesia, Polynesia, Micronesia, and New Zealand. He commences with a very interesting summary of the principal physical features and climatic conditions of Australia.

Australia with Tasmania is only a little less in area than Europe. Yet its highest mountain, Mount Kosciusko, is only 7,308 feet in height. Its greatest river, the Murray, has a basin the area of which is about equal to that of the Dnieper. The hottest climate in the world probably occurs in the desert interior of Australia. Capt. Sturt hung a thermometer on a tree shaded both from sun and wind. It was graduated to 127° F., yet so great was the heat of the air that the mercury rose till it burst the tube, and the temperature must thus have been at least 128° F., apparently the highest ever recorded in any part of the world. For three months Capt. Sturt found the mean temperature to be over 101° F. in the shade. Nevertheless in the southern mountains and tablelands three feet of snow sometimes falls in a day; in 1876 a man was lost in the snow on the borders of New South Wales. Snowstorms have been known to last three weeks, the snow lying from 4 to 15 feet in depth and burying the cattle. Forty miles of the railway from Sydney to Bathurst have been seen covered continuously with snow. Australia is the land of drought and flood. The annual rainfall at Sydney has varied from 22 to 82 inches. Lake George, near Goulburn, was, in 1824, 20 miles long and 8 miles broad.

It gradually shrank till, in 1837, it became quite dry, and its bottom was converted into a grassy plain. In 1865 it was a lake again, 17 feet deep; two years later, only 2 feet deep; and in 1876 it was 20 feet in depth.

The account of the flora of Australia Mr. Wallace takes from Sir Joseph Hooker's exhaustive essay. In the description of the zoology he makes a curious slip in stating (p. 57) that the Banded Ant-eater (*Myrmecobius*) has a greater number of teeth (fifty-two) than any known quadruped. He quite forgets the big Armadillo (*Priodonta*), which has nearly twice as many, to say nothing of the crocodiles. It is also hardly correct to say that the Monotremes have no teeth.

After an interesting summary of the geological features of the country and of the mode of occurrence of gold, an account of the natives ensues. It contains interesting information, but seems hardly precise enough, those points in culture in which Australians differ from all other races being hardly brought out with sufficient distinctness. Such a statement as "that the life of the Australian native is one of abundance and privation, idleness and activity," might be made of all savages in the world. It is hardly accurate to describe a boomerang as "about three feet long," boomerangs being used of very various sizes, and many of the Western Australian and Queensland weapons being of about only a foot and a half in length. Again, why denote the spear thrown by means of the throwing-stick as "about ten feet long"? The spears thus used are of most various lengths, and some employed at Cape York are not more than five feet long at the most. Again, the throwing-stick is not always "a straight flat stick," but ranges through many forms, one being oval and shield-like.

Throughout the book the implements and weapons of natives are described in a slipshod and insufficient manner, as where the Papuans are stated to possess "Knives and axes, both formed of sharply chipped flints, resembling those of the stone age found in Europe." We believe that no flint implement has ever been found in New Guinea. The Papuans have knives of obsidian, and stone-headed axes and adzes, but the blades of these latter are not made of flint, but of jade or greenstone, or some similar material, and are not chipped to an edge, but invariably ground smooth all over. The only recent savages, apparently, who employ unground stone axe blades are the Australians, and very many of their blades are wholly or partially ground. Again, the canoes of the Admiralty Islanders are described as "formed of a hollowed tree with the sides raised by a plank and fitted with an outrigger." Such a description might apply to numberless other canoes occurring in Mr. Wallace's region of Australasia. The peculiar interest in the Admiralty Island canoe lies in its having two outriggers, or rather, an inclined balance platform opposite to the ordinary outrigger.

The real interest in the study of savage weapons and implements lies in the differences to be observed in the form and structure of the contrivances used by each race. The implements manufactured are often as characteristic of the race as is its language. They have certain general family resemblances in their form to those employed by nearly allied races and certain special peculiarities, some, like words from a neighbouring language, have been imported, and may or may not have undergone subsequent modification, others are absolutely peculiar and characteristic. When taken as a whole they are as important for the elucidation of the past history, and the determination of the affinities of the races of men as are language, or even to some extent physical characteristics. A description of the implements used by a race in order to be of real value and interest, should point out what particular implements are peculiar to the race, and in what their peculiarity consists, and what are common to the race and its immediate allies. A mere catalogue of implements, ornaments, and weapons given without detail or explanation is valueless.

The several colonies of Australia are treated of in detail in the present work. In the account of New South Wales Port Jackson is, as usual, vaunted as one of the safest, deepest, and finest in the world, but it should always be remembered that though it is very pretty and very deep inside, its entrance channel is not deep enough to admit a first-rate ironclad, and that men-of-war sometimes suffer from lack of shelter in Farm Cove, and drag their anchors.

By an unfortunate slip, under the description of Queensland, *palms* of the genera *Cycas*, Areca, &c., are spoken of, a mistake the more misleading to unbotanical readers because Cycads are not unlike palms in outward appearance.

In the account of the Malay Archipelago which follows in the description of the Sulu Islands and their notorious pirates, it should have been mentioned that the Sultan of the islands has at last submitted to the Spanish rule on receipt of a sum of money. An arrangement to that effect was made about a year ago, and an agreement signed at Manila.

Dr. Horsfield's interesting account of the Tenger Mountain, the great volcano of Java, is quoted at some length in the account of that island. The crater of the mountain is said to "exceed perhaps in size every other in the globe;" yet it is only four miles and a half in larger diameter and three and a half in smaller, whilst the great crater of Haleahala, in the Sandwich Islands, really the largest in the world, is twice as big, measuring over twenty miles in circumference. Curiously enough, no mention whatever is made in the book of this wonderful crater, nor of the island of Maui, in which it occurs, in the very meagre account of the Sandwich Islands, in the part of the work which treats of Polynesia.

The first portion of the work, which treats of Australia and the Malay Archipelago, is by far the best. The account of Polynesia generally which follows is most indifferent, as might be expected from the astonishing fact that no reference whatever is made to the two most important works on the subject, viz., Meinicke's "Inseln des Stillen Oceans," and Gerland's stout volume in Waitz's "Anthropologie." If good use had only been made of these works the result would have been far more complete and trustworthy; but a translation of Meinicke's work would have been better still.

The figure given as that of a native of Fiji is very unfortunate, since the face is represented as elaborately tattooed, whereas tattooing on the face is excessively rare in Fiji, and tattooing on men at all rarer still. It is not correct, however, to state that "in Fiji the women only are

tattooed" (p. 488). Good photographs of Fijians are so common now and so easily procured that it is a great pity one of these was not copied for the book.

With regard to cannibalism in Fiji the statement is made that perhaps nowhere in the world has human life been so recklessly destroyed or cannibalism been reduced to such a system as here, and the putting of twenty bodies into the ovens at one feast is described as most astonishing; yet the New Zealanders, who are necessarily also treated of in this book, were quite as systematic in their cannibalism and far more profuse, as many as 1,000 prisoners having been slaughtered and put in the ovens at one time by them after a successful battle.

In the general account of Polynesia the Polynesians are said to have no bows and arrows. This is a mistake; both Hawaiians and Tahitians had bows and arrows, as we know from the writings of Cook and Ellis, though they did not use these weapons for war purposes. Ellis's account of the sacred archery of Huahine, where the ancient archery ground was close to his residence, is most interesting and full of detail. Bows and arrows were also used in Tonga and Samoa. To say of Polynesians generally that "all the men are tattooed from the navel to the thigh" (p. 495) is strangely misleading, since it would appear from it that all Polynesians were alike in their customs of tattooing, whereas, as is well known, the greatest differences occurred in this matter, and the description quoted would apply almost solely to the Samoans and Tongans, though there was a slight difference even between these two races in the matter.

Still more misleading is the statement that the Polynesians "have none of the savage thirst for blood of the Fijians," and that "their ceremonies are polluted by no human sacrifices; cannibalism with them has never become a habit." To such an absurd conclusion regarding Polynesians is the author led by his having separated off the New Zealanders from the Polynesians into a separate chapter. He treats of the New Zealanders correctly later on as "Brown Polynesians," like those he is describing as above. But cannibalism was not confined to New Zealanders amongst the Polynesians, but widely spread amongst all, occurring in the Hervey Islands, Paumotu, Tahiti, the Sandwich Islands, the Marquesas, and elsewhere. Human sacrifices were also regular institutions in all the islands, for example, in Hawaii, Tahiti, and the Marquesas, and in the latter group men killed their wives and children, and their aged parents for eating. In the time of Cook cannibalism was very much on the decline in Samoa and the Sandwich Islands, and had ceased in Tahiti, but evidence of its former more common occurrence was preserved in popular legends, proverbs, and traditions, and in some curious ceremonial customs. In the Paumotu Islands it long remained a regular institution, and Ellis saw a captive child there given a piece of its own father's body to eat. But what can be expected from a work on Polynesia which is without a reference to Ellis's "Researches," and in which Tonga is treated of without a reference to Mariner, or even mention of his name?

In the account of Tahiti Mr. Wallace becomes quite poetical, but stumbles rather in his zoology in consequence; he writes:—"The wayfarer's ears are ravished by the music of various songsters arrayed in the brilliant plumage of the tropics." There is, indeed, one thrush-like bird (*Tatare longirostris*) in Tahiti which sings sweetly, especially in the higher mountain regions, but it is no more brilliantly coloured than are singing birds usually elsewhere, in fact as dull as most songsters in appearance. There are brightly-coloured birds amongst the meagre list of about twenty-six land-birds of the island, but these are fruit-pigeons, parrots, and king-fishers. Though the great denudation of the surface of Tahiti is referred to the extraordinary steep and narrow ridges thus formed, and which are such characteristic features of its surface are not mentioned. The following passage will be most amusing to any one who knows anything of Tahiti. "At present we must visit the interior in order to see in their original forms the seductive dances of the native women, gaily decked with flowers." In fact the interior of the island is mountainous throughout, and uninhabited. The natives know very little about it, and it is quite a feat for a European to make his way across it. The dances in question take place usually close to the sea-shore, when they do occur now, and a large bribe administered to one of the native washermen will generally set one on foot, these worthies ministering to the pleasures of tourists as well as washing their clothes.

In the account of Rapanui (Easter Island), the conclusion "that at present the island is the great mystery of the Pacific, and that the more we know of its antiquities, the less we are able to understand them," is unworthy of the present state of ethnological knowledge. Too much mystery is made about the stone images of Rapanui, and in his "Tropical Nature," p. 291, Mr. Wallace, following Mr. A. Mott, actually brings these images forward as one of the proofs of a former general advanced intellectual condition of mankind as opposed to the accepted scientific position that primitive man was savage.

Earlier in the book he similarly cites the big upright stones found by Brenchley in Tongatabu as proving the existence of a preceding more highly civilised race. It is misleading to term these Rapanui remains "prehistoric," as implying that they have any vast antiquity. There is no reason to doubt that the present islanders, who are by language of Raratongan origin and by tradition come from Rapa Island, are the direct descendants of those who set up the images and constructed the underground houses for their chiefs. The wooden tablets with hieroglyphic inscriptions, and wooden gods cannot be very old, and the same characters are inscribed on the backs of the stone images, as may be seen in the case of the one in the British Museum as are cut on the slabs. The stone crowns on the images' heads merely represent the feather head-dresses worn by the chiefs. Similar blocks were appended to the heads of some of the Sandwich Islands gods and to the stone gods of the Marquesas Islands. The stone images are in point of artistic execution miserably low, and their workmanship does not go to prove that any high development of culture existed here in former times, though the absence of artistic merit would hardly be allowed to prove the opposite condition as to general culture by such authorities at least as those who ately erected a row of stone heads very little more advanced in their resemblance to the human form in front of the Sheldonian Theatre at Oxford. The Rapanui stone images resemble the wooden ones of the island in features

in many points, and there is also a resemblance in form between these stone images and the smaller ones of other Polynesian islanders. Mr. Wallace makes all the mystery out of the fact that the present islanders know nothing of the images, but savages quickly forget. The very name of the image platform Moai, as Meinicke remarks, seems to be the same as that of the old Tahitian chief's burial places, "Marae," Hawaiian, "Morai."

The account of the Sandwich Islands is very short and contains several errors. Mauna Kea, the highest of the three volcanic mountains of the Island of Hawaii, is described as an active volcano instead of as extinct. Kilauea should hardly be described as the most remarkable "*burning mountain*" in the world. It is really a lateral crater only on the side of Mauna Loa, the terminal crater of which is far more remarkable when in eruption than that of Kilauea. It is rather stretching a point to speak of the crater of Kilauea as a *fathomless* oval abyss, for tourists from the hotel on its brink usually walk nearly all over its bottom on a floor of hard lava, and the descent to the bottom is no great one. The figure given in the text as representing *Kilauea volcano* apparently is taken from a sketch of one of the ponds of fluid lava usually present at one end of the bottom of the crater.

No account is given of the ethnological characteristics of the Hawaiians, and nothing of the importance of the Chinese settlers in the group, nor of that of the developing half-caste population. The establishment at Honolulu of the hostile Church of England Mission is spoken of with the warmest approbation, whereas most unprejudiced persons regard it as an unmixed evil that the natives who have been Congregationalists for nearly eighty years, should be interfered with by a different Protestant sect.

In the account of New Zealand (p. 564) the possibility is suggested of a former land connection having existed between the Kermadecs and New Zealand. Such a connection would explain well some of the peculiarities of the flora, especially of the ferns of the Kermadec Islands, but unfortunately a depth of 2,000 fathoms was found by the *Gazelle* to exist between the two places, and the connection cannot therefore have existed. It is surprising that Mr. Wallace speaks of the Kermadecs as interesting *only* because they form a stepping-stone to Tongatabu to assist in the migration of Polynesians: he forgets entirely the interest of their flora as described by Sir J. D. Hooker.

The work concludes with an essay by Mr. A. H. Keane, on the Philology and Ethnology of the Inter-Oceanic Races. A long and very useful catalogue is given of the inter-oceanic races and languages, and of their very numerous and puzzling native names, with good references appended. It is very voluminous, and we were astonished to light upon an omission in so complete a catalogue. It was that of the Lutaos, the native name for the Sulu pirate race.

On the whole, it is to be regretted that Mr. Wallace has not studied other German sources of information than Hellwald's work with care. The fact is it is too much to undertake to describe Polynesia together with the Malay Archipelago, Melanesia, and Micronesia, all in one volume, and the result has been that Polynesia has suffered in treatment. The most striking defect in the book, however, lies in the meagreness of the references, the catalogue of which, at the beginning of the book is very small and contains almost solely English books. There is no reference to Finsch's work on New Guinea ("Neu Guinea und seine Bewohner") nor to the Goddefroys' publications; and with the splendid bibliography of Meinicke's and Gerland's works before us, the neglect of the literary side of the subject is most irritating; but Mr. Wallace, as most working zoologists know to their cost, neglected also to supply adequate references in his work on the "Distribution of Animals," and thus reduced the value of the work by at least one-half. If any one wishes to obtain a concise scientific account of any of the Polynesian or Melanesian islands, and references which will when consulted put them in possession of all the information to be obtained, they should read Meinicke's book, and not "Australasia."

In conclusion, our readers may be reminded that very much yet remains to be done in the exploration of the Australasian region, and most interesting results may be expected when the snow-clad Charles Louis Mountains of New Guinea, possibly 18,000 feet in height, shall have been climbed by the naturalist, and such other hitherto unvisited regions as the island of Timor Laut and the great central mountain of Ceram Nusa Heli, said to be near 10,000 feet in height, from which Mr. Wallace, who has best right to judge, expects great things.

OUR BOOK SHELF

Geological Glossary for the Use of Students. By the late Thomas Oldham, LL.D., F.R.S. Edited by R. D. Oldham. Pp. 62. (London: E. Stanford, 1879.)

THIS is a posthumous work by the late lamented Superintendent of the Geological Survey of India. In a modest preface the author's son, who edits the work, explains that its object is to furnish a companion to the recognised geological text-books by including such terms only as are likely to be met with by beginners, and explaining them in the most concise and simple manner possible.

The definitions given in the book are always brief and to the point, but in a few cases in the attempt to be concise, the author has scarcely succeeded in making his explanations sufficiently clear for a student. We notice that the common mistake is made of confounding together the German words *Keuper* and *Kupfer*. The book is, however, very carefully prepared and edited, the arrangement and typography leave nothing to be desired, and we have no doubt that it will prove of the greatest service to the class of students for whom it is designed.

Ueber die Tektonik der Vulcane von Böhmen. Von Dr. Ed. Reyer. (Vienna: Alfred Hölder, 1879.)

IN this memoir Dr. Reyer shows that the Schlossberg of Teplitz is really a volcanic cone which has been produced by the successive and continued out-wellings of masses of phonolite lava from a volcanic centre. This he is able to prove by a study of the position of the great divisional planes which intersect the mass. The diagram of the internal structure of the mass of volcanic material, which he is thus enabled to construct, shows the most complete agreement with that of the plaster models which Dr. Reyer has described in an earlier paper on the subject. The author also adds some interesting information upon the old denuded volcano of Klein Preisen, and the whole paper forms a valuable and suggestive contribution to our knowledge of volcanoes, which is well worthy of attentive study. J. W. J.

An Essay on Spiritual Evolution considered in its Bearing upon Modern Spiritualism, Science, and Religion. By J. P. B. (Trübner and Co., 1879.)

THIS is an essay of 150 pages by a thoroughgoing "spiritualist," according to the most "modern" signification of the term. As such it is not a book very easy to review in the pages of a periodical devoted to the consideration of modern science. Whether or not spiritualism has any basis of truth, it is certain that a genuine belief, if not in spiritual agency, at least in the occurrence of certain weird and inexplicable phenomena, has of late years spread with extraordinary rapidity, and now includes among its avowed supporters some distinguished scientific men of the day. The estimate that a reader will form concerning the merits of the essay will depend chiefly on his attitude of mind concerning its subject. For "J. P. B." assumes the genuineness of so-called spiritual manifestations, his thesis being that granting a future state and the reality of spiritual communications, these communications invariably teach a doctrine which is in harmony with—or rather analogous to—the doctrine of organic evolution; they teach that gradual development is the law of spiritual life after death as it is the law of bodily life before death. We feel that our function as reviewers ends, when we say that in all his statements of and references to the facts of physical science the essayist is accurate. These statements and references appear, indeed, to us more numerous than the treatment of his subject requires; but if so they at all events serve to show, what perhaps they are intended to show, that "J. P. B." is an intelligent man, who, while prosecuting his spiritual studies—whether in the body or out of the body we do not know—still keeps his eyes open to what is going on in the lower world around him.

LETTERS TO THE EDITOR

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

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

Sun-Spots in Earnest

AFTER three days of total cloud, but after months and months of general watching for sun-spots, and seeing either nothing at all, or only the smallest possible points visible in my household instrument, merely a little picture-forming model of an equatorial by the ancient Ramsden—I could hardly believe my eyes this (Saturday) morning on beholding, even in spite of driving clouds, haze, and smoke, three comparatively enormous sun-spots besides strings of smaller ones connecting them. The group was situated not in the sun's northern, as all the other little points had been, but in its southern, tropic; not just coming into view at the following limb after unknown periods of concealed growth on the other side of the solar orb, but only a day or two past the very middle meridian of its earthward side.

Hence these gigantic spots may have burst, exploded forth, only a day or two ago, and just when their locality was turned towards the earth; and it is indeed greatly to be hoped that some regular and accomplished solar observer in one of the astrophysical observatories may have been lucky enough to have positively seized and photographed this, for years past, most unequalled phenomenon both in its suddenness and immense extent. The energy too which must have presided at their birth, was borne continued witness to this day by rapid changes in the configuration of the spots; and certainly, take them all in all, the long quiescent period of the sun's internal heat-forces seems now to be fairly over, and the wondrous orb, on whose influences we all physically exist, is embarked on a new cycle of radiant activity. PIAZZI SMYTH

15, Royal Terrace, Edinburgh, October 18

Climatic Effects of the Present Eccentricity

I HAVE just read the Rev. O. Fisher's letter (vol. xx. p. 577) asking for an explanation of the reason why the January temperature at the equator, when the earth is in perihelion, is not much higher than in July when in aphelion. The temperature to which Mr. Fisher refers is the ordinary temperature as indicated by the shaded thermometer, which, of course, is simply the temperature of the air. I do not think it is difficult to explain why the *air* at the equator in January cannot be much hotter than in July.

If it can be shown from observation that the black bulb thermometer which indicates, not the temperature of the air, but the direct heat of the sun does not stand higher at the equator in January than in July there would certainly be a difficulty, if the temperature of space be as low as $-239°$ F. It would be desirable to know if such is actually the case. Perhaps some of your readers might be able to afford some information on this point, which seems to have been overlooked by meteorologists.

In a future letter I shall give what appears to me to be the reason why the air at the equator is not hotter in January than in July. JAMES CROLL

Greenwich Meteorological Observations

WITH reference to Mr. Ellis's letter in NATURE, vol. xx. p. 576, it may be enough to point out that, as Table 77 gives only the mean temperature of each day and month of the year for the whole period of the twenty years' observations, we must look elsewhere for the mean temperatures of the months of each successive year; and that this information is not furnished by Table 52, seeing that the means of that table have been prepared without correction for omitted days. Could Table 125 have been accepted as giving accurate mean temperatures this information would have been before us; but as matters stand a table showing the mean monthly and annual temperatures of Greenwich during each of these twenty years remains still to be constructed. An explanation as to how the daily mean values for those days on which no photographic value was available, were obtained in constructing Table 77, and a statement of the daily inequality of temperature of the underground apartment in which the photographic barometer is placed, would enable meteorologists to value even more exactly the highly important results of the Greenwich Meteorological Observations.

ALEXANDER BUCHAN

Rag-Bushes

CONSUL LAYARD has given a remarkable instance of this form of fetishism, practised by the Cingalese, near Jaffna, as illustrating the paper read by Mr. Walhouse at the Anthropological Institute, April 8, 1879. When passing through the Betsileo forest country many years ago we came frequently on somewhat analogous monuments.

"Often on the summit of some of the steepest ascents we found huge piles of branches, twigs, bits of cloth, &c., the thank-offerings of passing travellers for having reached thus far on their journey and surmounted the hill" ("Madagascar and the Malagasy," p. 32, Lieut. Oliver, R.A.). According to Mr. George A. Shaw, of the London Missionary Society, in the last number of the *Antananarivo Annual*, "These heaps are called *tatào*, and have been added to at various times by people carrying firewood or dried grass, &c., to market. They throw on a piece 'for luck,' repeating a form of words, signifying, that if they are fortunate in getting a good price for their goods, when they return they will add another piece to help the *tatào* to grow large. Men driving cattle, or sheep, or pigs, throw on stones with the same speech, often spoken mentally only."

The Rev. R. Batchelor, S.P.G., who accompanied Bishop Kestell-Cornish to the Antankarana country also mentions that when, in trying to knock down the seeds, he threw pieces of wood and stone up at a fan palm, he was requested to desist by one of the villagers "as the tree was *Zànahàry*, *i.e.*, God, adding at the same time, that a man who had dared to cut the trunk with a knife had been killed the same day by Zànahàry's anger." But should I find an intelligent Malagasy battering one of my pet conifers to obtain the cones I should also remonstrate, and unless he was a good linguist he would assuredly believe that I considered my specimen-plants *sacred*, *i.e.*, from stones and sticks. A far better example is that recorded by the Rev. J. Richardson, Head Master of the London M.S. Normal School at Antananarivo, as occurring at Vólotarày, in the Bara country,

en route to St. Augustine's Bay: "As we drew near to Vólotaràv River and town, I noticed a fetish tamarind tree that calls for a little notice. The tree itself is one of the largest in the neighbourhood, and is a notable object when viewed at a distance. The whole aspect of it strikes the stranger at once; its bell-shaped crown, and its branches reaching to the ground being particularly noticeable. I found on close examination, that its trunk divides into two a few feet from the ground; the diameter of its shade is 81 feet, and its branches touch the ground all round the circle. Through its branches there are other trees growing, seeking the sun through its dense foliage; some of these trees are quite a foot in circumference, and there are creepers clinging to them. So that the tree is a miniature forest in itself. The cool shade beneath its branches was most welcome. About a foot from the double trunk a trench encircling the tree has been cut in the sandy soil. This trench, or gutter, is about six inches deep, a foot broad, and is swept most scrupulously clean by some one, and the ridges on each side are patted down so that the sand may not fall into the gutter.

"On the raised earth between the gutter and the trunk of the tree are laid small baskets, mats, fan-palm leaves, locks of hair, &c., &c., and on the surrounding branches similar articles are hung, evidently placed there in making a vow, or as a thank-offering for some benefit, but what I could not tell. The tree is some hundred yards from the town, and when we arrived and inquired about it, no one knew (?) anything of there being such a tree. . . .

"The tamarind trees are apparently held in reverence by the Tanòsy as well as by the Bara, and at some little distance from Rabòdo's compound, at Kiliarivo, there is a very fine specimen of a fetish tree, to which they gave the name of Zànahàry. It is surrounded by a very high fence of prickly pear, and the narrow passage to it had been made impassable by cutting from the fence portions of the thorns and strewing them across the path."

Following is the translation by Mr. Jas. Sibree, jun., L.M.S., from an account by a Hova officer, who commanded an expedition against the Sàkalàvas in 1873:—"Before coming to this village we saw other things of a similar kind, for there is a certain tree they call 'Botóna,'[1] and in this tree there is some part considered as specially belonging to God. So they put on it a small mat about a hand-breadth in width, and they take long dry grass and twist it together, and hanging an ox-skull to the tree, they colour the tree with lines of charcoal and white clay and some yellow substance resembling turmeric, and then pray and render adoration before it. And many are the charms they place on the tree, fastening them to it, and every charm has a name peculiar to it. These are some of them: one is called 'Road-stopper,' another 'Raising up at a distance,' and another 'God's banner.' . . . In another direction which we took we saw some villages with a great many trees growing round them, and the largest tree which grew near the gate had a figure of a woman fixed to it, and ornamented with charms. We asked the meaning of this, and were told, This is the tree of adulterous desires, for here those pray who want women or are about to marry."

I may add that Mr. Richardson, mentioned above, with his wife and family, have lately landed in England, per steamer *Agra*, from Madagascar. It is greatly to be hoped that the reverend missionary will give a detailed account of his adventurous journey to the south-west coast. S. P. O.

The Theory of Hailstorms

WOULD you kindly allow me the space in the columns of your valuable journal to make a few remarks on this subject? Before proceeding, I would like to mention three results of observations on hailstorms in general. It has been observed (1) that they move over the country in sharply-defined bands; (2) that these long bands have their origin or source in mountainous regions; and (3) that the air, previous to the occurrence of the storm is frequently hot and sultry, and that when it has passed, the wind feels sharp and cold.

Theorists admit that the generation of hail seems always to depend on some very sudden introduction of an extremely cold current of air into the bosom of a quiescent, nearly saturated mass. Now, bearing in mind the above-mentioned facts, does it not seem probable, or at least possible, that hailstorms may be caused by a current of wind which has been forced over snow-covered mountains, and thus rendered extremely cold, descending into the warm plains beneath, and forcing the hot and saturated air resting thereon, into the higher regions of the atmosphere, where the moisture would become congealed into a cloud of ice particles, the condition required for the beautiful theory of the formation of hailstones of Prof. Osborne Reynolds? This would account for the great frequency of hailstorms in Southern France, which country is subject to the influence of both the Alps and the Pyrenees. The above conditions, viz., snow-covered mountains and warm plains, could only occur in this country in winter and spring, and it is found that the greatest proportion of our hailstorms are experienced in these seasons.

I do not here enter into details. Should the theory be considered admissible, I hope on some future occasion to give the results of a full investigation of the subject, with my arguments in support of the foregoing opinion. J. A. B. OLIVER

Springburn, near Glasgow, September 29

[1] Botóna, or Bontóna is the Baobab, or monkey-bread tree (*Adansonia digitata*).

Underground Tides

MENTION is made in NATURE, vol. xx. p. 401, of a spring in the Dux coal mines, Bohemia, exhibiting ebb and flow similar to tides. May not this be due to a subterranean syphon, acting precisely as a Field's flushing tank would in a house drainage system Mention of such springs is made in Silliman's "Principles of Physics." We have in our neighbourhood not far from the Mammoth Cave a surface pool about 50 feet in diameter exhibiting this apparent tidal action. The pool is situated in the cavernous limestone country that forms such a large portion of our state, and is only a few hundred yards from Green River, whose peculiarly tinted waters it closely resembles. There is but little doubt that the river furnishes it with water until a level is reached, bringing one of the numerous underground conduits in the limestone into action, when the pool ebbs.

Louisville, Ky., U.S.A., October 9 MORRIS B. BELKNAP

The Uses of Tails

A VERY important function of the tail of the yak, cat, squirrel, and many other animals, to which I drew attention some years ago, has escaped the notice of Prof. Mivart. It is that the bushy tails of these animals serve a very important function in preserving their body-heat during their nightly and their wintry sleep. In cold weather animals with bushy tails will be found lying curled up with their tails laid carefully over their feet like a rug, and with their noses buried in the fur of the tail, which is thus used exactly in the same way and for the same purpose as we use respirators.

I have a Manx tailless cat, who cannot, of course, carry on this function, but he makes a very good substitute for it by using the back of one of my other cats. When he cannot be so accommodated, he sleeps with his hands crossed over his face, "just like a Christian," as my cook says. LAWSON TAIT

OUR ASTRONOMICAL COLUMN

BINARY STARS.—Dr. Doberck, of Col. Cooper's Observatory, Markree Castle, Sligo, continues his interesting investigations on the orbits of the revolving double stars, and now gives a first approximation to the elements of O.Σ. 298, which, since the first measures by Mädler in 1843, has advanced upwards of 135°, the distance, meanwhile, diminishing from about $1\frac{1}{4}''$ to $0''.3$; the passage of the periastre is fixed to 1881·76, and the period of revolution assigned is 68·8 years. It may soon be possible to infer approximately the elements of several other binaries as μ Herculis, O.Σ. 518, the duplicity of which was detected by Herschel in 1783, and which has special claims to the attention of the observer, from its evident physical connection with the rapidly-moving star 40 Eridani (one, by the way, that Mr. Gill intends to attack for parallax), and No. 298 of M. Otto Struve's catalogue. In a new orbit of Σ 3062, by Dr. Doberck, the period is 102·94 years; periastre 1835·5.

THE SATELLITES OF MARS.—Mr. Marth has published data for facilitating the calculation of the positions of *Deimos* and *Phobos* (*Ast. Nach.*, No. 2280), including for

the former satellite the partial effect of perturbation, and leaving the remainder of the process in as simple a form as practicable. He remarks that if the satellites cannot be followed up to December 15, there is little chance of their being seen in 1881, except, perhaps, under greatly improved atmospheric conditions, and we may then have to wait for further observations until the very favourable opposition of 1892; a similar opinion has been expressed by Prof. Newcomb; hence the greater necessity for reliable measures of the satellites during the present opposition. We have not yet heard of any observation of *Phobos* in this country, but Mr. Common continues measures of the position of *Deimos*, which is not far from that given by Hall's elements.

THE MINOR PLANET, PANDORA.—Dr. Axel-Möller, of Lund, has communicated to the Academy at Stockholm an exhaustive determination of the orbit of this small planet, which he appears to have taken under his special charge. It is founded upon the observations at the sixteen oppositions between 1858 and 1877, the perturbations of Mars, Jupiter, and Saturn being rigorously determined by Encke's method. The residual errors are smaller than in any like case we remember, except in Mr. Godward's investigation of the elements of Ceres in 1878, from a similar length of observation (fifteen oppositions) and refined calculation of the perturbations. Dr. Axel-Möller had presented an elaborate memoir on the absolute perturbations of *Pandora* to the Swedish Academy in 1877.

PALISA'S COMET.—Herr Zelbr, of Vienna, has published elements of this comet, which will be probably nearer the truth than any others that have appeared; they are founded on four days' observations between August 21 and September 12, and are as follow :—

Perihelion passage, 1879, October 4·60015 M.T. at Berlin.

Longitude of perihelion	202 27 15	Mean Equinox,
,, ascending node ...	87 7 30	1879·0.
Inclination	77 6 12	
Log. perihelion distance	9·995932	

Motion—direct.

These elements give for Berlin midnight :—

	R.A.	Decl.
	h. m. s.	° ′
Oct. 23	15 36 56	+ 2 7·0
25	— 42 58	+ 0 24·4
27	— 48 50	− 1 15·2
29	15 54 32	2 51·8
31	16 0 6	4 25·3
Nov. 2	— 5 31	5 55·8
4	— 10 48	7 23·3
6	— 16 0	8 48·0
8	— 21 8	10 9·9
10	— 26 10	11 29·0
12	— 31 8	12 45·5
14	16 36 2	−13 59·4

On November 8 the intensity of light has the same value as on the day of discovery, August 21.

GEOGRAPHICAL NOTES

TWO members of the Greenland Scientific Expedition, viz., Lieut. Jenson and M. Kornerup, arrived back at Copenhagen on October 13 in the Greenland trading ship *Ceres*, which sailed from the colony of Egedesminde September 4. Lieut. R. Hammer left Egedesminde at the same time for the colony of Jacobshavn to take up his winter station there, in order to fulfil the special duties intrusted to him. M. Steenstrup takes up his winter station in the Umanak district, and it is intended that Steenstrup and Hammer shall meet next year, so that they may prosecute their researches together.

MÉNILIK, King of Shoa, has written a letter to the president of the Geographical Society of Paris in reference to the scientific mission which has been sent to Shoa by the Geographical Society of Rome and which has the protection of his government. But the King would like better to have to assist a French mission sent to him by the Geographical Society of Paris; consequently he desires the Society to fit out an expedition, promising them to employ all his power on their behalf. He complains bitterly against the Egyptian Government, which prevents Abyssinia from being placed in communication with European civilisation as it had been in former centuries. The letter is written in French and sent with an Abyssinian translation.

THE Grand Duke Nicholas of Russia has ordered M. Barante to translate into French his work "On the Canalisation of the Amu-Daria" and present it to the Paris Geographical Society. The work will be published *in extenso* in the Transactions of the Society.

A TELEGRAM received by the Russian Geographical Society communicates the following particulars as to the scientific expedition now exploring Tibet, under the leadership of Col. Prshevalski. On May 1 it was on the river Boolagan, having marched nearly 600 versts from Saizan, through Booluntokhoi, up the river Yrungo. The Colonel intended crossing the southern Altai Mountains by the shortest way to Barkool. All his companions were in good health, and success had attended all their efforts. Another telegram to the Russian General Staff, dated May 30, states that Col. Prshevalski had then accomplished a third part of the distance between Saizan and the Himalayas, reaching the town of Khani, whence he intended going to Shadsheoo and Paidan. Another Russian geographical expedition, it will be remembered, in three sections, is at present prosecuting researches east of the Caspian, though the same success does not seem to crown its labours. A letter reaching St. Petersburg by way of Orenburg says that the scientific party sent out to explore the Amu Darya, or Oxus, was attacked by about 100 mounted Turcomans, who were, however, repulsed. The whole course of the Amu Darya, as well as of its affluents, is described as having been found navigable.

M. REVAEL, who spent a long time with the Somalis on the western coast of the Gulf of Aden, has described to the Geographical Society of Paris the land and its inhabitants, who appear to be very anxious to trade with Europeans, and he presented an Arab firman signed by the Sultan inviting foreigners to visit his dominions. M. Revael is to return to Somali land with Prince Albert of Monaco.

IN the belief that not much is generally known in England on the subject, Mr. Consul Gollan devotes a considerable part of his last official report to a description of the geographical position, climate, population, industries, &c., of the two provinces of Santa Catharina and San Pedro do Rio Grande do Sul, in Southern Brazil. The former lies between 26° and 29° 30′ S. lat., and 48° 30′ and 52° W. long.; it contains an area of about 14,700 square miles, with a population of almost 160,000. The latter province, usually known as Rio Grande do Sul, lies between 25° 30′ and 32° 30′ S. lat., and 49° 40′ and 58° 20′ W. long.; it has an area of 118,758 miles, with a population of 430,000. The climate, more especially of the latter province, is described as excellent, a term which does not apply to the upper portions of the empire. Being some 700 miles outside of the tropics, these provinces have the advantage of a temperate climate, and are consequently the best adapted to immigration.

A LLOYD'S telegram dated Kobe, October 17, reports the *Vega*, Swedish exploring steamer, arrived at that port on the 14th inst.

SERIOUS preparations for the construction of a railway into the interior of Africa are now being made in France.

French engineers are investigating the territory from the starting-point of the future line to the Laghouat in the south. From that point as far as the line from Ain Sala au Khat military-technical expeditions are to prepare the way. Besides this the Oran Geographical Society and the Vice-Prefect of Tlemcen are to send caravans along the frontier of Marocco. MM. Soleillet and Duveyrier will travel on their own account for the same object.

A MEETING took place at Dortmund on the 4th inst., which had for its object the discussion of a project for connecting the Rhine and the Weser by means of a canal. The Government presidents of Westphalia, of the Rhineland, and of Hanover were present. The canal will be constructed *viâ* Ruhrort and Heinrichenburg, but it is undecided as yet whether from the latter place it will proceed to Emden or to Minden. Special committees were formed for the purpose of further investigating the latter question.

MESSRS. SCHMIDT AND GÜNTHER, of Leipzig, will shortly publish an elaborate work on India by Emil Schlagintweit. The work will appear in thirty-five parts, and will be profusely illustrated by eminent artists.

A PARLIAMENTARY caravan comprising about twenty members of the French Senate and Chamber of Deputies is travelling all over Algeria in order that the legislators may become acquainted with the peculiarities of the land and inhabitants. The tour will be terminated at the end of the month.

THE PLANETS OF THE SEASON

SELDOM could the aspect of the nocturnal sky be more attractive to the student of planetary phenomena; seldom has his inquiring gaze been repelled more pertinaciously by

"Vapours and clouds and storms,"

than during the past anomalous season; and our English climate has more than maintained its accustomed forbidding character, just when a few nights of transparency would have been especially welcome. Better things, however, may still be in store; and in that hope the following remarks on the distinctive features of the present ornaments of our midnight sky may be admissible as possibly of some suggestive value to comparatively inexperienced observers.

We have for some time past had a simultaneous presentation, under the favourable circumstances of proximity to the earth and a greatly improved altitude as compared with recent oppositions, of three peculiarly remarkable objects, the most magnificent, the most ornate, and—so to speak, the most earth-like member of the planetary family. Each holds his own pre-eminence on his own ground; each bespeaks especial study from his own individual character; and it is probable that some acquaintance with foregone results may economise time and labour by enabling us to leave on one side what is already, in comparison, sufficiently known.

The examination of Jupiter is not at present quite as satisfactory as it would be with as much north as he has south declination; it is always, however, greatly facilitated by the broad expanse of his noble disk, and a brilliancy so great as to have occasioned a suspicion of unborrowed light, emanating from internal incandescence. While, however, the shadows of the satellites upon his surface are so intensely black, and the satellites themselves so utterly invisible in eclipse, it is evident that any accession of luminosity from such a cause, even if it exists, must be quite insensible in the general effect, which can only be ascribed to an extraordinary reflective power in the whiter portions of the globe. A diminution of brightness towards the limb, which might be anticipated on optical grounds, and is frequently demonstrated by the reversal of the aspect of a passing satellite from light to dark, or the contrary, is nevertheless not distinguishable by the eye, nor even when a portion of the light has been intercepted by darkening glasses; it is, however, apparent if the screen is deep enough in tint to extinguish the satellites. This was scarcely to be expected. It might have been supposed that a central region so bright as to exhibit a white disk in front of it as dark, even to blackness, by contrast, could not escape being itself strongly contrasted with a border so much fainter that the same disk appears luminous on it as a background. Yet the difference is not obvious; and no other cause can be assigned excepting the imperceptible gradation. The idea of absorption in the upper region of an extensive atmosphere, not otherwise manifesting its existence, has indeed been entertained; but it seems unnecessary. The observed decrease of brilliancy is only what would result from obliquity of incidence in the solar rays, and it probably exists in no greater proportion than is due to that cause. The atmospheric hypothesis might indeed have been directly tested, by comparing the brightness of the satellites when near the limb in the superior and inferior portions of their orbits, had their light been sufficiently equable; but its variations are too evident and at the same time too irregular to render such comparisons satisfactory. A long course of observation might indeed eliminate these discrepancies, but it is questionable whether the result would repay the labour. Nevertheless the fact referred to, of the incompetence of, at least, ordinary vision to detect the diminution of light towards the limb is worth attention, as leading to inferences rather unfavourable to the sensitiveness of the eye in some of the processes of photometry. At a considerable distance from opposition, when the terminator encroaches slightly on the elliptical form of the limb, the defalcation of light on that side may be readily detected.

As to the real nature of that magnificent globe we are compelled to admit an embarrassing amount of ignorance. We see indeed that it is encompassed by an envelope, subject to occasional disturbances of a nature which on our earth would necessarily infer the extensive prevalence of vapour, sometimes in tranquil suspension, at others either agitated by rapid currents, or subject to equally speedy processes of precipitation and solution. Beyond this we can hardly be said to know anything. Jupiter is in no respect an enlarged resemblance of the earth. With so little similarity in point of density and gravitation—with so slight a diversity of seasons—with such rapid interchange of day and night—could we be transported there, we might probably find ourselves as among the imagery of an incomprehensible dream. Vapour we might recognise—and vapour occasionally in a state of rapid change; but possibly not the vapour of water; and whether exhibiting itself in the luminous or shady spaces could hardly be decided by a mere comparison with terrestrial clouds. These would no doubt be to a distant eye brighter than the surface beneath them, but among so much that is dissimilar a single point of analogy would hardly bear much weight; it is, however, the more probable alternative that the dark bands are the transparent part of the atmospheric envelope, from the fact that these become less distinct towards the limbs. The obliteration is not indeed always apparent, and is often absolutely imperceptible in a sharply defining instrument; but it has been frequently referred to, and if these ideas are correct, it may probably be found that in proportion to the darkness of the belts will be the nearness of their approach to the edge of the disk. The disappearance of dark spots near the limb would be accounted for by the rules of foreshortening in perspective.

The tendency to an equatorial arrangement in these streaks is one of the most familiar features of the planet; and almost self-evidently connects itself with the astonish-

ing velocity of rotation; yet there is a "missing link" which cannot readily be supplied. Friction against a surrounding medium, *combing out*, as it has been expressed, the vapours in a longitudinal direction, can hardly be admitted on mechanical grounds; and there is difficulty in conceiving the arrangement of the restoration of equilibrium in currents which set in one direction over the whole visible globe, if they originate by ascending from warmer depths, and lagging behind in a higher and more swiftly rotating region. We may remark, in passing, that only a trifling elevation of the luminous above the grey region, with a corresponding slight difference in velocity of rotation, is compatible with the undeviating contour of the limb as far as our telescopes may show it; though, of course, given an unlimited duration of time, the slightest preponderance would be ultimately adequate to such an effect. Possibly the best explanation may lie in some modification of electrical or magnetic polarity. At any rate the influence, though predominant, is not irresistible, since it neither precludes the formation of belts of a certain amount of obliquity, nor mixes up in confusion, though it seems to elongate, those very remarkable insulated luminous masses which occasionally encompass the gigantic equator in a comparatively equable series with a string of great oval beads, sometimes so curiously and uniformly shaded as to convey an almost irresistible impression of high relief. This strange phenomenon, not confined, as Dawes has found, solely to the equator, seems wholly beyond our conjectures. Nor can we satisfactorily explain those large spots, much darker than the belts, as though the atmosphere were there more perfectly transparent, which have occasionally shown such remarkable persistency as to indicate some relation to definite regions on the surface beneath them; at other times have disappeared with startling rapidity; and usually have been so far from absolute immobility that every attempt to determine the rotation by their means has ended in mere approximation. The occasional detection, too, of many minute white specks, like passing satellites, in various parts of the disk, has added nothing to our knowledge beyond the fact of their presence. The abnormal flattenings of the limb which have sometimes been noticed on the approach of a satellite, or even without it, seem to be of an illusory nature. And yet nothing should pass without attention.

Few things in this wonderful planet are more striking than the singular and beautiful colouring which occasionally adorns the disk. For a considerable season nothing beyond some feeble tinge may be made out, especially in the equatorial zone; then again we shall find purple, brown, greenish yellow, orange, and rosy tints marking out the surface with delicate but unmistakable variety. The darker the grey of the belts, the more apt it is to show a slaty purple hue; the polar regions sometimes, as at present, differ slightly in tint, so that temperature does not seem to be connected with it. The rosy spot of the present season south of the equatorial zone has naturally attracted much attention, and will of course be carefully watched. But as yet the origin of such varieties of colour sets conjecture at defiance. To depict these many changes both of form and hue will always be an interesting occupation, though it is never likely to have any more definite result than to deepen our sense of the wonders of creation, and our reverence for its First Great Cause.

One caution may be permitted here. It would be very desirable for those who attempt to delineate this magnificent planet that they should make themselves familiar with the perspective of a globe. The telescopic image has so precisely the aspect of a flat disk that it requires some mental effort to realise the fact that we are gazing on a great ball; and unless this is carefully borne in mind our drawings will and must be unsatisfactory. Especially it is perhaps seldom imagined how very little we know of the Polar regions, from an obliqueness of presentation amounting to virtual and unbroken concealment. From the analogy of Saturn we may infer that the poles of Jupiter present no remarkable feature; but it must ever remain a mere conjecture to all future generations.

It scarcely needs to be mentioned that no circular representation of the disk can ever give a resemblance tolerable to an experienced eye. An elliptical outline, apparent even with a power of 30 or 40, is too striking a characteristic not to affect materially the faithfulness of the picture.

Something remains to be said as to the beautiful retinue which attends on this leader of the planetary system and whose perpetual change of configuration is ever a source of fresh interest. In some respects they are subjects only for the finest telescopes, in others a very slight optical power can deal with them. The true dimensions of those minute disks are, perhaps, as fairly known as can be expected from measures of such difficulty; but the subject of their numerous changes of brilliancy, though frequently treated, cannot be said to be fairly exhausted. That such changes exist, and to an extent easily recognised in very moderate telescopes, is undeniable; and were they constant for the same orbital positions, they would find ready explanation in the very natural supposition that they rotate like our own satellite, each on his own axis, in the same time that they complete their monthly period. But this idea, though it approved itself to Herschel I. and Schröter, is found inconsistent with observation, which shows the changes to be too irregular in their returns; and we can only infer, what, indeed, has been actually shown by good instruments, both in front of and outside of the face of the primary, the variable darkening of portions of their disks, a result which, interpret it how we may, by atmospheric change, or unsymmetric rotation, or a combination of both (and no other supposition seems to occur), removes those little bodies still further from our analogies. There is no more resemblance between these satellites and our moon than there is between the primaries on which they respectively attend.

We must postpone our remarks on Saturn and Mars to a future opportunity.

T. W. WEBB

NORDENSKJÖLD'S ARCTIC VOYAGES[1]

IT is fifteen months, our readers will remember, since Prof. Nordenskjöld left Hammerfest in the *Vega* to prove that, if taken at the proper time, the North-East Passage is perfectly practicable. And the result has proved that he was right to within a day or two. Nearly a year ago he had practically accomplished the passage, and was only overtaken by the ice just as he was about to emerge into the Pacific. We know already that during their year's enforced imprisonment in the ice to the east of Serdze Kamen, Prof. Nordenskjöld and his accomplished and well-selected staff have made the best possible use of their time. We have already, on several occasions, briefly referred to some of the valuable results obtained in various departments of science, and the full narrative of the expedition will be looked for with impatience. We hope that it will be given to the world with the least possible delay after the leader's return to his home in Stockholm. Meantime we are concerned, not with this culmination of a long series of expeditions in the Arctic waters to the north of the Old Continent, but with the exploring work of its leader during the previous twenty years. Mr. Leslie has done good service in wading through the voluminous literature of Nordenskjöld's various expeditions, and culling from it the material wherewith to compile a

[1] "The Arctic Voyages of Adolf Erik Nordenskjöld, 1858-1879." With Illustrations and Maps. (London: Macmillan and Co., 1879.)

volume of genuine interest and of much scientific value, well provided with maps, and rendered attractive by numerous illustrations.

Mr. Leslie gives a preliminary account of the life of his hero, mostly in the latter's own words, and this is perhaps the most interesting part of the volume. Many of our readers do not need to be told that Prof. Nordenskjöld is a remarkable man, altogether apart from the long series of explorations in which he has done so much for a scientific knowledge of the Arctic regions. Nordenskjöld is a native of Finland, having been born in 1832, the descendant of an old family of good position. His father was chief of the Mining Department of Finland, and a well-known naturalist. Other members of this family were eminent in various departments of literature and science, and the grandfather, Col. Nordenskjöld, built a peculiar residence at Furgord, where stores of natural history have been collected. Here young Nordenskjöld was brought up, and while yet a boy was an industrious collector of minerals and insects, and was permitted to accompany his father on his tours, acquiring thus early the keen eye of the mineralogist. After attending the Gymnasium of Bergo for some time—

"Nordenskjöld entered the University of Helsingfors in 1849, devoting himself chiefly to the study of chemistry, natural history, mathematics, physics, and above all, of mineralogy and geology. 'Already before I became a student,' he writes, 'I had been allowed to accompany my father in mineralogical excursions, and had acquired from him skill in recognising and collecting minerals and in the use of the blowpipe, which he, being a pupil of Gahn and Berzelius, handled with a masterly skill unknown to most of the chemists of the present day. I now undertook the charge of the rich mineral collection at Frugord, and besides, during the vacations, made excursions to Pitkeranta, Tammela, Pargas, and others of Finland's interesting mineral localities. By practice I thus acquired a keen and certain eye for recognising minerals, which has been of 'great service to me in the path of life I afterwards followed.'

"After passing his candidate examination in 1853, Nordenskjöld accompanied his father on a mineralogical tour to Ural, devoting most of his attention to Demidoff's iron and copper mines at Tajilsk. Here he planned an extensive journey through Siberia, but the breaking out of the Crimean war put a stop to it.

"'After my return,' says Nordenskjöld, 'I continued to prosecute my chemical and mineralogical studies with zeal, and wrote as my dissertation for the degree of Licentiate a paper "On the Crystalline Forms of Graphite and Chondrodite," which was discussed under the presidency of Prof. Arppe on February 28, 1855. The following summer I was employed on a work of somewhat greater extent—"A Description of the Minerals found in Finland," which was published the same autumn. Various short papers in mineralogy and molecular chemistry were printed in "Acta Societatis scientiarum Fenniæ;" I also published, along with Dr. E. Nylander, "The Mollusca of Finland" (Helsingfors, 1856), as an answer to a prize question proposed by one of the faculty. In the interval I had been appointed Curator of the Mathematico-physical Faculty, and had obtained a post at the Mining Office as mining engineer extraordinary, with inconsiderable pay, and an express understanding that no service would be required from me in return. A salary was also attached to my curatorship.'"

Nordenskjöld did not, however, long enjoy these, his first paid appointments. Finland has never taken kindly to her severance from Sweden and her attachment as a province to Russia. Nordenskjöld naturally had a great love for Sweden, and on one or two occasions gave expression to his feelings in speeches at social gatherings. These expressions were certainly not significant of anything like disloyalty to Russia, but the shortsighted governor of the time magnified them into something like high treason. The result was that Nordenskjöld left Finland in 1857 and took up his residence in Stockholm; since then he has been to all intents and purposes a subject of the Swedish Government, and has risen in his adopted country to high honours. Shortly after his arrival he was appointed assistant to the celebrated mineralogist, Mosander, and in December, 1858, on the death of the latter, succeeded him as Professor and Intendant of the Mineralogical Department at the Riks-Museum of Copenhagen. Before this he had travelled and studied in various parts of Europe, especially in Berlin, had visited the Ural Mountains, and explored part of Finland. Since then he has more thoroughly explored Finland and visited many parts of the Scandinavian Peninsula, as a mineralogist. We need not remind our readers of the great amount of work done by Nordenskjöld, during the past twenty years in mineralogical investigation; his researches in this department have entitled him to take a high rank in his own department.

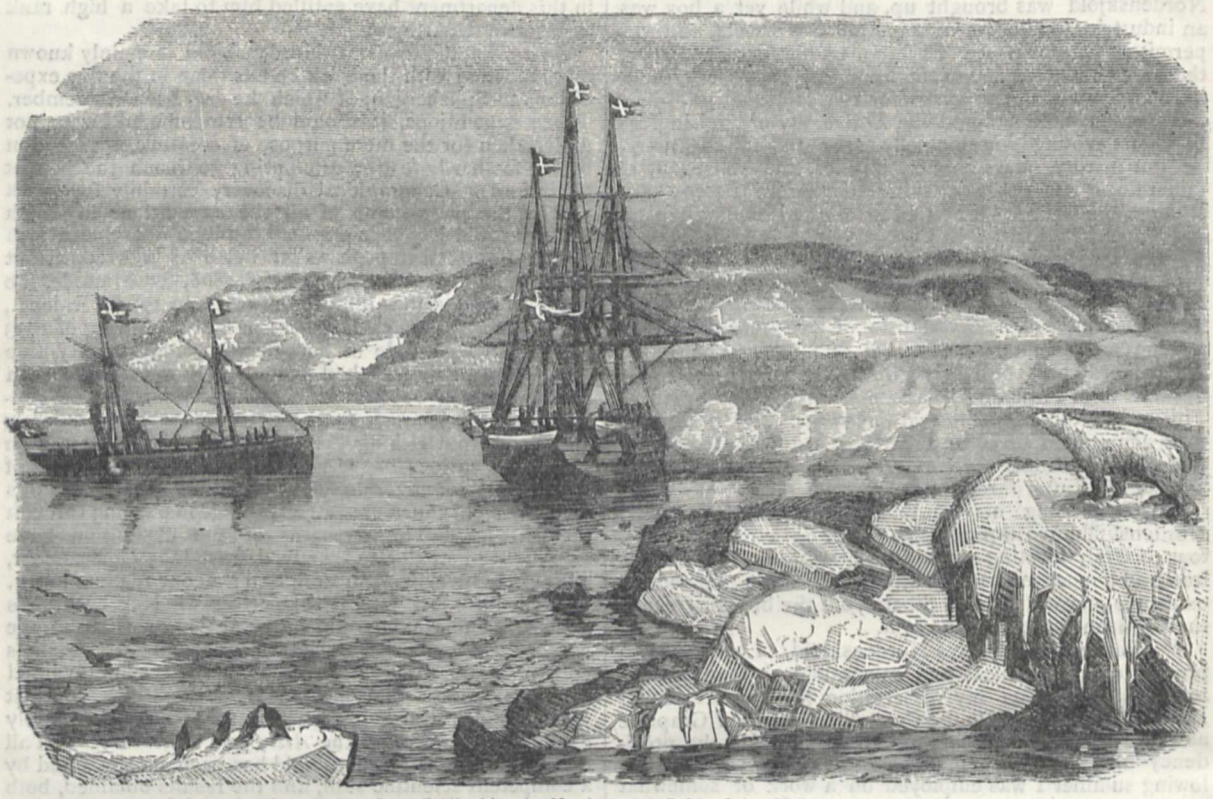
As a scientific explorer, Nordenskjöld is mainly known in connection with the work he has done in the five expeditions to Spitzbergen, of which he has been a member. These expeditions, it should be remembered, were not undertaken for the mere purpose of creating a sensation by the foolhardy feat of attempting to reach the pole at all hazards. Geographical discovery certainly formed a part of the programme of all the expeditions in which Nordenskjöld has been engaged, and on these occasions it was attempted to push as far north as was consistent with safety. In the expedition of 1868, for example, the *Sofia* succeeded in sailing to 81° 42′ N. in 17° 30′ E. long., 12′ beyond Scoresby's farthest; and in the spring of 1873 an attempt was made in man-drawn sledges (thirty-nine of the forty reindeer had bolted, and were never seen again) to push beyond the Seven Islands, but the condition of the ice was such that Nordenskjöld prudently abstained from risking his men's lives. The vessels in which the various expeditions have sailed have been of very small tonnage, in one case only 26½, but this Nordenskjöld considered an advantage in pushing through the drift-ice. The expenses of the expedition have always been moderate, partly defrayed by Government, but mostly by private subscription; as our readers know, one of the most liberal supporters of Nordenskjöld's exploring undertakings has been Mr. Oscar Dickson, the wealthy Gothenburg merchant, to whom Mr. Leslie's volume is appropriately dedicated. The results obtained in these modest and inexpensive expeditions contrast strongly with those of the expensive and elaborately equipped expedition in the *Alert* and *Discovery*. On all these expeditions Nordenskjöld has been accompanied by a competent scientific staff, and the results obtained, both in the natural history and the physics of the Arctic region, have been of the first importance. By means of these and other researches the Riks-Museum of Stockholm has now, probably, the richest collection in mineralogy in the world.

On the first two expeditions to Spitzbergen, in which Nordenskjöld was engaged, 1858 and 1861, he acted as geologist under the leader Otto Torrell, the head of the Swedish Geological Survey. On the former of these several parts of the west coast were visited and explored. At Bell Sound, on the south-west of the main island "dredging was undertaken with abundant success, birds and mammalia were shot and prepared, a tertiary formation containing fossil plants discovered, and botanical collections made, particularly of mosses and lichens. "On July 6 they left this anchorage to sail northwards, but calms and head-winds compelled them to seek the north harbour in the same fjord. There Nordenskjöld discovered thick vertical strata of limestone and siliceous slates rich in fossils of the genera Productus and Spirifer, and which therefore appeared to belong to the carboni-

ferous formation, and found these strata overlain by other nearly horizontal beds belonging to the same tertiary formations with impressions of leaves as he had observed at Middle Hook."

The expedition of 1861 consisted of two tiny vessels. They managed to sail right round the west and north coast to the entrance of Hinlopen Strait, which divides the main island from North-east Land, anchoring in Treurenberg Bay, the starting-point of Parry's famous sledge expedition of 1827.

"The Swedes paid a visit to Hecla Cove, Parry's harbour, protected from the north by Cape Crozier with its hill of quartzite. It was on this point that Parry and his lieutenant, Crozier, carried on their magnetic and astronomical observations, and on this height they erected a flagstaff with a copper plate bearing an inscription to preserve the memory of their visit. Here was found a flagstaff, which, however, was only the highest portion of Parry's flagstaff, and the copper plate was cut away so that only a few small pieces remained under the heads of the nails with which it had been fastened. Hecla Mount, about 1,720 feet high, was ascended, and from its top an extensive view was obtained of North-east Land, which along the coast is very flat with rounded hills of inconsiderable height, and in the interior is covered with a continuous snow-plain of about the same or somewhat greater height above the sea than the top of Hecla Mount, and to the south of Niew Vriesland, the interior of which is also occupied by a similar unbroken snow-plateau. In the neighbourhood large masses of hyperite were found; and to the iron which the eruptive rock contains the Swedes attributed certain irregularities which appeared in the magnetic observations. Interesting as was the discovery of this rock on the other



Cape Chelyuskin, the Northernmost Point of the Old World.

side of the bay to the geologists, it was not so to the physicists, who found that all their magnetic observations were affected by its presence."

During the weeks that elapsed from the imprisonment of the vessels in Treurenberg Bay till their release, the zoologists carried on dredgings, the other members of the expedition were employed in copying charts, with a view to future excursions, and in calculating observations; on board the *Æolus* meteorological observations were taken hourly; measurements were also made of the tides.

"At length the ice broke up, and on July 2 the ships got out to sea accompanied by the *Jaen Mayen*, a fishing vessel that had been imprisoned along with them.

"June is the spring month of Spitzbergen. The sun rose higher and higher above the horizon, and his rays were by no means powerless. The snow first became soft and water-drenched, and disappeared in spots from the ground. On June 11 *Cochlearia fenestrata*, and the polar willows began to open their buds; on June 22 the first expanded flowers of *Saxifraga oppositifolia* were gathered, a sign that the midsummer sun had at length won a victory over the northern winter, and on the 26th there were in flower *Draba alpina*, *Cochlearia*, *Cardamine bellidifolia*, and *Saxifraga cernua*, and here and there *Oxyria*, and the willow, and in the beginning of July *Cerastium alpinum*. Small *Poduri* hopped about in a lively way among the snow. By June 7 there were seen on Hecla Mount, more than 1,500 feet above the sea, a number of gnats, and on the 21st there were captured near Æolus's cross *Diptera*, which, however, were unable to raise their wings to a higher flight than a foot or two from the ground. Small spiders and a kind of worm, like our dew-worm, living in the already thawed ground, were found here and there."

After the ice broke up Torell and Nordenskjöld undertook a boat journey down Hinlopen Strait, during which a variety of important data were obtained and collections made. At several places they found immense glaciers,

one about seven miles long, and standing out into the sea with its perpendicular walls. South of Wahlenberg's Bay a bed of Permian fossils in great abundance was met with; these were the first fossils found in North Spitzbergen. After collecting a large quantity of fossils at Angelin's Mount, on the south-west of North-East Land, the party rowed along the shore to another mountain, 2,000 feet high, which strongly resembled it. This they named Lovén's Mount. Its upper part consists of hyperite, and with its flat, steep, and black sides strongly resembles a roof. Underlying the hyperite are horizontal lime- and sand-stone strata with nearly perpendicular faces towards the sound giving the whole mountain the appearance of a regular colossal building. Another rich collection of fossils was made here. The party then proceeded down the strait, but after two hours' rowing were met by fast ice which obliged them to turn. They then rowed along the west side of the sound, taking an hour to pass a broad glacier. After it they came to another which lay like a stratum of rock on a perpendicular cliff of hyperite, and accordingly tumbled with its ice over the rocks into the sea. The hyperite was found to be beautifully polished and marked, and here, as at several other places, were found many signs that the ice in former times had occupied a larger area on Spitzbergen. Between Dym Point and Cape Fanshawe the Swedes passed the greatest auk-fell they had hitherto seen. Here also was found, rising from the sea to a height of 1,000 feet, a perpendicular wall of hyperite, everywhere split vertically into basalt-like, upright, four- or eight-sided columns, standing free or only connected with the main rock by a small corner, and sometimes crowned capital-wise by a stratum of greyish-white limestone. After passing Cape Fanshawe the party next entered Lomme Bay, on the west side of which they found the largest glacier they had yet seen on Spitzbergen. It is about ten miles wide, and projects into the sound with a curved front. The stratification of the ice is horizontal. At Shoal Point, at the entrance to Hinlopen Strait, the beach was everywhere covered with an enormous mass of drift-wood among which are found pieces of pumice-stone, birch-bark, cork, poles, and floats from the Lofodden fisheries, with other things which had been carried hither by currents from the south. The drift-wood formed a broad line along the beach. Farther up was another line, where the water now scarcely comes even during spring tides, probably elevated by a raising of the land. In this line the drift-wood was far older and undergoing decomposition. While Torell was examining all this, he found among other things a well-preserved bean of the West Indian plant *Entada gigalobium*. This bean, which is upwards of an inch and a half across, floats with the Gulf Stream through the Atlantic, is found not unfrequently on the coast of Norway, and being also found on North Spitzbergen, affords the most convincing

Bean of *Entada gigalobium* (natural size).

evidence that the Gulf Stream reaches this high latitude. After the return from Hinlopen Strait, Torell and

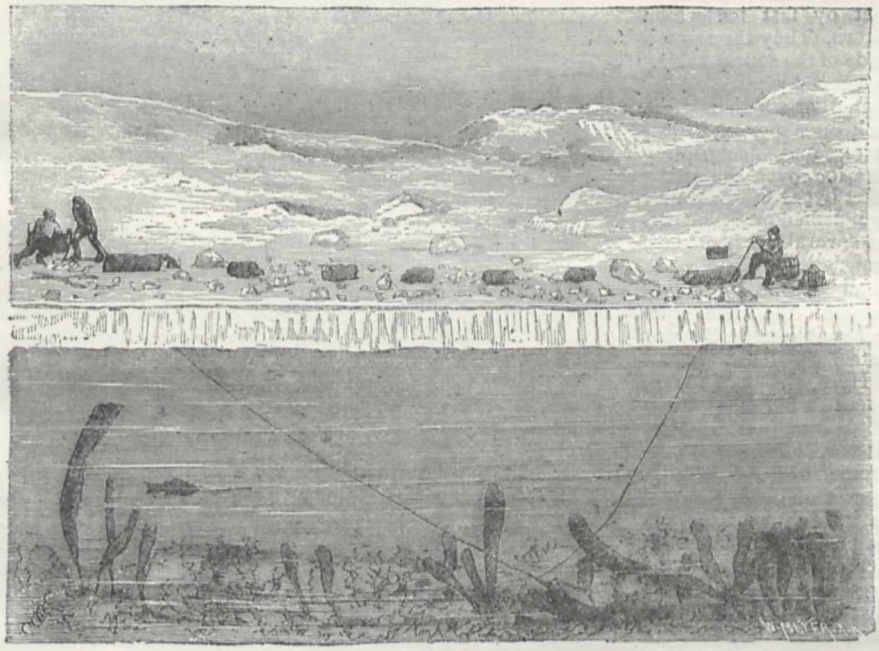
In the Interior of King's Bay.

Nordenskjöld explored a part of the north coast of North East Land. Near Waygatz Islands, on the south of

Hinlopen Strait, where one of the vessels lay for some time, the divergence between the marine fauna of East and West Spitzbergen was very striking. Here were found animals belonging exclusively to the fauna of Greenland, seen exceedingly seldom or never on the west coast. As an example of the flora to be found in Spitzbergen and of the thoroughness with which the expedition did its work, we quote the following passage from Mr. Leslie's volume :—

"After various excursions had been made the *Magdalena* sailed from the Norways on the 25th, and after passing Kobbe Bay and South Gat, the sound between Danes' Island and the mainland, anchored in Magdalena Bay. Here, at a height of 2,300 feet above the sea, the following plants were found growing, *Cochlearia fenestrata*, *Cerastium alpinum*, *Luzula hyperborea*, and several saxifrages; lower down, small soft tufts of the Arctic willow, *Alsine biflora*, and several grasses. Out of the gravel there rose nearly a foot high here and there the uncommon *Saxifraga hieracifolia* and *Pedicularis hirsuta* with its reddish head, alternating with yellow *Ranunculi* and bright red patches of the graceful *Silene acaulis*, of which, however, a flower here and there had begun to pale under the powerful rays of the sun, which had already caused several *Drabæ* and the here uncommon *Arabis alpina* to go to seed. High up on the fell grew the beautiful *Erigeron uniflorus*. By the side of the small streams that flowed from the top to the bottom of the mountain were mosses, *Saxifraga rivularis*, *Stellaria eduardsi*, and two species of *Poa*. It is remarkable that the vegetation diminishes quite inconsiderably with the height above the sea, so that almost all the plants that grow near the beach thrive as well at a height of 2,000 feet. The continual sunlight and the insignificant difference in temperature are undoubtedly the causes of this.

"The large granite blocks and broken stones, of which is formed the peculiar beach by which the fells are here almost always separated from the sea, are quite concealed by the most luxuriant moss and lichen vegetation. The grey covering, often six inches thick, is for the most part composed of lichens: *Sphærophoron fragile* and *Cladonia gracilis*, *Stereocaulon paschale*, *Cetraria islandica*—Iceland



Dredging under the Ice in Winter.

moss—*Bryopogon jubatum*, *Alectoria thulensis*, *Umbilicaria arctica*, *Solorina crocea* and many others; and among mosses of *Racomitrium lanuginosum*, with stalks nine inches long, *Encalypta rhaptocarpa*, *Gymnomitria* and *Bryæ*, *Polytrichum alpinum* and *Dicranum fuscescens*, &c. While the sloop lay in Magdalena Bay Cape Mitre was visited, a promontory which Scoresby ascended one of the few times he landed on Spitzbergen. When he had reached the summit, he was obliged to sit astride the ridge in order to keep his place. On July 31 the *Magdalena* again put to sea, and the same day anchored in Cross Bay. In this neighbourhood the first known fern on Spitzbergen was found—*Cystopteris fragilis*."

In the neighbourhood of King's Bay, was found a seam of coal, together with impressions of leaves and other parts of plants, showing that there was a period in the development of the globe when spreading forests, composed, it would appear, chiefly of broad-leaved trees, resembling maples, everywhere covered the valleys and mountain-slopes, where now, if they be not entirely filled with thick beds of ice, the Arctic willow, creeping inch high along the ground, is the only representative of plants of the nature of trees.

Thus sailing from one point to another, making boat and land excursions, dredging and collecting plants, animals, fossils, and minerals, and studying ice and other physical conditions, the members of the expedition carried on their work, returning only when the ice threatened to lock them in for the winter. This is a fair example of the methods and results of the various expeditions in which Nordenskjöld has been engaged.

In the third expedition to Spitzbergen, in which Nordenskjöld was engaged, that of 1864, he himself was leader. The vessel was an old but strongly-built gunboat, the *Axel Thordsen*, of 26½ tons, part of the object of the expedition being to complete the preliminary survey to ascertain the possibility of measuring an arc of the meridian. On this occasion the expedition succeeded in landing on Bear Island, but on a subsequent expedition it was explored for five days. On the visit of 1864 Nordenskjöld inserted a water-mark at the Burgomaster Port, to register the rise of the land, which is going on in Spitzbergen as in other Arctic lands. After attempting

Stor Fjord, the expedition made for Ice Fjord, which, at its east end, sends off three branches. A careful examination was made of several parts of the coast of this fjord, and in the neighbourhood of the North Fjord Nordenskjöld collected a large number of triassic fossils, among them large nautilus-like shells and fragments of bones, some of which were thought to have been four feet long, belonging to crocodile-like animals. While in Ice Fjord, the expedition met with Mr. Birkbeck's yacht *Sultana*, "a beautiful but fragile nutshell," having among others on board, Prof. Newton. Here also a water-mark was fixed. After leaving Ice Fjord, the *Axel Thordsen* succeeded in reaching Stans Foreland, a large island to the south-east of the main island, having on its south the Thousand Islands.

"Fortunately it appeared that the discouraging descriptions of the fogs prevailing here are properly applicable to the Thousand Islands, comparatively clear weather, on the contrary, being common in the inner part of the fjord. Here, as at many other places on Spitzbergen, may be found cloudless skies and sunshine, while an impenetrable fog lies at the mouth. The cause of this is to be sought for in the course of the marine currents. While an arm of the Gulf Stream, as the masses of drift-wood heaped up at South Cape and the Thousand Islands show, at least during a portion of the year, flows past the southern part of West Spitzbergen and Stans Foreland, it is the Arctic current entering from Helis Sound and Walter Thymen's Strait, which principally prevails in the interior of Stor Fjord. There is, therefore, no drift-wood to be met with on the shores of this fjord, on which account it is necessary on boat voyages to carry a supply of fuel. During boat voyages along the north coast of Spitzbergen one may, on the contrary, nearly always reckon on finding in the neighbourhood of the resting-place dry and excellent material even for a large log fire."

The west coast of Stor Fjord is occupied by enormous glaciers, which go down to the sea and are only interrupted by black, often conically-shaped mountain tops. On the east coast, on the contrary, between Whales' Point and Helis Sound, there is only a single considerable glacier, the coast being formed of a continuous rocky wall, which rises almost directly from the sea to a snow-free plateau of about 1,000 feet in height. At the foot of this wall there are here and there grassy slopes, which form the finest reindeer grounds on Spitzbergen. The west coast both of Stans Foreland and of Barents Land was examined as far north as the extremity of the fjord. In connection with this part of the expedition's work, some interesting remarks are made on the character of the Spitzbergen glaciers:—

"When icebergs are spoken of in the region of Spitzbergen, it ought to be remembered that what is meant is large blocks of ice which fall down from the perpendicular sea faces of the glaciers. Though these blocks are often exceedingly large, they cannot in any way be compared with the icebergs in the Greenland waters, which are said to reach a height of 1,000 feet. The glaciers on Greenland near the sea are indeed higher than on Spitzbergen, but this dissimilarity is not sufficiently great to explain the great difference in the dimensions of the glaciers at the two places. There is great probability in Prof. Edlund's hypothesis that the larger icebergs are formed by blocks of ice falling down from a glacier coming in contact in their lower parts with an over-cooled stratum of water which, as is well known, in contact with actual ice immediately assumes the solid form. For any such over-cooled stratum of water can, on account of the Gulf Stream, only exceptionally occur on the coasts of Spitzbergen, while the contrary is the case in the waters of Greenland, which are taken up almost exclusively by the Arctic current. The ice seeds which have fallen from the glaciers thus find only at Greenland a suitable soil for their further development, only there do they grow to enormous ice-masses, which are so often the cause of the navigator's astonishment and alarm."

(To be continued)

HERING'S THEORY OF THE VISION OF LIGHT AND COLOURS

A FEW years ago Herr Ewald Hering, Professor of Physiology at Prague, communicated to the Imperial Academy of Sciences at Vienna a series of six papers propounding a new explanation of the physiology of vision, so far as concerns the perception of light and colour. The papers were subsequently collected and published in a separate form,[1] and have had a wide circulation. The author is well known by his researches on various physiological subjects, and has long devoted attention specially to the phenomena of vision, many of his views having been discussed at much length in Helmholtz's "Handbook of Physiological Optics," published between 1856 and 1866.

The principles developed in the papers in question have attracted much attention on the Continent, and, it is believed, have been thought well of by many competent authorities. So far as I know, however, no account of them, beyond meagre notices of a few lines, has yet been made accessible to English readers. It is highly desirable, both for the reputation of the author and for the information of those of our countrymen who are interested in the subject, that this want should be supplied, and I propose now to offer to the readers of NATURE an abstract of Prof. Hering's theory, sufficiently explicit to enable its general nature to be understood, but at the same time not so full as to supersede reference to the work itself by those who desire to appreciate the reasoning more thoroughly.

The theory of the perception of light and colours at present best known and most generally adopted, is the one formed on the views of Thomas Young, and further elaborated by Helmholtz in his great optical work—hence called the Young-Helmholtz theory. That which Hering proposes to substitute for it may rather be considered as an extension and an improvement than an opposing theory, inasmuch as its chief aim is, by the introduction of additional elements, to account for phenomena which, according to the previous hypotheses, are left obscure, or receive insufficient explanations. This consideration will insure for the theory a more favourable reception than if its object were completely to overturn received ideas. It is not, however, intended here to offer any discussion of the theory; we have only to state what its general features are.

In the first place, it should be explained that the theory is developed chiefly in regard to the vision of black and white, and their mixture, gray. The subject of colour is introduced afterwards, following out the same principles.

The reasoning is founded for the most part on a class of visual phenomena of a subjective nature, such as the effect of contrasts, appearances after looking steadfastly at objects, and so on. These phenomena have long been considered important in regard to the theory of vision, and they are treated of by Helmholtz at much length. The author, however, contends that the endeavours made to explain them have been hitherto imperfect, inasmuch as it has been necessary to call in for this purpose the aid of psychological considerations, such as the effect of imagination and other causes of deception. As he expresses it, on every other page of a professed treatise on physiological optics, one finds the mental judgment invoked as a *deus ex machinâ* to explain any sort of diffi-

[1] "Zur Lehre vom Lichtsinne." Sechs Mittheilungen an die kaiserl. Akademie der Wissenschaften in Wien. Von Ewald Hering, Professor der Physiologie in Prag. Zweiter Abdruck. Wien, 1878.

culty. He objects to this, alleging that these phenomena ought to be capable of purely physiological explanations, and he considers that, when properly investigated, they afford the best means of determining the true character of light-vision.

Acting on this idea, he devotes his first three papers to an examination of these subjective phenomena. He describes a series of experiments of great simplicity, illustrating the various points of importance, and he founds upon them, as he goes on, a chain of reasoning which leads up eventually to the statement of his doctrine. It will be necessary briefly to notice this introductory matter.

The first paper treats of what the author calls "Successive Light-Induction," which he illustrates in several different ways.

If you look steadfastly for, say, fifteen seconds to a minute, at the centre of a small white circular disk, laid on a large black ground (white paper on dull black velvet is best), then, closing and covering the eyes, you will soon perceive a negative after-image (*Nachbild*) of what you have seen. The disk itself will appear dark, generally much darker than the general visual area, and will be sharply defined, but it will be surrounded by a peculiar "light-space" (*Lichthof*), brightest close to the disk, and becoming gradually darker as it recedes, until it fades into the general dark area around. The appearance is that of a halo, or more exactly that of the sun during a total eclipse, where the intensely black circle is seen surrounded by the corona.

This phenomenon is usually explained as follows:—There is a certain internal light-stimulus which acts when the eyes are closed; but the part of the retina which has been exposed to the bright light from the disk has become fatigued thereby and is less sensitive to the internal light-stimulus than the parts around; so that the fatigued circle appears darker than elsewhere. This explanation, which is purely physiological, answers very well so far as the disk is concerned, but it gives no account of the surrounding light-space, for which the psychical *deus ex machinâ* is called in, it being asserted that the halo is only a mental delusion caused by the contrast between the dark circle and the less dark space around. The author objects altogether to the sufficiency of this suggestion, and has devised an experiment to show that the appearance of the light-space is a real and not an imaginary one.

He proves that when the light-spaces of two neighbouring dark negative after-images are superposed, they cause an increase of brightness. To show this, cut out two squares of white paper and place them side by side on the black ground, leaving a small interval between them. Observe then, as before, fixing the eyes steadfastly on a point in the black interval. In the after-image it will be noticed that the narrow intervening strip is much brighter than the space around the other three sides of each square, showing the effect of the superposition in that place of the two light-spaces together.

For a further study, examine the negative after-image of a narrow strip of black paper laid on a white ground; and direct attention first to the absence of any partial darkening of the general ground close to the strip (which ought to result if it were merely the impression of contrast), and, secondly, to the intensity of the brightness of the image of the strip itself. Lastly, to prove that this brightness is far greater than can be due to the self-working inner light-excitation of the retina, an ingenious experiment is shown (easy to carry out, but somewhat lengthy to describe), by which an objective test of the strength of the illumination can be made. The negative light after-image of a black stripe is found, by direct comparison, to be much brighter than a certain amount of objective light thrown on a fresh and unused part of the field of vision, proving, therefore, that the former must be due to something more than the mere unfatigued inner light of the retina.

In concluding this paper the author gives some general conclusions from these experiments. From an analogy with certain effects of colour, he names the light produced in the after-image, around a dark area, *induced light*, and the general effect *successive light-induction*. This takes place on any part of the retina where there has, in the object originally looked at, been a boundary between light and dark, the light part inducing an impression of light in the neighbouring part, so that when the eyes are shut the latter appears bright. The induced light is naturally most powerful in the immediate neighbourhood of the boundary, and diminishes as the distance from this increases, until it fades into the general aspect of the visual field. The author draws two important conclusions from this part of the investigation: (1) that the activity of one part of the retina corresponds with that of others, the usual idea of the independence of each part being untrue; (2) that the so-called independent or inner light of the retina is capable, within certain physiological limits, of being considerably increased in intensity. The phenomena of light-induction are subsequently examined more fully from a more general point of view; in the meantime it is considered as sufficiently shown that the ordinary fatigue theory is not sufficient to explain the appearances observed.

The second memoir is on "Simultaneous Light-Contrast." The author begins with the simplest example:—If a strip of gray paper is placed alternately against a black and a white background, in the former case it will appear much lighter than in the latter. The psychical theory explains this as a false mental judgment, assuming that the absolute sensation conveyed by the gray paper to the eye is the same in both cases. The author controverts this, insisting that the impression is, as a matter of reality and not of imagination, different in the two cases, which he proves by the following experiment:—Make a ground half white and half black, and lay two narrow strips of the same gray paper parallel to each other and a short distance apart, one on each half of the ground. The one on the white ground will look so much darker than the other, that a new-comer would scarcely believe they were both the same shade. Now fix the eyes for half a minute or a minute intently on a point midway between the strips; then close and darken the eyes and observe the after-image. The difference in luminosity of the two strips will be even greater than the apparent difference of shade in the original. And as this after-image cannot recognise any matter of judgment, but only faithfully records the actual state of the retina, it proves that the difference in shade observed was real, and not imaginary; and the inapplicability of the false-judgment-by-contrast explanation is manifest by the fact that the difference between the two strips will often remain after the background, forming the contrast, has disappeared.

The author then goes on to give his explanation of simultaneous contrast, namely, *that the light-perception of any part of the retina depends not only on the illumination of that part, but also on the illumination of other parts adjoining*. He adds that as in modern physiology it is customary to explain the varying strength of reaction consequent on a uniform stimulus, as varying *excitability* (*Erregbarkeit*), it may be said that here the effect of contrast is due to the fact that the excitability, and consequently the excitement, of one part of the retina is a function of the contemporary illumination of the whole retina, or at least of the parts immediately around.

The next step is to point out the connection that exists between the effect of contrast treated of here, and the light-induction described under the former head. The phenomena of successive light-induction showed that a part

of the retina illuminated either not at all or very faintly, but whose immediate neighbourhood was brightly illuminated, gave, in the negative after-image, a much stronger brightness than one, the neighbourhood of which was not so illuminated. The phenomena of contrast show, on the other hand, that the light-perception of a weakly illuminated part of the retina is diminished when its surrounding part is brightly illuminated. Thus the lowering of the perception of brightness (or excitement) *during* the observation of an object, corresponds to the raising of this perception in the *after-image*, so that the successive light-induction appears as the opposite or reversal (*Gegensatz*) of the simultaneous contrast-action. And the latter may be denoted as a simultaneous negative light-induction.

It is, therefore, easy to imagine an internal causal connection between both phenomena, and to consider the lowering of the light-perception (excitability) which takes place during the contrast, as the cause of the raising of the perception which takes place afterwards.

The third memoir treats of "Simultaneous Light-Induction" and "Successive Contrast." To illustrate the former, look fixedly at any point in a line dividing a black space from a white one; after looking some time you will see that the originally deep black begins to lighten into gray; the brightening is the greatest close to the division line, and diminishes farther away, but after sufficiently long observation it will extend more or less over the whole black field. A contrary effect takes place, but less prominently, in the other half, the white darkening in a similar way.

This appearance is usually explained in the following half physiological, half psychological way. From the increasing fatigue of the retina, the white sensation becomes gradually weaker, and, as a consequence of this, the contrast action between the white and the black becomes weaker, and the latter appears lighter, through the same false judgment invoked to explain contrasts generally.

To show the insufficiency of this explanation the following experiment is proposed. Put a strip of black velvet on a white ground, well lighted by a gas flame; after observing it steadfastly for a time gradually diminish the light, and it will be seen that the black strip becomes brighter, and the white ground darker, until at length the former appears actually *lighter* than the latter. If the explanation is applied to this it must be assumed that the fatigue of the retina has become so great that the moderated white produces actually a less powerful impression than the black stripe, which gives out light of very small intensity, or in other words, that the power of the retina is so crippled that a moderate light is no longer able to produce an impression equal to the inner self-illumination of the unfatigued organ. This can be also shown by another trial which is described.

A further experiment enables a direct comparison to be made. In the middle of a broad white stripe laid on a black ground, cut a longitudinal opening; this will show an internal black stripe, surrounded by a white surface which is again surrounded by a black ground: then fix the eyes on the middle of the figure, and, after observing some time, gradually reduce the light. It will soon be found that the black internal stripe appears *lighter than the external black ground*, although both are objectively equally dark, and the parts of the retina brought into action are, as it is said, equally free from fatigue.

The changes consequent on the reduction of the illumination show that the simultaneous light-induction passes over into the successive, the latter being, indeed, only a more clearly manifested continuation of the former. The connection of the three phenomena hitherto treated of may be illustrated simply as follows:—When you first observe a line of division between dark and light, the dark part, especially near the division, appears darker than it would do if the white were absent; this is *simultaneous contrast*. Continue the fixed observation a longer time, and the darkening gradually changes to a contrary effect of brightening, which also is most powerful near the division; this is *simultaneous light-induction*. Lastly, close and darken the eyes, and this brightened space continues a long time visible in the after-image. This is *successive light-induction*.

The last of the subjective phenomena treated of by the author he calls "Successive Light Contrast." It differs from the three last mentioned in that, while they all refer to the comparison of one visual space with another close adjoining, this refers to a comparison of the impressions derived from the *same* space at two successive times. The simplest example is as follows:—Put a strip of white paper on a black ground, and observe it steadfastly for a time; then let it be suddenly removed, keeping the eyes fixed on the same spot. A negative after-image will result, of a changeable character, but showing generally a space corresponding to the paper, much darker than the already dark ground. This is very striking; an inexperienced observer will be loth to believe that he can see anything darker than the blackest velvet; but there can be no mistake about the impression conveyed. The usual explanation of this is that the part of the retina stimulated by the white paper is more fatigued than the rest, and therefore, after it is removed, is less sensitive to the faint light given off by the black ground, making it thus appear still fainter. The author deems this explanation insufficient, as it is inconsistent with many of the changing phases observed in the after-image; and he describes several other experiments to support this view. He points out that the "successive light-induction," before described, may play an important part in these phenomena, but he does not attempt here to give any complete explanation of them.

It is pointed out at the close of this part of the subject that many of the experiments may be made with colours, instead of with simple light and shade, it being understood that black and white hold the same relation to each other, for this purpose, as blue and yellow, or red and green.

WILLIAM POLE

(*To be continued.*)

ALFRED HENRY GARROD

IT has seldom been our lot to have to record the premature close of a career so full of promise as that which ended with the death of Alfred Henry Garrod, at his father's house in Harley Street, on Friday last, October 17. The son of an eminent physician, Dr. Alfred Baring Garrod, F.R.S., he was born in London on May 18, 1846, received a medical education at King's College, London, and in 1868 entered St. John's College, Cambridge. He graduated (B.A.) in 1871, taking the highest place in the natural science tripos. In due course he took his M.A. degree, and was elected a Fellow of his college in 1873. His earliest scientific predilections were chiefly for mathematics and physics, and the knowledge of these subjects which he acquired when a student was of great value to him in his biological researches. The mechanics of physiology was the subject to which he first turned his attention as a scientific investigator, and, while still an undergraduate, he communicated a paper on the cause of the diastole of the ventricles of the heart to the *Journal of Anatomy* (vol. iii., 1869). About the same time he sent to the Royal Society the results of an interesting series of experiments made upon himself with a view of ascertaining the causes of the minor fluctuations in the temperature of the human body while at rest, from which he concluded that these fluctuations mainly result from alterations in the amount of blood exposed at the surface to the influence of absorbing and conducting

media. These were published in the *Proceedings* of the Royal Society, vol. xvii., 1869. A series of papers in the *Proceedings* of the Royal Society and in the *Journal of Anatomy* followed, giving the result of observations upon the circulation of the blood, conducted with great ingenuity by means of the sphygmograph, aided by various modifications and improvements upon the original instrument due to his inventive and mechanical skill. It is, indeed, probable that physiology is the subject to which he would most willingly have devoted his attention had not his energies been turned to the pursuit of morphology by his receiving the appointment, in January, 1872, of Prosector to the Zoological Society. This appointment is one which, perhaps more than any now existing, comes near to an ideal endowment of research. An unlimited amount of new material is placed in the hands of its occupant there are no duties beyond those of making and recording original observations, and ample facilities are given for the publication and illustration of all the observations made. To the efficient performance of the duties of this office Mr. Garrod applied himself with great energy and zeal, as testified by his numerous contributions upon the comparative anatomy of the vertebrate animals, which have enriched the publications of the Society, from the date of his appointment to the present time. He devoted great attention to the anatomy of birds, hitherto too much neglected, and his observations upon their myology and visceral anatomy were beginning to throw some light upon the very difficult and obscure subject of the mutual affinities of the members of this class. The curious and most unexpected variations in structure often revealed in the dissection of species thought to be closely allied, soon convinced him of the necessity of far more extended and minute observations than had previously been made, and those who closely watched his work and knew that besides the observations he had had time to complete and publish, he had already accumulated a vast mass of facts, partly in notes and drawings and partly in the stores of his memory, feel most keenly how much has been lost by his early death.

His eagerness in acquiring knowledge was only equalled by his activity in imparting it to others, and he had a remarkably easy and lucid method of explaining, even to an uninstructed audience, difficult problems of physiology or anatomy. With the black-board or some ingeniously contrived diagram or mechanical illustration, he was never at a loss to make his hearers comprehend his meaning. These great and varied powers probably tempted him to overtask his strength. Not content with his work at the Zoological Society, he sought for and obtained the Professorship of Zoology and Comparative Anatomy at King's College, in 1874, and the Fullerian Professorship of Physiology at the Royal Institution in 1876. He was also appointed one of the Examiners in the Natural Science Tripos at Cambridge in 1875, and was for several years a constant contributor to this journal. In 1876, when he had but just completed his thirtieth year, he was elected a Fellow of the Royal Society.

In the simple and single-hearted devotion to the sciences he cultivated, he was without a particle of jealousy or mistrust of others, but was always anxious to assist those who were working in the same direction, and his room at the Zoological Gardens was gradually becoming the profitable resort of many of the younger workers at comparative anatomy, who were encouraged in their labours by his advice and example.

Up to little more than a year ago he was apparently in the enjoyment of vigorous health, but symptoms of the insidious disease, phthisis, which terminated his existence, then for the first time showed themselves. Through the gradual decline of his powers, and amid considerable suffering, borne with the greatest patience and calmness, he continued to the last to spend all his remaining strength in making the knowledge which he had acquired available for the instruction of those that should come after him.

W. H. F.

JOHN MIERS, F.R.S.

THIS well-known botanist, whose death took place on the 17th inst., was born in London on August 25, 1789, of Yorkshire parents. After leaving school he devoted his time to the study of mineralogy and chemistry, in which latter science he made a series of important researches, but it was only subsequently during his long residence in South America that he acquired his taste for botanical knowledge, and by making dissections and drawings of plants he became a botanist. In 1825 he paid a short visit to England and then published his "Travels in Chili and La Plata." In Brazil, where he subsequently resided eight years engaged in his professional engineering labours, he made extensive collections of plants and insects. After his return to England he was elected a Fellow of the Linnean Society in 1839 and a Fellow of the Royal Society in 1843, acting for a time on the Council of both societies. He contributed many papers of interest to the Linnean Society, and published the "Illustrations" and the "Contributions" to South American Botany. He served on the jury of the Brazilian Section of the Exhibitions of 1862, and of 1867 of Paris, and for his labours the Emperor conferred on him the honour of Commander of the Order of the Rose. His zeal and energy in his pursuits were most untiring, and he only desisted from his labours when forced by failing health in July last, since which time he gradually became weaker, till death ended his life on the 17th inst. in the ninety-first year of his age. It is understood that Mr. Miers has left his botanical collections to the British Museum.

As a botanist, Mr. Miers was most painstaking and accurate in his investigation of details. His descriptions, and especially his original drawings, afford ample evidence of this. On the other hand, his estimate of the relative value of the details he elaborated with such zeal and care was often at fault. His observation was keen and accurate, but his judgment was less to be relied on. It is on this account, probably, that multitudes of species and, in lesser numbers, genera, and even orders, proposed by him, have not been generally accepted by his brother naturalists. Mr. Miers, we believe, never adopted evolutionary views, but remained a believer in the fixity of specific types. What, however, is more remarkable is that to the last he disbelieved in the action of the pollen and of the pollen tube in the formation of the embryo plant. In this particular Mr. Miers probably stood alone among his fellows.

But whatever difference of opinion may exist as to the value of his inferences, there can be none as to the laborious accuracy of his descriptions, the fidelity and beauty of his drawings (too often spoiled in the reproduction), and the generous kindliness of the man.

NOTES

M. RAOUL PICTET has been appointed Professor of Physics by the Council of State of Geneva, at the University of his native city.

M. KRANTZ, the director of the Paris Exhibition of 1878, is publishing the lectures delivered at the Trocadero. It will consist of no less than thirty-five thick 8vo volumes, five of which have already gone through the press.

AT the meeting on October 7 of the Manchester Literary and Philosophical Society, the president, Dr. Joule, described a simple means for checking the oscillations of a telescope. It consisted of a leaden ring placed centrally about the axis of the

tube of the telescope and attached thereto by three or more elastic caoutchouc bands. He had employed two of these rings for his telescope, one placed near the object-glass, the other near the eye-piece. Their united weights were only one-quarter of that of the telescope tube, but nevertheless they diminished the time required for the cessation of vibration to one-sixth of what it was before their application.

It is curious to see the impression which the electric light has made on two semi-civilised monarchs, the recent barbarities of one of whom at least have proved him to be little better than a savage. The King of Burmah, the papers tell us, has recently ordered a wholesale importation of electric lighting apparatus; and from a note in the last number of *Les Mondes* we learn that the Shah of Persia has had the light introduced into Teheran, showing an intelligent interest in its working under the direction of a Frenchman, M. Fabius Boital. So pleased was his Persian Majesty with the display that, *Les Mondes* states, he "decided on the creation of a palace of industry, the construction of which he has confided to M. Boital." Let us hope that the Shah will continue in this laudable frame of mind, and be led on to introduce many of the other beneficial applications of science into his ill-governed country.

Mr. Francis Galton has reprinted, with some additions, an abstract of his Royal Institution lecture on Generic Images. Appended are some interesting autotype illustrations showing the result of composite likenesses of Alexander the Great and Napoleon I., and the composite result of likenesses of six Roman ladies and of eighteen criminals.

Mr. R. Irwin Lynch, late of the Royal Gardens, Kew, has been appointed Curator of the Cambridge Botanic Garden, in place of the late Mr. Mudd.

The following scientific missions have been authorised by the French Government for this year:—Ernst Chartre, of the Lyons Museum, is to carry out anthropological investigations in Kasan, the Caucasus, the Crimea, and Turkey; Emil Rivière, prehistoric researches in the department of Alpes Maritimes; and Paul Sárda to investigate the geology of the soil of Japan, and visit the most important mining districts.

Dr. Karl Russ, the well-known ornithologist, has, in his serial *Isis*, issued a request to all sportsmen in Germany to abstain during the present shooting season from killing hares and partridges, as he opines that in many places both kinds of game would be completely exterminated if his warning is not heeded. Sportsmen in this country would perhaps also do well to give the subject some consideration, as there is no doubt that the two species named must have suffered considerably from the unfavourable weather which prevailed during the last spring and summer.

Earthquakes are reported from Klagenfurt and Grafenstein in Carinthia. At the former place a violent shock was felt on the 1st inst. at 2h. 20m. 25s. A.M. The phenomenon lasted for 2–3 seconds, and was accompanied by loud subterranean rumbling. The direction in which it proceeded was north-north-east to south-south-west. At the latter place a shock was felt on the 1st inst. at 2h. 5m. P.M., also accompanied by a rumbling noise; direction, west to east. In the Chinese provinces of Shen-Si and Kan-Su earthquakes have quite recently caused much damaged. It would seem that the earthquake which occurred on Friday and Saturday, the 10th and 11th inst., extended over a far wider area than had at first been reported. Shocks of greater or less violence were felt not only all over Eastern Hungary, but throughout Transylvania, Servia, Roumania, and even Bessarabia. The phenomenon manifested itself in Belgrade at half-past four in the afternoon of the 10th, and lasted eight seconds, the direction of the motion being north-north-east and south-south-west. In Weisskirchen there were two violent shocks felt on Friday afternoon about a quarter before five o'clock. Further shocks were experienced at half-past seven, and again on Saturday morning at a quarter to five, and all through the night slighter quakings and oscillations of the earth were constantly being repeated. A large number of chimneys were thrown down, and a number of houses were cracked and otherwise damaged at this place. From Temesvar it is reported that a number of shocks, one rapidly succeeding the other, were felt, the ground oscillating under foot. The shocks in Karansebes were so violent as to dash plates and dishes from their shelves to the ground, while to people in the street the ground appeared to rock with an unsteady motion like that of a vessel on a rough sea.

We have more than once remarked on the extreme incompleteness of the indices to that most valuable journal, the *Quarterly Journal of Microscopical Science*. The index to the new volume (xix.) is not even as complete as the table of contents. It is in the interest of both zoology and botany that we make these remarks.

M. Edouard Sarasin has recently established a registering limnimeter, similar to those of MM. F. A. Forel and Th. Plantamour at Geneva, in a locality close to Vevey, near the eastern extremity of the Lake of Geneva. Several observations which he has made since the establishment of the instrument fully confirm the results of the investigations of Forel on the state of permanent oscillation of the fluid mass. The times of maxima and minima of the height of the water coincide with those which are observed at Geneva, showing their predicted alternation, and following an analogous period of seventy-eight minutes.

The establishment of the electric light at the British Museum appears to have been successful. Eleven lights in all have been fitted up, and of these four are placed in the reading-room, four in other parts of the building, and three outside it. The four in the reading-room are placed, one in the centre and three equidistantly around it. They are supplied with continuous currents, each from its own Siemens dynamo-electric machine. Of the lights in other parts of the Museum, two are placed in the entrance-hall, one in the reading-room corridor, and one in the Greek gallery. In the courtyard in front of the building are two more lights, while another is placed in the rear, near to the engine and machine-house. These seven lights are supplied from one Siemens machine, producing an alternating or divided current. It will thus be seen that two different systems of electric lighting are employed, both, however, being on the Siemens principle—the four lights in the reading-room being produced by continuous currents, and calculated to be each equal to 4,000 candles, the seven other lights, which are estimated at 400 candles each, being produced by an alternating current, and being connected in one circuit about 1,200 yards in length.

The Indian Museum will be finally closed to the public on Saturday.

The laying of the new cable from Marseilles to Oran, in Algeria, has been attended with several mischances. The operation has been executed in a singular manner. The *Dacia* laid down the land cable from Algiers and steamed to Marseilles, in order to begin the operation from France. The end of the land cable had been buoyed, but when the *Dacia* tried to pick it up to connect it with the end coming from France, it broke. The *Dacia* and *Charente* tried to recover it with grapnels, but up to the present time without any other result than deteriorating the existing cable, which is now out of use; so that instead of having two cables, the capital of Algeria has none. All the messages were sent by the Bone line, which is encumbered by work, being mostly devoted to messages from

Tunis and Tripoli. We believe the cable has at last been successfully laid.

In the note in NATURE, vol. xx. p. 563, on the elevations attained by railways, mention is omitted, Mr. D. Sharp writes us, of the Spanish lines which are so remarkable in this respect. The northern line is at the sea-level at San Sebastian, but attains a height of 614 metres, between Zumairaga and Alsasua; after descending from this, an elevation of 934 metres is reached, between Briviesca and Burgos; and after a long transit, 1,359·88 metres (4,476 feet) is touched by the railway while traversing the Guadairama about thirty miles from Madrid. The line from Santander to Alar del Rey reaches an elevation of 984 metres in passing the Cantabrican chain near Reinosa, and in the distance of 33 kilometres between Barcena and Reinosa, mounts 560 metres. The southern line from Madrid to Cordova does not reach such great elevations as the North Spanish lines; nevertheless, in passing the Sierra Moreno, it attains the considerable altitude of 798 metres, or 2,630 English feet above the sea-level.

It is stated that the heavy rains in Assam have flooded part s of the country and threaten serious damage to tea prospects. Some of the gardens are reported to be looking very unhealthy and yellow.

Her Majesty's Consul at Panama reports that india-rubber has almost ceased to be an article of export from the isthmus, mainly in consequence of the great difficulty and expense of getting at the trees in the remote districts of the interior. Those nearer the coast have been destroyed by the wasteful system pursued by the natives in cutting down the trees to procure the sap.

The German Society for Cultivation and Acclimatisation of Birds will hold its fifth exhibition at Berlin on November 21–25 next. Cage-birds in the widest sense of the word, and park-birds generally will form the principal objects of the exhibition, which will also include stuffed specimens, skeletons, skins, nests, and eggs, as well as all apparatus and paraphernalia applying to the object of the Society. Those of our readers interested in ornithology who wish for further particulars should apply to Herr H. Schmidt, 32, Lothringer-Strasse, Berlin, N.

At Pritschaberg, near Nassenfus in Lower Carniola more than 4,000 Roman copper coins have recently been found. Most of them were contained in an earthen jar and many others surrounded this; the whole was imbedded in the ground close to a road and at a depth of only half a metre. The coins are tolerably well preserved and date from the reign of the Emperors Severus (A.D. 193 to 211), Gallienus (254 to 268), Claudius (268 to 270), Aurelianus (270 to 275), Tacitus (275 to 276), and Probus (276 to 282). The greatest number date from the reigns of Aurelianus and Probus. The jar and coins were evidently buried during the reign of the latter, as not one coin dating from the reign of his successor Diocletian is amongst the number.

In a recent paper to the Berlin Academy, on Progress in Knowledge of the Chemical Nature of Meteorites, Prof. Rammelsberg states that since he wrote in 1870 a paper on the Chemical Nature of Meteorites, more than twenty meteoric irons and about as many chondrites have been obtained and examined, besides some meteorites belonging to the more rare species; and he therefore thinks it desirable to make a fresh survey of the subject. He adopts Prof. Rose's classification. Among other points noticed are the discussions relating to the iron masses of Ovifak. The presence of nickel can no longer be regarded as a sure sign of the meteoric nature of iron masses. The small group of pallasites has been increased by one new member, the bronzite-pallasite of Rittersgrün (found in 1833 and recognised as a meteorite since 1861, but its true nature only determined lately by Weisbach and Cl. Winkler). Specially interesting is the occurrence of a white mineral (asmanite) consisting entirely of silicic acid, found in the Rittersgrün meteorite, as also in that of Breitenbach. A second representative of the rare meteorites which are free from metallic iron has been found in the Ibbenbühren stone (which contains Fe.3Mg). The first was the stone of Manegaum, purely bronzite. Recent researches on meteoric iron do not elucidate certain chemical differences of physically distinguishable parts, to which the earlier works of Reichenbach and Meunier referred; nor is the nature of the crystalline combination schreibersite more exactly known. (For further details we must refer to the *Monatsbericht*.)

Through a recent landslip at the Salzberg, Hallstadt, a wooden structure was laid bare, in excavation of which were found a number of bones and tools, which appear to have belonged to the period of Celtic interments at the Salzberg. Among these objects was an implement (of unrecognisable nature) with a thick blue coating, which, on examination by Herr von Hochstetter, was found to be covellin or protosulphide of copper, the interior being copper. The coat was 0·5 to 1 ctm. thick, and showed a composition of 32·81 per cent. sulphur, and 64·45 per cent. copper. Its specific gravity was 4·611. The copper below presented a much-corroded surface, and in the hollows were spherules of arragonite about 2 mm. in diameter. The conditions of eating away of the copper and complete transformation of it into protosulphide of copper were furnished (says the author) in the burial-ground containing gypsum and greatly permeated with decaying animal and vegetable remains. From the gypsum and organic remains there would be formed abundant sulphide of calcium, which would cause transformation of the copper according to the formula—

$$Cu + SCa + CO_2 + O = SCu + CO_3Ca,$$

or $$Cu + SCa + (CO_2)_2\,CaO + O = SCu + 2CO_3Ca.$$

We receive from America details of the accident which terminated for this year the career of the New York captive balloon on August 16, the very day when the Paris captive balloon was torn to pieces by the wind because it had not gas enough to sustain its spherical form. The New York balloon was sent up with two persons only as a trial, and rose to 800 feet when it burst. The two passengers were precipitated to the ground, but no harm was done to them, the balloon having acted the part of a parachute. The bursting was inevitable, the balloon having been started full of gas and the neck having been fastened with a rope. The rent extended from the top to the equator.

The *Times* Paris correspondent states that at Guisseny, Finistère, a cave 15 metres long by 4 wide has been discovered under a heap of rocks. One entrance faces the sea at a height of 4 metres, and the other the land, so that it must have been well adapted for watch and defence. Below a layer of ashes were found stones laid together, human bones, remains of funeral urns, evidently Celtic, a considerable quantity of animal bones, some of them apparently of extinct species, and a stone hammer and polished porphyry hatchet.

We have received a pamphlet of fifteen pages entitled "Notes on the Flora of Hampshire," by F. Townsend, M.A., F.L.S. This consists principally of two carefully drawn-up lists or tables of plants. The first list comprises plants found on the Hants mainland but absent in the Isle of Wight or in one or more of the adjacent counties of Wilts, Dorset, Sussex, Surrey, or Berks. The second list is that of plants absent on the mainland in Hants but found in one or more of the counties referred to above. By the first of these lists Mr. Townsend points out "that of the seven floras enumerated those of Surrey and of Sussex more nearly

approach that of Hants, the former possessing 176, the latter 174 of the 242 species found in Hants mainland but absent in one or more of the adjacent floras; the maritime or coast plants being deducted, in order to compare a county not possessing a coast with one possessing such." Regarding the second list the author says:—"We should naturally suppose . . . the floras of Surrey and Sussex would again be shown to approach the flora of Hants mainland by thus possessing fewer species not found in the latter, and that the floras of Wilts, Berks, and Wight (which by the first list are shown to be most dissimilar from Hants mainland, for Wilts possesses 121, Berks 109, and Wight only 96 of the 242 species in List No. 1) would possess many more species not found on Hants mainland than would Surrey or Sussex; but the reverse is the truth, for these two last named counties are shown by List 2 to possess more species not found on Hants mainland than Wilts, Berks, Wight, or Dorset possess." The author advances an explanation for this apparent contradiction and concludes his "Notes" with "a few words on River Basin Districts," explaining why he "would choose them for showing the geographical distribution of plants in preference to civil or artificial divisions." The value of such notes as these is by no means slight; those before us, we are told by the author, have been published principally in the hope that they may be seen by competent botanists who may have it in their power to communicate additional species or perchance point out errors so that their insertion may be prevented in the flora of Hampshire, which Mr. Townsend hopes soon to publish.

THE additions to the Zoological Society's Gardens during the past week include two Rhesus Monkeys (*Macacus erythræus*) from India, presented respectively by Dr. Douglas and Mr. R. C. Bonsfield; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. T. Hobbs; a Bonnet Monkey (*Macacus radiatus*) from India, presented by Mrs. Bonamy Dobree; two Arabian Gazelles (*Gazella arabica*) from Arabia, presented by Capt. W. Bowden Smith, R.N.; a Great Bustard (*Otis tarda*) from Spain, presented by Mr. George G. Sandeman; two Chinese Tree Pies (*Dendrocitta sinensis*) from China, presented by Mr. Chas. Rice; a Common Waxbill (*Estrelda cinerea*) from West Africa, presented by Mr. J. C. Thorowgood; a Sun Bittern (*Eurypyga helias*) from South America, deposited; a Bosman's Potto (*Perodicticus potto*) from Sulymah, South-West Coast of Africa, two Crested Colins (*Eupyschortyx cristatus*) from Mexico, purchased.

THE SANITARY CONGRESS

THE Sanitary Science Congress opened its proceedings at Croydon on Tuesday under the presidency of Dr. B. W. Richardson, F.R.S., who spoke of the success which had attended the work of the Institute. In the evening a general meeting was held in the great public hall to hear the address of the president. As a sort of complement to his previous address in an ideal city, under the title of Hygeia, Dr. Richardson this year, under the title of Salutland, sketched an ideal land, polity, and people. He introduced his fancy sketch as follows:

"On the 19th of July of this year, at the home of the Father of modern Sanitary Progress, who has this moment resigned the chair to me, I met the most illustrious of now living men of science. Our conversation turned on many subjects, all of which were lighted up by the entrancing exposition which always gilds the genius of him to whom I specially refer, Prof. Owen. One subject peculiarly attracted the attention of us who listened to him as he expounded it. We had entered into a discussion on the question of the longevity and the natural duration of life of different classes of animals. With his usual scientific accuracy and industrious research, Owen had on that day estimated, from various data he had collected, the natural term of life of the curious animal, the hippopotamus. He had learned that its term of life was thirty years. He explained to us the mode by which he had arrived at that fact: how into the calculation it had been necesssary to take into account the dentition of the animal; the stages of development; the natural wearing out of the teeth; the period of gestation; the development of the skeleton into the perfection of a bony fabric, with particular reference to the combination of the epiphyses or loose ends of the bones to the shafts of the bones; and, lastly, the pathological or diseased condition of the dead animal of the species that had arrived at its full longevity, in order to determine whether or not there was evidence of cause of death from disease of some particular organ, or whether there was no such evidence, but simply a history of general decay from old age pure and simple.

"We were told that in a hippopotamus which had recently died, and which was known to have just turned thirty years of age, the two sets of teeth had fulfilled their allotted duty; that the bones of the skeleton were duly consolidated; and, that the organs of the body were equally degenerated; so that death had occurred, not from failure of any particular organ, but from failure of the organic parts altogether. In a sentence, the animal had died a natural death, and the constant of the term of life of it and its family was set down at thirty years, a constant to which all the facts that could be collated in respect to this species of animal definitely pointed.

"From this line of facts in respect to one type of animal life we were led to others, and the rule, laid down by the distinguished Flourens, by which the determination of natural old age is calculated on the basis of perfected maturity, was brought under review. The skeleton is perfected when the epiphyses or loose terminal parts of long bones are firmly united with the shaft of the bone. When the date of such perfection of development is known in the mammalian class of animals, the simple process of multiplying the age at that date by five, gives the natural anatomical life of the animal. The elephant came before us as an example. A young elephant, whose history has been related in the *Philosophical Transactions*, died at the age of thirty years. At that age the epiphyses of its bones were not completely united with the shafts. It was nearly but not quite matured. Multiply thirty by five, and one hundred and fifty years stand as the natural estimate of the life of the elephant, so that really an elephant might exist which had itself carried all the Governors-General of our Indian Empire. Moving from this animal of long life, we turned to the camel, to find full maturity at eight years, full life at forty. We turned to the horse, to find full maturity at five years, full life at twenty-five. We turned to the lion and the ox, to find full maturity at four years, full life at twenty. We turned to the dog to find, full maturity at two years of age, full life at ten. We turned to the cat, to find full maturity at eighteen months, full life at seven and a half years. We turned to the rabbit, to find full maturity at one year, full life at five.

"From these contemplations our minds very naturally reverted to the animal, man, to the members of the human family. Man, we learned, follows the same rule as the rest of living beings. Judged by the same test, his full maturity and full age may be calculated with equal precision. His maturity, —perhaps not quite the full maturity,—is twenty years. His full age, therefore, is one hundred years. This is the anatomical estimate of human life, the surest and by far the best of all that can be supplied, since it defines a law irrespective of and overriding all those accidental circumstances of social and physical storm and strife, which may interfere, and indeed do interfere, with every estimate based on the career of life itself, as it is shown in the ephemera by and through whom it is phenomenally demonstrated.

"This lesson, told with singular felicity of language from two masters of science,—for Owen never forgot Flourens,—struck Mr. Chadwick and myself with singular force. On a surer basis than we ever trod, it corroborated a view we had ourselves promulgated from entirely different stand-points; and it further corroborated a similar view which had been advanced by our eminent friend, Dr. William Farr. We were led, in a word, once again, to the inevitable conclusion that man, even in this stage of his probation on the planet, is naturally destined to walk upon it, endowed with sensibilities of life and intelligence, for a period of one hundred years, and that until he realises this destiny practically, he is in value of physical life actually degraded far below his earth-mates, whom he designates the brute creation, and over whom he presumes to exercise his, to

them, almighty will. The constant of human life is naturally one hundred years.

"In this statement I, for one, gathered up, on the occasion referred to, something never to be forgotten. The constant was before us in all its truthfulness. But more remains. Because the fulness of age is one hundred years, it is not an essential that death shall immediately crown the advent of that fulness. To certain parts of the scheme of natural life there is a boundary. The period of maturity of development has its boundary of twenty years; when the body, as Flourens says, ceases to grow; but if it ceases, in the ordinary sense of the term, to grow it does not cease to increase; its nutrition improves and perfects for twenty years more at least, and then only has reached its completed physical condition. It should never from that period gain in weight, and for a long time it should not lose. It goes on now through a third period, which Flourens admirably calls the period of invigoration, during which all its parts become firmer, all its functions more certain, all its organization more perfect; and this period covers thirty years. At seventy old age begins; the *first* old age, in which naturally the fruits of wisdom are most bountifully developed, and which lasts from fifteen years to twenty, to mellow down to a period of *ripe* old age, commencing at eighty-five years and lasting fifteen years more, *i.e.*, until the constant is attained.

"And yet there need not now be death; for though, as Lord Bacon has said, old men are like ruined towers, and though, as Flourens has quoted, youths live in a double sense, with forces in reserve and forces in action, *vires in posse et vires in actu*, the *radical* forces and *acting* forces of Barthez, while old men live only on the forces in action, '*vires in actu*,' possessing no reserve, it is wonderful how the forces in action will continue after the reserve is withdrawn. This kind of half-life has continued unquestionably many years beyond the fulness of age, both in man and lower animals, and to give it twenty years beyond the natural hundred is to be just without being in any extreme sense generous.

"In this anatomical reading of human life we see the growth, the increase, the invigoration, and the solidification, of the body: we see the life with its reserve on its two threads; the life without reserve on its one thread; and, finally,—the force in action being withdrawn—the life ceasing, and the earth, proclaiming her mastery, dragging the actor as unconsciously to herself at death, as he was unconsciously projected into the world at birth.

"All through this presentation of natural fact, moreover, there runs another physical truth. Death is centripetal action. Those two birds on the wing which up to heaven's gate sing, are physically filled, like the gyroscope, with the *vires in posse et vires in actu*, powers in reserve and powers in action. Yon wanton sportsman liberates a ball which pierces one bird, and the earth claims its prey. The living gyroscope falls. The fellow bird escapes. In time, it fails to rise to the same height, its force in reserve being withdrawn, but its force in action remains, and it lives on. At last, some trifling extra call upon it is final, and the triumphing earth brings it down to itself. That first bird fell from an interference with its life while yet it had its two powers; that second bird fell from failure of powers at different periods, but from the same inevitable, always present cause, the attraction of the earth.

"The same is true of men also. What we call death is gravitation: what we call disease, is some accidental shot inflicted, it may be, while still the self-resistance to gravitation is in operation: what we call natural death is the gradual overweighting, at different periods, of the natural powers, reserve and acting, by the persistent force that bears us down. We cease to grow at a certain stage of our life, because of the resistance of this downward force: we cease to increase in size from the same cause: we consolidate in structure from the same cause: we bend in old age from the same cause: and we die from the same cause. Every step has practically been a death from the same cause.

"As these facts appear, we are inclined to ask, How many of all men and women projected into life and charged with the reserve and acting forces,—how many die with these forces intact up to the time of death, and how many with the acting force alone in operation? How many, if I may use the simile, die on the wing, fall headlong to the earth, shot by some wanton shaft that need never have been discharged? How many sink naturally to the earth from her final and gentle embrace?

"The answer to this question appals the mind. The answer rings out:—Man reckless of life! every lower animal you do not immolate beats you in this! Man! civilized as you are proud to say, you have never yet given life a chance! Man of reserve and action, you die on the wing more certainly than the birds of the air on which you practise your fatal sports! You die within the first part of the second third of your natural lives. Let the elephant die at sixty, the camel at sixteen, the horse at ten, the dog at four, the cat at three years, and the rabbit at two years, and they will then match you in the value of life you train yourself to possess. Man, endowed with knowledge of science, who can divide the year into seasons, and history into centuries and eras; who can calculate the courses of the planets and predict their crossings and shadows; weigh the earth, as in a balance, and predicate storms and tempests, you have yet to learn that, with the precision that regulates all these things, your own life is meted out,—that such a childhood means such an adolescence, such an adolescence such a maturity, such a maturity such a decline, and such a decline such a periodof death.

Nay more; man so endowed does sometimes see by adventure, as it were, the whole law fulfilled without his studying for it or expecting it. Some individual lives the whole natural period of life, exceptionally, as an elephant, a horse, a lion, a dog, a cat lives it ordinarily, and thus by adventure, proves the truth of the law which has been laid down. The event, perfectly commonplace in the case of a lower animal,—a dog that lives to ten,—is a perfect marvel when it happens to a man who lives to a hundred years, the equal term. To see a centenarian we travel miles and miles, and discuss the time of his birth with keenest criticism, so truly unnatural is the state of things under which human existence at present is unfulfilled.

"The question arises, How long is this condition of affairs to last? No more vital question stands for solution at the bar of civilisation.

"The day, in fact, has now arrived, when the cultivation of life by the cultivated of mankind is the primary art for the continuance of the cultivated. If the civilised world would continue in the ascendant, it must learn to live. An average life of forty-one and under favourable circumstances of forty-nine years, with a world of disease and death up to that period, and a scattered struggle of the fittest for an exceptional existence into ripe old age, cannot maintain the relative efficiency of any nation, except in a world universally and equally bad. Ingenuity itself is bounded by life; device by faculty for devising. Weapons of precision give us victory over savages. Is that success? Weapons are made, not begotten, and savage tribes, fierce for contest and unscrupulous, may readily learn to apply what the civilised man has devised, and in repetition of history, make easy work of the short-lived civilised.

"We Sanitarians are forced by our studies to recognise these truths. We exist, if we exist for any great purpose at all, to protest against the casting away of nearly two-thirds of the life that is meted out for civilised men. We exist to protest that it is not a scientific civilisation which can permit such reckless waste of the gift that stands above all values and qualities; and our protest is the more earnest as we detect that the waste which we observe, is actually not at the time of life after the prime has been reached, but is most destructive in the very budding of life, and continues at the intermediate stages between the period of budding and the prime.

"To speak in plain terms,—and if ever plain terms were demanded, they are demanded now,—the world in this matter of life and death has, by daily observation of the phenomena, got into the habit of looking on wrong as right, and on what is practically suicidal death as death that is natural. It is a strange fatuity. If we were, for a short time, to see the lower domestic creatures under the same curse; if we were to witness horses enjoying ten, dogs four, and cats three years, as an average duration of their lives, we should think a persistent murrain had come upon them, and that, in relation to these useful domestic animals, the whole course of life had undergone a deteriorative change. Yet that is what, in effect, we are observing amongst our own kind, so that the Sanitarian in despair may exclaim: 'Oh that man were as wise as the horses and dogs, that he might have the bounty of life which the Allwise has awarded to him as the natural bounty, extended and beautified and exalted by the intelligence with which he is endowed above the beasts.'

"I press the question. Why should we, of all animals, perish as we do in the first part of the second third of our

natural career? Why are all the doctors of the human species, with their flowing knowledge and consummate skill, to carry out cure? Why are they so set at naught, that the lower animals, who have no advantage of their services, have a higher vital possession than man at their command?

"The answer is told in a few words. It is that we have never as a community let ourselves study the question; have never, in truth, looked at the facts, plainly as they stand forth.

"And now comes another question—Knowing the facts; knowing what is the natural term of human life, can mankind learn to attain that term? Can man learn to live his hundred years, with a prospective chance of extension to a fifth of a century more? Instead of being cut down at the moment when he has filled his intelligent mind with the learning of his time, and when his knowledge is just becoming transmutable into wisdom, can he go on, an intellectual being, brought to the highest pitch of usefulness? Can he go on to the full term of his natural and prospective course?

"I do not dare answer that question on my own account, because it is answered for me. He who gave the life has answered the question. He has written it for us in unmistakable language. He has shown all of us who can read His natural designs, that it is one of them that man may live the term if he will. Free-will making a man a free agent, is all that is set above the natural law, and free-will is natural law too, government by intelligence which is as natural, and is as freely supplied.

"How, then, shall civilised man live, that the natural term may be found?"

Dr. Richardson then proceeded to sketch his ideal Salutland, located somewhere to the extreme south of Mr. Hepworth Dixon's "New America," the time being the middle of the twenty-first century. He depicted its polity, its social and domestic life, its people, its work, its sanitary arrangements.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE ninth session of the Newcastle College of Science was opened on the 13th inst., when very satisfactory reports of the progress of the institute were made. Prof. Lebour delivered the inaugural address on Some Aspects of Geology. Interesting and genial speeches were given by Lord Ravenworth, the Dean of Durham, and others.

FROM the Calendar of Anderson's College, Glasgow, we see that a very complete education can be obtained at that institution in science and medicine, the fees being unusually low. The Calendar has an interesting sketch of the life of John Anderson, F.R.S., the founder of the college, as also of the institution itself.

M. FERRY, the Minister for Public Instruction, having arrived in Paris, has visited the Observatory and the School of Medicine, where important works are being carried out. One of the peculiarities of the new buildings will be the large number of dissection rooms. More than a hundred tables will be prepared for dissections, so that every student in medicine will be enabled to take part in *épreuves pratiques*, which will be an essential part of the education of medical students.

THE new college so liberally endowed by Mr. Mark Firth, at Sheffield, was opened on Monday by Prince Leopold. The endowment, it is expected, will soon reach 25,000*l.*, and the institution is mainly intended for carrying out the University extension scheme, which has been remarkably successful in Sheffield. The building seems to be altogether satisfactory, and, we are glad to see, contains provisions for experimental instruction in chemistry and physics. Prince Leopold insisted on the great benefits which must accrue to the working classes from the establishment of such an institution.

PROF. MAX MÜLLER, on Monday night, delivered the president's inaugural address on the opening of the winter session of the Birmingham and Midland Institute. His German and Italian friends, he said, while recognising that full political liberty reigned here, thought there was little intellectual freedom, and that, however it might be in London and a few other large cities, the Universities—the nurseries of thought and learning—were fettered by the mediæval spirit of monastic institutions and the principles of scholastic philosophy, which contrasted ill with the freshness and freedom of Continental Universities.

SCIENTIFIC SERIALS

The Quarterly Journal of Microscopical Science, October.—W. B. Scott and H. F. Osborne, On some points in the early development of the common newt, with pl. 20 and 21.—E. Ray Lankester, On the structure of *Haliphysema Tumanowiczii*, with pl. 22, generally confirming the facts recorded by Mr. Saville Kent, and failing to observe the collar-bearing flagellate cells described by Haeckel. Prof. Lankester shows the structure to be however not quite so simple as that which is supposed to characterise the body substance of such Foraminifers as the Lituolida.—E. Ray Lankester, On a new genus and species of Gymnomyxa (*Lethamœba discus*) pl. 23.—H. Gibbes, On the structure of the vertebrate spermatozoon, pl. 24.—Index to volume xix., N.S.

The American Naturalist, September.—Brazilian corals and coral reefs, by R. Rathbun.—The formation of Cape Cod (concluded), by W. Upham.—The hillocks or mound-formations of San Diego, California, by Dr. G. W. Barnes.—Insect powder, by W. Saunders.—Recent literature; General notes; Scientific news; Proceedings of Scientific Societies; Selected articles.

Journal de Physique, September.—M. Bouty here describes some mechanical phenomena which accompany electrolysis; his paper treats (1) of pressures exerted by galvanic deposits, (2) of the action of heat on metallised thermometers, and (3) of peculiarities of nickel.—M. Sebert gives an account of the accelerograph of M. Marcel Deprez, in its most recent form; the apparatus is for measuring pressures developed by gases from powder (which are caused to act on a piston).—There are also notices of M. Deprez's magneto-electric machine (in which a Siemens armature is arranged to work between the branches of a horse-shoe magnet, being about equal to these in length), and a new form of electroscope, by M. Guerout.

Asiatic Society of Bengal, vol. 47, No. 223, N.S., April 6.—Description of *Thaumantislouisa*, pl. 12, from Upper Tenasserim, by J. Wood Mason.—On a great snow-fall in Kashmir, by R. Lydekker.—Physiographical notes, &c., on Tanjore, by Lieut.-Colonel B. R. Branfell.—On the proper relative sectional areas for copper and iron lighting rods, by R. S. Brough.—Description of a new Homopteron (*Cosmoscarta masoni*), by W. L. Distant.—On the Indian species of the genus Erinaceus, by Prof. Dr. Anderson, with 4 plates.—On a supposed new hedgehog (*Erinaceus niger*) from Muscat Arabia, with a plate.—On *Arvicola indica*, Gray, and its relations to the sub-genus Nesokia, with a description of the species of Nesokia (pl. 13 and 14), by Prof. Dr. Anderson; Index to Volume.

Morphologisches Jahrbuch, Bd. 5, Heft 2.—A. Pansch, Memoir on the morphology of the cerebral hemispheres, in mammalia, pl. 14 and 15.—H. Strasser, On the development of the limb cartilages in Salamanders and Tritons, pl. 16-19.—G. v. Koch, Notes on the skeleton of corals, pl. 20.—M. Fürbringer, On the question of the formation of nerve plexi, pl. 21, 22.—C. Semper, Reply to Prof. Fürbringer's article "On Homology."—Prof. Fürbringer, On the chief points alluded to in Prof. Semper's reply.—Notices.

Zeitschrift für wissenschaftliche Zoologie, Bd. 32, Heft 4, August.—On the worm fauna of Madeira, by Prof. Langerhans, pl. 31-33. Describes a large number of new genera and species.—Researches into the structure and development of the Sponges, seventh notice: The family of the Spongidæ, by Prof. F. E. Schulze, pl. 34, 38.—*Typhloscolex mülleri*, W. Busch, being a supplement to notes on the pelagic annelids of the coasts of the Canary Islands, by Prof. R. Greef, pl. 39.—On the oral skeleton of Asterids and Ophiurids, by Dr. H. Ludwig.

SOCIETIES AND ACADEMIES

LONDON

Entomological Society.—October 1.—Sir John Lubbock, Bart., F.R.S., president, in the chair.—The President alluded to the loss which the Society had sustained by the death of Mr. Wm. Wilson Saunders, F.R.S., and a former President of the Entomological Society, and announced that the council had accepted the responsibility of awarding two prizes offered by Lord Walsingham and other gentlemen for the best and most complete life-his-

tories of *Sclerostoma syngamus*, Dies., and *Strongylus pergracilis*, Cob., supposed to produce the so-called "gapes" in poultry and other birds, and also the grouse disease. Messrs. Stainton and McLachlan, both objected to the Society dealing with subjects relating to the *Entozoa* which could in no case be considered as entomology, for the study of which the Society was founded, and considered that the matter would have been more properly placed in the hands of the Linnean or Zoological Societies.—Mr. Philip Hy. Gosse, F.R.S., of Torquay, was elected an Ordinary Member.—Mr. McLachlan exhibited specimens of the hemipterous insect, *Anthocoris nemorum*, reported to be doing great damage to hops growing in the neighbourhood of Canterbury, but the exhibitor suggested that it was on the hops in search of aphides or other small insects, and therefore beneficial to the hop-grower. He also exhibited examples of the larvæ of one of the *Embidæ* found by Mr. Wood Mason at Jubbulpore. Mr. McLachlan further called attention to the sculptured stones on the shores of Lake Leman, previously referred to and considered by Prof. Forel to be due to the action of trichopterous larvæ. From a recent examination of many similar stones on the shores of Lake Neuchâtel Mr. McLachlan inclined to the opinion that the markings were caused by Mollusca.—Mr. Pascoe exhibited a specimen of a species of the *Acridiidæ* remarkable for its aquatic habits, which was found in some numbers on the surface of a pool near Pará.—The Rev. A. E. Eaton exhibited larvæ, pupæ, and cases of species of *Hydroptila* (restricted) collected in the neighbourhood of the Haute Savoie, describing their habits and referring to a case of synonymy to which they had given rise.—Sir John Lubbock exhibited a specimen of *Orchesella rufescens* taken in Kent, being a species of Collembola new to Britain.—Mr. E. Boscher exhibited a coloured drawing showing the extreme forms of two varieties of the caterpillar of *Smerinthus ocellatus*, and remarked on their food-plants and habits.—The following papers were either read or communicated:—"Descriptions of Phytophagous Coleoptera," by Mr. J. S. Baly; "Descriptions of New Sphingidæ," by Mr. A. G. Butler; and "On the Affinity of the Genus *Polyctenes*, West, with Description of a New Species," by Mr. C. Waterhouse.

Royal Microscopical Society, October 8.—Dr. Beale, F.R.S., president, in the chair.—Prof. Martin Duncan and four other gentlemen were elected Fellows, and eleven nominations were made for the November meeting.—Several valuable donations to the Society were announced, consisting of a revolving table, a ruling machine, and a clock, and of books, apparatus, and slides, for which special votes of thanks were given to the donors.—Mr. J. Beck read a paper on the structure of the scale of a species of *Mormo*, Mr. Gilburt on the morphology of vegetable tissues, and Dr. Stolterforth on a new species of the genus *Eucampia*.—In the discussion on the papers the President, Mr. Stewart, Mr. Beck, Mr. Gilburt, Dr. Edmunds, and Mr. Crisp took part.

PARIS

Academy of Sciences, October 15.—M. Daubrée in the chair.—The following papers were read:—On the present state and the future of thermo-chemistry, by M. Berthelot. The author presented his new work, "Essai de Mécanique chimique fondée sur la Thermochimie," comprising the matter of some 300 memoirs published in the *Annales de Chimie*, &c. The first of the two volumes treats of calorimetry: its first part expounding the theoretical rules, its second experimental methods, while its third contains numerical data accumulated during the last sixty years by physicists and chemists, on heats of combination and of physical changes and on specific heats. The first part of the second volume comprises the general study of chemical combination and decomposition, and principally that of systems in equilibrium between two contrary tendencies. The next part deals with the fundamental object of the work, the prevision of reciprocal actions of substances, and the rules by which it is determined, which are deduced from the principle of maximum work. This simple principle separates effects due to chemical energies, between particles of ponderable matter, and foreign energies between ponderable matter and the etheric medium. This separation is (in the author's opinion) the chief original feature of the work. The prevision of phenomena, from numerical data of thermo-chemistry seems to him destined to work great changes in chemical science.—Regular alignments of joints or diaclases, in the tertiary strata of the environs of Fontainebleau; their relation with certain features of relief of the ground, by M. Daubrée.—M. Marey announced, by letter, that he had received an electrical Gymnotus alive from Para. Having recovered from the fatigues of the voyage, it now gives strong discharges when touched; it also grows tame and eats gudgeons offered it. It is placed in an aquarium at 25° C. The discharges are not so violent as those of a gymnotus received last year, which, wounded and ill, died soon after being experimented with, and which was probably frightened and angry when touched.—The President announced, with regret, the death of M. De Tessan, Member of the Section of Geography and Navigation.—Production of a new manure capable of meeting the requirements of agriculture, by M. De Molon. He utilises wrack or seaweed, mixing them, in successive layers, in pits, with pulverised phosphate of lime, in proportions suitable for fermentation. The mixture is allowed to ferment six weeks to two months, according to the season, and if the decomposition of organic matter is not completed then, the compost is mixed anew for further fermentation. The manure thus produced contains, besides phosphate of lime, rendered very assimilable, the fertilising elements, nitrogen, mineral salts, potash, soda, and magnesia.—A note by General Ibañez, accompanying the second volume of "Memoirs of the Geographical and Statistical Institute of Spain," was presented.—On the separation of roots of an algebraic equation with numerical coefficients, by M. Laguerre.—Experiments on the electric discharge of the chloride of silver battery, by Messrs. Warren de la Rue and Müller.—Action of metallic nitrates on monohydrated nitric acid, by M. Ditte. Certain nitrates combine with the acid named to form acid salts. Others (of which nitrate of magnesia is a type) are fused, under heat, in their water of crystallisation, which is then liberated along with nitric acid, and there remains a matter containing still more or less water, neutral nitrate, and either a sub-nitrate or an oxide. On contact with the monohydrated acids, the sub-salts are changed into neutral nitrates, setting at liberty some water, which is added to what the matter still contains, and which cannot be separated without decomposing the matter entirely. (The nitrates of manganese, zinc, alumina, iron, copper, and manium, also belong to this group). A third, and the largest group of nitrates, are simply insoluble or extremely little soluble in the acid considered. Nitrate of lead may be taken as a type.—On nitrate of silicium, by M. Schutzenberger.—On the physiological action of *Strychneæ* of South America, by M. Jobert. He has tried several of these, and finds they all act similarly; they are not tetanising, like the strychneæ of Asia. They quickly affect the motor-nervous system, not affecting the sensibility and the circulation.—On the treatment of sympathetic ophthalmia, by section of the ciliary nerves and the optic nerve, in place of removal of the eye, by M. Boucheron.—On the innervation and circulation of the breast, by M. Laffont. The breast contains true dilator nerves, as well as those which, when excited, cause increase in the quantity of milk secreted.—Origin and morphological value of the different pieces of the labium in Orthoptera, by M. Chatin.

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