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THURSDAY, AUGUST 1, 1872

DR. LIVINGSTONE

THE publication of two letters in the *New York Herald* from Dr. Livingstone has thrown some new light upon the discoveries on which the famous traveller has been engaged since 1867. The letters purport to have been written by the great traveller himself, but they bear unmistakeable marks of having been manipulated to suit the tastes of the readers of that very sensational newspaper. Yet, until the traveller's own journals are before the world, we must be content to gather as much information as may be picked up from this source, doubtful though it be.

These discoveries include the great mountain range separating the drainage of the Zambesi from that to the northward; a great valley receiving numerous streams, which Livingstone believes to be the true sources of the Nile; and a beautiful lake, called Liemba, which appears to form the southern extreme of Tanganyika. But the chief interest centres in the great valley commencing south of Lake Tanganyika, from which it is completely separated by intervening hills, and then turning to the north and west. It receives a vast quantity of rain, and appears to be subject to inundations. Its river, from its source in the southern mountains to Lake Bangweolo, is called the Chambese. Thence it turns due north, and flows, under the new name of Luapula, past Cazembe's town—first visited by the Portuguese—into Lake Moero. The great river then forces its way northward through the mountains of Rua, under the name of Lualaba, and spreads out into a vast lake named Ulenga, or Kamalondo, in the Manyema country. It then takes a westerly, and for a time even a southerly course, under the name of Lufira, spreading out into a lake called Lake Lincoln by the explorer; which also receives another important feeder from the mountain range to the south, called Lomame. Finally, the now mighty river turns to the north and enters an unknown land; for this was Livingstone's farthest point. But he heard that it flows into another unvisited lake, called Chowambe, and he believes it to be the Nile.

The discovery of this valley for an extent of some 700 miles, with its great river, receiving numerous affluents and flowing through four great lakes, has occupied Livingstone for the last five years. During 1867 and 1868 he crossed the mountains from the Zambesi valley, visited Cazembe, followed the river through two lakes, and traced it until it passed into the gorge of the Rua mountains. He then turned aside to the Tanganyika lake, to pick up the supplies that he expected to find at Ujiji, on its banks. His last letter was dated from Ujiji, on May 30, 1869. From Ujiji he set out to complete his work by connecting the Lualaba, where he left it in the mountains, with Baker's lake. But this expedition seems to have been a failure. He indeed crossed Lake Tanganyika again, penetrated into the Manyema country north of the Rua mountains, and traced the great river for some distance farther, and through two lakes, until he found it to be flowing due north. But here his men became mutinous, and he was obliged to return to Ujiji last year disheartened, and sorely in want of succour and fresh supplies.

That succour was at hand. Never has traveller been so keenly watched by those at home; never has assistance been forwarded with such lavish generosity. Fortunately Livingstone's old friend and fellow-traveller, during six long years of hardship and anxiety, Dr. John Kirk, had been appointed resident medical officer at Zanzibar, and he has superintended the measures for the explorer's relief with affectionate and untiring zeal. The first supplies, however, which Livingstone found at Ujiji in 1869, were sent up by Dr. Seward, Kirk's predecessor. Kirk sent up a second supply, while Livingstone was in the Manyema country, a great part of which was stolen by the men in charge. The mistaken policy of entrusting these supplies to natives was not Dr. Kirk's, but was apparently adopted under orders from the Foreign Office. A third large instalment of supplies was sent up, and Kirk zealously superintended its despatch from the mainland at Bagamoyo. It safely reached Unyanyembe, and has been of the greatest service to Livingstone. But the Geographical Society, and the people of England, were not satisfied with these measures. The great Explorer had not been heard of since May 1869, and an expedition was resolved upon to seek him out, and relieve his necessities. Liberal subscriptions, amounting to upwards of 5,000*l.*, poured in, and, as is well known, the Expedition sailed for Zanzibar under the brightest auspices last February. Thanks to the hearty and zealous co-operation of Dr. Kirk, the equipment was completed on the 27th of last April, and the members of the Expedition were on the mainland, and ready to start for the interior. Had it not been for an unforeseen intrusive element, in the shape of the Correspondent of a sensational American newspaper, all would have gone well, and the Explorer would by this time have been fully furnished forth with all necessary supplies and instruments, and with assistance which would have ensured the verification and completion of his discoveries. We cannot but feel that the members of the Expedition committed a very grave error in judgment in abandoning their work on very insufficient grounds.

It seems that the editor of the *New York Herald*, in looking about for fresh startling sensations wherewith to feed the appetites of his public, turned his attention to Livingstone and his discoveries, and despatched a correspondent to "interview" the great traveller, and so furnish new material for those large type headings and wonderful paragraphs in which that well-known paper delights to indulge. So far no harm had been done, except that a *New York Herald* "Correspondent" was the very worst messenger that could have been selected. For it was to his interest to keep all he had done, all Livingstone had told him, a close secret until a wondrous version of it could appear in New York. Carefully concealing his object while at Zanzibar, the correspondent advanced into the interior, found Dr. Kirk's ample supplies waiting at Unyanyembe, and after some difficulties caused by his own mismanagement, reached Ujiji, where he found Dr. Livingstone. There is some mention of Mr. Stanley, the correspondent,

having accompanied Livingstone on an excursion to the northern end of Lake Tanganyika; but this statement has not yet been corroborated by the great traveller himself. Livingstone then proceeded to Unyanyembe, which is about a third of the way from Lake Tanganyika to the coast, where he found the supplies sent up to him by his old fellow-traveller, Kirk. Here he awaits further supplies, before setting out on a fresh expedition of discovery; while the correspondent set out for the coast, after having "interviewed" the great traveller to his perfect satisfaction, and having obtained material for a whole series of sensational articles.

Mr. Stanley certainly did useful service, which deserves acknowledgment, in passing on from Unyanyembe to Ujiji, and announcing to Livingstone that the supplies were waiting for him at the former place. But this service has been marred by his subsequent conduct. His duty to his employers obliged him to keep Livingstone's countrymen at Zanzibar in as much ignorance as possible, and to withhold all information; and it is for his employers, not for Livingstone's countrymen, to thank and reward him. But how is it that the lonely traveller had his mind poisoned against his warmest and truest friend, who had used every means to send him help, and through whose exertions Livingstone had actually been put beyond immediate want at Kazeh? How is it that the ungrateful message was imputed to Livingstone, that he wished all relief expeditions to be turned back? How is it that one of Her Majesty's Consuls, the great enemy of slavery, is stated to have sent down to Zanzibar for slave chains? How is it that Livingstone's letters to his friends are still detained by him to whom they have been entrusted? None of these acts were obligatory, as regards duty to the New York employers. Judging him even by his own lights, the "Correspondent" has exceeded his duties to his masters, and has proportionately injured, unnecessarily, the great traveller out of whom capital was to be made. Mr. Stanley's secrecy, and refusal to give any information concerning Livingstone and his wants, to his countrymen at Zanzibar, has been most injurious to the great traveller's interests; while the system he is now pursuing of withholding Livingstone's private letters to friends, and even his despatches to the Foreign Office, is most unjustifiable.

We must repeat that the abandonment of the Relief Expedition, on the ground that its work had been anticipated, was a very serious, and may become a very fatal, mistake. The correspondent's secret proceedings ought not to have influenced the open and clearly-marked course of the Expedition in any way. Their duty was to relieve and assist Livingstone, and nothing should have turned them from it. As it is, only a party of fifty men, commanded by an Arab, has been sent up to Livingstone, with stores, arms, and other equipments entirely supplied from the funds of the English Search and Relief Expedition. But, in a letter dated June 3, unfavourable reports have been received of the character of the man who commands this party, and it may never reach its destination.

Dr. Livingstone, it is stated, intends to continue his travels for two years longer; but it has not yet transpired in what direction he will turn. He will probably endeavour to complete the examination of the great river which he believes to be the head stream of the Nile; or he may turn his steps south, as we conjectured in a former number, and solve the interesting geographical question connected with the drainage of Lake Tanganyika. He still has a vast field of discovery before him, and his countrymen will continue to watch his proceedings with warm sympathy and interest.

NICHOLSON'S INTRODUCTION TO BIOLOGY

Introduction to the Study of Biology. By H. Alleyne Nicholson, M.D., D.Sc., &c. &c., Professor of Natural History and Botany in University College, Toronto. (Blackwood, 1872.)

THIS book is an attempt to give a general view of the phenomena manifested by living beings, and to form a sort of basis for a more detailed study of some special branch of biology. It commences with an account of the differences between living and non-living matters, and with a discussion of the nature and conditions of life; then the distinctive peculiarities of animals and plants are considered, and the principles of biological classification laid down. There follow short chapters on the elementary chemistry of living beings, on the chief physiological functions, and on the varieties of the developmental process; and disquisitions on spontaneous generation, on the origin of species, and on distribution in space and time complete the volume.

In his preface the author states that his work is intended to be elementary, and useful at the same time both to the student and the general reader. This double object he can hardly be said to have succeeded in attaining. The book throughout is just one to interest the non-scientific general reader, but not one which can be recommended as fitted to lay a sound basis of biological knowledge in the mind of a student. Instead of describing typical instances minutely, and from them deducing the laws of life, the author, with few exceptions, deals throughout in generalities. Protoplasm, for example, is described, but no detailed account is given first of such a body as an amœba, or a white blood corpuscle, which would be much more fitted to leave on the mind of a beginner a clear and definite idea of the nature and properties of protoplasm than would any abstract account of its characters in general. So, again, no typical animal or plant is described in detail; but there is a chapter on the general differences between animals and plants, and, as scarcely any character of either can be mentioned to which there are not exceptions, the result of this method can only be to produce a very dim and confused state of mind in one new to the subject.

There are, however, worse faults than this in the book. There is a general retrograde tendency in it towards the point from which physiology has of late years been progressing—that of considering the actions manifested in living bodies as due to a source of energy essentially different from that of all other actions. A curious instance of this is found in the second page of the book, where among the differences between dead and living bodies, the author cites the fact that all the actions of living bodies are accompanied by a corresponding destruction of the matter by which these actions are manifested; of

course, by destruction here he can only mean the transformation of the matter into another form, which is exactly what occurs in thousands of cases in non-living sources of force—as when a steam-engine is moved by the combustion of the coal in its furnace ; and instead of being a difference between dead and living bodies, is a remarkable instance of similarity, and one which, a few pages farther on, Dr. Nicholson seems entirely to forget. Again, "Dead matter is completely passive, unable to originate motion ; living matter is the seat of energy, and can overcome the primary law of the inertia of matter." This point of difference is, to say the least, by no means proven. In a certain sense dead matter cannot originate motion, it can only convert some other form of force into it ; but there are very good grounds for supposing that when an animal moves its limb, and so originates motion, it does exactly the same thing : at any rate, no one is justified in making the express statement that it does not; if so, indeed, where is the need for "that destruction of matter" which accompanies vital actions, or why should an animal or plant need food at all ?

Protoplasm, the author states, may be regarded as a general term for all forms of albuminoid matter—an extension of the meaning of the word which is certainly not justifiable. Few would be inclined to call the boiled white of an egg, or coagulated fibrin, protoplasm. Yet upon this definition of the word Dr. Nicholson bases an argument against the theory of those who maintain that life is one of the properties of protoplasm. He represents them as asserting that life is the "result of the combined properties of the elements which form albuminous matter," and then brings forward the fact that dead albuminous matter exists, as an argument against the truth of this statement. What is really asserted is that life is a property of protoplasm, and that protoplasm is nitrogenous compound related in chemical composition to albuminous bodies ; but it would be as reasonable to call starch and dextrine by the same name because one is readily converted into the other, and because they have a similar chemical composition, as to call all albuminous matters protoplasm. But even were it admitted that protoplasm, as such, can exist in a dead state, to deny that life, under other conditions, can be one of its properties, is to deny altogether the possible existence of allotropic states of any kind of matter whatsoever ; and this is what Dr. Nicholson practically does. He says, moreover, that as water is a definite chemical compound, with universally the same properties, there is no need for ascribing its properties to any assumed principle of aquosity; but that, as living protoplasm has certain properties different from those of dead albuminous matter, it is best to regard *vitality* "as something superadded and foreign to the matter by which vital phenomena are manifested." But, admitting for the moment that albuminous matter and protoplasm are convertible terms, would the author assume a principle of *phosphorosity* to account for the different properties of yellow and red phosphorus.

The author falls into the very general error of stating that plants can only build up protoplasm in the light ; but certain fungi will flourish in Pasteur's solution, although kept in total darkness. The difference as regards food between animals and plants is stated in a manner calculated to mislead a beginner. It is hardly correct to say that the food of plants consists of inorganic compounds ; plants have the power of building up food out of these compounds, and it is this which distinguishes them from animals ; the essential nutritive processes of each are the same, and consist in the breaking up of the unstable compounds thus formed ; and the nutrition of plants cannot, as stated, be narrowed to the question of the modes and laws by which these unstable organic compounds are built up.

The chapters on Classification and Homology are good ; in fact, throughout the book morphological questions are much more ably treated than physiological. The account given of the chemistry of living beings is very bare. Fats are the only non-nitrogenous compounds mentioned as occurring in animals. Starch is rendered conspicuous by having the only chemical formula in the book attached to it, and that on the old system of notation.

The next chapter is one on "The Elementary Structure of Living Beings," and here the author closely follows Dr. Beale, accepting his views as to "germinal matter" and "formed material." In speaking again here of protoplasm (or as he, following Beale, prefers to call it, bioplasm), the word "contractility," as applied to the cause of amœboid movements, is objected to on the curious ground that it implies an identity in kind with the contractions of a muscle, an identity which most physiologists, we think, would readily admit. The accounts of development and reproduction are much better than the earlier parts of the book. In his account of the origin of species, the author simply states the opposing views on the subject, and the chief objections to them, but expresses no opinion of his own ; in fact, for some reason, he seems desirous to be regarded as having none, for in a foot-note he asks it to be remembered that a statement of each side of the case commits him to neither. "Distribution in Space" is the heading of an interesting chapter, but that on "Distribution in Time" is very imperfect, at least in a biological sense ; it contains an epitome of geology, but such questions of great interest as the succession of life on the globe, or the extraordinary persistence of certain species, as Nautilus and Lingula, are entirely ignored.

The book contains a considerable number of woodcuts, some of them very good ; but on the whole it is not one to be recommended as a safe guide to the acquirement of a firm foundation of biological knowledge.

OUR BOOK SHELF

Natural History of the Year. By the late B. B. Woodward, B.A. (London : S. W. Partridge.)

IT does not often fall to our lot to notice a book of this description which we can so heartily commend. The design is to interest young people in the varied productions of Nature, by taking them into the fields and woods from month to month, and pointing out the numberless objects of interest that will meet the observant eye at every turn. This is all told in a pleasant manner, and withal with a religious spirit. The author was himself a keen and accurate observer of Nature ; and we do not meet with those atrocious blunders with which books intended for the instruction of children too often abound in describing the most familiar things. The book is illustrated with some extremely tasteful illustrations, one for each month, and

forms altogether a most attractive gift-book for an intelligent child.

Annual Record of Science and Industry for 1871. Edited by Spencer F. Baird, with the assistance of eminent men of science. (New York: Harper and Brothers, 1872.)

THE Americans are more fortunate than ourselves in possessing a Year-Book of Science edited by a scientific man whose name is a guarantee for the accuracy and value of its contents. The various items of information are arranged under thirteen heads, viz. (1) Mathematics and Astronomy; (2) Terrestrial Physics and Meteorology; (3) Electricity, Light, Heat, and Sound; (4) Chemistry and Metallurgy; (5) Geology and Mineralogy; (6) Geography; (7) General Natural History and Zoology; (8) Botany and Horticulture; (9) Agriculture and Rural Economy; (10) Mechanics and Engineering; (11) Technology; (12) Materia Medica, Therapeutics, and Hygiene; and (13)—a very small one—Miscellaneous, with a very brief Necrology appended. To each paragraph is added the indispensable reference to the authority. Prof. Baird's position as Secretary of the Smithsonian Institution at Washington has given him unusual facility for consulting all the leading magazines, and other scientific publications of Great Britain, France, Germany, Holland, and America, of which he has availed himself to the full. An account of the discoveries made in Italy, Sweden, Russia, and other countries of Europe, some of which are daily rising into more and more importance, has been obtained only second-hand. The whole is prefixed by a general Summary of Scientific and Industrial Progress for the year 1871, occupying sixteen pages, wherein the more noteworthy incidents in each department of science are briefly chronicled. The work is the result of great labour; and, as far as we have been able to test it, presents a very fair and accurate record of the progress of science during the year. To those who desire to possess such a record for handy reference, we can confidently recommend Prof. Baird's Year-Book as the best and most complete work in the language, and decidedly preferable to anything published in this country.

LETTERS TO THE EDITOR

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

Atmospheric Effect

AN atmospheric effect, which is sometimes observed in England, displayed itself here in great beauty yesterday. The western sun had been cut off from us by an intervening ridge, while the upper atmosphere was still filled with his light. There was a good deal of opalescent haze in the atmosphere, which, had the sun shone upon it uniformly, would have presented a tolerably uniform hue. But besides the haze, small detached clouds floated in the air, and behind each of them was a sheaf of shadow, drawn through the haze. The density of these shadows varied with that of the clouds which produced them, nor was the density uniform for all parts of the transverse section of the same shadow. The parallel bars of graduated shade thus produced converged, through an effect of perspective, to a point *in the east*, exactly as if the sun were going to rise there. The display of the convergent glory was strikingly beautiful.

The same effect showed itself at Oran during one of the evenings spent there by the Eclipse Expedition. I have seen it two or three times in England (always, I think, near the coast), the last occasion being in company with Mr. Hirst at Margate.

Faraday, if I remember aright, has described this effect. There was also, I believe, a question asked regarding it some months ago in NATURE. This brief account may interest the questioner.

Bel Alp, July 22 JOHN TYNDALL

Spectrum of Aurora

IN the article on the Aurora Borealis of Feb. 4, a translation of which appears in your issue of April 25, Prof. Respighi mentions having noticed the green line of the aurora when observing the zodiacal light; also, that this line was visible—more or less defined—from horizon to zenith, in every part of the heavens.

In 1867, when Angström observed the green line in the spectrum of the zodiacal light, he also detected its presence in all parts of the sky. From his own and Angström's observations, the Professor demonstrates the identity of the zodiacal light and the aurora. This appears to me, at the least, premature. Had the spectrum appeared only where the zodiacal light was perceptible to the naked eye, there would have been reason for believing it due to that light; but, be it noticed, the green line is everywhere seen as bright as in the zodiacal light itself. We have only to suppose that in both cases auroral phenomena, imperceptible to unaided vision, were present, and the spectra seen by Angström and Respighi are at once accounted for.

With all due deference to the great authorities just named, I may state that at Mr. Lockyer's request I have been observing the zodiacal light with a spectroscope since last December, and brilliant as the phenomenon has frequeently been, I have hitherto failed to detect the slightest appearance of bright lines or bands. A faint diffuse—to use Capt. Herschel's nomenclature—spectrum, about as intense as that of a bright portion of the "milky way" is all I have yet obtained.

The spectroscope used is one of Browning's 5 prism ones.

G. H. PRINGLE

Camp Charmadi, South Canara, June 23

Kinetic Energy

IF the loss of kinetic energy in water which has flowed from lower to higher latitudes is due to friction, and represents work consumed in overcoming friction, as Mr. Croll maintains, how is the gain of kinetic energy in water which has flowed from higher to lower latitudes to be accounted for?

Mr. Croll's answer to this question will be awaited with interest. J. D. EVERETT

Belfast, July 27

Bree on Darwinism

I AM very much obliged to Mr. Alfred R. Wallace for pointing out some errors of the press, and some of hasty writing which were not corrected in the proofs, of my work upon the "Fallacies of Darwinism."

I do not think, however, he has adduced anything which justifies his virulent condemnation of a work which he has not ventured to criticise, and I do not, however, write for the purpose of making any complaint. I hope to have the opportunity of answering his remarks upon another occasion.

My object in writing is, however, to request you will give me the opportunity of pointing out that no blunder which I have made is so great as that committed by Mr. Wallace himself, when he states that Darwin's imaginary human ancestor with cocked ears and a tail should have been evolved after the incoming of catarrhine monkeys, which creatures, by what I presume some might call anticipatory retrogression of development, have actually been placed by Mr. Darwin in the human pedigree, and separated from their congeners the platyrrhine or new-world monkeys, because they had so far reached the human goal to which they were tending as to lose their tails.

Also according to Mr. Wallace the cocked-eared creature must have not only re-evolved a tail, but have gone so far backward as to lose the human-shaped, and gain the canine-like "cocked ear." C. M. BREE

Colchester, July 27

Volcanoes and Earthquakes

IT is generally admitted that an earthquake is due to the passing of a sensible wave through the earth's crust. It has also been observed that the occurrence of earthquakes is generally associated with eruptions from volcanic vents, usually in the neighbourhood, but not unfrequently at considerable distances. Now it is evident—and it has struck all observers—that there

must be some connection between the two classes of phenomena. The nature of this connection has been differently explained by different writers. But the purpose of this note is not to criticise existing theories, but to propose one, which I believe to be new, and to be capable of explaining why a sudden volcanic eruption must ordinarily be accompanied by earthquake shocks of greater or less violence (not necessarily always sensible), and why earthquakes may occur without any contemporaneous outburst.

In the preface to his "Physikalische Geologie," Bischof suggests that the phenomena observed in the laboratory should be taken as our guides to explain what happens in nature. Let us see, then, if in the laboratory we meet with any phenomena analogous to volcanoes and earthquakes.

When a reaction has to be performed in a sealed tube, and it is expected that much gas will be evolved, and consequently the pressure in the tube be much increased, it is one of the commonest precautions to draw out the tube to a capillary orifice before closing it. When this precaution has been neglected, and even although the point be allowed to blow itself out in the flame of a lamp, an explosion not unfrequently attends the attempt to open it. Let us consider the circumstances.

We have a tube whose walls are being pushed out by a very high pressure from within, which, however, it resists; but at the moment that this pressure is suddenly relieved at one point, the tube bursts. What is the cause of the explosion? It clearly cannot be the mere reduction of pressure. As long as the pressure was equally distributed over the walls of the vessel, we have seen that it was successfully resisted; as soon, however, as it was suddenly relieved at one point, a great inequality in the tension of the gas in the immediate vicinity of this point would be the result, the gas immediately at the opening assuming at once the atmospheric pressure, while that at, say, the eighth of an inch from it is at the tension of the gas in the tube. The practical effect of this sudden inequality of pressure would be to produce a tug on the mass of elastic fluid, which would cause the walls momentarily to tend to collapse, and this tendency to collapse would be transmitted through the glass as a wave. This wave would to a certain extent distort, and therefore weaken, the walls; and consequently, if the pressure inside were great enough, it would burst them; if not, the only effect would be that a shock would traverse the walls of the vessel, and the pressure would relieve itself by the orifice.

Now, suppose the vessel to be a subterraneous cavity containing an atmosphere of very great tension, and that suddenly the envelope gives way at one point, what will be the result? Just as in the case of the glass tube, the sudden relief of pressure will, in the way indicated above, cause the walls to experience a momentary collapsing impulse, which will be propagated as a wave until extinguished by the imperfect elasticity of the crust. The sudden outburst will be a volcanic eruption, and the consequent collapsing shock will be an earthquake, which either will or will not be accompanied by rending of the crust, according to the strength of the walls and the greatness of the pressure.

It is, however, not necessary that there should be a visible volcanic eruption. For, suppose two such subterraneous cavities at different pressures, separated from one another by a wall weaker than that which separates either of them from the outside of the earth; then, if the pressure in the one becomes so great as to burst the barrier between the two, the result will be an earthquake. And similarly, the pressure in the two thus united cavities may go on increasing until they burst into a third, and so on until they come to a vent, which is either open or weak enough to yield to the pressure. In this way an earthquake and an eruption may be in intimate connection with one another, although a considerable interval of time intervene between the occurrences, and the localities affected be at great distances from each other. And it is possible that some connection of this kind may have existed between the earthquake of Antioch and the eruption of Vesuvius, both having been extreme in their violence. Indeed, the whole series of disturbances, commencing with the earthquake in California and terminating with the eruption of Vesuvius, noticed by Mr. Corfield in NATURE of May 23, may possibly find an explanation under this theory.

The effect of sudden relief of pressure in weakening the walls of vessels explains many cases of explosion which otherwise appear anomalous. Thus, high-pressure boilers have been frequently observed to burst at the moment when the engineer turns on the steam.

In conclusion, the above sketched theory assumes nothing but what we know to be fact. We know that, at least in the neighbourhood of volcanoes, there must be subterraneous cavities whose atmosphere is at an exceedingly high-pressure, for we not only see it emitted from the vent, but it projects enormous masses of rock high into the air, thus testifying to the energy with which it was endowed. Further, given this high-pressure atmosphere, it is certain that, on its being suddenly relieved, it would communicate a shock to the crust, and this, on being felt outside, would be described as an earthquake. I think it is therefore clear that some earthquakes must be produced in this way. Of course this does not include the possibility of there being other causes of concussion which might produce similar effects.

Edinburgh, June 10 J. Y. BUCHANAN

On the Cohesion of Figures of Creosote, Carbolic and Cresylic Acids

WITH reference to the note by Mr. J. H. Spalding contained in NATURE of June 13, I am reminded by my friend Mr. Rodwell that some five or six years ago I showed him the cohesion figure of carbolic acid. A crystal of this acid was taken up on the end of a platinum spatula, and gently delivered to the surface of clean water contained in a clean glass; the crystal gave a few jerks, then suddenly liquified, and displayed its highly characteristic figure so well described by your correspondent. I may further remark that I showed this figure in the chemical section of the British Association, at Manchester, in September 1861, and a drawing of it is given in the plate which accompanies my paper in the *Philosophical Magazine* for October of that year. In this paper it is described as "an exaggerated form of the figure of creosote; the water seems to tear it to pieces; the crispations are amazingly active, and the disc quickly breaks up and disappears. Indeed, while a drop of creosote will endure five minutes on the surface of an ounce of distilled water in a small glass, a drop of carbolic acid will last only a few seconds on the same quantity of water. The cohesion figure is however quite characteristic of the substance, and cannot be for a moment mistaken for any other substance that I have examined."

Creosote, carbolic and cresylic acids, and newly-distilled oil of cloves, give remarkable figures of the same type, each of which is characteristic of the substance.

Mr. Spalding remarks that warm water destroys all action, by lessening, as he supposes, the adhesion of the liquids. I am sorry to have to object to this remark, but I have no doubt that Mr. Spalding was led to make it by employing unclean water or an unclean recipient. If distilled or even ordinary tap water be heated over a spirit lamp in a clean flask, and be poured into a clean vessel, the surface of the water is active at all degrees between the temperature of the air and just below boiling. On the surface of cold water a drop of creosote passes through the following changes:—(1) As soon as the drop is placed on the surface of the water the figure is formed for an instant; (2) it splits open and forms a kind of brittle arc, which (3) is shivered into a number of separate discs, each of which is a perfect cohesion figure of creosote. These figures perform their evolutions independently of each other, sailing about with rapidity, but never clashing with or disturbing each other. In the *Philosophical Magazine* for June 1867, figures are given of these different phases of the figure.

Now, if the water be heated to 100° Fah., or from that to 150°, a drop of creosote deposited on its surface produces a good active figure, but it does not split open or form the brittle arc above referred to; it sails slowly over the surface, firing off volleys of small globules in radial lines, and only when much wasted does it split into smaller systems. All this is what might be expected from the diminished surface-tension occasioned by the heat. Indeed, it is a beautiful illustration of the slight diminution of surface-tension in hot water as compared with cold. In consequence of not splitting open, the duration of the figure is greater on the surface of hot water as compared with cold.

Carbolic and cresylic acids are also very active on hot water, at all temperatures up to 210° Fah. C. TOMLINSON

Highgate, N.

Hereditary Instinct

WILL you allow me to recount to your readers what appears to me to be a striking instance of the transmission of impression in animals?

A few years ago I bought in Skye a perfectly uneducated Skye terrier. The first accomplishment which I taught him was

that of "sitting up"—an accomplishment which he had great difficulty in acquiring. This was not owing to any stupidity on his part, for when he had once passed over this *pons asinorum* of dog-performances, he proved to be a very clever animal, and learnt many other tricks with great ease. He appears, however, never to have forgotten the pains which were taken to teach him his first trick, and to have judged therefrom that there is great merit in sitting up. Not only does he rely upon this as a last resource to move me to take him out, or not to whip him, but he judges that it must soften even the heart of an india-rubber ball. Sometimes when annoyed at his playing with this, his favourite toy, I have placed it on a chimney-piece, and turned my attention elsewhere. On looking round again I have seen my dog sitting up to the india-rubber ball, evidently hoping that it would jump down and play with him again. Perhaps he looks upon this ball as "animated by a living essence" (*vide* Chap. ii. of Darwin's "Descent of Man").

My dog is now the father of a family, and one of his daughters, who has never seen her father, is in the constant habit of sitting up, although she has never been taught to do so, and has not seen others sit up. She is especially given to this performance when any other dog is being scolded. Whether this is an instance of helping a fellow animal, of which Mr. Darwin gives such curious examples, or whether the dog simply hopes to avert the passing storm from her own head, the fact appears to me patent, that this dog has inherited the impression that sitting up has some special virtue for turning away wrath.

L. HURT

Alexandra Hotel, Harrogate, July 27

RECENT OBSERVATIONS IN THE BERMUDAS

AS my late visit to these islands has placed me in possession of facts relating to their original aspect of a somewhat conclusive nature, I deem it advisable to communicate such in a brief form, instead of awaiting the time requisite for the preparation of a more elaborate paper on the subject.

On previous occasions I have always regretted my inability, from lack of time, to look more closely into their geological character in the hope of discovering some satisfactory clue to their primitive condition. I was aware that in different parts of the islands road cuttings and well borings had revealed layers of red earth at certain depths below the surface, the consistence of which was similar to that now forming the present surface soil, and it did not require much force of imagination, after personal inspection, to conceive that such layers of red earth were first formed by the decomposition of vegetable matter which grew upon former surfaces, and became covered to their respective depths by accumulated masses of drift sand, which from natural causes hardened into more or less compact sandstone. But these different layers were but a few feet beneath the surface, and so, although interesting as throwing light upon the gradual elevation of the land by drift material forming over them, yet they afforded no evidence of a contrary nature—viz., the *submergence* of the Bermuda group. Indeed, I have always been led to suppose from appearances that the whole group was the result of an upheaval of the ocean bed slightly above the water level, and a gradual elevation afterwards by means of drift matter aided by the consolidating agency of reef-building zoophytes encircling the whole with a barrier reef, and by isolated patches gradually filling up the space within. The investigations, however, which I have recently been able to make, tend I think to prove that the barrier reef encircling the islands which has hitherto been considered an atoll is merely the remnant of the more compact calcareous rock which formed the shore of a much more extensive island group than that now existing.

My views in this respect are borne out by the following facts:—The barrier reef, as far as I have inspected it, is merely ordinary calcareous rock coated with serpulæ, nullipores, &c., the reef builders only working in the sheltered waters between the reef and the shore in three to eight fathoms. About two years ago submarine blastings were carried on at the entrance of Hamilton Harbour, and at a depth of over six fathoms a cavern was broken into which contained stalactites and red earth. Again, within the last few months, I have, through the kindness of his Excellency Major-General Lefroy, C.B., F.R.S., the present Governor, been placed in possession of still more satisfactory information. During the past two years extensive submarine blastings have taken place inside an artificial harbour, situate at the western extremity of the islands, for the purpose of forming a bed of sufficient depth for the reception of the "Great Bermuda Dock," which attracted so much attention off Woolwich when launched some three or four years ago. The excavations extended to a depth of fifty-two feet below low water mark. At forty-six feet occurred a layer of red earth two feet in thickness, containing remains of cedar trees, which layer rested upon a bed of compact calcareous sandstone. Here we have the first satisfactory evidence of the submergence of an extensive deposit of soil once upon the surface, and that to the depth of forty-eight feet below the present low water level, which consequently grants an equal elevation above it in former times. Now, on carefully surveying the Bermuda chart, we find that an elevation of forty-eight feet will bring the whole space which intervenes between the present land and the barrier reef, now covered with water, above the water level. This attained, what more is required to prove the former extent of the island group before the present submergence to the present barrier reef? But having clearly ascertained beyond doubt that the Bermudas were once forty-eight feet higher than at present, will any one be bold enough to deny them a greater elevation? I have reason to believe that they once extended in a south-westerly direction—not only out to the reef, but to a greater distance. There are some rocky ledges about twenty to twenty-five miles from land in that direction, known as "The Flatts," lying in about thirty-five to forty fathoms water; and, singularly enough, in the very oldest maps of the Atlantic, copies of which I have consulted in the British Museum, "The False Bermudas" are put down about this position. Is it unreasonable to suppose that a low lying group of islets did actually exist here in former times? Again, in Smith's "History of Virginia," which gives an excellent account of the islands in the early part of the seventeenth century, it is stated among other notes upon their natural history that flocks of crows, no doubt the same species (*Corvus Americanus*) which now inhabits them, were in the habit every evening of winging their flight from the main island towards the north. This observation, which from its simplicity I should the more readily believe to be a true statement, would clearly prove the existence of land in that direction at no great distance; for the habit of this bird to leave its roosting place for distant feeding grounds during the day, to return at random, is one of its well-known characteristics.

Taking these matters into consideration, I see everything to support the supposition that the Bermudas once presented a much more extensive aspect than they do at present, and certain additional evidences which I hope to bring forward shortly in a collected form will, I conceive, tend to confirm my impression that the restricted terraqueous area lying within the limits of the outer barrier reef is merely the summit of one of a range of islands which extended in somewhat semicircular form for a distance of seventy or eighty miles, and which have suffered submergence to a depth only to be correctly ascertained by borings, which might be successfully accomplished under the auspices of the Imperial Government at a trifling expense.

J. MATTHEW JONES

SPONTANEOUS APPEARANCE OF EXOTIC FORAGE PLANTS IN FRANCE AFTER THE LATE WAR

IN a communication lately made to the Paris Academy, M. Vibraye states the fact of certain exotic forage plants having appeared in considerable numbers in the central parts of France, after the stay of the army in these localities. He gives the following account of these plants :

"Their appearance, no doubt, results from forage supplied from abroad, the seeds of which had fallen into the ground. At the present time several Mediterranean plants, (chiefly Algerian), having braved the cold of an exceptionally severe winter, are being largely propagated, forming extensive meadows, and changing soil that was formerly arid, and produced no vegetation of importance, to veritable oases. This may probably lead to the definitive introduction of a large number of plants into a more northern region than that which they appear naturally to occupy and to prefer.

"The first notion of the possibility of such plants being brought into French soil, through the fodder consumption of the army, arose in 1870. A botanist of Strasburg, M. Buchinger, wrote to M. Franchet (conservator of my collections) some days before the investment of the place that, on examining the fodder which was being given to the horses, he had found in it forty-four species of plants belonging to the Mediterranean region, and most of which were Algerian. He suggested to M. Franchet to make observations, and see whether some of these plants would not appear in the soil. The prediction was verified ; and in April 1871, M. Franchet found two exotic centauries, and communicated the fact to M. Nouel, the director of the Orleans Museum. Since then these two botanists have made minute researches on the subject, and have discovered many more such plants. This is, briefly, the history of the discovery. The places where the phenomenon has been best observed are in the Department of the Loire-et-Cher : (1) on the right bank of the Loire, near the railway ; (2) on the left bank, the country about Blois. Then, too, in the Communes of Cour, and more especially of Cheverny, which districts were successively occupied. Observations have also been made at Orleans, on the Boulevard Saint Jean, and the Isle of Arrault.

"I shall best recount these observations by giving them as they were written down in the order of date.

"On the 18th March, 1872, certain new plants, observed the previous year at Blois and Orleans, had increased considerably on arid soil, which formerly bore only some poor and stunted herbs. Each of the districts furnished about 90 to 100 species. But the species were not the same in each district, and the total number of species met with, was 157, belonging to twenty-one families, as follows :—

Ranunculaceæ	3	Compositæ	28
Resedaceæ	1	Convolvulaceæ	1
Cruciferæ	8	Borragineæ	1
Sileneæ	5	Verbasceæ	1
Alsineæ	1	Plantagineæ	1
Lineæ	1	Labiatæ	2
Malvaceæ	8	Amaranthaceæ	1
Geraniaceæ	7	Salsolaceæ	2
Leguminosæ	52	Polygoneæ	1
Umbelliferæ	4	Gramineæ	28
Dipsaceæ	1		
Entire total	157		

"The first observations could not be considered quite definitive, and there were some species which it was, perhaps, a little premature to determine ; but after deductions made on this account there remained 140 species ; a number much larger than that of the plants on the best meadow lands in France, which, according to botanists, do not furnish more than 90 to 100 species.

"It will be seen that the Leguminosæ (52 species) form about one-third of the whole, while the Gramineæ and the Compositæ form each about one-fifth (28 species). Among the Leguminosæ trefoil and lucerne predominated ; 12 kinds of trifolium were counted, and 10 or 11 of medicago ; the 28 Compositæ belonged to 21 genera, and the 28 Gramineæ to 16 different genera. Two thirds of these forage plants are annuals or biennials.

"On the 12th April a fresh examination of the Blois district showed that many of the species, and especially the medicagos, had not only persisted but been propagated from seeds. Unfortunately for the full development of this, the land was used as a pasturage for sheep, which devoured the plants in proportion to their growth, and uprooted many with their feet, the arid soil having little cohesion. At Cheverny, where I had enclosed certain spaces, several Algerian plants attained a superb growth ; among these, trefoil, melilot, phalaris, and alopecurus.

"By the 19th April it was evident that not only a large number of species had persisted, but that from being rare and poor the previous year, they had developed to a wonderful extent, notably the *Alopecurus utriculatus*, *Vulpia ligustica*, *Avena barbata*, *Trifolium nigrescens*, *Trifolium isthocarpum*, all southern and forage plants. The *Medicagos sphærocarpa* and *pentacycla* reappeared in great abundance where they had escaped the cattle, or the sickles of women in search of herbs. It was difficult to persuade these herb-gatherers to a temporary self-sacrifice with the view of ultimate advantage in respect of forage.

"On the 27th April my attention was called to the large number of annuals and biennials disseminated. The annual plants, which De Candolle called monocarpian, because they terminated their existence by a perfect and unique fructification, are invariably reproduced by the dissemination of their seeds when they have come to maturity ; the individual dies, while the species becomes perennial ; which duration, on the other hand, is temporarily acquired by the individual, when a scythe, or the grazing of cattle, retards the last and indispensable phase of the plant's existence.

"At this date, April 27, trefoil and lucerne promised to be very abundant in the Blois district. By the 1st of May an incessant appearance of new species was noticed ; and it seemed beyond a doubt that before the end of the season the four localities of Blois, Cheverny, Vendôme, and Orleans, would furnish not fewer than 200 species, of which 170 at least were peculiar to meadows and pasture lands.

"On the 3rd May a new fact presented itself. During the war a forage depôt had stood at the side of the market place of Cour Cheverny, but last year no appearance of any new plant had been discovered there, notwithstanding careful search. On the 3rd some twelve species of foreign forage plants made their appearance, and others were expected. This shows that the seeds had remained in the soil for sixteen months without alteration of their germinating properties. This is an interesting fact, and a corollary of a law of rotation observed in all natural meadows, viz., the temporary disappearance of dominant species, yielding for an indeterminate period to new types, which they by-and-by come to displace, when they meet with certain favouring atmospheric influences, not very fully understood.

"The Algerian plants withstood successfully the frost of the 12th May, which did much damage to our vines and the shoots of certain trees, especially indigenous conifers."

M. Vibraye, in closing his note, speaks of the above phenomena as being quite an event. It is not the ephemeral appearance of a few plants sparsely disseminated, raising the problematical hope of fixing in the soil a useful vegetable—it is an exodus ; the migration, not of a modest *florule*, but of a *flora*, independent and complete. It is, in a word, a treasure which the central districts of France are called on to study and to appropriate. He argues that the propagation of these plants should not be left to chance, but that human skill should be brought to bear on it.

A. B. M.

THE HURON RACE AND ITS HEAD FORM*

THE tribe of North American Indians known by the name of Hurons appears, when first brought to the knowledge of the intruding French, to have been settled in palisaded villages around Lake Simcoe, in Western Canada. They called themselves Ouandots or Wyandots. They consisted of four septs or nations; the Attignaouentans, or Nation of the Bear, the chief member of the league, the Attignenonghaes, the Ahrendarrhonons, and the Tohotaenrats. They occupied thirty-two villages when visited by the Jesuit missionaries in 1639. Brébeuf reckoned them in all in 1635 at 30,000, and they were stated in the *Relation* of 1660 at 35,000. The Hurons with other tribes dwelling at this time in Canada, were fully acquainted with agriculture, as Dr. Wilson shows, wholly independent of any European influences. The Hurons became known to the civilised world only in their decline, and immediately before their extirpation. They were then in alliance with the Adirondacks and other Algonquins, against their common Iroquois enemy. This latter is the name of a league of tribes often designated the Indians of the Five or of the Six Nations. This confederation of tribes during the seventeenth century was the great aggressive nationality of the American Continent, which subdued, exterminated, or incorporated the other tribes with which they came into contact. Cartier discovered Canada in 1535. Champlain explored and settled it subsequently. He visited the Huron country in 1615, and appears to have found the whole district between the river Ottawa and Lake Simcoe to have been almost depopulated, which is to be attributed to the implacable enmity of the Iroquois. This region, "in the latter part of the seventeenth century became the scene of the indefatigable operations of a succession of missionary fathers, some of whom divided their self-denying labours between them and their Iroquois foes, and several suffered martyrdom at the hands of the savage nations whose conversion they aimed at. Minutely detailed maps and narratives of exploration and missionary labours, record the progress of discovery in the region around the Georgian Bay, and illustrate the topography of the Huron villages so accurately, that most of their sites have been identified in recent years. Dr. J. C. Taché devoted such leisure as he could command during a period of five years, prior to 1865, to a minute exploration of the Huron country. Following in the steps of early writers whose accounts are preserved in the *Relations* of the Jesuit Fathers, communicated to the Provincial of the Order at Paris, from 1611 to 1672, he was able to determine the sites of their principal villages, and to explore their cemeteries, abounding with implements, weapons, and numerous other archæological records of native arts and habits.

The sepulchral rites of the Hurons were of a peculiar character. Their dead were primarily exposed on raised biers, as is still done by the Cowlitz, Columbia River, and other tribes; and around them were hung implements and personal ornaments of the deceased, with the tributes of affection of the survivors. In the case of death on a journey, or on the war-path, the body was temporarily interred. But the place of sepulture was carefully noted for future transfer of the bones to the general cemetery of the tribe. At intervals of ten or twelve years the great "Feast of the Dead" was celebrated by each nation of the Huron confederacy. One of these grand ceremonies, performed at Ossosane, the chief town of the Bear nation, on Nottawasaga Bay, was witnessed by the Jesuit missionaries in 1636. Skeletons were gathered from old scaffoldings, or disinterred from distant graves, by the relations of the deceased. The bones of those more recently dead were cleansed of the remaining flesh, and then wrapped carefully in skins, and adorned with prized decorations. The old wampum-belts, pipes, kettles, bows, arrows, axes, beads, and shells, which had been hung around the bier, or deposited in the grave, were anew gathered together, and the whole were brought to the appointed cemetery. There a great trench was dug, and carefully lined with beaver skins and other furs, and after a funeral-feast, with lamentations by the women, and orations by some of the chiefs in praise of the dead, the relics of mortality were cast into the trench, along with the funeral offerings. Only in cases of recent death were the corpses wrapped in furs and deposited entire; and then, amid the shrieks and wails of the mourners, the earth was thrown in, logs and stones piled over the cemetery, and with a closing funeral chant, the great "Feast of the Dead" was brought to a close.

Owing to the systematic practice of thus gathering together the remains of the Huron dead, one or more ossuaries were to be looked for in the vicinity of each village. Dr. Taché explored sixteen of them in all, containing from 600 to 1,200 skeletons in each. From the same depositories he also recovered numerous specimens of native art, and illustrations of the various customs of that people. From the same cemeteries, Dr. Taché selected upwards of eighty skulls, most of which with the accompanying relics he deposited in the museum of the Laval University, at Quebec. Another inquirer, Mr. John Langton, a writer "On the Early Discoveries of the French in North America," conceived the same idea of tracing the villages of the Hurons. He succeeded in tracing out the sites of fourteen villages, in many of which the remains of houses and stockades could still be recognised. He even succeeded in identifying St. Ignace, a village at which the principal chief and nearly 100 of the Iroquois warriors fell before the Hurons were overpowered, and the miserable remnant bound to stakes to perish in the relics of their blazing settlement. St. Ignace was finally destroyed in 1649. Some few Hurons found refuge among the Petuns, Neutres, and Eries, and shared in the subsequent fate of these tribes. The fortunes of another body of the fugitives illustrate the Indian practice of adoption into another tribe. The survivors of two Huron towns opened negotiations with their Seneca foes, and were adopted into the Seneca nation. And another band, under the conduct of the Jesuit missionaries, made their way to Quebec, then subsequently settled at Lorette, on St. Charles's river, where their lineal descendants remain, their blood mingled with that of European colonists, and speaking a French *patois*, and where they still share in certain Indian funds distributed to them by the Canadian Government.

The admixture of blood has nearly effaced the genuine characteristics of the Hurons of Lorette, although this tribe originally does not appear to have been exposed in the same degree to the adoption of prisoners of other tribes as that of the Iroquois Confederacy. Hence the remains recovered from the ancient cemeteries of the Huron country have a special value for ethnological purposes; they are the most authentic relics of the pure Hurons. As an instance of the readiness with which the aggressive Iroquois received those of other races into their tribe, Dr. Wilson speaks of an old squaw of pure white blood, reputed to be nearly a century old, who survived till recently, if she be not still living, as a member of the Mohawk tribe, of the Bay of Quinte. Her Indian name is Ste-nah, supposed to be a contraction of Christiana, and she is described as a full-blood Sko-ha-ra, or Dutchwoman. When the author last heard of her, in 1868, she was living with her granddaughter, the wife of a Mohawk chief.

The learned author is probably the solitary instance of a well-instructed British Craniologist being transferred to American soil, who has continued his favourite pursuit in the new field with perseverance. Dr. Daniel Wilson has given numerous and valuable proofs of his abiding taste for, and persistent investigation in, this fundamental branch of anthropological inquiry. In his compre-

* The Huron Race and its Head Form. By Daniel Wilson, LL.D. 3 plates.

hensive "Pre-Historic Man," which has reached a second edition, he has already paid a good deal of attention to the Huron tribe, as well as to other tribes of the North American Indians, which, in fact, constitutes one great feature of value in the work.

In this volume Dr. Wilson gave a table of the measurements of thirty-seven Huron skulls "obtained from Indian graves to the north of the water-shed between Georgian Bay and Lakes Erie and Ontario." The great purpose of the construction of this table, as of so many other investigations made by the author, was to test the truth of a doctrine which had been generally received and was in great measure endorsed by Dr. S. G. Morton, who produced the classical "Crania Americana." This doctrine, in few words, is that the American race is almost uniform in its head characters from one end of the continent to the other, and that the American typical cranium is distinguished for its shortness. To Dr. D. Wilson's persevering researches we must allow the merit of having shown that there is much variety in native American races, and that in their skulls there is considerable diversity of length. This may be very confidently asserted, without conceding to him an agreement with his assertions respecting the long skulls among the ancient Peruvians; for he evidently mistook the deformed crania of these people for the representatives of the natural form of their heads.

In the table of the measurements of thirty-seven human skulls referred to, it was seen that their length varied much. If we exclude the "Barrie skull," No. 23, which appears to be quite aberrantly short, and it is thought has been distorted by art, we find their longitudinal diameter to vary from 7·9 inches to 6·8 inches, or above an inch. The cephalic indices of these two examples, unfortunately, cannot be accurately calculated from Dr. Wilson's measurements. One of his items of measurement is "F. D." frontal diameter, which he says in this memoir "is taken from the point of junction of the frontal, parietal, and malar bones." This latter is probably an inadvertence, and should be sphenoidal bone, as the malar bone nowhere joins the frontal.

Since this table was constructed, thanks to the efforts of Dr. Taché and others, Dr. Wilson has had the opportunity of measuring many more Huron skulls. He now says: "The sight of upwards of seventy skulls, all derived from the cemeteries of a single tribe or nation, is a peculiarly interesting study to the ethnologist. But to one at all impressed with the uniform persistency of a specific ethnical type, the result is far from satisfactory." They are seen to vary materially, and especially in length. The skulls of women present a decided projection of the occiput, and here we may be permitted to allude to Dr. Wilson's plates. The first, which gives shaded profile views of the calvaria of a Huron man and woman, is excellent and very characteristic. Plate II. is lettered, "Long Huron skull, male." It is often very difficult to determine positively the sex in crania, but in this example it seems doubtful whether the plate does not exhibit the calvarium of a woman. We incline to think that it does. The long oval, vertical view is quite apparent and unquestionable. Plate III. is an undoubted instance of a "Long Huron skull, male."

Dr. Wilson, after attesting the great range of diversities in the Huron skulls he has seen, concludes in these noticeable terms: "But the specialties of the whole, in their front aspect, suggest a greater uniformity in their physiognomy than in cranial conformation. The nose is in most cases large and prominent; the superciliary ridges in the males are strongly developed; and a common ethnical character may be traced in the full-face as a whole, including the massive broad cheek-bones and superior maxilla; as well as in the indications in the greater number of a tendency towards a pointed apex, or meeting of the parietal bones at an angle at the sagittal suture." Perhaps this is as much as anyone can reasonably expect, even when divergences are to be acknowledged in the proper calvarial form. And it is difficult to conceive that these divergences are so utter and so puzzling as to prevent our seeing any constancy among them.

Dr. Wilson, in showing that some tribes of American Indians are characterised by long or dolichocephalic heads, still admits that other tribes have short or brachycephalic heads. This must be conceded, as well as that Morton's generalisation was too comprehensive and too literal. Former sweeping conclusions as to dolichocephaly and brachycephaly cannot now be sustained. It was long since seen that among the crania of any extended race of people, as the ancient Britons, there is much variation as to length, indeed that a scale might be exhibited from the shortest to the longest, in which the numerous intermediate lengths intervene to fill up the ascending degrees of the range. This truth is now more than ever apparent, since the elaborate researches among the skulls of Italian races by the distinguished anatomist, Prof. Luigi Calori, of Bologna. He has conclusively shown that there is much more dolichocephaly among the races of Italy than was previously known.

Much of the difficulty that craniologists have encountered in the study of the head-forms of different races, has had its foundation in the too rigid rules which they have assumed these forms to observe. Dr. Wilson's labours have served well to illustrate this point in reference to the American races. Were this the proper place, it would be easy to point to examples of the futile labours which have resulted from these self-imposed rules. How many learned controversies have been entertained to determine the race of a man whose only existing relic was his lower jaw? On finding that such rules cannot be fixed and defined in so absolute a manner, it has often been the case that other inquirers have lost confidence in craniology itself. This is a transition from one extreme to another. More moderate expectations from the doctrine of skull-forms would have prevented confidence in their value from being so often shaken. Larger views must be taken, but these are quite compatible with our knowledge, without any necessary leaning to the meanderings of the evolutionary hypotheses alluded to by our author.

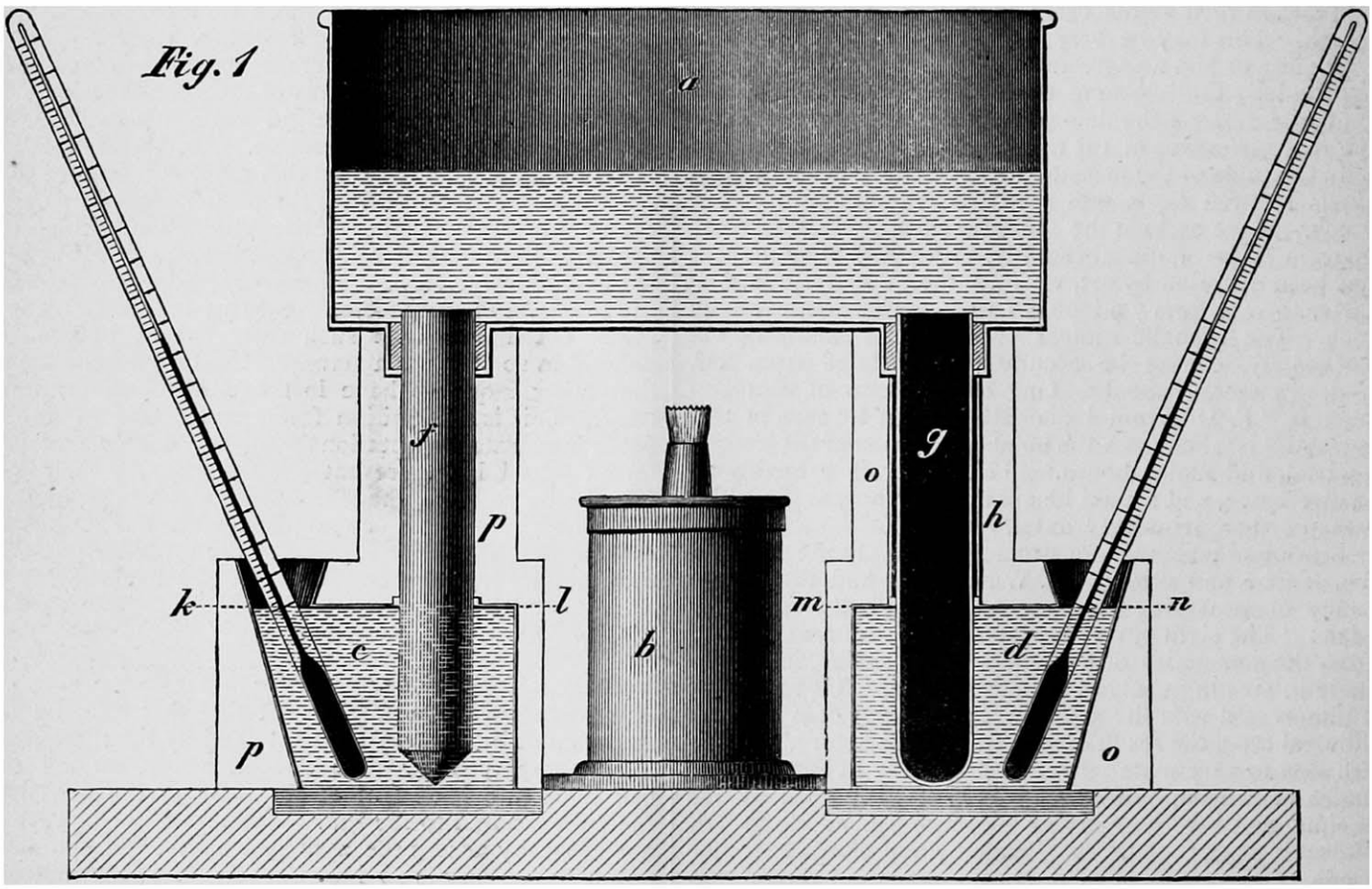
CONDUCTIVITY OF MERCURY

IT was shown in a previous article * that solar intensity cannot be accurately ascertained by the thermoheliometer employed by Père Secchi, owing, among other causes, to the imperfect conductivity of the mercury in the bulb exposed to the sun. Meteorologists, however, do not generally accept the assumption that the conducting power of mercury is so imperfect as to affect materially the correctness of the indication of mercurial thermometers, Deschanel being quoted in support of the opinion that mercury is not an imperfect conductor. We are reminded that Prof. Everett, in a recent translation of the works of the author mentioned, assumed that the conductivity of quicksilver in the bulb of a thermometer is the same as a vessel "with thin metallic sides containing water which is stirred" (see Prof. Everett's translation of "Deschanel's Natural Philosophy," Part II., pp. 245-387). The subject is so intimately connected with the determination of solar temperature and solar energy, that it has become indispensable to settle the question by some thorough practical test. Accordingly an apparatus, represented by the following illustration (Fig. 1, p. 266) has been constructed by the writer, to ascertain the conductivity of mercury. Before entering on a description, it will be instructive to point out that the heat communicated to the bulb of a thermometer by solar radiation is transmitted to its contents chiefly by convection, hence that the altitude of the sun during the observation influences the accuracy of the

* NATURE, vol. v. pp. 344-347.

indication. This will be readily comprehended. Fig. 2 (p. 267) represents the bulb of a thermometer exposed to the rays when the sun's zenith distance is 65°; Fig. 3 representing the bulb when the zenith distance is 18° 23′, the latter being the minimum at the Observatory of the Roman College, where the thermo-heliometer has been long employed for the purpose of ascertaining the intensity of solar radiation. Referring to Fig. 2, it will seen that the blank crescent *c*, whose varying thickness indicates very nearly the amount of heat imparted at each point of the spherical surface presented towards the sun, occupies a nearly vertical position. The mercury contained within the space indicated by the said crescent, having its specific gravity reduced by the radiant heat, will ascend; while the mercury on the opposite side, which retains its specific gravity, will descend; thus a circulation will be established by means of which the heat received from the sun will be gradually communicated to the entire mass of mercury in the bulb. But, when the latter is exposed to the sun's rays under a zenith distance of about 18°, as shown in Fig. 3, the heated mass of mercury contained within the crescent *a* has so slight an inclination that scarcely any circulation takes place. Consequently, if it can be shown practically that mercury is incapable of transmitting heat from particle to particle with sufficient velocity, it will be evident that thermometers and thermoheliometers, with spherical bulbs are worthless as means of measuring the intensity of solar radiation. It will be perceived that if the bulb in Fig. 3 be surrounded by an enclosure, as in the thermo-heliometer, the mercury contained within the space indicated by the crescent *b* will radiate far less heat towards such enclosure than the mercury within the opposite heated crescent *a*. It will also be perceived that by in-

Fig. 1



creasing the size of the bulk the transmission of heat from *a* to *b* will be retarded unless the conductivity of mercury be perfect. Hence the *size* of the bulb is an element affecting the accuracy of the indication—a circumstance atal to the employment of a spherical bulb in the thermo-heliometer.

The nature of the illustrated apparatus constructed for the determination of the conductivity of mercury will be readily understood from the following description:—Fig. 1 represents a longitudinal section through the vertical pane. *a* is a boiler, with a flat bottom and semicircular ends, supported on two columns, *f* and *g*, resting on the bottom of the cisterns *c* and *d*. The column *f* is composed of wrought copper plated with silver, highly polished. The column *g* consists of a cylindrical vessel of glass open at the top, filled with mercury, and surrounded with a socket, *h*, composed of polished silver. The cisterns *c* and *d*, supported on nonconducting substances, are plated with polished silver, and provided with funnel-shaped openings at the top, through which thermometers are inserted. These cisterns, as well as the columns *f* and *g*, are surrounded with nonconducting coverings, *p*, *p*, and *o*, *o*. A lamp, *b*, is applied behind the cisterns for heating the water in the boiler. It is scarcely necessary to observe that the polished silver plating of the copper column, and the polished silver socket round the mercurial column, are intended to prevent loss of heat by radiation, while the coverings before mentioned are intended to prevent loss of heat by convection attending atmospheric currents. The inside diameter of the cylindrical vessel *g*, it should be noticed, is 0·5 in., corresponding exactly with the diameter of the copper column *f*, the top of which is on a level with that of the mercurial column. The lines *k l* and *m n* are in the same horizontal plane, their distance below the upper ends of the columns *f* and *g* being precisely two inches.

The object of the apparatus being that of comparing the conductivity of mercury to that of some other metal

copper has been selected, as its conducting property is better known than that of any other. The leading feature of the arrangement will be comprehended by a mere glance at the illustration. An equal amount of heat being applied to each column, it is intended to show by the elevation of the temperature of the water in the cisterns *c* and *d*, what relation exists between the conductivity of mercury and copper. Regarding the application of the heat, it will be evident that an equal amount must infallibly be imparted to each column if the lamp be sufficiently powerful to keep the water in a state of continuous ebullition. Obviously the heat from the lamp, if urged, will cause a rapid upward motion of the water in the middle of the boiler, and a correspondingly rapid descending current at each end. Accordingly lateral currents varying in velocity with the strength of the flame applied under the boiler, will flow inwards over the upper ends of the columns *f* and *g*.

Several experiments have been made under varying barometric pressures and different atmospheric pressures; but the results as regards the comparative conductivity of mercury and copper have proved to be very nearly alike in all. The accompanying tables record the result of the last trial, conducted as carefully as practicable. The headings of the several columns explain so clearly the object of the tables that it will only be necessary to state that the energy inserted in the fourth column is the energy developed from the beginning of the experiment.

Referring to Table I., it will be seen that at the termination of four minutes from the commencement of the experiment, the temperature of the water in the cistern *c* had increased 29·06°, the differential temperature being then 212° − 102·56° = 109·44°. During the same period a dynamic energy represented by 2·525 thermal units had been transmitted past the line *k l*, communicated to (1) the water in the cistern; (2) the part of the copper column immersed; (3) the metal composing the cistern; (4) the immersed part of the thermometer. But, while the entire energy transmitted past the line *k l*, during the four minutes thus amounted to only 2·525 units, the rate of transmission was actually 0·850 unit per minute at the termination of the fourth minute. This apparent discrepancy was caused by the heat absorbed by that part of the column which extends above the line *k l*, the temperature at the commencement of the experiment being the same as that of the surrounding air, 73·50°. Referring to Table II., it will be seen that the energy transmitted through the mercurial column, past the line *m n*, during four minutes, was only 0·087 unit against 2·525 units for the copper column, although the differential temperature of the water in the cistern *d* was 137·50° − 109·44° = 28·06° higher than in cistern *c*. Accordingly, the conductivity of the copper composing the column *f* has proved to be $\frac{2\cdot525}{0\cdot087}$ = 29·06 times greater than the conductivity of the mercury of the column *g*, notwithstanding the higher differential temperature to which the latter was exposed. It will be observed that the glass, 0·02 in. thick, composing the cylindrical vessel which contains the mercury, will conduct some heat downward, tending to increase the temperature in the cistern *d*. This tendency, however, will be balanced by the loss of heat occasioned by the radiation of the glass cylinder, since the application of the polished silver socket and the non-conducting covering cannot wholly prevent the refrigerating action of the surrounding air. It is important to observe, regarding the loss of heat from the latter cause, that the cisterns, previous to trial, are charged with water of the same temperature as the atmosphere. Now, considering that the increment of temperature in the cistern *d* does not average more than 0·40° above that of the atmosphere during the trial, it will be evident that the amount of error caused by radiation will be quite inappreciable. We are therefore warranted in concluding that the conductivity of mercury, determined by the increment of temperature in cistern *d*, and by the dynamic energy transmitted past the line *m n*, cannot be far from correct. It will be asked why columns of such small diameter have been employed. The principal object has been that of presenting a sectional area in the mercurial column *g*, corresponding as nearly as possible to the size of the bulb of an ordinary thermometer. Regarding the dimensions, it will be readily admitted that the conductivity of mercury might have been ascertained with greater exactness, if columns of very large sectional area had been employed; but the trial has conclusively established the fact that mercury transmits heat from particle to particle too slowly to

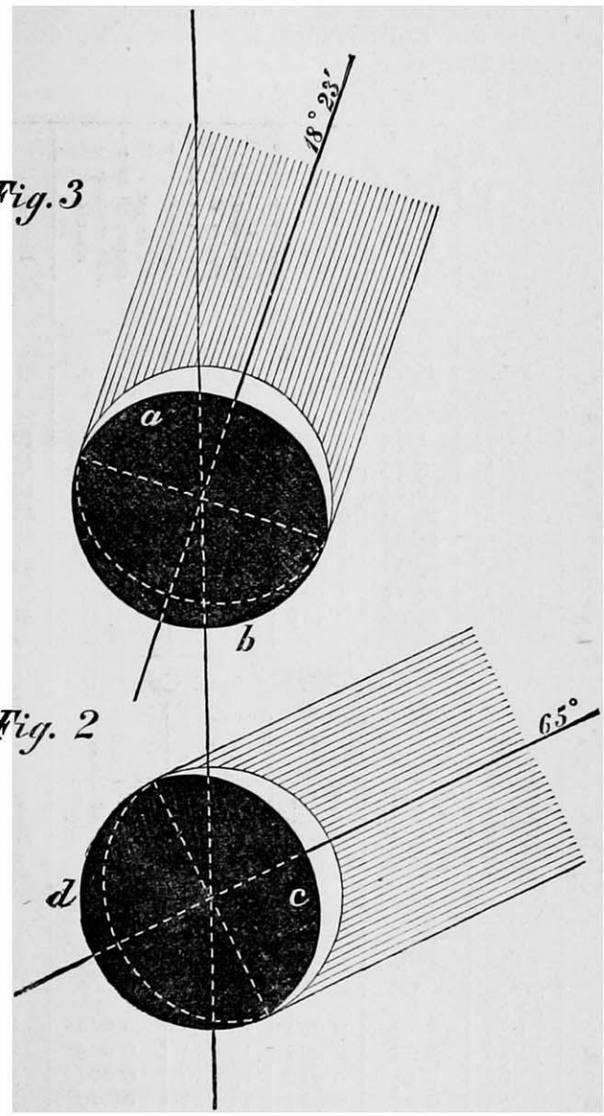


Fig. 3

Fig. 2

effect a sufficiently rapid indication of mercurial thermometers provided with *spherical* bulbs; and that, when the heat is applied from above, the indication of such thermometers is wholly unreliable.

A subject of profound interest presents itself in connection with the rate of transmission of energy exhibited in the sixth column of Table I. It will be seen that although the copper column *f* is only 0·5 in. in diameter = 0·19635 sq. in. section, the rate of transmission at the termination of the fourth minute is 0·850 unit per minute. Reducing this amount to the usual standard of one square foot, it will be found that the energy developed is $\frac{144}{0\cdot19635} \times 0\cdot850 = 623$ thermal units per minute for a sectional area of 1 sq. foot. It will be observed that this

extraordinary amount of energy (theoretically capable of exerting $\frac{623}{42{\cdot}7} = 14{\cdot}5$ horse-power) is called forth by the moderate differential temperature of $212° - 102{\cdot}56° = 109{\cdot}44°$ F. Now, let us compare the energy of 623 thermal units per minute to that produced by the radiation of a metallic surface coated with lamp black, and maintained at a temperature of 212°, within an enclosure of 102°. Actual trial shows that under these conditions, the radiant energy of a blackened plate composed of copper, containing 144 sq. inches, scarcely reaches 6 thermal units per minute. Our experiment has therefore established the fact, incidentally, that under the stated conditions, a plate of wrought copper two inches in thickness is capable of transmitting by conduction from one side to the other, in a given time, an amount of mechanical energy more than 100 times greater than the mechanical energy developed by the radiation of the same plate during an equal interval of time.

TABLE I.—COPPER COLUMN

TIME.	Temperature of Water in Cistern.	Increment of Temperature in Cistern.	Energy Transmitted past $k\,l$.	Differential Temperature Between Boiler and Cistern.	Energy Transmitted past $k\,l$ per Half-minute.	Energy Transmitted per Square Foot per Half-minute.
Min.	Fah. °	Fah. °	Therm. Units.	Fah. °	Therm. Units.	Therm. Units.
	73·50			138·50		
0·5	75·15	1·65	0·143	136·85	0·143	104·873
1·0	77·25	3·75	0·326	134·75	0·183	134·208
1·5	80·14	6·64	0·577	131·80	0·251	184·078
2·0	83·84	10·34	0·898	128·10	0·321	235·415
2·5	88·14	14·64	1·272	123·80	0·374	274·284
3·0	92·81	19·31	1·678	119·00	0·406	297·752
3·5	97·67	24·17	2·100	114·25	0·422	309·486
4·0	102·56	29·06	2·525	109·44	0·425	311·686

TABLE II.—MERCURIAL COLUMN

TIME.	Temperature of Water in Cistern.	Increment of Temperature in Cistern.	Energy Transmitted past $m\,n$.	Differential Temperature Between Boiler and Cistern.	Energy Transmitted past $m\,n$ per Half-minute.	Energy Transmitted per Square Foot per Half-minute.
Min.	Fah. °	Fah. °	Therm. Units.	Fah. °	Therm. Units.	Therm. Units.
	73·50			138·50		
0·5	73·52	0·02	0·002	138·48	0·002	1·466
1·0	73·56	0·06	0·005	138·44	0·003	2·200
1·5	73·64	0·14	0·012	138·36	0·007	5·133
2·0	73·75	0·25	0·022	138·25	0·010	7·334
2·5	73·90	0·40	0·035	138·10	0·013	9·534
3·0	74·08	0·58	0·051	137·92	0·016	11·734
3·5	74·28	0·78	0·068	137·72	0·017	12·467
4·0	74·50	1·00	0·087	137·50	0·019	13·934

J. ERICSSON

NOTES

THE voluminous correspondence connected with the management of Kew Gardens, printed by order of Parliament, was issued at the close of last week. In the debate in the House of Lords on Monday, introduced by Lord Derby, the essential points of the controversy were hardly touched; and pending the debate in the House of Commons on Sir John Lubbock's motion, which was not reached on Tuesday evening, it is obviously premature to enter into the various discussions which are prompted by the contents of the Parliamentary papers.

THE choice of a foreign correspondent of the French *Académie des Sciences* has resulted in the defeat of Mr. Darwin and the election of M. Loewen, of Stockholm, who received 32 votes, against 15 given to the English naturalist. The discussion had extended over three long sittings in secret committee, the leader of the advocates of Mr. Darwin's claim being again his opponent in controversy, M. de Quatrefages, while M. Emile Blanchard led the opposition. A correspondent of *Les Mondes*, an eminent member of the Academy, in commenting on the result, states that not one of those who voted for Mr. Darwin shared his philosophical doctrines, and not one of those who opposed his candidature alleged as their motive the error or danger of his doctrines. "What has closed the door of the Academy to Mr. Darwin is that the science of those of his books which have made his chief title to fame—the 'Origin of Species,' and still more the 'Descent of Man'—is not science, but a mass of assertions and absolutely gratuitous hypotheses, often evidently fallacious. This kind of publication and these theories are a bad example, which a body that respects itself cannot encourage."

THE subject of Prof. W. K. Clifford's discourse at the ensuing meeting of the British Association will be, "The Aims and Instruments of Scientific Thought." Mr. W. Spottiswoode will deliver a lecture to working men, on "Some Properties of Light, Sunshine, Sea, and Sky."

THE Iron and Steel Institute will hold its next meeting in Glasgow, under the presidency of Mr. Henry Bessemer. The reception room will be in the Corporation Galleries, Sauchiehall Street. The general meetings will be held in the Lecture Hall, Corporation Galleries, Sauchiehall Street, as under:—Tuesday, Aug. 6, 1.30 P.M., Election of Members, Report of Council to be presented, Papers; Wednesday, Aug. 7, 10.30 A.M., Reading and Discussion of Papers; Thursday, Aug. 8, 10.30 A.M., Reading and Discussion of Papers. A room will be provided in the Corporation Galleries for the exhibition of objects of interest to the trade, either from the neighbourhood of Glasgow or elsewhere. The business proceedings will terminate about 3 o'clock on Tuesday, and it is proposed that members should devote the remainder of the day to visiting the iron and other works in the neighbourhood of Glasgow. A list of these works will be given in the detailed programme to be distributed at the meeting; and a sketch map of the district will also be ready at the same time. On Wednesday, immediately after the conclusion of the business meeting, a special train will be provided to convey the members to Coatbridge and Monkland, where the Gartsherrie, Summerlee, Langloan, Coatbridge, Malleable, and Monkland Iron Works will be inspected. On Thursday, after the conclusion of the general meeting in Glasgow, a special train will be arranged for the Motherwell district, and for the inspection of the iron works in that locality. On Thursday evening, at 7 o'clock, the members will be entertained at dinner, in the Corporation Galleries, Glasgow, by the Local Reception Committee. On Friday an excursion will be made down the Clyde, for the purpose of seeing the industrial features connected with the river. The excursion will also be prolonged to the head of Loch Long, the return being by Loch Lomond to Balloch, and thence by train to Glasgow. Luncheon will be provided at Tarbet. The following papers have been already promised:—"On the Geological Features of the Iron and Coal Districts of Scotland," by Mr. James Geikie, F.G.S., of the Geological Survey of Scotland; "On the Rise and Progress of the Iron Trade in Scotland," by Mr. Jno. Mayer, F.C.S., Glasgow; "On the Differential Clutch for Reversing Mills," by Mr. R. D. Napier, Glasgow; "On Reversing of Rolling Mills," by Mr. Graham Stevenson Airdrie; "On an improved form of Squeezer for Blooms produced in

Rotary Puddling Furnaces," by Mr. James Robertson, Glasgow; "On the Rise of Iron Steamship Building on the Clyde;" "On further Improvements in Spencer's Revolving Puddling Machine," by Mr. Adam Spencer, West Hartlepool; "On the Westward Development of the Iron Manufacture in the United States," by Mr. T. Guilford Smith, Philadelphia.

THE Annual Meeting of the Association of German Naturalists and Physicians will be held at Leipzig, from Aug. 12 to Aug. 18.

A MATHEMATICAL society of Paris has been formed, on the plan of the similar societies of London, Moscow, and Berlin, having for its object to encourage mathematical studies and increase mathematical knowledge, and to form a bond of union of those interested in the mathematical sciences. Among its original members are MM. Chasles, Serret, Ossian Bonnet, Resal, Bourget, Mannheim, Laurent, Halphen, de Polignac, Ribeaucourt, Lemoine, Laguerre, Gros, Brisse, and André. The Society proposes publishing a *Bulletin* of its Proceedings.

WE regret to learn that Prof. H. E. Roscoe is laid by from a serious accident—a kick from a horse. The injuries, however, we understand, are only such as complete rest will repair.

JUDGMENT has been given by Lord Gifford, in the Court of Session at Edinburgh, in favour of Miss Jex Blake and other lady students in their action against the Senatus Academicus, asserting their right to complete at the University their full medical curriculum, and to graduate on the same footing as male medical students. The judgment finds the ladies entitled to all the privileges of medical students, and to graduate in medicine at the University. The laws of Scotland, continues the judge, hardly as they bear against women in some respects, have never gone so far as to forbid their entering the medical profession.

WE are glad to observe that a movement which we noted in April last has succeeded in giving a well-earned reward to Mr. James Lindsay, Experimental Assistant to the Professors of Natural Philosophy in Edinburgh University for the last fifty-four years. A meeting was held in Edinburgh on the 24th, presided over by Prof. Sir R. Christison, Bart., M.D., who, in a few words, pointed out the great merit which had induced Mr. Lindsay's friends to present him with this manifestation of their respect, and gave a sketch of his long connection with the Natural Philosophy chair at the University. The subscriptions amounted in all to 235*l.*; the list of subscribers including the names of H.R.H. the Duke of Edinburgh, the Marquis of Tweeddale, the Duke of Argyll, Dr. Lyon Playfair, M.P., Mr. Carlyle, Prof. Tyndall, Prof. Sir R. Christison, Sir W. Thomson, W. M. Rankine, Tait, &c.

MR. J. LOWTHIAN BELL, of Newcastle-on-Tyne, has been elected an honorary member of the United States Mining and Engineering Institute, in recognition of his labours.

IT has been determined to erect a statue in Berlin to the memory of Albert von Graefe, the eminent oculist. The names of some of the most distinguished surgeons of Europe are on the committee.

WE understand that the Royal College of Chemistry will resume its operations at the commencement of the Autumn Term, in the new laboratories at South Kensington.

THE Museum at Thornhill, Dumfriesshire, is now open to the public on Saturdays from one o'clock. Admission will be by free tickets, which may be obtained by application at the museum, and a description will be given of some special class of objects. On other days of the week, Sunday excepted, admission will be by tickets for which the charge of sixpence will be made. To the museum will be added a small library of selected books, which may be had on loan; also a library of books for consultation at the museum. This library consists of about two thousand volumes. A few periodicals will also be added. A descriptive catalogue of the museum and a catalogue of the library are in preparation.

THE most recent publication of the Geological Survey consists of the explanation of quarter-sheet 98 S.E., illustrating the geology of the neighbourhood of Kirkby Lonsdale and Kendal, by Messrs. Aveline, Hughes, and Tiddeman. It contains the usual sketch of the physical geography of the district, and lists of the fossils of the various formations, and is illustrated by several sections.

MR. W. R. HAYWARD has in preparation a new work, which will be called "The Botanist's Pocket-Book." It is intended as a handy pocket companion for the botanist in the field, to enable him to identify on the spot the plants he may meet with in his researches. It will contain the characteristics of species and varieties, the botanical name, common name, soil, and situation, colour, growth, and time of flowering, of every plant, arranged under its own order. The volume will be published by Bell and Daldy, York Street, Covent Garden.

AN excellent compendium of our present knowledge of the sun and the phenomena of its atmosphere, from the pen of Prof. Young, has just been published by Chatfield and Co., of New Haven. This author, it is well known, has himself occupied a very prominent part in the history of more recent discoveries in regard to the sun, and the article referred to is the substance of a lecture delivered at New Haven during the past winter. This has, however, been materially modified, so as to bring the subject up to the present state of our knowledge, as rendered necessary by the rapid progress made in the science of solar physics.

IN the form of a 4to pamphlet is printed "Discussion of the anemometrical Results furnished by the Anemometer at Sandwick Manse, Orkney, 1863-1868, from the Appendix to the Quarterly Weather Report for 1871.

WE have received three papers by Prof. O. C. Marsh, on "The Discovery of Additional Remains of Pterosauria, and of the Dermal Scutes of Mosasauroid Reptiles;" "The Structure of the Skull and Limbs in Mosasauroid Reptiles," and a "Preliminary Description of Hesperornis Regalis." These have already been alluded to in our *résumé* of the contents of *Silliman's Journal.*

WE have a reprint from the *Geological Magazine* of Mr. James Geikie's valuable and interesting papers "On Changes of Climate during the Glacial Epoch." The author has made several additions and alterations, one of the most valuable additions being a summary of the general results arrived at in the memoir in a series of thirty-six short paragraphs.

THE *Notizblatt des Vereins für Erdkunde und verwandte Wissenschaften zu Darmstadt und des Mittelrheinischen Geologischen Vereins* for 1871 contains a host of valuable papers and statistical tables connected with all branches of geography—physical, political, and social, and the sciences connected therewith, especially meteorology and geology, relating to the Grand Duchy of Hesse-Darmstadt. We notice especially two very elaborately-constructed charts of the meteorological observations taken during the years 1870 and 1871.

THE *Chemical News* contains a paper by Mr. Hugo Tamm on "A Ferro-Tungstine, a New and Interesting Mineral," which Mr. Tamm desires to designate "Crookesite." This name, however, having been already appropriated, Mr. Crookes pro-

poses that, when the missing constituent is discovered, it should be called "Tammite." Mr. Tamm's analysis of the new mineral gives:—Metallic Tungsten 88·05, Metallic Iron 5·60, Metallic Manganese 0·15, Undetermined Substance 6·20. Mr. Tamm ventures upon various conjectures as to this last substance, and thinks it just possible that, after all, he may have made an analytical error, and that there may be 6·2 per cent. more of tungsten than appears in the analysis. He has, however, strong doubts on this point.

REGARDING "sea-serpents," the following note may be interesting:—The South African Museum, Cape Town, recently received a specimen of the Ribbon fish (*Gymnoterus*) fifteen feet long without the tail. It appears that this fish is known to distant inland fishermen as being forty feet long, and from its slender shape and snake-like movement is probably the "sea serpent" of late years so minutely described by navigators. From its head there is erected a plume of flexible rose-coloured spines, and from head to tail along its back there is a conspicuous mane-like fin. Its general colour is like burnished silver. The eye is large and silvery, and the profile of the head comports well with that of the horse. The specimen could not be preserved, but there are two smaller specimens in the Museum.

THE *Garden* calls attention to the great value of the Island of Jamaica as a tropical garden. Its oranges, pine-apples, bananas, limes, lime-juice, cocoa-nuts, and other such products, could not be surpassed in quality, and might be cultivated to any imaginable extent. Besides all this, the soil and climate are eminently suitable to the growth of precious drugs and plants. Bark is raised easily, the cinchona plantation being in a most satisfactory state. Then there are hemp and China grass of excellent quality, nor would any arrowroot be superior to that of Jamaica if it were but more carefully prepared for market. Here, it will be said, is a noble prospect for the colony. True, but it is a prospect only. Not until the very last returns is there shown any "tendency to the development of new industries requiring little capital and no extraordinary skill." It is the old story, "minor articles" are neglected, though they are the very articles which are wanted, and which the colonists could send. However, Jamaica is fortunate in having a Governor in Sir J. P. Grant, who can discern the true capabilities of the island, and the true place for its industry in the markets of the world.

A CORRESPONDENT of the *Madras Mail*, quoted by the *Times of India*, says that on the night of June 15 last the plain to the east, north, and north-east of Nandidroog was covered with "many thousands" of lights, which have been observed occasionally in former years. The correspondent compares the appearance to that of a large city brilliantly illuminated, and in one direction the scene, through a binocular glass, "looked like a view of part of the starry heavens, each flame being like a star." As many of the lights were from ten to fifteen miles distant from the reporter's point of view, he conjectures that each flame must have been five to six feet in length. An attempt is being made to find out the cause of the curious phenomenon, the most likely hypothesis being that the lights are "caused by the ignition of some inflammable gas escaping in jets from the surface of the earth."

WE learn from the *Field* of July 20, that Mr. Parnaby has succeeded in bringing sixty black bass fry home from America, and that they are safely deposited in the tanks at Troutdale, Keswick, and are feeding heartily, so that they may now be considered safe. He found great difficulty in collecting the fry and bringing them safely across the Atlantic on account of the intense heat. Mr. Francis considers this the second greatest feat in pisciculture, the first being the conveyance of salmon to Australia.

*PROFESSOR AGASSIZ'S SOUTH AMERICA EXPEDITION**

III.

IN Mayne Harbour, on the western side of Owen's Islands, I had an opportunity of investigating two very interesting new genera of naked-eyed Acalephs. The locality naturally suggested appropriate names, and I called one after Captain Mayne, *Crossotoca Maynei*, from the festooned disposition of the ovaries, and the other after my old friend Owen, *Staurotoca Owenii*, from the cross-like figure of the ovaries. While I was collecting on board, Pourtales and Steindachner ascended the adjoining hills in search of glacial marks and land animals. The result of their excursion was most satisfactory. Pourtales found very well preserved glacial scratches and furrows upon wide greenstone dykes, which here intersected the rocks in every direction. Upon one such ledge the marks were divided into two distinct series, one running S.W. by W., the other crossing these S.S.W. Higher up on other dykes of the same character, the first series of marks occurred again, being perfectly rectilinear, in the same direction, and though in one instance interrupted, were renewed on the other side of the break on the same level with the same bearing. Still higher up on the same hillside he found also very distinct glacial furrows upon granite ridges, the furrows bearing S.W. by S., and finer lines again on greenstone dykes. The highest marks in the locality were some 500 or 600 feet above the sea level. Steindachner collected frogs and their tadpoles, and some insects and earthworms.

On approaching the Guia Narrows, the hills on Chatham Island are plainly furrowed in a north-westerly direction, and large boulders are seen all along upon the ridge of the range, while Esperanza Island appears in the south like a large rounded dome between two channels running N. and S. In wide channels we saw many whales and also small icebergs. The hills to the height of about 2,000 feet were everywhere distinctly *moutonnées*. Saumarez Island, opposite the mouth of Eyre Sound, and the island to the west of it, were particularly instructive. We followed the western channel, which is also the narrowest, and it soon became plain that wherever opposite shores with high walls approached near one another the glacial scratches and furrows, alike distinct, assumed an ascending direction, as is the case whenever a moving glacier meets an obstacle. That the south side was here also everywhere the strike side, was equally apparent from the facts that all these marks were either wanting or less distinct on the north side of the islands. Had any abrading agent advanced from the North, all appearances must have been reversed in these narrow channels; or they must have crossed them at right angles had the action come from East or West. Floating ice is out of the question where the furrows are not horizontal, and here in the narrowest part of the channel, west of Saumarez Island, there is a track where the scratches and furrows are distinctly ascending on the west side of the channel, and horizontally on the eastern side opposite, showing that the pressure of the ice-sheet must have been from S.E. to N.W.

Looking south, after passing Saumarez Island, the scenery appears totally different, from the fact that this is the lee side of the glacier action; and yet the channels have about the same width and bear the same relations to one another. In the narrowest channels the polished surfaces, with their scratches and furrows, are as well preserved and as distinct as in those of the Helle Platten at the Handeck in the valley of the Hassli in Switzerland. About Iceberg Sound all the mountains are beautifully rounded and *moutonnées*. That local glaciers, however, existed, and extended much beyond their present range, may be plainly seen in many of the inlets crossing the main channels in an east-westerly and west-easterly direction. It is true that general and local glacial phenomena are so interwoven throughout this region that it is at times difficult to appreciate their true connection; but there are also many localities where the difference is quite obvious. The most interesting of the places here have been well photographed by Dr. White, and may serve at some future time as illustrations of the fact described in this report.

In some places the various kinds of glacial marks were as plain as in the valleys of Switzerland, and I am surprised that travellers who have visited this region since the glacial phenomena have been so much discussed, have failed to notice them here. As in Switzerland, there seems to be a level above which the ice-sheet has never risen; at least there is a line above which the mountain ridges remain jagged and abrupt, while

* Reprinted from the *New York Tribune*, concluded from p. 231.

below their crusts the whole land is *moutonnée*. The abrasion by ice is so uniform and so general that I found it difficult to trace the direction of the abrading motion. There seemed to be nowhere a distinct lee and strike-side among the hllls. But, as I grew more familiar with the appearance of the country, I became satisfied, and succeeded in convincing others also, that the abrading movement had taken place from the south northward—or, in other words, had been connected with the climatic condition of the Southern Hemisphere In Smyth's Channel there is no possibility of mistaking the evidence. I know no more interesting locality for the study of glacial phenomena than the vicinity of Saumarez Island. It shows in the most palpable manner that glaciers only—that is, terrestrial masses of ice moving upon solid ground—can have produced these abrasions, that floating icebergs cannot have been the cause. Their direction is such, also, that no one could suppose the adjoining cordillera to have been in any way connected with the abrasion or planing of the rock, or with its grooving and furrowing. The country has everywhere a glacier-worn aspect as far as the Gulf of Pennas. On reaching Chiloe I noticed that the rounded knolls became somewhat less marked, but yet the prominent trend of the hills continued to be in a north-southerly direction. An observer not familiar with the character of glacial denudation may sometimes be perplexed by finding the seeming lee and strike-side of the rocks in a position exactly the reverse of the general one. A critical scrutiny shows that these appearances are due to a superficial disintegration, often producing a rough side of a hill or rocky ledge where the observer of glacial phenomena would expect a smooth and polished surface. This is especially the case here, where, from the character of the stone as well as from the climate, the rock peels off and splits up very readily. One must be careful not to blinded by local appearances to the more general phenomena. At the entrance of Corner's Cove, for instance, a beautiful inlet trending east-west in Messier Channel, the rocks forming the southern and northern entrance might seem at first sight to have been ground or smoothed by a local glacier, moving out of the cove in an east-westerly direction. Seen however from a certain distance, where the local disintegration is merged in the general aspect of the exposed surfaces, the direction of the main abrasion from south-northward becomes as plain as daylight. You can trace rectilinear furrows upon the knolls both south and north of the entrance of the cove, following not only the same direction, but occupying the same identical level on both sides. There can be no doubt that they were continuous. Darwin has stated that the erratics, the only part of the ancient glacial phenomena observed by him in these regions, follow everywhere the course of the main channels, and he believes this to be an evidence of iceberg action. Valuable as are his results, being, indeed, almost the only connected geological observations ever made in this region, he is mistaken in his facts upon this point. Whenever we entered an inlet opening at right angles into the main channel and intersecting several parallel ridges of hills, the *roches moutonnées* and all the accompanying glacial phenomena trended in a south-northerly direction; as they did also in the main channel. Before entering the Gulf of Pennas, in Messier Channel, we passed an opening through which seven parallel ridges could be seen on the eastern side and five toward the west, all trending mainly northward, and plainly exhibiting glacier-worn surfaces.

Moreover, the Strait of Magellan itself has a main trend from east to west, and yet there is no sign throughout the whole length of any transportation of erratics from east to west, or from west to east. Dawson has made a similar mistake with reference to Switzerland. He supposes that the erratics of the Jura were deposited by icebergs sweeping up and down the great valley of Switzerland, from east to west and from west to east. He seems not to know that the older Escher von der Linth and Leopold von Bach had already clearly demonstrated the line of their transportation across the valley of Switzerland from south to northward; and that Guyot, more than twenty-five years ago, traced the different tracks of those boulders separately through the chief valleys of Switzerland northward across the very road which Dawson would have them follow.

The erratic pebbles and boulders from the eastern to the western coast of Patagonia, judging from my observations at Montevideo, in the Bay of San Mathias, in Possession Bay, at Sandy Point, in all the ports of the Straits of Magellan which we have visited, at Shell Bay, on entering Smyth's Channel, throughout Smyth's Channel itself, and upon the shores of Chiloe, have the same character. They consist of a mixture of plutonic and metamorphic rocks, among which the hardest siliceous rocks prevail. Their geological identity is further shown by the unfailing presence of a very hard, compact, epidotic rock, never absent from these erratic materials, yet never found in place, as far as I know, over the whole extent of country through which I have traced them. You will remember that I mentioned it among the loose pebbles of San Mathias Bay; nor did I lose sight of it until we left San Carlos, at the northern end of Chiloe Island, where I found it again, and as you will soon see, in still more interesting juxtaposition. This fact is of great significance, inasmuch as it shows that the drift phenomena in this region cannot have been due to the enlargement of the present glaciers, otherwise the drift would consist mainly of the rocks in place, and differ from one locality to the other. And yet their glacial origin is unmistakable, since a considerable proportion of these pebbles and boulders are polished, scratched, grooved, and furrowed, like the erratics of the United States and of Northern Europe. It is this uniformity in the character of the drift which has led me from the first to discriminate between the glaciers as they exist, and even as they once existed in their greater extension, in short, between all the phenomena connected with local glaciers, and those belonging to what I have called the glacial period, during which the two hemispheres must have been capped with a sheet of ice of enormous thickness and extent. The equatorial limit of this ice-sheet, both in the northern and southern hemisphere, is part of the problem upon which we have thus far fewest facts in our possession. In South America I have now traced the facts from the southernmost point of the continent uninterruptedly to 37° S. latitude, on the Atlantic as well as the Pacific coast. Even here at Talcahuano, large erratic boulders and *roches moutonnées* exist at the mouth of the Biobio on the hills of Hualpen.

In San Carlos de Anend, at the northern end of Chiloe Island, I have observed a fact which introduces a new element in the study of the glacial period. The ground upon which San Carlos is built is volcanic: the promontory of San Carlos consists of a volcanic breccia, the precise age of which I had no means of determining. From its mineralogical character, it must belong to the age of volcanoes proper. Now, erratic materials, small pebbles, and large boulders, among which some exhibit unmistakable glacial polish, rest in considerable quantity upon this volcanic ground. It is therefore plain that the glacial period in this part of the world, at least, has followed the older volcanic eruptions. Among these erratic materials the green epidote which I had followed so far was still to be found. The facts observed by me at San Carlos, taken in connection with Pourtales's discovery of a great many extinct craters near Possession Bay, point to the possibility of climatic changes in this region, which, should similar facts be found elsewhere, may account for the glacial period. At all events, it shows a direct connection between the glacial period and volcanic phenomena. Since finding drift upon volcanic ground at Anend, I have been watching for erratic pebbles and boulders of volcanic rocks along the coast of Chili. Their presence near the shore would prove that the glaciers of the Andes formerly reached the sea-level, after crossing the coast ranges in the temperate, and perhaps also in the tropical zone. Thus far I have failed to find anything of the kind. Darwin assumes that the erratics of western Patagonia have descended from the Andes, and he compares the outlying islands, such as Chiloe, in their relation to the Corderillas, with the chain of the Jura in its relations to the Alps. But the erratics of Chiloe have the same character as those of the Strait of Magellan and of San Mathias Bay and the two latter, and those of the two latter can hardly be referred to this source. Neither did I see any indication of very large glaciers coming down from the Andes in a westerly direction, though I have no doubt that I shall find them farther north. Evidently we are not yet sufficiently advanced in our journey from the southern extremity of the continent northward that the influences of altitude should outweigh those of latitude in the increase and decrease of those climatic conditions upon which the extension of glaciers has depended in former ages. During the waning of the glacial period, the glaciers of the Cordillera have unquestionably been much more extensive than now, and I shall not be surprised to find, upon a more careful survey, that the glacier of Snowy Bay in Smyth's Channel and those of Eyre Sound, and perhaps some of the other parts of the Cordilleras, once crossed the main channel and reached the opposite island. But I doubt that they ever reached the shores of the Pacific Ocean. It is at all events certain that the local glaciers of the present time have never had

the power in their greatest extension, or lasted long enough to obliterate or even obscure the phenomena of the glacial period. To refer the latter to an enlargement of the present glacier is simply absurd.

This leads me naturally to some remarks about the present glaciers of South America, of which we have seen great numbers during our journey. On the whole the glaciers of these southern regions recall those of Switzerland, with which I am so familiar. And yet there are marked differences also. The form of the mountains in the Straits is not favourable to the accumulation of large masses of snow, in extensive depressions and troughs like those from which the river-like glaciers of my native country descend. There are some of that character, it is true, on the highest ranges bordering Magdalena Bay and Gabriel Channel, such as Mount Sarmiento, Mount Buckland, and no doubt also Mount Darwin, though the latter were too far out of our track to be examined. Of course, as we have approached the range of the Andes with its deeper valleys, I have seen more glaciers with an Alpine character. But most of the glaciers of the Straits are dome-like, with an indented edge marking the limits where the glacial ice moved down beyond the névé. It is already known to all students of glacial phenomena that these southern ice-fields have the same general aspect, produce the same effects, and are bordered by the same loose materials, as those of other countries. But it is interesting to find that, like the glaciers of Switzerland, those of the Straits of Magellan have had a much greater extension in past times, and have gradually shrunk to their present size and relations. I have studied these facts in one of them very carefully, choosing for that purpose a glacier occupying a gorge on the northern side of the Straits. I preferred the northern side, because a glacier moving from the north southward must necessarily have encroached upon the area covered, at a still earlier time, by the Antarctic ice-sheet moving from the south northward. By the way, our party agreed, at my suggestion, to call this glacier the "Hassler Glacier," in remembrance of the Coast Survey and of the vessel in which our trip was made. It lies in what is known as Glacier Bay, so marked on the Admiralty maps, made from the combined observations of Capts. King, Fitzroy, and Mayne.

I expected to find here all the "facts" now accepted by geologists as evidence of the former greater extension of glaciers. I looked, in other words, for polished ground and furrowed surfaces, for dykes and strata on edge abraded to one level with the surrounding rocks; for moraines on a higher level and at greater distance from the ice than those at its present terminus; for erratic glacial materials of all kinds in the trough formerly occupied by the ice, and even for the peculiar scooped surfaces, called *coups de gouge*, on otherwise level slopes of rocks. I was not disappointed. All these signs are as legible about the Hassler glacier as they are in the neighbourhood of the glacier of the Aar, or that of the Rhone, and I found, besides, what is quite as characteristic, namely, a small lake shut into its basin, and kept there by an old moraine, 500 feet above the trough of the valley. There can be no doubt that this glacier once filled the whole bay down to its entrance into the main channel of the Straits, that is, three miles beyond its present termination.

Although I made a more careful examination of this glacier than of any other, we saw many local glaciers descending from the south northward, or from the north southward through similar gorges toward the main channel of the straits, and in Smyth's Channel also we passed many glaciers moving down from the W. and E. through valleys on either side of the Channel. Along our whole course we met with like evidence that all these ice fields have had a greater extension in former times. From a general survey of these appearances, it is plain that all phenomena connected with local glaciers and their former extension are independent of those produced by the more universal accumulation of ice during the glacial period proper. They form, of course, a consecutive phase—the last phase, indeed, of the waning glacial period during its passage into the present condition of things. By what combination of circumstances the glacial period was ushered in cannot be determined as yet; but after seeing the dispersion of the drift in a south-northerly direction over this part of the South American continent, and observing the relation of the local to the general glacial phenomena, I protest anew against the confusion introduced into the subject by those who imagine that what I have called the glacial period was produced by the gradual enlargement and subsequent shrinking of the glaciers now in existence.

You see that my anticipation of finding drift phenomena here independent of any local glacial action, has been realised on a greater scale than I had dared to hope. I most earnestly wish the European geologists would make a special investigation of glacial tracks upon the summit of high table lands and of mountain ranges, where, from their position, these characteristic marks cannot be traced to other ranges in the neighbourhood rising to greater heights. The true way to study general glacial phenomena is indeed to trace them over disconnected mountain surfaces, which were once entirely covered by the great ice mantle of the glacial period. Such localities I have already pointed out in New England and in Great Britain. Several appear to exist in Scandinavia also. It is most important to discriminate between the local and the general phenomena. Until this is done, we shall never understand the true relations of the facts.

Let me state that I have not noticed anything to confirm the idea that the glaciers of the northern hemisphere have alternated with those of the southern hemisphere in their greatest extension, as is assumed by those who connect with the precession of the equinoxes the difference of temperature required for the change. The abrasions of the rocks seemed to me neither more nor less fresh in one hemisphere than in the other; nor do the veins of molten rocks rising above the surrounding disintegrating rocks stand out in a more or less bold relief in either case. However astronomical causes may have been connected with the climatic conditions of the world, I see no reason for believing, from any facts I have observed, that alternations of temperature in the northern and southern hemispheres have ever been the primary and efficient clause of glacial phenomena. The more I consider these phenomena, the more am I satisfied that ice has been the great paring machine by which rocky surfaces have been fashioned. The great geological agents are not alone fire and water, as is universally admitted. Ice has had a great share in the work, and I believe this also will sooner or later be recognised with equal unanimity. After having traced what seems to me palpable evidence of an ice mantle over-spreading once the southern part of this Continent, the effect of which I have seen from Monte Video on the Atlantic to Talcahuano on the Pacific coast, the question naturally arises how far the southern extremity of Africa, as well as New Zealand and Australia, were involved in the extension. I hope I may live to see younger naturalists investigate these regions with the same object. I believe that whenever such an investigation is undertaken by a competent observer it will be found that over and above all local glacial phenomena, and still by side with them, there is also evidence of a southern circumpolar glacial agency.

You may think that I have given you too many details. I have done so purposely that no one may accuse me of basing theories on imperfect observations. I am well aware that my results will be questioned, and I shall be thought fanciful by geologists of all schools, as I have been at every step of my glacial researches. But an old hunter does not take the track of a fox for that of a wolf. I am an old hunter of glacial tracks, and I know the footprint whenever I find it.

While I was transcribing this report, Pourtales came in with the statement that he had noticed the first indications of an Andean glacier in this vicinity. I have visited the locality twice since. It is a magnificent polished surface, as well preserved as any I have ever seen upon cold glaciated ground, or under glaciers of the present day, with well marked furrows and scratches. Think of it! A characteristic surface indicating glacier action in lat. 37° S., at the level of the sea! The place is only a few feet above tide level upon the slope of a hill on which stand the ruins of a Spanish fort, near the fishermen's huts of San Vicente, in the Bay of San Vicente, which lies between Concepcion Bay and the Bay of Arauco. Whether this polished surface is the work of a glacier descending from the Andes to the sea shore or not I have not yet been able to determine. I find no volcanic pebbles or boulders in this vicinity, which, after my experience in San Carlos, I should expect all along the shore if the glaciers of the Andes had descended to the level of the ocean in this part of the country. The erratics here have the character of those observed farther south. It is true the furrows and scratches of this polished surface run mainly from east to west; but there are some crossing the main trend at angles varying from 20° to 35°, and running south-east and north-west. Moreover, the magnetic variation is 18° 3′ at Talcahuano, April 23, the true meridian bearing to the right of the magnetic. I shall soon know what to make of this, as I start to-morrow for the interior to go to Santiago and join the ship

again at Valparaiso. The trend of the glacial scratches in San Vicente reminds me of a fact I have often observed in New England near the sea shore, where the glacial furrows dip to a considerable extent eastward toward the deep ocean, while farther inland their trend is more regular and due north and south.

While in Talcahuano we have made very extensive collections of littoral marine animals, so that we now have an excellent basis for comparison with the results of the deep-sea dredgings, which Pourtales is going to make between this and Juan Fernandez. I shall make similar collections in Valparaiso, and in order to do so in the short time allowed me I take Dr. Steindachner with me.

I had almost forgotten to say that I have obtained unquestionable evidence of the cretaceous age of the coal deposits of Lota and the adjoining localities north and south, which are generally supposed to be tertiary lignites. They are overlain by sandstone containing baculites. I need not adduce other evidence to satisfy geologists of the correctness of my assertion. I have collected myself a great many specimens of these fossils in beds resting upon coal seams. L. AGASSIZ

To Prof. Benj. Peirce, Superintendent U.S. Coast Survey

ANATOMY

The Placenta of the "Tamandua" Ant-eater

To the last number of the *Annales des Sciences Naturelles* M. Alphonse Milne-Edwards contributes an important paper upon the structure of the placenta of the "Tamandua" ant-eater (*Tamandua tetradactyla*)—important, at all events, to those who, with us, reckon the *Bruta* as one of the most interesting, but, at the same time, spite of Dr. Gray's most elaborate but somewhat intricate arrangement,* least satisfactorily classified groups of the mammalian class.

M. Milne-Edwards, after mentioning his countryman Lenou's division of the ant-eaters proper into three genera—viz., the terrestrial *Myrmecophaga*, and the *Tamandua* and *Cyclothurus* with arboreal habit and correlated prehensile tail, draws attention to the fact that as yet no opportunity has been had of examining the fœtal envelopes of the great ant-eater (*M. jubata*), that the placenta of the two-toed genus *Cyclothurus* is described in the *Leçons* as a kind of concave disc, but it has not been determined to what extent the walls of the ovum are occupied by the specialised vascular tuft.

The fœtal specimen of the Tamandua examined by M. Milne-Edwards was derived from a female which had come from New Grenada. The placenta is described as situated at the end of a pretty long and cylindrical umbilical cord, in which the vessels did not take any special course. It occupies a considerable extent of the ovum, and though circular and made up of but a single lobe, is of a form too convex (*trop bombée*) to come under the category of the so-called "discoidal" placenta. It would be, in fact, more correct to term it a "placenta discoïdale envahissante." It is not made up of single villosities, such as the placenta of Pachyderms, of Camels, and of Tragulines, for the vascular tufts are much crowded together, especially at the central portion, so as to give the organ at this point a spongy appearance. The edges are sharply defined, leaving that portion of the chorion smooth which corresponds to the neck of the uterus. The vascular vegetations do not, in their disposition, remind one in any degree of the reticulated fold and the honeycombed aspect described by Sharpey as occurring in the placenta of the Pangolin. Towards the centre there appeared to be *débris* of the uterine tissue, suggesting the existence of a "decidua," but on this point there is, unfortunately, no certainty. No trace of an allantois was discovered, from which it is concluded that this fœtal appendage must be at least greatly reduced in size. Owing to the long immersion of the animal in alcohol, it was impossible to dissect out the laminæ of the envelopes of the ovum, or the factors of the umbilical cord. The internal surface of the chorion is stated to have been perfectly smooth, and not to have presented any of the protuberances which have been observed on that of the Unau.

If the placenta of the Tamandua, remarks M. Milne-Edwards in conclusion, be compared with that of some other members of the groups into which the *Edentata* have been subdivided, we shall not fail to be struck with the considerable differences which seem to exist in the structure of this organ in the different members of a group considered by zoologists as constituting but a single order.

The figures given by Carus (*Tabulæ Anatomiam comparativam illustrantes*, Pars. iii., Pl. ix., fig. 15), of the placenta of the Unau, do not, in the eyes of M. Milne-Edwards, resemble that of an ant-eater, of any other kind of Edentata, or even of any Mammal.* According to Prof. Owen's description of the placenta of the "Tatou,"—a general term for the Armadilloes—this organ resembles, at least in general form, the discoid placenta of an Insectivore, while that of the Pangolin, described by Huxley "Introduction to the Classification of Animals," p. 98), after Sharpey, presents a third mode of organisation not less distinct from the preceding. The Tamandua, in fine, thinks M. Milne-Edwards, offers an arrangement which, though differing in some particulars from that existing in *Cyclothurus*, seems to be only an exaggeration.

M. Milne-Edwards concludes by putting the pertinent question—"are we to regard this diversity in the order *Edentata* as of less importance than that accorded by naturalists to like variations in the fœtal envelopes in other groups of the class Mammalia? or are we to conclude that the different zoological types included by zoologists under the name *Edentata* have less affinity between them than is generally believed, and might be represented in our system of classification by division of a higher character." M. Milne-Edwards inclines—and in this we feel also disposed to follow him—to the latter proposition, and proposes at some future time to discuss and enlarge upon the same.

J. C. G.

* "Revision of the Genera and Species of Entomophagous Edentata." Proc. Zool. Soc., April 11, 1865.

METEOROLOGY

On a Meteoric Iron lately found in El Dorado County, California †

FOR my knowledge of the meteoric iron of El Dorado Co., I am indebted to Mr. Alfred Stebbins, librarian of the Mercantile Library Association of San Francisco. A letter from him, dated April 26, inclosed a few grams of turnings obtained during the separation of a slice of the mass destined for the collection of the geological survey now in progress under the direction of Prof. Whitney.

The mass is described by Mr. Stebbins as having the size and shape of a man's head. It was found in a field, and, as usual, was first taken to a blacksmith's shop, where it was soon found to be an unmanageable subject for working, and hence, fortunately, found its way into scientific hands. Its surface possesses the indentations common to these bodies—the crust or coating being partially oxidised. It weighs eighty-five pounds.

I find the turnings to have a specific gravity of 7·80, which may perhaps be a trifle above what the mass possesses, as it is presumable that the turnings have suffered a slight condensation in the process of separation.

The fragments sent are free from all traces of sulphur. A single analysis upon one gram has afforded me,

Iron	88·02 per cent.
Nickel	8·88 ,,
Insoluble, consisting of a mixture of Fe_2O_3 and FeO, with minute silvery particles of supposed phosphor-metals (Schreibersite)	3·50 ,,

The amount of material at command was too small to search for the other metals commonly found in meteoric irons.

† By Charles Upham Shepard, Sen., Massachusetts, Professor of Natural History in Amherst College. Reprinted from the Amer. Jour. Science and Art.

SCIENTIFIC SERIALS

Le Moniteur Scientifique, April, 1872. This number commences with a translation of a paper by M. Mayer, on alcoholic fermentation, and on the nutrition of the yeast plant, and is followed by a long dissertation on scents, according to recent discoveries in chemistry and physiology, by M. Papillon. The next is a translation of a lecture by Dr. Hofmann on organic chemistry and therapeutics. The author points out the numerous discoveries which have advanced the science of

* Rapp seems to have made more out of Carus's plates than did M. Milne-Edwards, for he states (*Anatomische Untersuchungen über die Edentaten*, 2te Aufl., p. 103. Tübingen, 1852), that according to the said anatomist, the placenta in this animal is made up of several *cotyledons*, which are from half-an-inch to an inch in transverse measurement.

medicine, showing also clearly that to the remarkable and rapid development of this branch of chemistry during the past few years, is due the more scientific and complete system of therapeutics now obtained. He also points out in how many instances medicine has derived immense benefit from the discoveries of new compounds, which at first seemed only to possess a theoretical interest to chemists.—A paper on Anthracene and its derivatives, follows, by M. E. Kopp. It treats, in the first instance, of the formation from anthracene of dichloranthracene, and on the action of sulphuric acid on this body. This yields an acid called disulphodichloranthracenic, and which possesses in dilute aqueous solutions a most intense and beautiful fluorescence in the blue end of the spectrum. The salts of this acid, the soluble ones of which exhibit the same property, are here described. This acid, by simply heating or by the aid of oxidising agents, is converted into disulphanthraquinonic acid. Dibromanthracene may be made to yield an analogous series of compounds, which in some instances are also beautifully fluorescent. Disulphanthraquinonic acid, heated strongly with a caustic alkali, is converted into alizarin, which is identical with the colouring matter obtained from madder root. In this paper a description is given of the methods proposed by the various patentees in the matter, thus forming a tolerably complete history of this new branch of industry. Some space is also occupied with a discussion as to the state in which alizarin occurs in garancin; the balance of evidence seems to show that it is glucoside, which may be called ruberythric acid, and which by the assimilation of two equivalents of water, forms alizarin and two equivalents of glucose.—M. Blossum contributes another part of his memoir on Caoutchouc and Gutta-percha considered from a chemical standpoint. In this article he discusses the vulcanisation of caoutchouc, and the manufacture of the softened variety, giving Parkes' process for vulcanising, which consists in exposing the articles to the action of a mixture of carbonic disulphide and chloride of sulphur, after which treatment they are boiled in dilute soda solution; the same communication also deals with vulcanite and the vulcanite employed in dentistry.—Dr. Benrath has a paper on the Chemical Theory of Devitrification. The author has made numerous analyses which show reason to think that a part of devitrification is due to a separation of silica, which was previously held in solution by a silicate. The number finishes with a critical analysis by M. F. Papillon on the recent work of M. Ritter, "On the Relation between the Modifications of the Blood Corpuscles and the Modification of the Excretions," which appears to be a very valuable work.

THE *Journal of the Franklin Institute* for June contains, besides papers to which we have specially alluded, continuations of papers previously commenced, and the usual Editorial items and novelties, the Report of the Committee of Judges upon the Trial of Steam Boilers, American Institute, 1871; experiments on various coals of the Carboniferous and Cretaceous periods, an article on the gunpowder pile driver, by F. C. Prindle, C.E., with a plate; one on the great fires of 1871 in the North-west, by Prof. J. A. Lapham; and one on the utilisation of the light petroleum oils, by W. H. Wahl.

THE *Archives des Sciences physiques et naturelles* of Geneva, No. 174 for June 15, commences with an interesting article by Alph. De Candolle on the question whether modifications in vegetable species are caused by prolonged influence of climate. For this purpose he obtained from remote localities in Europe, Moscow, Edinburgh, Montpellier, and Palermo, seeds of widely-distributed plants, and sowed them in the same soil and at the same time in Geneva. Although the series of experiments was not sufficiently extensive for the conclusions to have any decisive value, the general result was that the seeds obtained from the more northern localities germinated somewhat earlier than those grown in more southern latitudes, and the plants resulting from them also came to maturity somewhat more rapidly, a difference which was more decidedly manifested in the second generation. If these results are confirmed by a more complete investigation, they will be of considerable importance in the question of acclimatisation.—The only other original articles in this number are by M. Ador on phtalyl, the radical of phtalic acid, and on the increase of intensity of voltaic induction currents, by Prof. Lemström.

IN the *Journal of Botany* for July, Dr. Braithwaite continues his series of papers, "Recent Additions to our Moss Flora," this instalment being illustrated by two plates, of *Splachnobryum Wrightii*, and several species of *Grimmia*; and the Rev. Eugene O'Meara contributes further researches on the Diatomaceæ. Two useful local lists of flowering plants are also given, by Dr. M. M. Bull, of the Island of Sark, and by Mr. J. F. Duthie, of the Islands of Malta and Gozo.

THE *Quarterly Journal of Science* for July contains four original articles. The first is a short one, entitled "The Music of Speech," by the Rev. R. W. Higgs, consisting chiefly of an epitome of "The Philosophy of the Human Voice," by Dr. James Rush, of Philadelphia, who claims to have shown that "the sentiment and the logic of our speech have a distinct mode of expression apart from the subject matter." The article is interesting; but we must protest against the introduction into our language of such barbarisms as an "orotund," compounded from *ore rotundo*, and a "vocality," to express a vocal sound.—The second article is an able advocacy of the advantages of a uniform decimal system of weights and measures, compared with our present multifarious scales.—Mr. R. A. Proctor on "The Construction of the Heavens" gives an outline of the different theories which have been started as to the constitution of the sidereal system, especially those of the two Herschels and the elder Struve, and argues in support of his view that all the nebulæ hitherto discovered, whether gaseous or stellar, exist within the limits of the sidereal system.—The last article is by Captain Oliver on "Mediæval and Modern Ordnance and Projectiles compared."—The remainder of the number is taken up with notices of scientific works and reports of progress in physical and mechanical science.

Revue Scientifique, Nos. 51-53, and 2nd series, 2nd year, Nos. 1-4.—The report of M. Claude Bernard's course of lectures at the Collège de France on experimental medicine is brought to a conclusion with the close of the volume. Further reports are given of papers read at the Rostock meeting of the Association of German naturalists and physicians. M. L. Dumont has an article on civilisation considered as accummulated force. Report of M. Milne-Edwards' lecture on the Classification of Mammalia, being the introduction to his course at the Museum of Natural History on Zoology (Mammalia and Aves).—The new volume commences with a translation of Sir John Lubbock on the Origin of the Family. Sir W. Stokes's lecture before the University of Dublin on Public Medicine in Germany is translated. Of courses of lectures in France, we have M. de Quatrefage on the origin of the Prussian race at the Museum of Natural History; M. A. Chauveau, before the Society of Medical Sciences at Lyons, on the general physiology of virus; and M. Georges Ville, at Vincennes, on Chemical Manures. No. 4 contains an interesting sketch of the history of the Observatory at Greenwich, a sequel to the history of the Paris Observatory in an earlier number. We have also the usual amount of reports of the proceedings of foreign scientific societies.

SOCIETIES AND ACADEMIES

LONDON

Entomological Society, July 1.—Prof. Westwood, president, in the chair.—Mr. Jenner Weir exhibited two examples of a rare British lepidopterous insect, *Agrotera nemoralis*, captured by him in Abbot's Wood, Sussex.—Mr. Meldola exhibited varieties of several species of British Lepidoptera, and an example of *Leucania vitellina*, taken at Brighton in 1869.—Prof. Westwood exhibited several remarkable coleopterous insects sent from Ceylon by Mr. Thwaites; also, from the same locality, banded cocoons of a species of *Ichneumonidæ* attached to threads nearly three inches long; and an illustration of the habits of some species of moth which cuts out large oval pieces from the leaves of *Citrus* and forms therewith a moveable flattened tent, beneath which it lives and undergoes its transformations.—Mr. Müller exhibited portions of the leaves of *Pteris aquilina* from Weybridge, attacked by three species of dipterous larvæ.—Mr. Dunning called attention to a letter in NATURE from Dr. Leconte concerning the parasite of the beaver on which Prof. Westwood had founded the order *Achreioptera*. Dr. Leconte considered the insect pertained to the *Coleoptera*. Prof. Westwood dissented therefrom.—Mr. Dunning also read extracts from an article in the same journal by Mr. Moseley, concerning the sound produced by the Death's-head Moth, in which the writer maintained that the noise proceeded from the proboscis, and was caused by the expiration of air.—Mr. Lewis brought to the notice of the meeting a circular addressed to entomologists (with a list of signatures appended

thereto), urging them to ignore the re-instatement of forgotten names until such time as the method of dealing with them shall be settled by common agreement.

Meteorological Society, June 19.—Mr. John Tripe, president, in the chair. At the ordinary meeting, which preceded the Anniversary Meeting, Captain Toynbee exhibited charts showing the results already obtained in the meteorological office by the discussion of the observations for a portion of the North Atlantic, comprising ten degrees square, for the first four months of the year. The district extends from the Equator to 10° N., and is bounded by the meridians of 20° and 30° W. He explained the variations in the several elements from month to month which had been rendered visible by the minute discussion to which the materials had been subjected, and pointed out the importance to navigators of the precise information as to winds, &c., now presented to them. He stated that the meteorological committee intended to distribute copies of the chart for January, in order to elicit opinions as to the proposed method of publication. At the Anniversary Meeting which followed, the Report of the Council was read. In the Report the Council stated that as the number of Fellows showed a diminution from 340 to 314, it had been deemed advisable to introduce a change into the management of the society. Accordingly a room had been taken at No. 30,'Great George Street, Westminster, and an assistant secretary appointed to attend there daily. The gentleman selected is Mr. W. Marriott, formerly engaged at Greenwich Observatory, and he entered upon his duties on May 1st. It is hoped that by these means the business of the Society will be conducted in a more satisfactory manner.—The fifth volume of the Proceedings being now complete, the Council have increased the size of the publication to royal 8vo, so as to allow of the binding up of the Registrar-General's Quarterly Returns with the Proceedings of the Society. The new series will be entitled the "Quarterly Journal of the Meteorological Society," and will be edited by a committee of the council, Mr. Glaisher having resigned the editorship. The Report concluded with the usual obituary notices of deceased Fellows.—The president then delivered an address, in which he said that he would allude briefly to some facts connected with meteorology and its correlations with sickness and death. The careful daily record of meteorological observations made with standard instruments was commenced at many stations some time before the compilation of mortality returns, in the office of the Registrar-General of Births and Deaths, so that the mortality tables of the metropolis can safely be compared with the Greenwich returns, and for extra-metropolitan localities with those supplied by any of our observers. He had carefully compared the Greenwich observations for some years with those made by himself at Hackney, by Mr. Burge at Fulham, Mr. Symons at Camden Town, and Mr. Heywood in the City, and ascertained that the mean daily temperature did not vary on an average more than half a degree, although the maximum and minimum observations differed very considerably. He had therefore used the Greenwich tables in all his comparisons between the rate of death from different diseases and varying states of the weather. A number of valuable results have already been obtained as regards the course of epidemics, the influence of high and low temperatures on the public health, and, to a less extent, of different hygrometric conditions of the air. Dr. Hoskins long since (about 1855) wrote a valuable paper on the "Correlation between Meteorological, Medical, and Agricultural Science;" and he (the president) commenced a series of essays in 1848 on the influence of variations in the temperature, moisture, weight, and electricity of the atmosphere on the death-rates of scarlet fever and other epidemic diseases. The Manchester Medical Association, Dr. Ballard, and others, have written on the effects of variations of temperature on the health of the people. The whole of the writers have arrived at tolerably uniform conclusions, viz., that very cold and very hot weather induce an increase in the number of cases of disease and of deaths, and that a temperature between 55° and 65° is most beneficial to health in this country. He stated many years since, in one of his reports, that a cold wet summer always coincides with a less amount of sickness and fewer deaths than a hot dry summer. It is somewhat singular that, whilst very cold weather causes a great increase in the sickness and mortality of any given population, and especially amongst the very young and very old, the increase should extend to almost all diseases. It is true that the chief sickness and mortality are caused by affections of the lungs; but there is also a greater number of cases, although not of deaths, even from diarrhœa. Thus the rate of death, in weeks having a mean temperature of less than 35°, was nearly 45 per cent. greater than in weeks having a temperature of 60° to 65°; and in weeks having a mean temperature above 65° the average rate of death was about 30 per cent. more than in weeks having a mean ranging between 60° and 65°. The range of temperature in this country which is the best for health is so small that every one should use reasonable care when the mean is above or below the standard; at the same time we must not forget that extremes are always injurious, whatever the average may be. This is especially the case as regards diarrhœa, for the mortality from this cause, with a continuance of the mean above 65°, is at least twenty times as great as at 40° to 45°. The comparison between temperature and epidemic diseases has led to the important facts that, as regards small-pox, it produces the smallest number of deaths as soon as the daily mean reaches 62°, and has continued a short time at that degree of heat, which is usually about the end of July or early in August, and does not become so fatal again until the mean temperature has sunk for a short time below 54°, which is generally about the end of September. This is not quite invariable, as it varies somewhat in epidemic and non-epidemic years. The fatality from small-pox increases as the temperature sinks below 54°, until the middle of January, when the lowest average temperature is ordinarily reached, viz., about 35·5°. Scarlet fever, on the other hand, is at its lowest point from the middle of March to the end of the third week in April, when the daily mean varies between 41·5° and 47·5°, from which it gradually increases in fatality as the weather gets warmer, but not quite at an equal ratio, until the end of October or early in November, when the impetus apparently given to it by the warm weather has ceased, and the mortality declines. He had very carefully examined the influence of other meteorological elements on the disease, and find all of them to be almost inert as compared with that of temperature. How far the temperature, moisture, and electricity of the atmosphere are concerned in exciting diseases to become epidemic, we are unable at present to state; but the periodicity which epidemics exhibit is opposed to these being the chief causes. Thus small-pox, scarlet fever, and measles, have a very decided tendency to become epidemic in the metropolis every fourth year, whilst there is no single meteorological element or combination of elements which has so decided a periodical excess or minus of its average amount. A record of correct observations extending over many more years than we now possess, and a close comparison of these with correct returns of sickness and death in any sufficiently large area will, he does not doubt, enable statisticians to determine the precise relations which exist between the state of the public health and meteorology. There is at present, however, so little known of the varying electrical conditions of the air (at least so as to measure the changes) that it is perhaps somewhat premature to express this opinion.

BOSTON

Lyceum of Natural History, November 13, 1871.—Dr. H. Endemann read a paper "On Meat and the Methods of Preserving it," in which he described the extract of meat made according to Liebig's process, and stated that its value is overestimated, as experiments have shown that the ashes of the extract are as nutritious as the extract itself. No organic substance has been found that will produce the effects of extract. He then described the process of salting meat, and showed that the salts used, as well as any water employed subsequently to freshen the meat, remove a large part of the extractive salts, leaving it difficult of digestion. Smoking depends on the carbolic or cresylic acid contained in the smoke, by which the albumen and fibrin are coagulated, hence the meat is not readily digested. One of the best processes for preserving meat is enclosing it in air-tight cans, but this often fails on account of mechanical difficulties. He proposed to preserve meat by cutting it into slices and drying it in a hot-air chamber, at a temperature below 140° F., which may be done within two hours. This dried meat is then ground in a mill. The fibrin and albumen are not coagulated, and will take up water. The apparatus used in the preparation of the dried meat, and its applications for soup, solid dishes, and for invalids, was also described.

November 20.—Prof. B. N. Martin, vice-president, in the chair. Prof. T. Egleston exhibited five crystals of Diamond and one of red spinel, from South Africa. Two of the diamond crystals showed the cleavage parallel to the octahedron, two were curved hexoctahedra. The fifth was a cube one quarter of an inch square, weighing 0·666 gms. The cube is a twin by interpenetration, and shows the faces of the rhombic dodecahedron

on both crystals. The cube faces are all striated in the direction of the diagonals of the faces of the cube, and show, consequently, the tendency toward the octahedral form. The spinel was perfectly transparent, of a beautiful ruby colour. Its form was that of a hemitrope octahedron. —Prof. D. S. Martin exhibited specimens of a clay containing recent shells, from a deposit which had been the bed of a lagoon within quite a modern period, near the town of Lewes, Delaware. The shells are in very perfect preservation, though the epidermis is nearly gone, and the texture is becoming fragile and chalky. The principal species are *Sanguinolaria fusca*, *Nassa obsoleta*, and *Modiola plicatula*, of which the first two are now living on the beaches outside, and probably the last also. These specimens give an excellent illustration of the mode of formation of many of our fossiliferous clays and marls. The deposit may, perhaps, have value as a fertiliser. He also gave some description of the very remarkable sand-dunes or moving hills at Cape Henlopen, a mile or two east of Lewes. The sand brought down by the Delaware River accumulates at this point, and when thrown up on the beach, is taken in charge by the heavy east winds, and carried inland in a great line of drifting hills, which rises in a very long and gentle slope on the windward side, and falls off abruptly from the crest on the leeward, as is usual in wind drifts. The whole surface of the windward side is studded with the tops of dead tree trunks, the remnants of a pine forest, overwhelmed by the advance of the hill. The crest seems steadily approaching the lighthouse keeper's dwelling, and will, probably, necessitate its removal in the course of some few years. Prof. A. M. Edwards said the specimens just exhibited are of considerable interest, as they show very nicely the mode in which certain stratified rocks containing fossils are evidently formed. Under certain circumstances, say when formed in a locality like the tropics, where animal life abounded, and the mollusca especially occurred in large quantities, so that calcareous matter would accumulate, such a deposit might become, in time, converted into a limestone in which the forms of the enclosed shells and other organic remains would be preserved in a more or less perfect manner. If, on the other hand, calcium compounds were not present in abundance, but the particles of the deposit thrown down should consist of coarse and for the most part siliceous sand, sandstone, also enclosing fossils, would eventuate. But to me, the material of which the deposit exhibited consists, and which encloses the well-preserved remains of mollusca, is of more special interest, as this is the third time that such a formation has come under my observation, and I have studied one of these deposits with some care, as it proved to be, for the most part, made up of the siliceous skeletons of Diatomaceæ, to the consideration of which, both recent and fossil, I have devoted many years. All cases of marsh inversion are of interest to geologists, and the opportunities they present the microscopists of obtaining specimens for study makes them doubly attractive. The Hoboken and the Cape Henlopen specimens will be examined and reported upon hereafter.—Mr. Jas. Hyatt made some remarks on the occurrence of some plants in the vicinity of New York city. The cotton thistle, *Onopordon*, may be found at Fishkill Landing, on the Hudson River, a short distance from the railroad station, at the office of the iron works. He was able to secure flowers there for Dr. Torrey's collection. The plant has maintained itself there for several years. *Gentiana quinqueflora* abounds in South-Eastern Duchess County, and from thence he was able to furnish for Dr. Torrey's collection the only specimens from this State. *Viola rotundifolia* abounds at Weehawken, N.J., at the foot of the Palisades, west of the Ferry dock.

PARIS

Academy of Sciences, July 15.—M. de Pambour presented a further note on the reaction water wheel.—An important memoir by MM. Jamin and Richard on the cooling of gases was read.—M. A. Thenard described an apparatus for subjecting gases and vapours to the action of electricity.—M. Gaiffe described a new and cheap form of battery, consisting of a vessel in which are immersed a rod of lead and a rod of zinc, the former reaching the bottom, which is covered with a layer of aluminium; the exciting fluid in water containing 10 per cent of hydrochlorate of ammonia.—M. H. Sainte-Claire Deville communicated a note by M. J. M. Gaugain on the induction currents developed in M. Gramme's machine.—M. Faye presented a note by M. Respighi in reply to some criticisms of Father Secchi, upon his observations on the constitution of the sun.—M. J. A. Broun read a second note on the simultaneity of barometric variations between the tropics.—M. H. Tarry presented a note on the magnetic currents and solar explosions, which accompanied an aurora borealis observed on July 7. Upon this paper MM. C. Sainte-Claire Deville and Tissot made some remarks.—M. C. Sainte-Claire Deville also presented a note by M. J. Gay, describing cloud-shadows observed by him at the Grande Chartreuse, with reference to a recent balloon observation by M. Tissandier.—M. H. Sainte-Claire Deville communicated a note by M. A. Houzeau on the instantaneous oxidation of alcohol, in which the author described the conversion of alcohol into acetic acid and aldehyde by the direct action of ozonised oxygen.—M. C. Bernard presented a note by M. N. Gréhaut on the quantitative determination of urea by means of Millon's test and the mercurial pump.—M. C. Dareste communicated his discovery of the presence of starch in the young of the European fresh-water tortoise (*T. europæa*).—M. Des Cloizeaux read a further note upon amblygonite and montebrasite.—M. Daubrée reported upon a collection of minerals from Chili, offered by M. Domeyko to the School of Mines at Paris.—M. Sainte-Claire Deville read a paper on the absence of Combustible Gases in the emanations from the Caldeira of Furnas in St. Michael's. The same gentleman communicated an extract from a letter by M. H. de Saussure, giving an account of his observations upon the late eruption of Vesuvius in April of the present year, and made some remarks upon its contents. He also presented a note by M. Gorceix on the state of Vesuvius, and of the gaseous emanations of the Phlegræan fields in the month of June, 1869.—M. Milne Edwards presented a note by M. Wetelet upon the genus *Ovulites*, which the author regards as belonging to the Polyzoa. He describes a new form under the name of *Ovituba margaritula*. M. Milne Edwards also communicated a note by MM. A. Grandidier and L. Vaillant on the fossil crocodile of Ambouli nt-satre in Madagascar, which they regard as a new species, and name *Crocodilus robustus*.

BOOKS RECEIVED

ENGLISH.—The Thanatophidia of India: J. Fayrer (J. and A. Churchill).—Qualitative Analysis by Dr. C. R. Fresenius, translated by A. Vacher, 8th edition (Churchill).—The Battle of the Gauges renewed, 1872: R. T. Fairlie (E. Wilson).—Perspective, or the Art of Drawing what one sees: Lieut. W. H. Collins (Longmans).

AMERICAN.—Description of the *Balænoptera musculus* in the possession of the Boston Soc. Nat. Hist.: T. Dwight (Boston Soc. Nat. Hist.).—Embryological Studies on Hexapodous Insects: A. S. Packard, jun. (Peabody Academy of Science.)

FOREIGN.—Die Pflanzen Galiziens u. der Bukowina: J. A. Knapp.—(Through Williams and Norgate).—Révue d'Anthropologie, 1872, No. 1.—Zeitschrift der Biologie, 8 Band 2 Heft.—Ueber algenartige Einschlüsse in Diamanten u. über Bildung derselben: Dr. Göppert.

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