THURSDAY, AUGUST 6, 1874

HITZIG v. FERRIER.

IN a German contemporary, *Das Ausland*, for July 6, the editor has a note on the comparative value of the researches of Drs. Hitzig and Ferrier, in which he animadverts severely on English journals, specially mentioning NATURE, because they have not taken up the subject, and shown that all the credit of the discovery of the localisation of the cerebral functions is due to Fritsch and Hitzig, and that Ferrier has only followed up their line of investigation without giving them due credit for their work.

It is evident that the editor of *Das Ausland* is not a constant reader of this journal, for if he were he would not have stated that we have taken no notice of the work of Fritsch and Hitzig. We believe that we were the first, or, if not the very first, among the first in this country to draw attention to the researches of the able German physiologists, when we gave an abstract (NATURE, vol. viii. p. 467) of an excellent report by Dr. Neftel in Dr. Brown-Séquard's Archives of Scientific and Practical Medicine (New York), upon some of the recent researches in Neuropathology, including an account of the investigations of Fritsch and Hitzig, Gudden, Nothnagel, and others Our object in publishing that abstract was to enable our readers to form their own opinion on the subject.

The facts, as far as they affect the question at issue, are these :—It had until quite recently been thought that the cortical substance of the cerebral hemispheres was devoid of irritability, being the seat of mental phenomena. Hitzig in 1870* found that contraction of the eye-muscles in man can be produced by galvanic excitation of the hemispheres. This discovery led Hitzig, and with him Fritsch, to commence a series of investigations on the lower animals, with very feeble galvanic currents ; and as the results of their experiments they were able to state that the excitation of distinct and limited portions of the anterior convex portion of the brain produces movements of certain groups of muscles on the opposite side of the body, the following new facts being established. †

1. The indication of the points for the irritation o almost all the muscles.

2. The proof that after the irritation with the induced current, secondary movements appear.

3. The proof that epileptiform fits may follow the application of this current.

4. The proof that the loss of blood destroys the excitability of the brain.

In the "West Riding Lunatic Asylum Medical Reports for 1873" (vol. iii.), Dr. Ferrier published a paper containing the results of experiments on various animals, in which the cerebral surface was excited by the interrupted current. This physiologist also localises the seat for the stimulation of different sets of muscles, in many cases going more into detail than do Fritsch and Hitzig ; the method of stimulation which he adopts—the interrupted current—being one which the German authors had rejected as unsuitable.

What Dr. Hitzig complains of is, that in the original paper above referred to Dr. Ferrier only mentions his name and that of Fritsch in connection with the first of the four above-stated propositions, thereby retaining for himself the whole credit for the other three. In a review of Hitzig's recent work, published in the *London Medical Record*, Dr. Ferrier—writing in a spirit which we hardly think suitable to the occasion, and regretting that he has not indicated some *minor* coincidences between his observations and those of Fritsch and Hitzig, "on account of the construction which Hitzig puts upon them"—acknowledges, we are glad to see, that there are several points which the two German physiologists recorded, and which he had previously failed to credit them with. Nevertheless, he still seems to fail to realise that his true relationship to the original discoverers of the method he employs is that of disciple to master, and not that of an equal, as far as the subject itself is concerned.

To show that due credit has not been given in the right direction, it may be mentioned that in this country the localisation of the cerebral functions has thus become associated with the name of Dr. Ferrier, so much so that in his recent work on "Mental Physiology," Dr. Carpenter, in an appendix, has a chapter on the subject, in which the names of Fritsch and of Hitzig are not even mentioned, the title being "Dr. Ferrier on the Brain." Now, Dr. Carpenter, in this chapter, gives a kind of abstract of Dr. Ferrier's paper above referred to, and it is impossible that an author of so much experience could have omitted even the mention of the true workers-out of the method and facts he recounts, unless these facts and methods had been brought before his notice in a manner which does but very insufficient justice to their originators.

The same cause has probably led most Englishmen to associate the name of Dr. Ferrier so intimately with the doctrine. The question is, Has this author given due credit to Hitzig and to Fritsch, whose careful series of experiments—called into existence by the logical working-out of an opportunity which many less competent observers would have let pass unheeded—gives them full reason to expect all the honour due to the discoverers of the localisation of the cerebral functions ?

Dr. Ferrier may remark that the work of Fritsch and Hitzig was public property for three years before he published his investigations, and that in his paper he assumes that the reader was acquainted with the foreign literature on the subject. Other physiologists have acted on that assumption, and have received credit for a depth of thought and power of observation which they have not deserved ; and this experience should make all authors more than ordinarily careful, when continuing the investigations of other than their own countrymen, to state clearly and fully all that has been previously done by foreigners in their particular line.

Dr. Hitzig seems much aggrieved at the little credit given him by Englishmen in comparison with that which has been bestowed on Dr. Ferrier ; but he may rest assured that all working physiologists fully appreciate the value of his methods and his facts, and that their conviction that his position is impregnable is the only reason why they have not thought it necessary publicly to state in print what time will prove to all, namely, that he was the undoubted discoverer of the important doctrine with which his name is so intimately associated.

* Du Bois-Reymond's *Archiv.*

† See *London Medical Record*, vol ii., p. 448.

A MARINE AQUARIUM FOR INLAND STUDENTS

A COMMITTEE of the British Association was last year appointed to make some inquiries into the best mode of preserving delicate marine organisms during life, the question being whether the injection of a fine stream of air into the tank in which they are living would be as efficient as, or better for this purpose than, a jet of running water. Dr. Hubrecht, of the Hague, has furnished Mr. Ray Lankester with the following account of a contrivance worked with great success by Prof. Selenka, who has recently given up his chair at Leyden, on account of malaria, and taken a similar post at Erlangen.

A point of the greatest importance for those who study marine animals and who want to keep them alive for a certain time, is the way to keep a limited supply of sea-water fresh and in good condition so as to sustain life in the objects of their researches. Even in those vast institutions on the coast at Brighton, Naples, &c., where the inhabitants of the ocean exhibit their splendours to the eyes of the public, and where there would seem to be no difficulty at all in changing and refreshing the sea-water at any given moment, this point requires more attention and care than is ordinarily supposed, and the success of an aquarium often depends upon the more or less ingenious method by which the refreshing of the water is brought about. Especially important is a free access of atmospheric air, which must enter into solution and sustain the respiration of the different inmates.

To attain this end on a small scale in a laboratory situated at a distance from the sea-coast, with glass vessels of various sizes instead of tanks, and a small barrel of sea-water, which must suffice for a considerable time, the following system, adopted by Prof. Selenka, first in Leyden and at present in Erlangen, gives the most satisfactory results.

A receptacle for fresh water of about 2 cubic ft. or larger is placed in some spare corner, two stories higher than the room in which the aquarium is situated. By means of a siphon reaching to the bottom, the water can be put into communication with a tube leading to the lower floor. A tap enables one to regulate the quantity of water flowing through the siphon. Immediately behind the bend of this and fastened to the side of the receptacle, a so-called Bunsen's aspirator effects the distribution of air-bubbles in the water streaming down. This instrument simply consists of a tube in glass or gutta percha, with an opening as large as a pin's head. The water now continues its way downward through a series of glass tubes of no great width, fastened to nails in the walls by strings.

This system of tubes, to be had at a very small cost and labour, leads the water into a second receptacle in the same room with the improvised aquaria. It consists of a cylinder in zinc of about three feet by one in diameter placed upon a wooden stool; a large tap at the bottom permits its being emptied into a pail. In the lid three small tubes form a communication with the exterior, each of them, as well as the whole apparatus, being closed by taps as hermetically as possible. One of these is put into communication with the above system of tubes which descend to the bottom of the receptacle. The second, to which no interior tube is fastened, is in communication with a pair of bellows which permit the creation of an initial atmospheric pressure in the reservoir. Instead of the bellows a simple tube, half india-rubber, half glass, may do as well, the pressure then being obtained by simple blowing with the mouth. The function of the above apparatus is clearly that of compressing the atmospheric air in the zinc receptacle by means of water descending from a certain height. This compressed air is now used for the refreshing and providing with oxygen of the sea-water in the different smaller vessels.

A third tap in the lid of the zinc reservoir permits the air to escape into a glass bell, where a small mercury manometer indicates the amount of pressure, a detail which may, however, be omitted. In the perforated stop of this bottle from six to twelve hermetically sealed glass tubes—shellac is best for sealing them, india-rubber for the stop itself—are ready to provide the different vessels with a supply of air. With this view india-rubber tubes, which can be shut up by glass staves, form the continuation of the glass ones. When made ready for use, a spring screw applied to this india-rubber tube, regulates the quantity of air flowing out, while a special end-piece conducting the air-bubbles into the vessel with sea-water is pushed into the open end of the tube.

Those end pieces form an important part of the apparatus and may give rise to a great economy of the force required, when by some well-adapted combination their effect is multiplied.

In order to obtain the greatest advantage from the air-bubble which, when the apparatus is put into working order, rises through the sea-water in the vessel into which one of the tubes is brought, it is desirable that it should present as large a surface as possible to the water; making the contact more perfect and the dissolving process easier.

A so-called vulcanised rose, with numerous fine pores, is for this purpose fixed to the extremity of the tube on the bottom of the vessel. This may be replaced by a simple india-rubber stop which has been applied to the extremity of the tube, and into which extremely fine glass tubes—easily got by pulling out a thicker one before the blowpipe and cutting it to the required lengths—have been inserted. Or we may take two flat circular pieces of vulcanised india-rubber connected together, and fix into the border of the lower one a series of such fine glass tubes disposed like the spikes of a wheel, care being at the same time taken that the communication be maintained between the hollow part of this india-rubber disc to which the hair tubes correspond and the glass tube providing the air.

To make the effect in the water still more complete, a small water wheel (the paddles of which are made of thin half-spheres of glass, the axis of a vulcanised tube revolving round a glass stave) may be placed above the rising stream of air-bubbles, which put the wheel in a slow rotation, and cause in this way a constant movement of the particles in the sea-water, a circumstance which cannot but be favourable.

Nearly the whole of the apparatus described above may be made at home, and can be had at very little cost. It is of great efficiency and keeps the sea-water in the

smaller vessels in a wonderful condition of purity, if care be taken to remove dying specimens and if no feeding be going on. Development of eggs and larvæ may be studied without the necessity of changing the sea-water excepting at considerable intervals of time, and marine animals of the most varied types can be kept alive very long indeed at a very small expenditure.

If put into practice by any private zoologist or laboratory in Britain, the results will most probably be no less gratifying than they have been in the above-named places where the system has only as yet been carried out.

A little more costly but still more efficient is a zinc gasometer, which can contain about half a million cubic centimetres of air, with a diameter of about 60 centims. This may be placed as it is in Erlangen without difficulty in the corner of any laboratory. It is wound up every morning by means of a simple capstan, and the pressure is effected by stones put on the top. The quantity of air escaping can be accurately regulated by hermetic taps in the conducting tube.

The great advantage which it has in common with the apparatus described above is that it remains active without further interference for a space of twenty-four hours.

FOSTER'S "PHYSIOLOGY"

Physiology. (Science Primers). By M. Foster, M.A., M.D., F.R.S. (Macmillan and Co., 1874.)

IT is extremely seldom that a fairly informed reader can lay down any text-book, after having read it from end to end, and feel that it has completely fulfilled the purpose for which it was written. Either the method of explanation is imperfect and involved, the facts that are given being correctly stated, or the language may be excellent at the same time that there is a want of attention to accuracy. We believe, however, that all will agree with us in thinking that in this short "Science Primer" Dr. Michael Foster has succeeded in producing an introductory manual which is perfect in itself, and quite a type for future authors of similar productions.

Many who devote themselves to the higher branches of scientific inquiry seem to have an inborn fear of putting the arguments and facts of their favourite subject in any but the most uninteresting and unintelligible language. They write on the assumption that their readers are all as well informed, or nearly so, as themselves on the literature of the science of which they treat; consequently, to the majority their works are of comparatively little value. This imperfection is manifest in many text-books, the utility of which is thereby reduced below that of many otherwise less worthy productions to the commencing student.

In the work before us, however, we think that Dr. Foster has succeeded, beyond any author with which we are acquainted, in placing himself on a level with his intended readers, and in putting the fundamental principles of physiology before the commencing student in a language, and by means of a consecutive argument, which possesses quite sufficient intrinsic attraction to tempt anyone with the least predilection in that direction, to study, reason out, and attempt to verify his statements. Dr. Foster's similes are peculiarly to the point, and are at the same time drawn from such well-known sources, that no one will have the least difficulty in perceiving their applicability, at the same time that he will be able to realise the full importance of their bearing. The following is one of the best of these, and will well repay the reading:—

"When you look down upon a great city from a high place, as upon London from St. Paul's, you see stretched below you a network of streets, the meshes of which are filled with blocks of houses. You can watch the crowds of men and carts jostling through the streets, but the work within the houses is hidden from your view. Yet you know that, busy as seems the street, the turmoil and press which you see there are but tokens of the real business which is being carried on in the house. So it is with any piece of the body upon which you look through the microscope. You can watch the red blood jostling through the network of capillary streets. But each mesh bounded by red lines is filled with living flesh, is a block of tiny houses, built of muscle, or of skin, or of brain, as the case may be. You cannot see much going on there, however strong your microscope; yet that is where the chief work goes on. In the city the raw material is carried through the street to the factory, and the manufactured article may be brought out again into the street, but the din of the labour is within the factory gates. In the body the blood within the capillary is a stream of raw material about to be made muscle, or bone, or brain, and of stuff which, having been muscle, or bone, or brain, is no longer of any use, and is on its way to be cast out. The actual making of muscle, or of bone, or of brain, is carried on, and the work of each is done, outside the blood, in the little plots of tissue into which no red corpuscle comes."

Notwithstanding the simplification of the argument to its extreme degree, no attempt is made to arrive at this simplification at the expense of truth. We are not informed, as is often said, that venous blood contains carbonic anhydride dissolved in it, whilst in arterial blood this is replaced by oxygen; but more accurately, though less simply, that "both contain, dissolved in them, oxygen, nitrogen, and carbonic acid; venous blood contains less oxygen and more carbonic acid than arterial blood."

Some will think that many of the straightforward facts of the circulation should not be studied until they can be appreciated, unassisted, in their logical sequence; but we think that the following quotation will give a reality to the peregrinations of a blood-corpuscle which comes home to even very young minds. "Suppose you were a little red corpuscle, all by yourself, in the quite empty blood-vessels of a dead body, squeezed in the narrow pathway of a capillary, say of the biceps muscle of the arm, able to walk about, and anxious to explore the country in which you found yourself. There would be two ways in which you might go. Let us first imagine that you set out in the way which we will call backwards. Squeezing your way along the narrow passage of the capillary in which you had hardly room to move, you would at every few steps pass, on your right hand and on your left, the openings into other capillary channels as small as the one in which you were. Passing by these you would presently find the passage widening, you would have more room to move, and the more openings you

passed the wider and higher would grow the tunnel in which you were groping your way. The walls of the tunnel would grow thicker at every step, and their thickness and stoutness would tell you that you were already in an artery, but the inside would be delightfully smooth. As you went on you would keep passing the openings into similar tunnels, but the further you went on the fewer they would be. Sometimes the tunnels into which these openings led would be smaller, sometimes bigger, sometimes of the same size as the one in which you were. Sometimes one would be so much bigger that it would seem absurd to say that it opened into your tunnel. On the contrary, it would appear to you that you were passing out of a narrow side passage into a great wide thoroughfare. I dare say you would notice that every time one passage opened into another the way suddenly grew wider, and then kept about the same size until it joined the next. Travelling onwards in this way you would, after a while, find yourself in a great wide tunnel, so big that you, poor little corpuscle, would seem quite lost in it. Had you anyone to ask, they would tell you that it was the main artery of the arm. Toiling onward through this, and passing a few, but, for the most part, large openings, you would suddenly tumble into a space so vast that at first you would hardly be able to realise that it was the tunnel of an artery like those in which you had been journeying. This you would learn to be the *aorta*, the great artery of all; and a little further on you would be in the heart."

In conclusion, we are sure that there is no book which could be more profitably placed in the hands of the youth of both sexes, as a means of intellectual training and general culture, than this small work of Dr. Foster's. It possesses the advantage of combining precise reasoning with information on a subject which is all-important in every-day life; a subject which, if more universally understood, would lead to the adoption, by all, of means for the healthy maintenance of life which are now as systematically ignored as they are misunderstood. The reader is referred to Prof. Huxley's "Elementary Physiology" for the discussion of many subjects which the space allowed and the age of the pupils make it necessary to omit in the work before us.

OUR BOOK SHELF

Exposition Géométrique des propriétés générales des Courbes. Par Charles Ruchonnet (de Lausanne). Troisième édition, augmentée et en partie refondue. (Paris, 1874.)

Eléments de Calcul approximatif. Par Charles Ruchonnet. Seconde édition augmentée. (Paris, 1874.)

WE have read these works with interest and somewhat of surprise: with interest because the subjects are fairly interesting and are treated in the well-marked style which distinguishes the writings of French mathematicians; with somewhat of surprise that the subjects treated at such length should have met with such a large circle of readers as is indicated by the number of editions that have been called for. The first work on our list establishes many general properties of curves by means of first principles and by the use of infinitesimals. This mode of treatment, so far as we know, is confined in our own text-books to a chapter or two in Dr. Salmon's works, and it would be hard to find more than he has given in any other work. The author himself states that this elementary knowledge will carry the student through the book with the sole exception that a more extended acquaintance with mathematics is required for an article devoted to the finding the distance between a curve and its osculating sphere in the neighbourhood of the point of contact. The author, too, claims the major part of the demonstrations as his own, though in some cases he has generalised results previously given, and in some cases has established known properties in a novel way.

The work is divided into two parts; the first treating of the tangency, curvature, and osculating circle of plane curves: the second part treats of the analogous properties for non-plane curves, and deals also with the polar surface, the osculating sphere, ruled surfaces, developables, and the osculating helix. There are five pages of plates containing eighty clearly drawn figures.

The "Calcul approximatif" is concerned with numbers only. M. Ruchonnet considers that he has improved upon the processes given by previous writers as regards their generality and precision as well as the facility with which they are effected. There are six articles and two notes. In the preliminary observations, the writer's aim is concisely stated to be the turning of an expression composed of incommensurable numbers (incommensurables avec l'unité) into a decimal to any given degree of exactness. He here treats of *absolute* and *relative* error, and then proceeds to summation. In the third article, in applying his methods to multiplication and involution, he sketches out the contracted process of multiplication employed by Oughtred; then follow contracted division (reference made to Serret's "Arithmétique"), evolution, and functions of a single variable. Amongst the important additions in this edition, is a complete solution of the problem "Combien de chiffres exacts faut-il calculer d'un nombre pour pouvoir en extraire la racine $m^{ième}$ avec n chiffres exacts?"

Many illustrative selections might be made, but as these would not be of general interest, we content ourselves with recommending those who take an interest in either of the subjects discussed by M. Ruchonnet to taste and judge for themselves.

LETTERS TO THE EDITOR

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

Flight of Birds

IN NATURE, vol. x. p. 147, I observe a letter signed "J Guthrie," and dated from the Cape, on the subject of the Flight of Birds, and particularly on the "hovering" of birds. It appears that one of your correspondents had referred to my chapter on this subject in the "Reign of Law" as giving a satisfactory explanation of this phenomenon. Mr. Guthrie thinks, on the contrary, that what I have there said "requires no refutation;" which is not wonderful considering the entire misconception which he evinces of the explanation I have given. He quotes me as affirming that "by a proper arrangement of its wings and tail and the position of its body, a bird can, *without muscular exertion*, remain suspended in a horizontal air-current, provided the latter be of sufficient velocity." If I had said this I should have talked nonsense. But I have not said it, as your readers may see by referring to the page (170, first edition) to which Mr. Guthrie himself refers. What I have said is, that under certain conditions of strength of air-current a kestrel can maintain the hovering position "with no *visible* muscular motion whatever." Mr. Guthrie omits the word "visible," and probably has no idea of its force and meaning in the sentence referred to. The maintenance of the wings and tail in the proper position, and of the body at the proper angle, does in itself, of course, involve continuous and difficult muscular action, although it is not visible, just as a rope-dancer standing still in some tiptoe attitude may require immense muscular effort although no motion be visible, and although the whole aim, object, and effect of that exertion be to produce stillness, and not motion.

So far is it from being true that I have represented hovering as an accomplishment of wingmanship which requires little exertion, that I have asserted with emphasis the exactly opposite doctrine—that it is a specially difficult operation, requiring very often great exertion, and always requiring special muscular effort.

It is evident, however, that Mr. Guthrie is still ignorant of the facts which have to be explained. In the passage which he misquotes I am not stating any theory; I am stating a fact which I have seen over and over again. It is a fact beyond all question that a kestrel can maintain itself hovering in a strong horizontal air-current, with no other muscular exertion than that which is required to keep its wings and body at th right angle. I have seen it done a hundred times in level countries, when by no possibility could any upward deflection of the wind have arisen from the configuration of the ground.

One of the first and most fundamental facts to be admitted and accounted for in the flight of birds is, that perfectly horizontal air-currents have a powerfully sustaining effect upon vane surfaces, which are presented to them as birds' wings are presented. "Hovering" and "soaring" are only to be explained when this fact is seen and admitted. ARGYLL

Inverary, Argyllshire, July 30

Exhibition of Specimens and Apparatus at British Association Meetings

I AM anxious to draw the attention of the readers of NATURE to the arrangements to be made this year at the British Association meeting (for the first time) for the reception of specimens and apparatus illustrating papers or short communications made to the sections. The provision of a room for this purpose—a kind of temporary museum—has during the last four years been recommended by the committees of Sections C and D, several times, and this year the experiment is to be made. Those who have promoted this plan are naturally anxious that it should be a success. I would therefore appeal to the secretaries of the various sections to assist in initiating this new feature of the meeting, by endeavouring, as far as possible, to secure from the authors of papers objects which illustrate their communications; such objects to be deposited during the week of meeting in the room provided by the Council. This room will be open to inspection under the same regulations as the sectional meeting rooms, and the objects deposited will be carefully ticketed and arranged, and, where necessary, placed under glass cases.

From Section A we may expect physical and astronomical apparatus and models; from B, new chemical products and specimens of apparatus illustrating new processes; from C, geological specimens of rarity or new to science; from D, zoological and botanical specimens, anatomical preparations, for the exhibition of which microscopes will be provided, and also ethnological specimens; from E, maps and geographical models; from F and G, models or machinery not too large for a room.

It is necessary to mention that objects exhibited must be in illustration of some communication (however short) to one of the sections, in order that they may thus be sanctioned by the committee of such section.

By the co-operation of the sectional secretaries with the members of the committee appointed to superintend the arrangements of this room or repository, we ought to succeed in adding an important and valuable feature to the scientific interest of the meetings of the Association. E. RAY LANKESTER

A Waterspout at Milford Haven

THE enclosed account of a waterspout which was sent to me by one of our telegraphic reporters may perhaps be of interest to your readers. ROBERT H. SCOTT

Aug. 1

"St. Ann's Head, Milford Haven, July 28

"Sir,—The waterspout mentioned in this morning's report was observed yesterday at 4.50 P.M., about a mile outside the port, following in the wake of a squall. Its course lay about N.E., and the progressive movement was judged to be between twenty-five and thirty knots per hour. Its diameter at the base was about 40 ft., and the direction of the whirl from left to right, or with the hands of a watch. The lower portion was well defined, but the middle and upper portions were not so distinct; in fact, the connection with the clouds above, although undoubtedly existing, could not be discerned from our point of view. The sea immediately under it was greatly agitated and white with foam, the spray ascending in a spiral form. Thunder was heard with the squall that preceded it, and the wind veered from S. to S.S.W., although it backed to S. again afterwards. (Signed) JOHN C. WALKER

"R. H. Scott, Esq."

Periodicity of Rainfall

MY attention has been recalled to the letter (vol. viii. p. 547) of my old friend Mr. Meldrum, dated Sept. 15 last, upon the above subject, by its recent republication in a Barbados newspaper. I had intended at the time to examine whether his objections to my statements were valid, but absence from the island and other occupations interfered. On reperusing his letter, I perceive that he notices a disagreement between my figures and those given by Mr. Symons, which requires to be explained, and I take the opportunity of endeavouring to remove his doubts with regard to the correctness of my results. Mr. Symons's annual averages for 1843–61 were drawn from one station, or rather from two; from Fairfield for the years 1843–46, and from Halton, a station nearly three miles distant, and having twice the elevation, for the rest of the period. My averages were taken for the first four years from the same single station, the only record then in existence, and from a varying number of stations during the other years.

Mr. Meldrum thinks that, with certain alterations which he suggests, my calculations will support his theory. I should be very glad if they did. My object in pursuing my inquiries into the rainfall of Barbados has been to assist the planters in forecasting the coming seasons, so as to guide them in their agricultural operations; and I would gladly welcome every contribution to this end, whether it be Mr. Meldrum's sun-spots or Prof. Chase's lunar influences. I was therefore disappointed when I found that the experience of this island did not coincide with that of Mauritius, and I am sorry that a further comparison of the data, which is not open to any objection of discordance of elements, confirms my first calculations.

If I take Fairfield and Halton alone, for the thirty-one years 1843–73, I obtain the following results:—

	Maximum years.	Minimum years.
1843–45 ...	... —	163·7
1847–49 ...	... 158·3	—
1855–57 ...	... —	170·7
1859–61 ...	... 186·6	—
1866–68 ...	... —	177·8
1870–72 ...	... 157·1	—
Total ...	502·0	512·2

This calculation shows an annual average excess in *minimum* years of 3·4 inches. But the rainfall at Fairfield during the last three years, for which alone I have the means of comparison, is 13·33 per cent. below that of Halton. Therefore 21·7 inches have to be added to the minimum average of 1843–45, which would increase the above excess to 10·6 inches. If Halton alone be taken for the five periods, the average of the maxima is 167·3, and that of the minima 174·2, yielding an excess of *minima* of 6·9 inches.

A comparison of three stations for 19 years, 1855–73, being the longest comparable period, exhibits the same results. These three stations, Halton, Binfield, and Husbands, are situated in opposite parts of the island, and furnish a fair average of the whole:—

	Maximum years.	Minimum years.
1855–57 ...	... —	192·7
1859–61 ...	... 193·6	—
1866–68 ...	... —	182·6
1870–72 ...	... 162·7	—
Total ...	356·3	375·3

This calculation shows an annual average excess of 9·5 inches in *minimum* years, which differs only by 1·1 inch from the above corrected calculations founded on the returns of a single station.

Mr. Meldrum, in his letter of September, writes, that I have "taken 1846 and 1871 as middle maxima years [in my first paper I also took 1848], whereas 1849–72 are probably more correct." Mr. Meldrum is in error as to my having taken 1846 as

a middle maximum, as a reference to my former letter (NATURE, vol. viii. p. 245) will show; and I do not find any reference to 1846 as a maximum in Prof. Tyndall's letter, or in that of Mr. Symons, which alone I had seen when I last wrote. In both of these 1848 is named, and I demur to the changes to 1849 and 1872; to the first because, apparently without any sufficient reason, a dry year (48·10 inches) is discarded, and a wet year (67·88 inches) is added, and to the second, not because it affects my calculations, but because no reason is given. The change appears to favour Mr. Meldrum's views, but it scarcely does so, because the estimated quantity of 65 inches in 1873 resulted in an actual average of only 51·26 inches, which would make a difference of 13·74 inches in that year, and would change the trifling excess of 2·64 inches on the maximum side into a larger excess of 11·10 inches on the minimum side.

It is unnecessary, however, to go beyond the calculation which I have above submitted to show that Barbados does not bear out Mr. Meldrum's theory. I am quite prepared to agree with him that, if the preponderance of evidence drawn from a wider area and from longer periods does support it, the opposite results obtained in Barbados, although it is most favourably situated for observations of this nature, being fully exposed to the trade winds blowing over the Atlantic during the greater part of the year, and not apparently subject to any disturbing influences, only show that no particular locality can draw a safe inference as to the manner in which the presence or absence of sun-spots is likely to affect it.

A further consequence presents itself to my mind. It appears to me that the atmospheric influences entering into this question —chiefly evaporation and rainfall—must balance one another pretty equally over the face of the globe, either contemporaneously or by seasons; that the excess of rain received by some places has been drawn from others, which have consequently experienced the opposite effects of evaporation and drought. If therefore certain solar influences, whose presence is indicated by the appearance of sun-spots, have the effect of causing an excess of rain in certain years over so wide an area as Mr. Meldrum supposes, whence does this excess come? If from some atmospheric reservoir, independent of the globe, the excess would be general; the alternations of rain and drought might vary by years or by seasons, more or less long, but not contemporaneously by, or in, localities. If, however, they be drawn from the earth, or from atmospheric strata near the earth, there must be evaporation and drought in those parts whence the excess is drawn. Barbados, as I have pointed out, is singularly free from local influences which would affect its rainfall differently from the rest of the globe. When therefore I find the experience of Barbados differing from that of Mauritius, and of many other parts of the world, I am driven to the conclusion that the influences indicated by the existence of sun-spots are not universal, although they may possibly operate on, and intensify, other influences already existing from other causes; and that the absence of those influences and the existence of different effects in Barbados is not an exceptional result, but a necessary consequence, to be expected in other parts of the globe also, and to be anticipated from the ordinary operation of known physical laws. I shall not, however, be dogmatic on the point, and shall hail further proof of the correctness of Mr. Meldrum's theory as a welcome contribution to the "Meteorology of the future."

RAWSON W. RAWSON

Care of Rabbits for their Dead

SEVERAL months ago you published, among others, a letter of mine, on the "care of monkeys for their dead." Since then I have been making observations upon a similar attention displayed by rabbits, although the considerations which lead to its exercise are apparently much more practical than in the case of monkeys.

Most people are aware that if a rabbit is shot near the mouth of its burrow, the animal will employ the last remnant of its life in struggling into it. Having several times observed that wounded rabbits which had thus escaped appeared again several days afterwards above-ground, lying dead a few feet from the mouth of the burrow, I wished to ascertain whether the wounded animals had themselves come out before dying—possibly for air, —or had been taken out after death by their companions. I therefore shot numerous rabbits while they were sitting near their burrows, taking care that the distance between the gun and the animal should be such as to ensure a speedy, though not an immediate, death. Having marked the burrows at which I shot rabbits in this manner, I returned to them at intervals for a fortnight or more, and found that about one half of the bodies appeared again on the surface in the way described. That this reappearance above-ground is not due to the victim's own exertions, I am now quite satisfied; for not only did two or three days generally elapse before the body thus showed itself—a period much too long for a severely wounded rabbit to survive,—but in a number of cases decomposition had set in. Indeed, on one occasion scarcely anything of the animal was left, save the skin and bones. This was in a large warren.

It is a curious thing that I have hitherto been unable to get any bodies returned to the surface, of rabbits which I *inserted* into their burrows *after death*. I account for this by supposing that the stench of the decomposing carcase is not so intolerable to the other occupants of the burrow, when it is near the orifice, as it is when further in. Similarly, I find that there is not so good a chance of bodies being returned from an extensive warren of intercommunicating holes, as there is from smaller warrens or blind holes; the reason probably being, that in the one case the living inhabitants are free to vacate the offensive locality, while in the other case they are not so. Anyhow, there can be no reasonable doubt that the instinct of removing their dead has arisen in rabbits, from the necessity of keeping their confined domiciles in a pure condition.

GEORGE J. ROMANES

Dunskaith, Ross-shire, July 26

THE NEWFOUNDLAND SEAL FISHERY*

THE vessels employed in this fishery are generally built for the purpose at Aberdeen, Greenock, or Dundee; but some obsolete men-of-war have been bought and strengthened to meet the requirements of the trade. Those steamers built for the purpose range from 170 to 470 tons register, and have screw propellers. The *Bear*, in which I went, belonging to Messrs. Walter Green and Co., and commanded by Captain Alexander Graham, a sealing master of thirty years' experience, was a new vessel of the largest class, built by Messrs. Stephens, of Dundee, was barquentine rigged, and had compound engines of 110 H.P.

The smallest rod in the latter was 2½ inches in diameter, the minimum that has been found to stand the shock of concussion with the ice. Propellers are made in one piece of cast-iron; metal having been tried was found to twist, and those made with separate blades to screw in inevitably broke in the thread of the screw. They are about 7 in. in thickness near the boss and about 2 in. at the point, and should be made without a sling hole, two propellers of the *Bear* having broken at that place. Over the banjo frame are the "slip boards," pieces of hard wood about 3 in. thick, that slide down the screw well on each side of the Sampson posts to prevent ice getting in above the propeller. They should be made to hoist up in one piece with the banjo, otherwise considerable time is lost in unbolting them. The brine from salt-meat casks is kept and poured down boiling to loosen the gear set fast by frost and ice. The propeller may be known to be broken by the great increase in vibration that inevitably follows when in the ice. After watching for a long time I found the effect produced on the engines by the ship striking the ice was scarcely perceptible, and the stoppage of the propeller by ice even at full speed only caused the connecting rod to vibrate slightly.

The bows for about 20 ft. from the stem are built nearly solid with the numerous beams, timbers, and diagonals; this space is called "the fortification." The bows are sharply built with a raking gripe, the advantage of which is that the vessel does not strike the ice on all the stem at once, but gradually meets the pan, and by the force of the way runs on it as up an inclined plane, and thus adds weight to momentum in breaking a passage. The stern should be

* The following notes from personal experience were made in the present year by Navigating Lieutenant Wm. Maxwell, R.N., and communicated to the Hydrographer of the Admiralty.

full, to carry the ice clear of the propeller, a fine run having a tendency to guide the ice into the screw well.

The vessels are surrounded completely with iron-wood bark about three inches thick; the stern has an iron plate down it, the rudder is sheathed on both sides and abaft, and from the stem about ten feet aft iron plating about half an inch in thickness is bolted. The rudder hole is unusually large to admit a rapid change, and chains are used for steering with.

The "sheer poles," two long spars, are crossed and lashed at one end and suspended from the bows with heavy chains that cross from the bowsprit-cap and one of the other ends on each side from the cat-head. They are intended for men to jump on from the ice when coming on board, or as a temporary resting-place when breaking the ice from the bows or guiding the vessel, and for those purposes man-ropes are slung and a ladder led from the bulwarks to them and the ice. "Pokers," long poles with iron spikes, are used as levers to move the ice, and occasionally as tracking poles. The "crows' nest" is a barrel lashed to the mast-head, fitted with a seat and rest for a telescope and a trap-door, to prevent cold air rising. The hold is divided into spaces called "pounds" by strong partitions, to prevent the cargo shifting with the lurch of the vessel. A tank fitted with a steam-pipe from the boilers, to convert ice into water, completes the list of exceptional fittings in these vessels. The water so made tastes like condensed water at first, but acquires the aëration more rapidly.

Twenty-three similarly fitted steamers went to the fishery this year. The crew, 273 in all, consisted of captain, masters of watches, engineers, firemen, cooks, stewards, and seamen. All share alike, except the captain, in the proceeds of the voyage; but the masters of watches, engineers, and firemen have their pay in addition. The captain has 6*d.* currency for each young pelt brought in, and 1*s.* 3*d.* to 1*s.* 6*d.* currency for each hundredweight of old seal blubber.

The men ship in one of three capacities, viz., "gunner," "gunner without gun," and "batsman." If there is much shooting, the gunners get each 10*s.* for the hire of their guns; those with no gun are supplied with them from the ship's stores.

The only necessaries for the men's outfit, besides woollen clothing, are a pair of sealskin boots with thick soles, a lacing at the top to tie them close round the calf of the leg and prevent water getting in, and large pyramidal nails, "frosters," or "sparrowbills," to avoid slipping on smooth ice. A sheath-knife, a small steel, and eye-preservers of glass with wire gauze surroundings, complete the list. The men are furnished from the ship's stores with bats, straight poles 4½ ft. long and 1½ in. diameter, and "starts," iron hooks and spikes, with a small piece bent at right angles to the butt to stick into the bat. A groove is cut in the latter, and the start is seized in the whole, constituting a "gaff," and combining the uses of boat-hook and alpenstock. A hauling rope, about three fathoms of 1½ in. cordage, to lace up and drag on board the seals, is also supplied.

The men are divided into three watches under masters of watches, who choose their men in turn, one at a time, and each watch is again subdivided under quarter-masters, who are responsible for their men on the ice and are furnished with two numbered flags bearing the ship's name. These numbers are entered against the names of those to whom they are given in a book kept for the purpose, enabling the captain to tell at a glance what men are away by the absence of flags. They are also divided into boats' crews, consisting of "bow" and "after" gunners and two oarsmen, chosen in a similar manner to the watches by the bow-gunners, who take charge of the punts, rough-built country boats, that are numbered to distinguish them. The *Bear* carried twenty-five of these punts.

The men in steamers divide amongst them one-third of the gross catch; the remainder goes to the owners for expenses of outfit and share of the profits. In sailing vessels the men share a half between them, but have to pay 1*l.* to 2*l.* currency berth money for their chance. Nearly 8,500 men were engaged in the fishery during the spring of this year.

When young seals are met with, the men are sent on to the ice, equipped as described. If the seals are not numerous, the ship is kept as close as possible to them; each man secures as many as he can, and drags them to the ship, the first tow being the property of that man who sees the seals first. They are killed by blows on the nose with the gaff, and are then scalped, by drawing a line with the knife through the skin and blubber from chin to tail, and skinning until the ribs on the left side are reached. The knife is then stuck in the heart, to make a hole through which a finger can be thrust to grasp a rib, and the carcase is held in that way till the pelt is removed. The scudders, or hinder flippers, are cut off, and when "panning," one of the foremost paws is taken out to make a hole through which to pass the slings for hoisting on board; but when towed to the ship both are left in to be eaten afterwards. The fore-paws (or "flippers" in the vernacular) when roasted are esteemed great delicacies, and much attention is paid to the cook to obtain permission to cook them.

As soon as a sufficient number are collected for a "tow" (six average-sized young ones being considered enough), the first is laced from the head through one or two holes cut close to the edges of the pelt, so that the hair is on the ice; the second skin is then laid half-way along the first, and the hauling-ropes passed for two turns through both, then for one turn through the second only. The third is then placed on the second, and so on to the last, when the end is made fast. The other end of the hauling-rope is passed through a hole cut in the nose of the first pelt, and a loop is made for one hand to grasp while the other grasps the end over one of the shoulders. The gaff is pushed through the tow-butt behind, and forms a tail to the whole. When the pelts are brought to the ship, they are hoisted thus on board, and each man unlaces his own to secure the hauling-rope and gaff belonging to him.

When the vessel cannot get near the seals or they are extended over a large area, they are "panned" or collected in heaps, each marked with a flag by the different sub-divisions. When taken to the pan the pelts are unlaced and stowed flat, with the hair on the ice, to prevent the sun burning them. If night comes on before the pan is picked up by the ship, a lantern is sent and is watched by a man till the vessel arrives. With the prospect before them of a whole night to be so passed, the men take axes to make ice-houses, and light a fire of the carcases to keep themselves warm. Often, however, the only chance of the men being picked up is to remain by the pan until the ship arrives, without any material to shelter or keep themselves warm.

The pelts are kept on deck at least one night to cool, and are then stowed in the pounds as soon as time permits; otherwise they are a most unsafe deck cargo, threatening to lurch with each motion of the vessel. "Sish," or broken up ice, is sometimes placed between the layers of skins; they are counted when stowed, and the account is kept by the senior "master of watch."

The system of capture is the same with the old seals, but one is considered enough for a tow, and shooting is often resorted to when the ice is at all open, and becomes a necessity in the case of the male "Hood," who fights desperately.

When the vessels are fast in the ice and no seals are near, the gunners are sent away "swatching," or waiting an opportunity to shoot any that may show themselves in the lakes of water near. When sent away for long distances, the men carry a board to rest on, and build ice-

houses to protect them from the wind ; but at the best it is bitterly cold work. They also take a few biscuits with them, and eat, in addition, the hearts of the young seals, uncooked. The signals for recall are the ensign at the mast-head in clear, and the steam whistle in foggy weather.

The seals taken generally are of two kinds, "Harps," or Saddle-back, and "Hoods," or Bladder-nose Seal.

The "Harps" are distinguished by the sealers as "White Coats" when young, from their colour ; "Dippers" after the white coat has fallen off and the spotted skin shows ; "Bedlemers" till the saddle or harp is formed ; and "Saddle Harps" when they arrive at maturity. "Jennies" or "Tuckers" are the females in the first year of whelping, and "Lords" or "Noggerheads" those deformed from the want of proper nourishment consequent on the mother being driven away or killed. Harps have black claws.

The "White Coat" remains perfectly passive to be killed, and the "Dipper" may be attracted by whistling or singing, and approached till within striking distance ; but the mothers take to the water and desert their pups at the slightest alarm. The males are never with their families, but are always to be found on the south-west edge of the whelping ice. This generally consists of ice made on the coast of Labrador with small hummocks on it, that give shelter to the young from the north-easterly winds, the approach of which may be known by the incessant crying of the young Harps. The "harp" or saddle begins to form at the age of one year, is perceptible at the second, and perfect at the third. After that it is difficult to judge the age, but the teeth generally give evidence of extreme age.

The "Hood" is much the finer kind in size and appearance, and is so called from an air-bag covering the head of the full-grown male, that can be inflated at will, and is so when danger is apprehended. It resists completely the blows from a gaff, and the slugs used in sealing do not penetrate it except at close quarters. They can, however, be killed by a blow under and along the line of the jaw, but considerable dexterity is required to effect this, and they can be shot dead by hitting them behind the air-bag or hood. They live in "families," male, female, and pup. Unlike the "Harps," the female rarely deserts her young, but makes a feeble and ineffectual defence in its behalf, and is killed by its side ; and in most cases the male offers a desperate resistance, making it unsafe for one man to attack it. They have white claws, and the male attains a length of 7 ft., and has a beautiful dark spotted skin. The young are white with a black stripe down the back, and rarely cry, nor have either sex any sign of the hood. The ice on which they whelp is heavy Arctic ice, rafted into large hummocks, and is generally to the north-eastward of the "Harps." The young of this species come to maturity and take to the water earlier than the "White Coats."

The females of both species are ready for fishing as soon as the young are born, and beat inshore to the shoal fishing-grounds, returning with unerring certainty to the pan on which they had left their young, notwithstanding wheel or drift of ice in the interval. The inference on seeing old seals is that the young are outside ; they are never to be seen northward of their whelps. Both species have the power of protruding and withdrawing the teat, so that after the young have suckled, no danger may accrue from crawling over the ice.

When the vessels have secured a large cargo, or at the latest by April 10, they return to St. John's to prevent the loss of the blubber by running from excess of heat. On the south side of the harbour large vats have been constructed, and machines erected for preparing and refining the oil from the blubber. The pelts are taken from the hold and passed through the hands of "skinners," who separate blubber from the skin, take out the flippers, cut off the noses, &c. The blubber is then weighed and the quantity recorded as the catch, less 1½lbs. for each pelt to balance the flesh left on in scalping. The skins are counted and a deduction of sixpence currency made from their value for every hole found in addition to those necessary for lacing, &c. "Cats" are pelts that weigh less than 25 lbs., and are not included with the other seals, but have a specially low market value of their own, that helps to prevent the animals being taken while too young.

The blubber is thrown into a trough and conveyed thence into tearing machines, two cylinders with rough teeth that grind the blubber and tear the vesicles ; thence to tanks, where it is converted by steam into oil and conveyed to other receptacles. A further process of bleaching takes place in reservoirs covered with glass roofs, and sometimes lined with tin, that in a few days makes the oil as clear as water. The refuse is subjected to great pressure to take off the last and worst kind of oil, and is then sold for manure. Seal blubber is valuable in the following order, viz. : that of (1) Young Harp ; (2) Young Hood ; (3) Bedlemers ; (4) Old Harps ; (5) Male or "Dog" Hood ; (6) Female Hood. The blubber of the last is of much the least value as the small amount of oil contained tints with a yellow colour oil from the other species, and the vesicles are so tough as occasionally to break the teeth of the tearing machines. The skins are salted and exported to England, where they are converted into fine leather and used in the manufacture of ladies' boots.

If the vessels are cleared before April 15, they make a second voyage and hunt the Dippers and old Harps, principally the latter. The Hoods, both old and young, have by that time entirely disappeared. In rare successful cases a third trip is sometimes made, and the vessels do not return till the middle of May. The catch of 1874 has been very poor, from a great number of very young seals having been taken, but in former years as many as 33,000 have been brought in by a steamer from the first voyage.

The ice encountered in the course of the voyage is of various kinds. In mild winters large areas of "sish," or frozen snow and salt water, are met with. This is most difficult to walk on, and the men rarely escape a ducking during a day's tramp. Harp ice is the next in point of thickness, and is generally rafted ice made on the Labrador shore, while the heaviest, or true Arctic ice, large hummocks and heavy pans, is the favourite place of resort for Hoods. Though all icebergs travel from the north, those predominating this year were large, low, and flat ; one was seen from twenty to forty feet in height, that was quite two miles measured diagonally. It is dangerous to try to cross their track, because the ice is packed by the pressure of the berg, so that not even a powerful steamer can force her way through. Ice navigation is very uncertain from many causes, but principally from tides, currents, and "wheel" of the ice. When near the land the two former have to be specially guarded against, as the surrounding ice remains the same and gives no evidence of the change of position. In one case a drift of twenty-five miles was experienced in two days ; ship, icebergs, and field ice remaining in exactly the same relative positions.

The "wheel" of the ice is caused by pressure of heavier ice on one corner of the field, causing the latter to turn as on a pivot in the direction of the pressure. This is quite uncertain in direction and speed, and no experience can foresee either. Running ice is also a source of danger to vessels fast in it, as they are propelled with irresistible force against any obstacles to their progress—icebergs, rocks, &c. In the spring of 1872 a steamer (*Wolf*) was crushed in an instant by that means, and the vessel went down before the men had time to secure their clothes. Often before a breeze of wind comes the ice rafts or squeezes, layer on layer, with a creaking sound. This also occurs in heavy squalls, and is a source of great danger to vessels fast in heavy ice.

In foggy or stormy weather, the vessel is kept under command, if possible, to clear any icebergs seen, but if not able to move, should be placed broadside to the wind or before it; the danger of being head to wind is, that if the ice anchors carry away and a crack forms under the stern, the force of concussion with the ice may damage the rudder fittings irreparably.

When crossing the water at night and approaching ice, the vessel is always stopped to take the shock gently, and because icebergs loom much like field ice. The whereabouts of water is inevitably shown by a dark horizon, and that of ice by the blink or "glinny."

There are no laws regulating the prosecution of the seal fishery except one passed in 1873, forbidding the departure of sailing vessels before the 5th, and steamers before the 10th of March.

Little Placentia, Newfoundland, June 22

THE INTERNATIONAL GEOGRAPHICAL CONGRESS

THE Organising Committee of the Geographical Congress to be held in Paris in the spring of 1875 have issued a programme of subjects to be discussed during the meeting. The "Commissaire Général" of the Congress is M. le Baron Reille, to whom, at 10, Boulevard Latour-Maubourg, all communications ought to be addressed. The Congress will last eight days, the first of which will be devoted to a general meeting for the purpose of inaugurating the work of the Congress. The members will be divided into sections, each of which will meet separately on the following forenoons to discuss the subjects connected with the section; the afternoons will be devoted to general *séances*. During the meeting of the Congress there will be an exhibition of objects relating to the study of geography, and on the last day prizes will be awarded to exhibitors. The transactions of the Congress will be ultimately published. The conditions of subscription are much the same as those of the French Association for the Advancement of Science.

The sectional sub-committees have provisionally prepared a series of questions for discussion under each section; proposed additions to or modifications of these should be addressed to M. le Baron Reille as above. The sections are as follows:—

I. *Mathematical Section*, including Mathematical Geography, Geodesy, and Topography. The following are some of the questions to be discussed in this section:—Substitution of the centesimal division of the quadrant for the division called sexagesimal; consequences relative to the division of time in astronomy.—Choice of a zero for a general level.—Measure of the differences of longitude; utilisation of telegraphic lines for the purpose of determining longitudes; advantages to geography by the electric telegraph.—Employment of chronometers.—Measure of an arc of the meridian in the southern hemisphere, and particularly in the Argentine Republic.—The most simple instruments and the quickest methods for determining magnetic declination.

II. *Hydrographical Section*, including Hydrography and Maritime Geography.—Among the questions to be discussed in this section are the following:—Choice of a simple and uniform method for reckoning the points of the compass.—Researches concerning the depth to which the agitation of the surface of the sea penetrates.—Study of marine currents; question of the currents in straits.—Determination of the temperature of the sea at different depths; instruments used; selection of the special points where these observations ought to be made.—Causes of the temperature of the Gulf Stream.—Programme of international instructions relative to observations which could usefully be made at once.

III. *Physical Section*, including Physical Geography, General Meteorology, General Geology, Botanical and Zoological Geography, General Anthropology. Among the subjects proposed for discussion in this section are:—New and well-established facts relative to the mobility of the crust of the earth during historical times.—Various theories as to the origin of mountains.—Lithology of the bed of the ocean.—Actual results of recent researches on the influences exercised by astronomical phenomena, such as solar spots, meteoric showers, &c.—To investigate new facts relative to the circulation of the atmosphere and the ocean, the movements of aërial and maritime currents, and their influence upon climates.—To discover the origin and general progress of great atmospheric whirlwinds or cyclones, as well as their periods; to determine their duration, their force, and the extent of the countries exposed to their effects.—Means to be adopted in order to extend more widely the establishment and the discussion of simultaneous meteorological observations, recommended by the International Congress at Vienna.—Geographical distribution of animal and vegetable species during tertiary times; consequences which flow therefrom relative to the climatology of the globe during that period; geographical relation between the quaternary and the existing fauna and flora; extinctions and migrations; distribution of land and water during that period.—Species, genera, and families of plants which are characteristic of the great natural regions.—Also many questions relative to the geology, zoology, botany, anthropology, &c., of the various great divisions of the globe—Europe, Asia, America, Oceania.

IV. *Historical Section*, including Historical Geography and the History of Geography, Ethnography, and Philology.—This section includes questions as to the condition of man both in prehistoric and historical times, comprehending the discussion of many particular points of history and ethnography.

V. *Economical Section*.—This section is concerned with subjects connected wirh Economical, Commercial, and Statistical Geography.

VI. *The Didactic Section* will discuss questions connected with Geographical Education and the diffusion of Geographical Knowledge.

VII. *Section of Voyages*, including explorations and voyages, scientific, commercial, and picturesque. In this section such points as the following are proposed for discussion:—How could a permanent bureau be constituted to indicate to travellers, by land and sea, the *desiderata* of geographical science?—Questions as to the undiscovered portion of Africa, as to the equipment of voyagers and travellers, instruments for various purposes, the bearing of explorers towards natives, narratives of travel, &c., &c.

There are proposed for discussion in the seven sections in all 123 questions, of which the above are a sample; and it will be seen, we think, that if the right men are induced to attend the Congress, and if the discussions are conducted in a truly scientific and candid spirit, great good must be the result to the many branches of science which are more or less connected with the subject of geography.

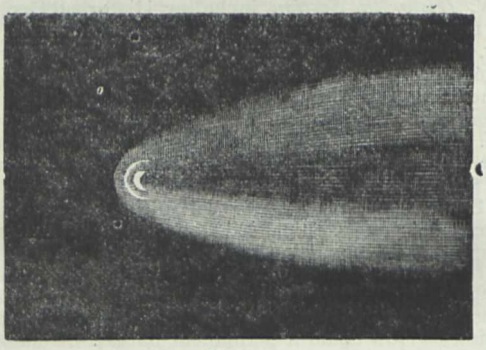
THE LAST NEW COMET

MR. J. R. HIND, F.R.S., writes as follows to the *Times* from Mr. Bishop's Observatory, Twickenham, August 1:—"From three consecutive nights' observations of the new comet of Marseilles, received from M. Stephan, I have calculated a first approximation to the orbit. It appears the comet will not reach its perihelion till about the 25th inst., but is already slowly receding from the earth, being distant from us at the time of discovery about 55,000,000 miles. Though it may continue visible in good telescopes for several weeks, it is not likely to become an object of any general interest, like the comet which has just left this hemisphere. The elements bear no resemblance to those of any comet previously computed."

THE FORM OF COMETS*

III.

WE are now arriving at a conclusion, for the conditions mentioned are very narrow. In order that a force exerted by the sun may present at any point whatever of the trajectory of a moving body these two radial and tangential components, it is sufficient, and it seems to me absolutely necessary, that this force should not be propagated instantaneously like attraction, but successively, *i.e.* at a definite rate. In order that it may drive to a distance the rarest materials of comets, at the same time exerting only an extremely weak action upon their much more dense and more compact nuclei, it is necessary, and it is sufficient, that this force should be one of surface and not of mass, like attraction. If the light of the sun were due, as was long believed, to the emission of innumerable atoms moving at the rate of 77,000 leagues a second, the force exerted by these atoms would fully satisfy these conditions. Unfortunately, the emission hypothesis has been shown to be false, and is now replaced by that of the undulations of an imponderable fluid on which attraction has no hold. If statical electricity, in order to produce attractions and repulsions, had no need of a particular material medium, such as our atmosphere, we might perhaps be able to call in the aid of that force; but it would still be necessary to prove that the sun is electrical, and that it is able to develop a very marked electric state in comets without acting similarly upon



[FIG. 8.

other bodies. As to magnetism, which appears independent of any medium, we know very well that it is not a surface-action, but an entirely specific force, capable of attracting or repelling the densest materials; and besides, the phenomena of terrestrial magnetism scarcely leave room for attributing to the sun a magnetic power sensible at such distances. Finally, electricity and magnetism are polar forces which impart to bodies opposite powers of attraction and repulsion, while cometary phenomena argue only a simple repulsive force.

There remains the repulsive force of solar heat. In all bodies heat gives rise to a force among the molecules which tends to separate them more and more; it is this which enables our steam-engines to work, and which forces projectiles from our guns. It is evidently a surface-action, and not one of mass; and at least, in maintaining that it is sensible only between the molecules of bodies, *i.e.* that its sphere of action is infinitely small, it is natural to think that the surface of a heated body exerts its repelling action all round it, as well as towards the interior. Moreover, there is nothing opposed to the supposition that this force is propagated successively, since its cause, heat, is itself propagated in planetary space with a definite speed, that of light.

Here is our hypothesis formulated. By introducing this repulsive force, acting by successive propagation, into

* Continued from p. 248.

the differential equations of the movement of comets, along with that of attraction, we see that there springs from them the established phenomenon of their acceleration with its most delicate characteristics.* The analysis which I made has been latterly revised and verified by an illustrious Italian geometer, M. Plana, with developments which leave nothing to be desired in point of mathematical rigour, while the hypothesis of a resisting medium starts, as I have said, with conditions incompatible with the principles of mechanics. It only now remains for us to see whether the same force will also account for the highly complicated phenomena of the figure of comets.

Let us set out from this distinctive characteristic:—The repulsive force exercised at a distance by the incandescent surface of the sun is a surface-action, the more capable of driving off a body, the smaller the density of the body is. According to an estimate deduced from the observed acceleration of Encke's comet, it will be sufficient to reduce, in the proportion of 1,000,000 to 1, the density of the nucleus of that comet to represent the excess of this repulsive force over attraction. The ques-

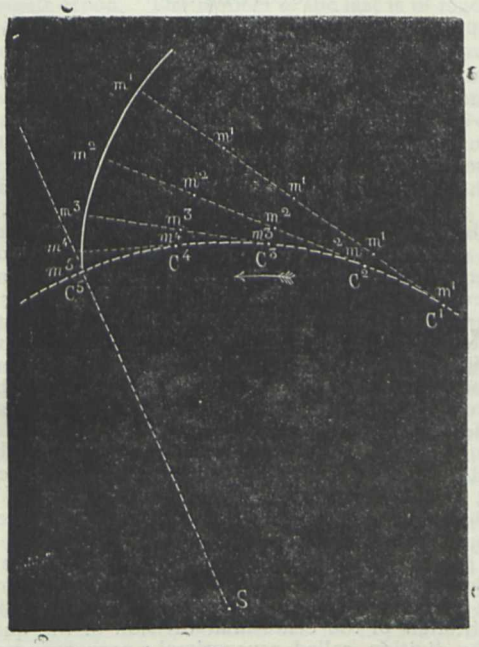


FIG. 9.

tion, then, is, to discover if such great variations of density are exhibited by the various appendages of comets, of which the most compact parts have already so small a mass under so enormous a volume. But this is precisely what facts establish in the most exact and striking manner. The figure of Donati's comet, which I am about to bring before you, shows that the nucleus, in proportion as it is subjected to the heating action of the sun, emits vapours which go on dilating more and more, so as to form around the nucleus envelopes having a radius ten or even a hundred times greater. But if the matter of a sphere with a radius equal to 1 expands into a sphere having a radius equal to 100, it is sufficient to make the density become one million times less. In fact, all the matter of the nucleus is not thus disseminated in the head of the comet; this dilatation affects only a very small portion of the primitive mass, and we see how the density of the extreme layers of the head may fall much below the figure given by the above calculation.

* The progressive change of two elements alone, to wit, mean motion and eccentricity; nothing on the position of the plane of the orbit; for the rest, simple periodic inequalities scarcely sensible, but differing, however, from those which the resistance of a medium would give.

We shall understand better what precedes by examining for a little in detail some phenomena presented by the head of the comet of 1858, at the time when the already formed tail was continually fed by materials emitted by the nucleus, and carried away by solar repulsion. (See Fig. 8.)

The concentric zones of a decreasing brightness, which are noticed around the nucleus, on the side next to the sun, are due to an intermittent emission of matter. This matter is seen to dilate more and more with a very moderate initial speed of about 19 metres per second, and finally to reach the limits of the head of the comet; a second, a third, &c. emission closely follow the first, and are developed in the same manner. The brightness, at first very marked, of these successive envelopes of the nucleus grows rapidly weaker in proportion as their density diminishes. Finally, in the exterior layers, the more and more rarefied materials become the prey of the solar repulsion, which makes them turn back, driving them towards the tail at a rate incomparably greater than the former, for in twenty-five days the tail of Donati's comet

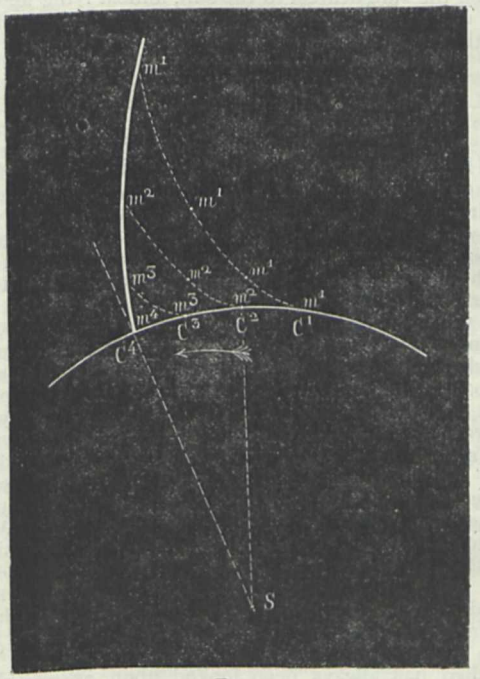


FIG. 10.

had reached a length of 14,000,000 leagues; it increased in length at the rate, not of 19 metres, but of 8 leagues per second. I showed, at the outset, to what excessive rarefaction the materials of these immense appendages attain.

You see that upon such materials a surface-action like the repulsive force must have beautiful play, while the solar attraction, independent of the surface and density, continues to act in the same manner upon all these molecules. The struggle, then, between these two forces will turn in favour of the former as soon as the progressive dilatation of the cometary matter, gradually spreading itself in surrounding space, will have brought it to a certain degree of diffusion, and there is nothing to hinder the repulsive action thus becoming twice, three times, even ten times more powerful than attraction.

From the fact that this force, or rather that the radial component of this force, acts in the direction of the radius vector, from the fact that the expelled molecules preserve very nearly the tangential speed which the comet possessed, it necessarily results, as we shall see, that the tails, from the first, must be opposite to the sun and bent in a backward direction.

Fig. 9 represents the successive positions of a series of molecules emitted by the nucleus of a comet so as to constitute the axis of the tail. In this figure, we suppose for the molecules a density such that the repulsive force exactly counterbalances the solar attraction: thus their motion, solely due to the tangential velocity of the comet, takes place in a straight line. To simplify matters, this

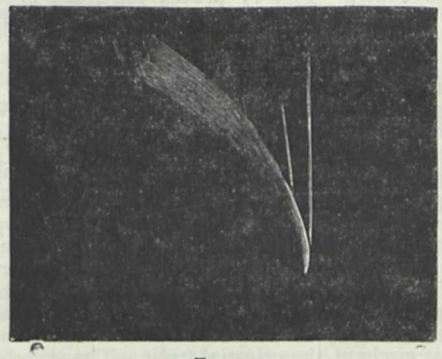


FIG. 11.

rate has even been supposed constant, as if the orbit were a circle.

On the first day, the comet being at C^1, a molecule m^1 is detached and subsequently follows the line $m^1\ m^1\ m^1$.... On the second day, a molecule m^2, likewise leaves the nucleus at C^2, and subsequently describes the tangent $m^2\ m^2\ m^2$....Similarly, on the third day, for a molecule m^3, and so on. If we join by a continuous line the series of positions occupied at the same time, the fifth day, by all these molecules m^5, m^4, m^3, m^2, m^1, we shall

FIG. 12

have the curvilinear axis of the tail; this will be, in this particular case, the involute of a circle. This construction accounts for the three laws which have been ascertained as the result of observation:—1. The tail, at its origin, is sensibly opposed to the sun, S;* 2. The tail is curved backwards on its path; 3. The axis of the tail is a plane curve situated in the plane of the orbit.

If the density of these molecules were still smaller, the repulsive force would prevail over the solar attraction, and these molecules would describe no longer straight lines,

FIG. 13.

but sections of an hyperbola whose convexity would be turned towards their common focus, S. (See Fig. 10.)

The series of points m^1, m^2, m^3, m^4, emitted at C^1, C^2, C^3, C^4, by the comet, gives yet another curve like the former, but with a curvature much less pronounced and nearer to the radius vector.

There results from this theory a consequence to which

* In reality the axis of the tail is not rigorously tangential at C^5 to the radius vector; it makes with this radius a small angle for which the theory accounts, but which I think may be neglected here for the sake of brevity and simplicity.

I must call your earnest attention, for it is verified in nature in the most striking way and upon the largest scale. All molecules of the same density must naturally group themselves together in the vicinity of the curvilinear axis of the tail m^5 m^4 m^3. . . . and thus form the open plume to which we have referred; but if the comet emit molecules of very unequal densities, on which the repulsive force acts with different energies, there ought to be several distinct tails, more or less curved, all situated behind the radius vector. This is precisely the case with Donati's comet. Fig. 11 proves the truth of this; it shows the comet with three distinct tails. The two smaller tails were almost straight, but always in rear of the radius vector; they presented their less marked convexity in the same direction as the bright tail.

The great comet of 1861 had also two tails. When we saw it for the first time, on June 30, it appeared to have only one, 118° long and perfectly straight, except a singular irregularity for which we could not at first account (see Fig. 12). But soon the two tails separated, and it became evident that we had been deceived by a simple play of perspective. The earth, in fact, on June 30 was in the plane of the orbit of this comet, and as the curvilinear axes of the tails are always situated in this plane, they were united, from our point of view, into one and the same straight line, or at least into one and the same arc of the great circle of the celestial vault. The sketch of the same comet (Fig. 13) seen a fortnight previously by observers in the southern hemisphere, shows clearly the disposition of this double tail, the most curved half of which almost touched the earth with its extremity.

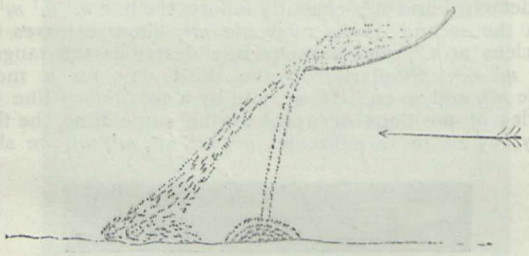


FIG. 14.

These singular effects of the repulsive force are easily explained by a comparison which will appear at first to be far removed from our subject, but the fundamental analogy of which is palpable: I refer to the winnowing of corn. In fact, we cannot better compare the entire surface-action of the repulsive force than to that of a puff of air which repels light bodies and has no sensible action upon denser bodies. When we wish to separate the grain from the chaff by means of the winnowing fan, we allow both to fall gradually into a current of air; the grain escapes from its action and falls at the feet of the winnower, while the chaff, much lighter, is carried to a distance, and forms upon the ground a separate heap (see Fig. 14). If a third material, still lighter than the chaff, is found mixed with the grains placed upon the fan, it will be drawn away still farther, and will form a third heap beyond the second. Evidently the fall into space, under the sole influence of terrestrial attraction, would not operate with such discrimination, for all matters placed upon the fan would fall at the same rate and along the same curve, whatever might be their density.

Well, the repulsive force of the sun—a surface-action, and not one of mass, like attraction—winnows, so to speak, the materials which are separated from the cometary nucleus by being rarefied; it picks them out and distributes them, according to their density, into tails of different curvatures. The lightest form the straightest tails, and those nearest to the prolonged radius vector, while the nucleus, escaping the repulsive action on account of its relatively enormous density, continues to obey, almost rigorously, the Keplerian laws of attraction.

We need not believe that the phenomenon of muliple tails is rare; without speaking of the horrible dragon depicted in Fig. 2, many comets have had several tails. The facility with which the almost straight but very feebly luminous tails of Donati's comet escaped observers in France, leads us to believe that the phenomenon may be general, and that by careful inspection several tails may almost always be found to each comet. And according to theory, a perfect homogeneity of materials, the necessary condition for a single tail, must be, for any celestial body, rather the exception than the rule.

But then, it may be said, if very dense matters are drawn away by nucleal emission on the side next the sun, ought these materials escaping the repulsive action not to take the lead of the nucleus and form a sort of tail on the side next to the sun? Yes, without doubt; and this case is effectually fulfilled, for some rare comets have presented it, such as those of 1823, 1845, and 1851. I would not insist upon these exceptional but not abnormal tails, situated on the side nearest to the sun, almost lying upon the orbit, or at least forming an obtuse angle with the initial direction of the ordinary tails.

(*To be continued.*)

DR. BHAU DAJEE

THIS very remarkable native of India, the true friend of his fellow-countrymen as well as of science and learning, died on May 31 at the comparatively early age of 51 years. As many of our readers may be ignorant of the claims of Dr. Bhau Dajee to notice, we give a brief sketch of his career, for which we are indebted to the *Times of India*.

He was born in 1823 in the village of Manjeren, near Sawunt Warree. His parents were in poor circumstances, and when he was about seven years of age they came to Bombay, bringing him with them. He was first placed in the native Education Society's Schools in Bombay, and afterwards went to the Elphinstone College. There he took a foremost place amongst the scholars, and was noted for his ability and unremitting application to his studies. The highest scholarships were taken by him, and he was specially rewarded with a gold medal. When his studies were concluded he was appointed assistant professor of chemistry and natural philosophy at the college. About this time (1842) a prize of 600 rupees was offered by Government for the best essay in English and Guzerathi on Female Infanticide. This prize Bhau Dajee gained, and the essay, which has since been published, has always been looked upon as one of the best contributions on that subject. He commenced his studies at the Grant Medical College, under Dr. Morehead, in 1845. The college had only then been established for a short time. His success here was again most marked, and gained for him the lasting friendship of many distinguished members of the medical profession. He received his diploma in 1851. He soon created a name for himself as a clever and rising medical practitioner, and quickly found himself in possession of an extensive practice amongst all classes. His time was divided between his medical duties and his historical and philological researches. From the first he took a great interest in all public questions, especially those which affected the interests of his fellow-countrymen. He, with Dr. Birdwood, was instrumental in the establishment of the Gardens and Victoria and Albert Museum, Bombay. The Bombay Association too may be said to owe its existence to his energy; he was the first secretary, and always took a deep interest in the discussions of the society on Indian affairs and measures. A considerable portion of his income was expended in procuring rare and valuable MSS. from Cashmere, Orissa, Benares, and Southern India

These he carefully translated and annotated, and numbers of the translations and remarks appeared in the scientific journals of the day both in India and in Europe. He was president of the Bombay branch of the East India Association, and up to the time of his illness constantly took part in the discussions of that body. His exertions in the cause of native female education procured for him the respect and gratitude of his more advanced fellow-countrymen. He established the Literary and Scientific Society, Bombay, and became its first president. His exertions to procure a recognised system of female education amongst the Hindoos were rewarded by a collection made by his admirers of some 12,000 rupees, which, at his request, was expended in establishing a school which has ever since been known by the name of "Bhau Dajee's Girls' School." He was elected a member of the Bombay Board of Education in 1852. He also filled the presidential chair of the Grant Medical College Society. As vice-president of the Bombay branch of the Royal Asiatic Society, he devoted a considerable portion of his spare time to furthering the interests of the society, and to the museum he presented many valuable contributions. With all the leading public questions of his time Bhau Dajee was familiar, and invariably took part in their discussion. Although he was in possession of a large practice he never accumulated a fortune, as he always willingly and readily gave money for the relief of distress. One of his latest and most important discoveries in medical science was the cure for leprosy, which he was on the point of perfecting when seized with paralysis. While ill he was most anxious that his manuscripts should be collected and got ready for publication. This duty will, we understand, be performed by his brother, Dr. Narayen Dajee, himself an accomplished scholar and well-known medical practitioner. Dr. Bhau visited many parts of India, but never went to England, though we believe he had a strong inclination to do so. Numberless instances of his public spirit and generosity might be cited did our space permit.

The public services of Dr. Bhau Dajee have been so numerous and important that it is but right that steps should be taken to commemorate them by means of a memorial, and we hope that but a short period will be allowed to elapse before some definite proposal will be laid before the public.

The deceased doctor was a member of numerous scientific societies both in India, in Europe, and in America.

OUR SULPHUR SUPPLIES

SIGNOR PARODI has addressed a report to the Italian Government, in which he gives his estimates that the sulphur of Sicily will be exhausted in fifty or sixty years. At present it is on Sicily we depend almost entirely for the supply of our sulphur—that "mainstay of present industrial chemistry"—which is so largely used in our arts and manufactures. Our demand, too, has been a steadily increasing one. In 1842 we imported 16,686 tons, and in 1862 the demand had risen to 75,000 tons. In the production of nearly every textile fabric sulphuric acid is used; it is more or less directly employed in soap and glass-making, metal refining, and the preparation of artificial manures requires large quantities. Our consumption seems to be limited only by the supply.

Recently a correspondent in the *Journal of the Society of Arts* stated, from his own experience of Sicily, that "with few exceptions, the ore is carried to the surface on the backs of boys. . . . The produce of a mine in Sicily is chiefly determined by the difficulty of getting boys . . . and the mines soon reach a depth at which they cease to be profitably worked. All the sulphur in the island, therefore, below 400 feet is untouched." He consequently doubts the correctness of Signor Parodi's estimate.

Still this report of Signor Parodi's is likely to cause some uneasiness, and the prospects of our obtaining a large supply at a cheap rate from Iceland must not be forgotten. The island is but two days' journey from Scotland, and from recent reports on the harbours there seems no reason why a continual intercourse might not be kept up. Many travellers have borne testimony to the immense fields of unworked sulphur there, and the fresh deposition in worked districts is stated to take place at a wonderfully rapid rate. In the celebrated solfatara of Puzzuoli, near Naples, after the mixture of gravel and sulphur has been submitted to the distillation of the sulphur,* the gravel is returned, and in thirty years is again so rich in sulphur as to admit of the same process. In Iceland this renewal of sulphur in the gravel is said to occupy but three years; the supply is therefore practically inexhaustible. Estimates show that while Sicilian sulphur is 5*l.* 17*s.* a ton in Britain, Icelandic would be about 2*l.* 18*s.* a ton.

According to a pamphlet by Dr. Carter Blake, recently issued, we learn that a lease for working some of the mines in the northern and eastern provinces of Iceland has been granted to Mr. Lock, of London.

A GREAT TELESCOPE

WE have already referred to the series of splendid gifts from Mr. James Lick, from San Francisco, to the State of California, the whole amounting to 2,000,000 dols. The most remarkable of these donations is one of 700,000 dols. for the purpose of erecting and endowing an astronomical observatory, and equipping it with "a powerful telescope, superior to, and more powerful than, any telescope ever yet made." The author of this magnificent bequest (the *New York Times* states) is in every sense of the word a self-made man, and has followed the wise example of the founders of our Cooper Institute and Lennox Library in securing the proper fulfilment of his trust by providing for its organisation in his lifetime. The United States already possess in the telescope of the Naval Observatory at Washington an instrument of the same gigantic proportions as that erected by Mr. Newall in this country; and we may add that this was the first instrument constructed after Mr. Newall had shown by his costly experiment that such dimensions were possible. The glass for the lenses of both these instruments was furnished by Chance and Co., of Birmingham, England. Under Mr. Lick's gift, Messrs. Alvan Clark and Sons are designated as the final judges of the most appropriate site for the proposed great telescope of California and of the world. How amply endowed will be the Lick Observatory, on the summit of the Sierra, may be conjectured from the fact that the great Washington telescope cost but 44,000 dols. The trustees who have the spending of the 700,000 dols. will be limited simply by the ability of the glass-makers to turn out a lens of sufficient size. We assume (continues the above paper) that the proposed telescope will be a refractor, since the great reflectors, of which the best known are Herschel's and Rosse's, have been found comparatively useless for accurate observations. The great speculum or object-mirror of the former was 49½ in. diameter, and the latter had two specula of 6 ft. diameter. Both were among the marvels of the generations that saw them constructed; but the latter, albeit only thirty years old, is nearly as much out of date as the former, which was constructed eighty-five years ago. It is just possible that the existence of a bequest large enough to yield six times the price which has ever been paid for a telescope may be the means of giving birth to lenses of what would now be reckoned impossible size and perfection. The 26-in. object lens of the Washington telescope has been duplicated in the one ordered by Mr. M'Cormick, of Chicago, for the Washington and Lee University of Lexington; but, though larger lenses have been talked of, their successful production is still problematical. Many costly

* Ure's Dict. of Arts, &c., vol. iii., p. 830.

failures have preceded the attainment of the 26-in. diameter, and Chance and Co. are said to be the only firm in the world who will undertake the manufacture of a disc of that size. Science knows no country, and Mr. Lick's munificent bequest in the cause of astronomy will be hailed by *savans* all over the world.

MENTAL POTENTIALITY IN CHILDREN OF DIFFERENT RACES

M. ONS. J. C. HOUZEAU, the author of the "Études sur les facultés mentales des animaux comparées a celles de l'homme," has lately concluded, in Jamaica, a series of laborious experimental investigations on the relative or comparative intellectual capacity and development of the children of different races inhabiting that island. The conclusions arrived at by such an observer are worthy of the highest consideration in Europe: while the subject is one that has an important bearing on various popular educational, ethnological, and social questions of the day—such as the unity of mankind, and the possibility or probability of civilising savage races A recent letter addressed to me by M. Houzeau, contains the following brief account of his experiments and conclusions; an account that cannot fail, I think, to be interesting to the readers of NATURE.

"I have been busy, meanwhile, on a curious study about the comparative development of intelligence of children belonging to different races. I had an opportunity here to submit to the test black, brown, and white children. Fifteen of them were sent to me every day for two hours by their parents, my country neighbours: three of them white, seven coloured of various shades, and five black. For a whole year I gave them myself common instruction, and carefully watched their proceedings and their rate of improvement. I do not expect to publish anything about that experiment, at least at this time. But I will state here the conclusions to which it has led me.

"1. There is in each child a different degree of intellectual proficiency, which could be called, in mathematical language, his or her 'personal coefficient.' However, these individual differences are much less than I had anticipated, and are not the striking feature in the unequal rate or speed of improvement.

"2. In this unequal speed, I see nothing—at least nothing clearly and unmistakably discernible—that can be referred to the differences of race. This will probably appear strange after all that has been said of 'inferior races.' Should other facts show that my experiment was not properly conducted, and that the trial was not conclusive, I am ready to give up. Still, it is at least my 'provisional conclusion.'

"3. The rate of improvement is due almost entirely to the relative elevation of the parental circle in which children live—the home influence. Those whose parents are restricted to the narrowest gauge of intellectual exercise, live in such a material and coarse *milieu*, that their mental faculties remain slumbering and gradually become atrophied; while those who hear at home of many things, and are brought up to intellectual life, show a corresponding proficiency in their learning.

"The question of course would require more space and development. I rather mention it as a subject for study than anything else. I had in my life some rare opportunities to study 'inferior races,' including Indians of America, and 'half-breed Indians' of the mixed race of Mexico. I believe most of the *savans* of Europe have but a very incomplete idea of the mental, and still more of the moral, status of 'inferior societies.' Much remains to be said about it."

My present object being briefly to introduce to English readers M. Houzeau's views as to the relative intellectuality of the children of different races in Jamaica, I will not here explain in what respects I differ from his conclusions—how far I regard his experiments inconclusive. I would only remind him, as well as the reader, of the impossibility of duly estimating the direction or amount of future or adult mental development by the study of mental phenomena in the young. It has been, I think, proved, for instance, that—

1. At or up to a certain age girls are as sharp as, or sharper than, boys at lesson-learning and repeating. Cases are constantly being recorded—perhaps paraded—in the newspapers of girls or young women beating boys or young men of equal age in competitive examinations. And yet it is not to be inferred that the female mind is either superior or equal to the male, that is, in a comparison of averages. For the fact is, that throughout the animal series, including Man, the female mind is, in some respects, different from, and inferior to, that of the male. We know, moreover, that female superiority, when it exists, is usually at least confined to school life. In subsequent intellectual development proper, man, as a rule, far surpasses woman. Again—

2. Up to a certain point there is the closest possible parallelism between the mental endowments of the human child and of the young of sundry other animals. At certain stages of development, and in certain animals, the comparison is not even in favour of the child. And yet, though we are still far from knowing what is the range of the mental potentialities of other animals than man, we have no reason for supposing that in any of them will the maximum intellectual or moral development attain to the average in cultured and civilised man.

W. LAUDER LINDSAY

NOTES

AT a recent meeting of the Trustees of the "Gilchrist Educational Trust," they decided to appropriate a sum not exceeding 1,000*l.* to the promotion of scientific research, with the prospect of repeating this grant annually if it should bear adequate fruit. The plan proposed is to ask the Council of the Royal Society to make recommendations to the Trustees, stating in each case the object of the research, the qualifications of the individual by whom it is to be conducted, and the sum they propose to be assigned to him; the purpose of the grant being to assist men of science who have shown themselves capable of advancing science, and who may feel themselves precluded from devoting their time to *unremunerated* work, by freeing them from the necessity of giving up investigations of great promise for the sake of mere bread-earning. We believe that this important movement is due to the representations of Dr. Carpenter, the Secretary, to the Trustees, that they would be in this mode worthily applying about a fourth part of their income in meeting a great national want, and in promoting the second of the objects as to which they have an uncontrolled discretion under the will of the founder—"The benefit, *advancement*, and propagation of learning in every part of the world." The Council of the Royal Society has, we understand, appointed a Committee to consider the conditions under which the Council may most fittingly undertake the responsibility of advising the Gilchrist Trustees as to the appropriation of their grants.

THE matter in dispute between the President and Council of the Linnean Society and a certain section of the Fellows, which caused so much excitement in the Society some months ago, and led to the premature retirement of Mr. Bentham from the chair, was referred to Lord Hatherley as arbitrator, and has just been decided entirely in favour of the President and Council; so that no further action will be taken in the matter.

WE regret to record the death, on July 31, of Dr. Charles T. Beke, whose name is so well known in connection with geography, ethnology, and philology.

We have reason to believe that it is the intention of Dr. J. E. Gray to send in his resignation of the Curatorship of the Zoological Department of the British Museum at the close of the present year. Such being the case, he would retire from office towards the middle of 1875, within six months of his resignation being accepted.

An interesting experiment was recently made by MM. Bertrand and Mortillet, directors of the St. Germains Museum, in the Champ de Manœuvre: the war implements constructed from designs of Trajan's Column were tested, when it was found that the catapult threw arrows a distance of 300 yards. The mark was hit regularly each time up to 180 yards. The same can be said of the *onager*, which sends stones to a distance of 180 yards with astonishing precision, although weighing 1½lbs. The initial velocity was calculated to be more than fifty metres per second, as the time taken to reach the mark is not more than seven seconds and sometimes less than five. All these apparatus are to be tried at a public exhibition to be given in the beginning of next October.

On Saturday last, the "capping day" of the graduates of Edinburgh, the occasion was celebrated by the customary dinner of the Edinburgh University Club, at St. James's Hall; Dr. Cobbold, F.R.S., in the chair. Amongst the distinguished visitors present was the Right Hon. Sir Bartle Frere, K.C.B., who, on replying to the toast of "The Visitors," remarked on the high state of efficiency of the men who entered on Foreign Service, having previously studied at the northern University. During the afternoon a telegram was received from Prof. Balfour announcing that upwards of 100 new graduates were enrolled amongst the alumni of the University.

At the last meeting of the Connecticut Academy of Arts and Sciences, Prof. Marsh made a communication on the size of brains of tertiary mammals, comparing the relative sizes of those of the Eocene, Miocene, and Pliocene. His facts appear to have a very important bearing on the history of the evolution of mammals, and indicate future interesting lines of research. In all the known examples of groups he has been able to compare, he finds those of the Eocene have remarkably small brains; those of the Miocene are larger, and the Pliocene still larger, while the existing species are again still larger.

Dr. G. B. Halford writes to the *Melbourne Argus* on the strength of the poison of Australian snakes as compared with those of India, and also of the efficacy of liquor ammoniæ in counteracting the poison. It is established that the poison of the Australian tiger snake is as deadly as that of the cobra, but Dr. Ewart of Calcutta concludes from experiments that the liquor ammoniæ as a counter-agent is inert. Dr. Halford gives the details of a case in which a greyhound which had been so badly bitten by a snake as to be totally "insensible either to sound or feeling, and never moved," was rapidly brought to life and strength by the injection of ammonia and water into the jugular vein. Dr. Halford thus concludes his letter:—"They have far more advantages in India for these inquiries than we have at present. They have their snake men, who handle the reptiles freely for them—a Government that has already given thousands of pounds for the purpose of experiment and publication. I feel myself a very poor and insignificant rival, and yet there is nothing I should like better than to pursue the subject to the end, if that be possible—not to publish an illustrated work on snakes, with details of all the failures in treatment that have ever occurred, but to discover the best remedy or remedies for the treatment of snake-poisoning. If the Government would assist, I would do the work; or if they would appoint anyone else I would help with every suggestion possible, for in the long interval that has elapsed since my first experiments I have not been idle. It is good in science, as in other things, occasionally to *reculer pour mieux sauter*."

It is said on good authority that the introduction of sheep into the foot hills and higher portions of the Sierra Nevada, in California, is beginning to make havoc of its proper flora.

A Mathematical Society of Bohemia, with its headquarters at Prague, has announced its formation.

The last meeting for the year of the American Academy of Science and Arts was held in May, yet early in June the volume of Proceedings was issued, containing all the papers of the session.

Prof. Silvestri, who has made a special study of the phenomena of Mount Etna, announces that an eruption may be expected shortly.

The Hope Chemistry Prize in the University of Edinburgh, now converted into a travelling scholarship, has been awarded to Mr. R. M. Robertson.

A telegram from Melbourne, of Aug. 1, states that Coggia's comet is visible there and presents a brilliant appearance.

M. Sidoroff, says the *Eastern Budget*, member of the Geographical Society of St. Petersburg, has addressed a report to the Russian Admiralty with regard to the Austrian Polar Expedition, of which nothing has been heard since August 1872. M. Sidoroff says in his report that the *Tegetthoff* was last seen by Count Wiltczek in a gulf near Cape Nassau, whose outlet was then being choked up with ice. Since that time various seamen coming from Novaya Zemlya have reported that the quantity of drift ice in the Icy Sea had considerably increased, and that in the summer of 1873 it was extraordinarily abundant. Formerly the ice on the coast of the above island only extended to a distance of five versts in the month of June, while in midsummer 1873 the width of the icy zone amounted to about 100 versts. M. Sidoroff believes that if Cape Nassau had been free of ice, the *Tegetthoff* would certainly have gone round the north-eastern point of Novaya Zemlya, which is only a day's journey from Cape Nassau, and thus reached the gulf of Yeniseisk without difficulty. It is therefore probable that the expedition is frozen up and in want of provisions, and M. Sidoroff accordingly recommends the Russian Government to send food, &c., by land to Cape Nassau, adding that he will contribute 100*l.* to the expenses of the undertaking. The Admiralty has approved of this proposal, and is now taking the necessary steps for carrying it out.

With regard to the question of "Sounding and Sensitive Flames," Mr. A. K. Irvine, of Glasgow, writes—"About twelve years ago I first observed the 'sounding' flame as it occurs on the combustion of gas and air passing through a disc of wire gauze enclosed in a tube, and showed it to one or two scientific friends, but I published nothing on the subject till 1871, when I took patents in this and other countries for a miners' safety lamp, which indicates by a loud musical note the presence of an explosive atmosphere, by the ignition (at the ordinary flame of the lamp) and combustion of the gas and air entering through a disc of wire-gauze surrounding the wick tube."

The annual session of the British Archæological Association commenced on Tuesday morning in Bristol, under the presidency of Mr. Kirkman Hodgson, M.P., and will continue all the week and conclude next Monday at noon. The members of the Association, numbering about 100, and including archæologists from all parts of the country, assembled in the Guildhall, where they were welcomed by the Mayor and Corporation. The party then proceeded to the first point of interest on the day's programme, namely, St. Mary Redcliffe Church; here Mr. F.

Godard, F.S.A., read a short paper on the church. The members of the Association afterwards visited the Temple Church, which is noted for the fact of its tower being 4 ft. out of the perpendicular.

THE great work "On the Marine Mammals of the North Pacific," by Capt. C. M. Scammon, of the United States Revenue Service, has now been completed and is published by John H. Carmany & Co., San Francisco. It forms a stout quarto volume, with many plates, and contains an exhaustive history of the whales, porpoises, and other Cetaceans, together with that of the sea-elephant, sea-lion, sea-otter, the walrus, &c., all accurately figured and described. A specially important section of the volume is that upon the American whale-fishery, giving an account of its origin, extent, mode of prosecution, its progress and present condition, with a full description of all the apparatus used in the capture and utilisation of the Cetaceans, and the incidents of a whaling life. In an appendix is a systematic account and catalogue of the Cetaceans of the North Pacific, by Mr. Dall, a glossary of words and phrases used by whalemen, and a list of stores and outfits. As an exhaustive treatise, even of a limited field of the whale-fishery, this book will probably occupy the first rank in the literature of the subject.

THE Reports and Proceedings for 1873 of the Miners' Association of Cornwall and Devon contain a number of valuable papers on various subjects connected with mining. The Association, we regret to see, is somewhat cramped for want of funds, though we are glad to see from the lecturer's report that much good work is being done in the way of spreading scientific knowledge among the young men of the districts in the midst of which the Association is established.

THE sum of 22 guineas, subscribed by a few gentlemen, having been placed in the hands of the Council of the Leicester Literary and Philosophical Society to be distributed in prizes, in such a manner as to promote the study of natural science, the Committee appointed for carrying out the scheme have resolved to offer the prizes on a plan by which they hope that the interest and co-operation of a large number of persons will be secured, and the Town Museum at the same time greatly benefited. The prizes will be awarded for specimens of Leicestershire rocks, minerals, and fossils ; Leicestershire insects and spiders ; Leicestershire shells, land and water ; Leicestershire plants, including cryptogams. Every specimen must have been collected within the borders of the county ; and the other precautions are such as ought to produce a valuable local collection of specimens.

FEW persons are aware of the important exploration which has been going on for a year or two past in Costa Rica, under the direction of Prof. William M. Gabb, a geologist and explorer of Philadelphia, well known for his excellent scientific work, especially in connection with the geological survey of California, under Prof. Whitney. The special object is an investigation of an entirely unknown region of South-eastern Costa Rica, inhabited only by savages, but known to contain rich treasures of minerals, worked by the Spaniards in the early days of the Conquest ; this knowledge being only by traditions. Although the party has consisted only of Prof. Gabb and four assistants, it has already gathered a great deal of important information and material in reference to the economical, scientific, and political history of the region investigated. In the course of his labours, Prof. Gabb found the people less savage than had been supposed, and he has already succeeded in winning their confidence to such an extent as to induce their chief to accompany him on a visit to San José. As might have been expected, the geological structure of the country has occupied a large share of Prof. Gabb's attention, and enough has been discovered to warrant the belief that the mineral resources are of great importance. The greatest interest attaches, however, to the discovery of two previously unknown volcanoes, not less than 7,000 ft. high, in the main cordillera just north-west of Pico Blanco. Of these he is about to make a thorough examination. The natural history collections made by the professor are of unusual magnitude and value, embracing all departments of zoology, and especially rich in mammals, birds, reptiles, and insects. Of fish there were but few species, but all that could be found were secured. The ethnology and philology of the country have been attended to very thoroughly. Material illustrating the manners and customs of the people was also gathered in great quantities, and important discoveries made of *Huacos*, or prehistoric graves. In addition to these, Prof. Gabb is on the track of an ancient buried city, of which no mention is made in any history of the country. The natural history and ethnological collections made have been sent to the National Museum, where they form a conspicuous feature in the Central American series. The material thus collected by Prof. Gabb will, on his return, be made the subject of an elaborate work, in which he hopes to present the whole subject of the physical and natural history of the country in its fullest detail. An important geological discovery made by him is that the appearance of dry land on the isthmus is of Tertiary date, and that it is coeval with the period of volcanic excitement in the Californian sierra.

MR. E. DUNKENFIELD JONES, of Pyroleira, near Jacareby, province of Saô Paulo, Brazil, writes us that on April 21 he witnessed a most glorious lunar rainbow just after a thunderstorm, at about 8.30 P.M. The arc was one of about 120°, and the secondary bow was just visible though not distinct ; but the most remarkable part of the phenomenon was the increase of light over the *whole segment* of the circle. The clouds within the rainbow appeared much lighter than those outside. The bow was quite white, not the slightest trace of colour appearing. The moon was only five days old, and it seems strange that the rainbow should have been so bright with so young a moon. Our correspondent understands that lunar rainbows are very uncommon in that part of the world. This is natural, he states, for *showers* (during which alone the phenomenon can take place) generally occur before sunset and are rare at night.

THE exhibition intended to celebrate the fiftieth year of the Franklin Institute is to be held in Philadelphia from Oct. 6 to Oct. 31. All products of national industry may be sent for exhibition. In addition to three classes of premiums—a silver medal of the Franklin Institute, a bronze medal, and a diploma of honourable mention—cases of special merit may be referred to the Committee on Science and Arts, with a recommendation for the award of the Scott legacy premium or the Elliot Cresson gold medal. The Scott legacy premium—a bronze medal and 20 dols.—is vested in the City of Philadelphia by the provisions of the will of John Scott, of Edinburgh, made in 1816, and the city has confided the trust to the Franklin Institute. The Elliot Cresson gold medal is an honour which has rarely been awarded.

"REPORT on the Physical Character and Resources of Gippsland" (Melbourne, 1874) is the title of a pamphlet of upwards of 60 pp., containing a report of the Surveyor-General and the Secretary of Mines for Victoria of observations made on a recent tour through that part of the colony of Victoria. Gippsland includes that part of the colony between E. long. 145° 50′ and 150°, and contains an area of 13,898 square miles. The report contains many careful observations on the geology, natural history, and resources of the district, and is a valuable addition to our knowledge of the great southern continent. A good map and a geological section accompany the report.

LAST week two remarkably fine examples of the Smooth Hound or Skate-toothed Shark (*Mustelus vulgaris*) were taken in the fish weirs at Rhos Tynach, near Llandudno, and have been secured by Mr. W. Saville-Kent for the tanks of the Manchester Aquarium. The fish arrived in good condition, and have proved to be a pair, male and female. The latter, since its arrival, has presented the institution with six young ones; these are all doing well, already take food, and are now swimming about with the parents in the tank allotted them, 40 ft. long, presenting a most interesting spectacle. Some young herring have been introduced by way of experiment, and the result has been so satisfactory that it is sanguinely anticipated that the Manchester Aquarium will shortly possess as fine a shoal of herring as may be seen at Brighton. The inland position of the former station and the consequent difficulties to be overcome in transit will considerably enhance the value of such an exhibition. The attendance at the weekly lectures and the interest manifested in them continue to increase.

THE additions to the Zoological Society's Gardens during the past week include a Laughing Kingfisher (*Dacelo gigantea*) from Australia, presented by Mr. J. S. White; two Black-handed Spider Monkeys (*Ateles melanochir*) from Central America, presented by Mr. S. W. Rix; a Greater Sulphur-crested Cockatoo (*Cacatua galerita*) from Australia, presented by Miss S. Hooper; a Tamandua Ant-eater (*Tamandua tetradactyla*) from South America, deposited; and three Blotched Genets (*Genetta tigrina*), born in the Gardens.

SCIENTIFIC SERIALS

THE *Journal of the Chemical Society* for July contains the following papers:—Note on a new mineral from New Caledonia, by Archibald Liversidge. This mineral is a hydrated silicate of nickel and magnesium allied to *alipite*.—Messrs. Gladstone and Tribe contribute the seventh part of their researches on the action of the copper-zinc couple on organic compounds. The substances now submitted to the action of the couple are the chlorides of ethylene and ethylidene. The dry chlorides are not acted on by the couple, even at a boiling heat, but in presence of water a feeble decomposition occurs. The decomposition is more energetic in the case of ethylidene chloride in the presence of alcohol, decomposition taking place according to the equations:—

$$C_2H_4Cl_2 + 2\left.\begin{matrix}C_2H_5O\\H\end{matrix}\right\} + 2Zn = C_2H_6 + 2\left.\begin{matrix}C_2H_5O\\Cl\end{matrix}\right\} Zn$$

$$C_5H_4Cl_2 + Zn = C_2H_4 + ZnCl_2.$$

Ethylene chloride only undergoes a small amount of decomposition when mixed with alcohol and heated with the couple.—Isomeric terpenes and their derivatives, Part IV., §1.—On cajeput oil, by Dr. C. R. A. Wright and T. Lambert. The oil was fractionally distilled, and the fraction boiling at 176°—179° (giving on analysis numbers agreeing with the formula $C_{10}H_{18}O$) was used for the experiments described. When treated with bromine the compound $C_{10}H_{18}Br_2O$ is produced, and this, on distillation, decomposes as follows:—

$$C_{10}H_{18}Br_2O = H_2O + 2HBr + C_{10}H_{14}.$$

The cymene thus obtained is identical with that obtainable from many other terpene derivatives, since it yields by oxidation a mixture of terephthalic and acetic acids.—§ 2. On the action of pentasulphide of phosphorus on terpenes and their derivatives, by Dr. C. R. A. Wright. The action of this substance appears to be the same in the case of citronellol and cajeputol, a terpene being first produced according to the reaction:—

$$C_{10}H_{18}O - H_2O = C_{10}H_{16}$$

and this terpene by the further action of the pentasulphide splitting up thus:—

$$C_{10}H_{16} + S = H_2S + C_{10}H_{14}$$

The cymene produced is identical with the preceding.—Action of ammonia on phenyl-chloracetamide and cresyl-chloracetamide, by Dr. D. Tommasi. When ammonia is dissolved in a mixture of alcohol and water, and the amides warmed with this solution, chlorine is exchanged for hydroxyl, according to the equation:—

$$\left.\begin{matrix}C_6H_5\\H\\CH_2ClCO\end{matrix}\right\} N + \left.\begin{matrix}NH_4\\H\end{matrix}\right\} O = \left.\begin{matrix}NH_4\\Cl\end{matrix}\right\} + \left.\begin{matrix}C_6H_5\\H\\CH_2HOCO\end{matrix}\right\} N$$

and similarly with the cresyl compound. This new compound, termed by its discoverer *phenyl-hydroxylacetamide*, is decomposed by boiling water, by potassic, sodic, and baric hydrates, this latter substance yielding aniline and some barium salt not examined. *Cresyl-hydroxylacetamide* is obtained by a similar process, and possesses very similar properties.—On Aqua Regia and the nitroxyl chlorides, by Dr. W. A. Tilden. The dried gases evolved from hot *aqua regia* when passed into concentrated sulphuric acid give rise to the deposition of a crystalline substance of the formula $NOHSO_4$, while free chlorine and hydrochloric acid gas escape. The acid nitroxyl sulphate heated with dry sodium chloride yields nitroxyl monochloride (NOCl) as an orange-yellow gas liquefying by a freezing mixture of ice and salt. The author's researches prove that this gas is the only compound of nitrogen, oxygen, and chlorine evolved from *aqua regia*, the reaction being:—

$$HNO_3 + 3HCl = NOCl + Cl_2 + 2H_2O.$$

The concluding paper is by Charles E. Groves, On the preparation of ethyl chloride and its homologues. The author passes hydrochloric acid gas into ethylic or methylic alcohol containing fused zinc chloride in solution. The present part contains its usual collection of valuable abstracts.

THE *American Journal of Science and Arts*, July.—Results derived from an examination of the United States weather maps 1872-3, by Elias Loomis; this we shall notice separately.—Prof. C. F. Himes describes a method of preparing photographic dry-plates by daylight, by desensitising and resensitising the silver compounds.—On a molecular change produced by the passage of electrical currents through iron and steel bars, by John Trowbridge. The conclusions are:—(1) The passage of an electric current through an iron or steel bar produces molecular change in it, which is apparent both at the closing and breaking of the circuit. (2) The rapid change of direction of a current through iron or steel bars produces a molecular disturbance which is greater than that imparted by a current sent in one direction alone. (3) Magnetisation of the iron or steel is sufficient to restore it to the normal magnetic state which is imparted by the magnetising helix. (4) The molecular action increases with the strength of the electric current.—The magnetism of soft iron, by David Sears. Mr. Sears follows up the investigations of M. Jamin given in the *Comptes Rendus* for Jan. 12 last. His results are:—(1). With poles of the same name opposed to each other the magnetisation of an iron bar forming the armature of the two poles is greater on a part of the armature beyond the two poles than it is when poles of opposite signs are opposed. (2) On points of the armature between the two poles the magnetisation is greatest when poles of the opposite names are opposed. A north and south pole attract an armature, therefore, with much greater force than two north or two south poles. (3) M. Jamin's conclusions from the experiments upon an iron bar forming a core to the enveloping helices are as follows:—(3°) "If the theory of solenoids is admitted, the action of parallel currents should be to increase the intensity of magnetisation; on the contrary, it is diminished. (4°) When the currents in the magnetising helices run in opposite directions, they should act opposed to each other on the currents circulating around the particles of the iron, and should diminish each other's action; on the contrary, it is increased. (5°) The action of the helices should be annulled at the middle of the bar. It is not." When the bar to be experimented on forms not the core, but the armature of two electro-magnets, the effects obtained are the reverse of those obtained by M. Jamin, and tend to confirm the theory of solenoids.—Mineralogical notes: Tellurium ores of Colorado; Geology of the Gold Hill Mining Region, with a map.—Notes on diffraction gratings, by John M. Blake, with woodcuts. After a long account Mr. Blake mentions that in many points he has been anticipated by Lord Rayleigh in the Phil. Mag. for February last. The explanation of the origination of the "bands" differs from Lord Rayleigh's.—On the spectrum of the Zodiacal Light, by A. W. Wright. A Duboscq spectroscope with a single prism was employed, the telescope and collimator of which have a clear aperture of 2·4 centimetres. The magnifying power of the former is nine diameters. Special

precautions were taken with the observations, and from them is drawn the following conclusions:—(1) The spectrum of the zodiacal light is continuous and is sensibly the same as that of faint sunlight or twilight. (2) No bright line or band can be recognised as belonging to this spectrum. (3) There is no evidence of any connection between the zodiacal light and the polar aurora. The deduction, drawn from the fact of its polarisation, that the zodiacal light is derived from the sun and is reflected from solid matter, is thus strengthened and confirmed by the identity of its spectrum with that of solar light. A discussion of the distribution of the reflecting matter in space is reserved for another article.—On the age of the copper-bearing rocks of Lake Superior; and on the westward continuation of the Lake Superior synclinal, by Roland Irving, with map and section.—On the parallelism of coal seams, by E. B. Andrews. This refers to the difference of opinion already expressed between Dr. Newberry and Mr. Andrews. Their question is whether the ancient shore lines with their coal marshes subsided in an even and uniform way, or very unevenly.

Journal of the Franklin Institute, May and June.—Section: Chemistry, Physics, Technology.—Prof. H. Wurtz's report On the water supply of the cities of Newark and Jersey City is continued, as is also Prof. Thurston's communication On investigations of the resistance of materials.—Dr. Lewis Feuchtwanger contributes a paper On baryta: its manifold uses in the arts.—Dr. C. Cooley describes a new connection thermoscope, by which the sensibility is increased, and its adaptation to a wider range of experiments secured.—Mr. Isherwood reports on Russian coals from the basin of the Don. He states they will doubtless soon be substituted for English coal along the shores of the Black and Mediterranean seas.

Neue Denkschriften der Allgemeinen Schweizerischen Gesellschaft für die Gesammten Naturwissenschaften, Band xxv. Zurich, 1873.—M. Mousson has made a general revision of the terrestrial malacological fauna of the Canary Islands, discussing and defining, as far as possible, all the species hitherto mentioned; and the results of this inquiry are here detailed in a comprehensive memoir on the subject. It appears that, according to the present state of our knowledge, the Canaries altogether contain 183 certain species of terrestrial and fluviatile molluscs; the largest numbers being presented by Teneriffe (90) and Palma (43); which may, in part, be explained by greater extent and richness of soil, and fuller exploration. The small proportion of fluviatile species is striking (there are only ten); it is probably due to the irregular character of most of the water courses, at times quite torrential, at others attenuated to a mere thread, or wholly dried up. Deposits of terrestrial shells are found at various points of the Canaries; and some lists which the author constructs from M. de Fritsch's inquiries on the subject appear to indicate three different degrees of antiquity in these remains. The deposits of Gomera and Fuerteventura, containing a series of species which have no present analogues, are older than those of Gran Canaria, which do present actual species though modified in the form of varieties; and the latter again are older than those of Teneriffe, the *débris* of which correspond entirely to extant forms. M. Mousson's observations in comparison of the Canarian fauna with those of neighbouring continents and islands are specially interesting. He concludes that the essential part of the malacological fauna of the Canaries is not reducible to any other fauna, and appears to have been developed in a manner perfectly autonomous. The particular features characterising the Canarian fauna consist of the predominance of certain sections of species, or of certain types, which elsewhere do not appear in the same manner, and the elimination of entire genera that occupy an important place in neighbouring fauna. "The only satisfactory explanation of this fact," says M. Mousson, "is that these islands, the objects in which, though often distinct from one another, yet range for the most part about common centres, have formed, since the origin of the present epoch (that is, since the great overturns which have separated the Tertiary epoch from the Quaternary, and opened the era which still continues), an independent whole separated by uncrossable barriers, by the sea, doubtless, from the African and European continents, as also rom the Madeira and Cape Verde Islands; which, themselves also, were independent." The differences between the old and recent fauna are attributable (on this view) rather to local overturns connected with the variable and volcanic nature of the ground than to geological and general climateric conditions; for most of the types have remained nearly the same, and have traversed the different sub-fossil fauna that are distinguishable. The diversity of neighbouring forms in the different islands denotes a separation of distant date, but proves nothing as regards the possibility of these islands having once formed a small compact continent, afterwards broken up.—The second and only remaining memoir in this volume is by Prof. Rütimeyer, and has for its subject the fossil tortoises of Solothurn and the rest of the Jura formation. The author's investigation is of a thorough and exhaustive character, and the paper (with its 17 beautifully executed lithograph plates), will be found a valuable contribution to this branch of palæontology.

Revue d'Anthropologie, t. iii. No. 1, 1874.—M. Gustave Lagneau, in the first paper, considers the grounds on which a purely Celtic origin may be ascribed to the primitive inhabitants of the Basin of the Saone and of the Rhone valley and its dependencies; and after sifting the evidence afforded by ancient and modern authorities he is led to ascribe a mixed origin to these peoples.—M. G. de Rialle devotes a long and very comprehensive paper to the history of the peoples of Central Asia.—M. F. Moreno's account of his discovery of some Prehistoric burying-grounds and *paredos*, or ancient Indian habitations, on the shores of the Rio Negro (Patagonia) forms a valuable contribution to our knowledge of the anthropological characters of the primitive inhabitants. M. Moreno's paper is enriched with a table of cranial measurements, comprising a series of results obtained from forty-five skulls.—M. T. Chudzinski gives the result of his observations on the muscular system of the negro, derived from the autopsy of three subjects at the Paris School of Anthropology, reserving for a future number the general considerations to which the facts observed seem to point.—The recent discovery in one of the Canaries of a Libyan inscription, such as has hitherto been found only in Numidia, has called forth some remarks from M. Faidherbe on the ethnology of the Canarian group. The writer believes that the population of the Canaries may be referred to Ouolofs, or West African blacks, to African Libyans, and probably to Phœnicians, besides a later intermingling with Europeans; and it is to the agency of Phœnician traders that he ascribes the knowledge of the Libyan characters and the practice—whose prevalence is amply proved—of embalming the dead, and reducing them to the state of mummies, in which condition they have been found among the natives of these islands.—In No. 2 of this year's series M. Topinard discusses at length the accuracy of Camper's facial angle, and the correctness and sufficiency of the data on which it was based. As the first attempt to establish a system of human craniometry, Camper's definition of the facial angle deserves the greatest respect, and M. Topinard shows that the subsequent depreciation of the value of his method is chiefly due to the vague and variable modes of its application, which originated with Geoffrey Saint-Hilaire and Cuvier. M. Topinard is of opinion that even when used with the greatest attention to the rules which Camper himself prescribed, his method can scarcely be employed with perfectly identical results by different observers, and hence he thinks it would be advisable to adopt some less variable process of determining the maxima and minima for the facial angle. The science of craniology is beginning to assume a more reliable character, and we may therefore hope that craniologists will soon find themselves in a position to adopt some definite and universally applicable method. This, however, can scarcely be attained till the fact is recognised that in craniometric measurements it is the means and not the extremes which we ought to aim at obtaining; the former are alone safe, the latter tend to error.—French geologists are still devoting a large amount of attention to that richest of all palæontological sources, the limestone districts of the Dordogne. In an additional note on the cave of the church at Excideuil, M. Parrot gives us the results of one of the most recent explorations of that region. A careful examination of this cave or crypt has revealed the fact that below the floor, at various depths, lie buried the *débris* of the Quaternary fauna intermingled with the remains of products of industry, belonging evidently to men contemporaneous with the animal deposits with which they are mixed. Reindeer, beavers, bears, are here all represented, and the industrial objects found are similar in character to those of the other caverns, but there are also numerous remains of jasper not met with elsewhere, and the bones have undergone a softening process hitherto unobserved. In other respects the cave of Excideuil offers no novel interest.—M. Hovelacque discusses the ethnological characters of seven genuine Tsigane skulls in the Paris Museum.

SOCIETIES AND ACADEMIES

LONDON

Royal Horticultural Society, July 15.—Scientific Committee.—A. Smee, F.R.S., in the chair.—Mr. McLachlan showed damson leaves affected with a gall produced by *Volvulifex pruni*, a species commonly found on the sloe.—Dr. Hooker sent a note stating that since the last meeting a Ward's case had been received from Mr. Moseley of the *Challenger*, and though all the plants were dead, the soil, when spread out and watered, yielded numerous seedlings of *Pringlea* and *Azorella*.—Dr. Masters exhibited a branch of Privet, furnished with large woody spines.

General Meeting.—Dr. Masters, F.R.S., in the chair.—The Rev. M. J. Berkeley commented on the most important of the objects submitted to the Fruit and Floral Committees.

PHILADELPHIA

Academy of Natural Sciences, Dec. 30, 1873.—Dr. Ruschenberger, president, in the chair.—The following paper was presented for publication:—Remarkable variations in coloration, ornamentation, &c., of certain larvæ of Nocturnal Lepidoptera, by Thos. G. Gentry.—On report of the committees, the following papers were ordered to be printed: Description of seven new species of *Unionidæ* of the United States, by Isaac Lea; Description of three new species of *Uniones* of the United States, by Isaac Lea.

Jan. 6.—Dr. Ruschenberger, president, in the chair.—Dr. J. G. Hunt remarked that the structure of the *Schizæa pusilla* differed widely from that of our other indigenous schizaceous ferns, viz., *Lygodium palmatum*, and its morphological elements are unlike those of our ferns in general. The barren frond of *Schizæa pusilla* is marked on its epidermal surface with a *double line* of stomata, and these organs extend the entire length of the frond. The cells which make up the interior of this delicate fern are cylindrical and vary in size, but their distinctive characters lie in minute projections or outgrowths from all sides of the cells, and these projections meet and are articulated with corresponding outgrowth from adjoining cells, so that the cells of *Schizæa* have penetrating between them in every direction intercellular spaces and channels of *remarkable regularity* and beauty, and so characteristic is this plan of cell-union that the botanist need find no difficulty in identifying the smallest fragment of the plant. This morphological peculiarity has not been noticed before.—Mr. Thomas Meehan exhibited some flowers of *Passiflora quadrangularis*, in which some of them had the pistils almost wanting, while the flowers were perfect in all other particulars. He said it was well known that in cultivation this plant never produced fruit unless by artificial cross-impregnation, but he thought the tendency to abort in the female flowers, and thus approach the classes which were in structure as well as practically uni-sexual, had not been noticed before. There was a species in New Zealand, however, known to be monœcious, and it might be just possible that the *Passifloraceæ*, with mostly hermaphrodite flowers, were following in the wake of the allied *Cucurbitaceæ*, in which a complete separation of the sexes was the rule.

Jan. 13.—Dr. Ruschenberger, president, in the chair.—Prof. Leidy remarked that two species of *Hydra* were common in the neighbourhood of Philadelphia. One is of a light brownish hue and is found on the under side of stones and on aquatic plants in the Delaware and Schuylkill rivers, and in ditches communicating with the same. Preserved in an aquarium, after some days the animals will often elongate the tentacula for several inches in length. The green *Hydra* is found in ponds and springs attached to aquatic plants. It has from six to eight tentacles, which never elongate to the extent they do in the brown *Hydra*. In winter the animal is frequently observed with the male organs developed just below the head as a mamma-like process on each side of the body. He had not been able to satisfy himself that these *Hydræ* were different from *H. fusca* and *H. viridis* of Europe. Prof. Agassiz had indicated similar coloured forms in Massachusetts and Connecticut, under the names of *H. carnea* and *H. gracilis*. Of the former he remarks that it has very short tentacles, and, if this is correct under all circumstances, it must be different from our brown *Hydra*, which can elongate its arms for 3 in. or more.

Jan. 20.—Dr. Ruschenberger, president, in the chair.—Prof. E. D. Cope described some species of extinct tortoises from certain formations of north-eastern Colorado, which had been previously found in the Fort Union or lignite beds of the Missouri river region by Dr. Hayden. He had in 1868 recognised the age of the latter as Cretaceous, contrary to the opinion expressed by some geologists, that the formation both in Dakota and Colorado is Tertiary.—Mr. Cope incidentally mentioned the recent discovery of remains of *Dinosaurs* in the lignite beds of Colorado, which were thus proved to belong to the Cretaceous period, and not Tertiary, as the evidence of the fossil plants had been interpreted by Mr. Lesquereux and others. Dr. LeConte expressed his great satisfaction at the complete confirmation, by his friend Mr. Cope, of the statements he made several years ago (Notes on the Geology of the Survey for the Extension of the Union Pacific Railway, Eastern Division: Philadelphia, Feb. 1867), concerning the Cretaceous age of the lignites at the eastern base of the Rocky Mountains, from near Denver southwards into New Mexico.

Jan. 27.—Dr. Ruschenberger, president, in the chair.—Prof. Cope made some observations on the age of the lignite and other corresponding formations of the West, and especially its supposed equivalent in Northern Colorado. He referred to his determination of the Upper Missouri formation as Cretaceous in 1868; of the Wyoming Bitter Creek series as of the same age in 1872. He now added the Colorado strata to the same, on the evidence of vertebrate remains procured by himself during the past season, in connection with the United States Geological Survey under Dr. F. V. Hayden. These remains consisted of *Dinosauria* of three species, tortoises of five, and a single species of crocodile. Five of the genera were diagnostic. The *Dinosauria* were referred to the old genus *Hadrosaurus* and the new genera *Polyonax* and *Cionodon*. The *Cionodon arctatus* was a large herbivorous saurian, allied to *Hadrosaurus*, but with a most complex and singular type of dentition; the size that of a horse. The other two species are much larger.

BOSTON, U.S.

Society of Natural History, Feb. 18.—Dr. H. Hagen read a paper On amber in North America, calling attention to a forgotten paper by Dr. G. Troost, published in Silliman's *American Journal of Science*, 1821, entitled, "Description of a variety of Amber, and of a fossil substance supposed to be the nest of an insect, discovered at Cape Sable, Md." This paper contains much more than its title would indicate, giving an elaborate account of the geological formation of Cape Sable Dr. Hagen then described the different strata at Cape Sable, as given by Dr. Troost; comparing which with the profile of the coast of Samland in Eastern Prussia, where most of the amber was found, he showed there was little resemblance between the two, except the occurrence of amber in sandy strata and the agglutination of sand by iron oxide, although whether this sand has any similarity to the glauconite of the amber strata in Prussia he did not know. A striking difference between the amber strata in Eastern Prussia and in Maryland is the occurrence of lignite only below these strata in the latter and only above in the former locality. This fact perhaps indicates some similarity with the occurrence of amber in the so-called *striped sand* of the lignite layers of Prussia.—Dr. Hunt then read a paper on the deposition of clays. Having examined the water of the Mississippi near its mouth, he found it to contain about 1-2000 of suspended matter, chiefly clay, which required from ten to fourteen days to subside. He, however, observed that the addition of sea-water or of salt, sulphate of magnesia, alum, or sulphuric acid, rendered the turbid water clear in from twelve to eighteen hours. He thus explained the ready precipitation of the suspended clay when the river water comes in contact with the salt waters of the Gulf of Mexico, causing thus great deposits of fine mud and helping us to understand the origin of the accumulations of argillites and clay slates which are met with in various geological formations. An explanation of this phenomenon is to be found, Dr. Hunt thinks, in the researches of Guthrie on the formation of drops (Proc. Royal Soc., xiv., 1864). Studying the size of drops of water falling from a small sphere of ivory, he found that the cohesion of the water was diminished when it held saline matter in solution, as was shown by the smaller size of the drops. This was verified by experiments with solutions of various strengths, of nitre and chloride of calcium. It was found that the addition of eight parts of the latter salt to 1,000 parts of water reduced by one-ninth the size of the drops, which was determined by their diminished weight. These results show a diminished cohesion of the liquid to the ivory sphere, from which it was by the force of gravity made to fall. The cohesion in virtue of which extremely attenuated particles of clay are held

in suspension in water in opposition to gravity, is in this manner so far reduced by the addition of saline matters that gravity and cohesion rapidly assert themselves among the suspended particles, which collect together and subside, leaving the saline liquid clear. The precipitation of suspended clay is made very rapid when a strong solution of salt is employed.

VIENNA

Imperial Academy of Sciences, March 12.—M. Puschl communicated a paper on heat of bodies and ether-density. To explain Dulong and Petit's law, he assumes that, in solid bodies, the *vis-viva* of atom-motion is small compared with the quantity of rays collected in the ether between the atoms, through reflection; that, at ordinary temperatures, bodies are nearly quite opaque for their own internal radiation; and that the chemical equivalent weights of bodies are no relative atomic weights, but weight quantities with equal amounts of atom surface. He thinks that possibly all chemical changes in bodies may be accounted for by heat radiation. The heat of bodies consisting mainly in motion of ether, a means is given of determining the lower limit of density of the latter; and M. Puschl considers it must be more than 26 billionths of that of water (regard being had to the specific heat of water).—A note from Prof. Maley stated that he had been able to make the urine of dogs alkaline through simple removal of the acid gastric juice from the body. —M. Oppolzer, from experiments on the velocity of propagation of the electric current, estimated it at 4,000 geographical miles in a second.—Prof. Böhm read a paper On formation of starch in the germinating leaves of cress, radish, and flax. He opposes Kundt's view that starch developed among the chlorophyll granules, on exposure to light, is an assimilation-product formed immediately from decomposed carbonic acid. He considers it rather a transformation-product of reserve nutriment already present in the cotyledons (adducing evidence of this from various experiments).—Dr. Streintz communicated a paper On deadening of torsion-oscillations of wires. Internal metal-deadening (as he calls that part of the deadening which has its cause in torsion of the wire), does not, he finds, follow the laws of air-deadening. One property they have in common; the logarithmic decrement for different amplitudes is the same. But the metal deadening remains unaltered when the moment of inertia is changed, or the wire lengthened or shortened, and so the time of vibration altered. It is independent of the diameter and tension of the wire; it grows quickly with the temperature. Annealed wires show a much less deadening than unannealed. These properties explain some peculiarities of musical instruments, and may be variously utilised.—M. Schrauf presented a note on the thermo-electric properties of various minerals.

March 19.—Prof. Mach communicated a third paper On the sense of equilibrium, giving a formula which applies to pressure of parts of the body on each other, muscular efforts, skin sensations, hydrostatic blood pressure, and the hypothetical functions of the labyrinth.— Dr. Boué gave an extract from his treatise on the constituent parts of mountain chains, on mountain systems, and comparison of the surfaces of the earth and moon. He criticises M. Elie de Beaumont's theory, regarding it as merely a fragment of a more general orogeny.

GÖTTINGEN

Royal Society of Sciences, Feb. 7.—M. Grisebach read a paper On a collection of plants made by Prof. Lorenz in the provinces of Cordova, Santiago del Estero, Tucuman, and Catamarca, in South America (between 26° and 31° S. lat.). The diligent labour of two years, and in widely different localities, furnished only 900 species, showing how little varied, comparatively, are the Argentine flora. Neither climate nor soil seems to account for this homogeneity. The author considers it explained by the fact of this part of South America having been raised out of the bed of the Atlantic later than the neighbouring regions of Brazil and Chili, long geological periods being necessary for the appearance of new organisms. As to the question whether there has been only immigration of species, or new species have arisen independently, it appears from comparison of Brazilian and Chilian flora that the latter is true; the number of endemic species is about 43 per cent., a proportion similar to that in flora regarded as independent. Among the immigrant species the relationship to Chili is most marked.—M. Kohlrausch communicated a paper On thermo-electricity, conduction of heat, and electricity. He sets out with the hypothesis that with a heat-current of certain amount dependent on the nature of the conductor, an electric current is connected; and explains by means of it the phenomena of thermo-electricity. To explain Peltier's observation of development of heat by an electric current at a point of junction, it is added, that heat is moved by an electric current; and the heat-moving force of the unit electric current in any body is proportional to the electromotive force of the unit heat-current in the same body. This suggestive paper also treats of the relations of the hypothesis to the principle of conservation of energy, displacement of the thermo-electric order of metals by temperature, heat conduction and work, &c.—M. Heymannrpresented a paper On an Indian drama, Bharata's Natyaçastram.—M. Enneper discussed some theorems relating to surfaces of the second order.

PARIS

Academy of Sciences, July 27.—M. Bertrand in the chair —The following papers were read:—Action of differently refrangible rays on iodide and bromide of silver; influence of colouring matters, by M. Edm. Becquerel.—On the Algerian meteorological tracing, by M. Ch. Sainte-Claire Deville.—Objections to the method of uprooting vines for the destruction of *Phylloxera*; indication of another process; a letter from M. C. Naudin to M. Elie de Beaumont.—Report on M. Cauvy's memoir concerning the means of preserving vines from the invasion of *Phylloxera*, by the Commissioners.—Researches on explosive bodies: explosion of powder, by MM. Noble and F. A. Abel, first memoir.—Note on the quantity of water consumed by wheat during its growth, by M. Marié-Davy.—Actual state of the invasion of *Phylloxera* in the Charente provinces, extract from a letter from M. M. Girard to M. Dumas.—Indications given in 1845 of the existence of an ancient sea in Algeria, in the meridional portion of the Atlas, and on the possibility of re-establishing this sea, by M. Virlet d'Aoust, in a letter to the perpetual secretary.—On the production in the same medium and at the same temperature of the two varieties of sulphur, octahedral and prismatic, by M. D. Gernez.—On the action of ether on cupric oxide for transforming it into cuprous oxide and into metallic copper, by M. A. Guerout.—On isoterebenthene, by M. J. Riban.—On a division of the fibrin of blood from whence is derived a substance analogous to ordinary albumen, by M. A. Gautier.—On the anti-putrid property of the heavy oil of coal-tar, by M. L. Dusart.—New process for the manufacture of the so-called "*alummed*" stuccoes or plasters, by M. Ed. Landrin.—On decomposition of albuminoid matters *in vacuo*, by MM. N. Gréhaut and E. Modrzejewski.—Storm of May 26, at Vendôme (Loire et Cher); thunderbolt; scheme for a simplified lightning conductor, by M. E. Nouel.—On the metamorphoses of *Sacculina Carcini*, by M. A. Giard.—Note on the development of the spermatozoids of the brachyurous decapods, by M. P. Hallez. —On the origin of the hot winds of the Alps and the physical constitution of the Sahara, by M. Ch. Grad.—On a vitreous feldspathic orthose from the Isle of Rachgoun (Algeria, province of Oran), by M. Ch. Vélain.—Note on the geology and palæontology of the estuarine formations of the upper tertiary at the environs of Oran, by M. Bleicher.—On the phosphates of lime from Ciply, in Belgium, by M. Nivoit.

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