THURSDAY, FEBRUARY 12, 1880

EDISON AND THE ELECTRIC LIGHT

MR. EDISON has once more come forward with an electric lamp, which we are assured solves the problem of the economic subdivision of the electric light. We have heard this statement so many times with respect to one form or other of lamp devised by this most ingenious and indefatigable inventor, each of which in turn has come to no tangible result, that it becomes harder than ever to trust to the rash announcements flourished so airily by the newspaper press on both sides of the Atlantic.

What is then the nature of the inventions thus heralded before the world? Regarded quietly, and without prejudice, from a scientific standpoint, what is the value of the discoveries which can thus play havoc on the Stock Exchange?

A recent number of the *New York Herald* contained a long and detailed history of Edison's experiments on electric lighting, from which the following description of the new lamp is taken :—

"With a suitable punch there is cut from a piece of 'Bristol' cardboard a strip of the same in the form of a miniature horseshoe, about two inches in length and one-eighth of an inch in width. A number of these strips are laid flatwise in a wrought iron mould about the size of the hand and separated from each other by tissue paper. The mould is then covered and placed in an oven, where it is gradually raised to a temperature of about six hundred degrees Fahrenheit. This allows the volatile portions of the paper to pass away. The mould is then placed in a furnace and heated almost to a white heat, and then removed and allowed to cool gradually. On opening the mould the charred remains of the little horseshoe cardboard are found. It (*sic*) must be taken out with the greatest care, else it will fall to pieces. After being removed from the mould it is placed in a little globe and attached to the wires leading to the generating machine. The globe is then connected with an air-pump, and the latter is at once set to work extracting the air. After the air has been extracted the globe is sealed, and the lamp is ready for use. . . . The entire cost of constructing them is not more than twenty-five cents."

Since the date of this article a paper has been published in *Scribner's Monthly Magazine* for February, written by Mr. Upton ("Mr. Edison's mathematician") but attested by Mr. Edison's signature as the "first correct and authoritative account" of the invention, which confirms the *Herald* article to the minutest details.

We fear Mr. Edison is thirty-five years behind the time in his new invention. The patent-roll of Great Britain for 1845 contains the specification of a lamp invented by King, in which a thin rod of carbon was placed in an exhausted globe; and the inventor specially dwells on the advantage of the Torricellian vacuum for the purpose. A similar lamp was designed by Lodyguine in 1873. The only difference between these lamps and that now brought forward is that Edison prefers a different, and apparently less durable, kind of prepared carbon to that employed by his predecessors, though, again, in the employment of carbonised paper he has been more than once anticipated.

We need not animadvert on the reckless and amusing statements made by newspaper correspondents and interviewers; for these accounts, we believe, Mr. Edison cannot be held responsible. Mr. Edison's first steps in electric lighting, we are told, were to invent a lamp and a generator. The lamp consisted of a piece of platinum to be made incandescent, and so arranged that any excess of heat would cause a small lever to cut off the current. It was an old device described by Draper in 1847. The generator was, on the other hand, a startling novelty. Instead of causing, as in all ordinary dynamo-electric machines, a set of coils to revolve about an axis in a magnetic field, Edison proposed to mount the coils upon the prongs of a huge tuning-fork which should be vibrated by a steam-engine. The friction and waste of power inseparable from rotation was to be completely abolished. Unfortunately "the machine was not practical, and it was laid aside." In other words it was a hopeless failure, wrong in design, wrong in principle, useful only in showing how singularly devoid of sound scientific knowledge a clever practical man may be. The next idea was to make the incandescent metallic strip give light by proxy, causing it to communicate its heat, either directly or by the intervention of reflectors, to a piece of lime or zircon. The fusible nature of platinum, however, spoiled his efforts, and he proposed expensive alloys of iridium and osmium, only to find, what all experimenters with incandescent metals had long known, that there is a constant disintegration going on at the surface and a consequent waste. Mr. Edison discovered, what is for every student of the theory of electricity the most simple and obvious conclusion from Joule's law, namely, "that economy in the production of light from incandescence demanded that the incandescent substance should offer a very great resistance to the passage of the electric current." Forthwith the spirals of platinum, iridium, and iridio-osmium were thrown aside. A carbon filament prepared from charred paper, as described, was adopted. It will be difficult to convince us that the fragile horseshoe paper cinder will resist disintegration better than the carbon used in exhausted tubes by dozens of other experimenters; indeed the invention is avowedly so recent that no lamp can have been tried for a period of time long enough to warrant an assertion of its permanence. The latest telegrams from the States inform us that Edison finds great difficulty in maintaining good vacua, and that further experiments are necessary. It must not be forgotten that even in a globe exhausted to one-millionth of an atmosphere, there yet remain many millions of millions of molecules of air enough to make the disintegration of the incandescent carbon fibre only a question of time.

Meantime Edison had "discovered"—what had been known in Europe for many months—that mercurial air-pumps could be constructed to exhaust to one-millionth of an atmosphere; and, what is more to the point, he found a workman formerly in the employ of the late Herr Geissler, of Bonn, to make his pumps and glass bulbs for him. The tuning-fork generator had already been abandoned in favour of a new generator, christened the Faradic machine, which embodied no new principle nor indeed any very important improvement in construction, being essentially a modification of the well-known Siemens' machine, having a longitudinally-wound armature rotating between the poles of a powerful electro-

magnet, which in this new form is vertical and provided with unusually massive cheeks. One detail of construction is, however, singular, though it seems to have escaped the notice of electricians. Beneath the longitudinal strands of covered wire the central core of the armature, which is of wood, is overspun with a few layers of iron wire wound transversely. This layer of iron resembles in a kind of way the iron ring in the armature of the Gramme machine, and though no conducting wires traverse the interior of it, it clearly may serve one of the important functions of the iron ring in the Gramme machine in concentrating the lines of force in the field. In support of the allegation that this machine gives out in electricity 90 per cent. of the energy it receives from the driving engine, Mr. Edison caused certain calculations by Mr. Upton to be published in the *Scientific American*. We have examined these calculations and find that they are based on the supposition that the electromotive force of the generator is a constant quantity when the speed of revolution is constant, and independent of the resistances of the circuit and of the quantity of current generated. This can only be true if the field magnets are excited by a separate current and generator. Now, in the numerical calculations which have thus been put forth *in proof* of the above assertion, there is no statement made as to the power necessary to supply this auxiliary current, nor indeed are any statistics whatever given of the actual power (in foot pounds or any other measure) delivered by the driving engine to the generator; only a cut-and-dry calculation to show that if the external resistance be greater than the internal the machine will theoretically work more economically when not generating the maximum current! In the *Scribner* article it is explicitly stated that a second Faradic machine is used to render active the magnets of the machine which supplies the light, and in two admirable pictures, one of which is a view of the battery of Faradic machines set up in a "central station," the nature of the arrangements is shown.

We need not refer in detail to the enthusiastic inconsistencies in the *Times* correspondent's accounts. Upon Edison's own data, electricity, instead of costing one-fortieth of the price of gas, costs at least seven-eighths as much, or about thirty-five times as dear as the *Times* correspondent declares. As to the cost of the lamp itself, with its carefully incinerated horseshoe of paper, its glass globe exhausted to one-millionth of an atmosphere, and its platinum-connecting wires, we confess we do not know where the work could be done for anything like the cost of a shilling. "The current can be transmitted on wire as small as No. 36," says the *Times* reporter, who, probably being unaware that the resistance of a yard of such wire is at least half an ohm, avoids saying what length of such wire may be used. With a generating machine "in a central station, perhaps a half-mile away," the introduction of 400 ohms' resistance would be serious—to the light.

But apart from the mild absurdities of newspaper correspondents, the more we study the detailed accounts of the new inventions the more we regret that Mr. Edison does not devote some time to learn what has been already done in this field. An inventor who ignores what has been done ought not to be mortified to find himself occasionally forestalled by others in some discovery which he prides himself is his own. Possibly this may explain the inability sometimes shown by an inventor to credit the good faith of a rival who has priority. The worst feature of such a course of thought lies in its absolute incompatibility with a truly scientific spirit. Here the scientific man and the inventor part company; since the habits of accurate thinking and the necessary candour of the scientific method preclude the truly scientific man from ignoring, even for the sake of scientific discovery, that which is already a part of scientific truth. We are doing no injustice to Mr. Edison's splendid genius when we say that it is to the character of the inventor, not to that of the scientific thinker, that he aspires.

What shall we say, finally, to the whole system of these reckless newspaper announcements—for which, as we have said, we ought not to hold Mr. Edison responsible—by which the public mind is periodically fluttered?

The remedy to these things is obvious enough. Let scientific men once and for all repudiate these false and unwholesome displays of ignorance. Let public opinion insist that the inventor shall be allowed to pursue his way unhampered by the officious interference of the unprincipled speculators whom his soul abhors, or by the irrepressible unscientific reporter who is only one degree less reprehensible for the part he plays. Whether the latest forms of the invention are doomed to the fate of their predecessors or not, the man who can struggle against failures and discouragements as indomitably as Edison has done deserves to succeed, however erratic his methods. But if he succeeds ultimately, it will be in spite of the vampires of the Stock Exchange and the hangers-on of the New York press, who dog his steps for their own selfish ends.

THE MOTION OF FLUIDS

A Treatise on the Mathematical Theory of the Motion of Fluids. By Horace Lamb, M.A., formerly Fellow and Assistant Tutor of Trinity College, Cambridge; Professor of Mathematics in the University of Adelaide. (Cambridge University Press, 1879.)

NOT the least part of the good that must be attributed to the publication of the first volume of Thomson's and Tait's "Natural Philosophy" is that, as in the cases of Maxwell's "Electricity" and Lord Rayleigh's "Sound," it has led and prepared the way for the complete revision and great advancement of several branches of mathematical physics at the hands of those who have made a special study of these branches. Lamb's "Theory of the Motion of Fluids" must be looked upon as another, and for the most part a worthy, offshoot of this wonderful volume. Although it would be too much to expect that one so young as Mr. Lamb should display the same masterly knowledge of his subject as has been displayed by the authors of the two previously-mentioned works, still the thoroughness with which the very difficult and somewhat extensive literature has been handled, and the appreciation of the mathematical points displayed by the author, together with a rare facility in abbreviating and expressing, render this in most respects about the best possible text-book of which the present state of the subject admits. Having said this, it will be seen that I do not make the following remarks with any view of disparaging the

book. These remarks, although directed to the matter in the book, do not, excepting one rather important case, refer unfavourably to anything for which the author is responsible.

Of all subjects on which to produce a satisfactory text-book, perhaps the theory of the motion of fluids, as actual fluids, presents the greatest difficulties. The phenomena of fluid motion, at once commonplace and very obscure, have excited so little interest and called forth such slight observation that at the present time a writer is unable to set before his readers any adequate description of the phenomena which it is his implied object to explain. And as regards the theory, he has to begin by apologising for his fundamental assumptions as being obviously contrary to facts, and after carrying his readers through most difficult and complex mathematics, he has again to apologise for his conclusions, which are in general contrary to experience. As applied to one class of phenomena—that of waves—it is true the theoretical results accord closely with facts; but the satisfaction to be derived from this is largely mitigated for want of a sufficient reason why the theoretical conclusions should be right in this case while they are entirely wrong in others, such as the flow of fluids and the resistance offered to the motion of solids. The usual explanation, that in the theory no account is taken of the friction or viscosity of actual fluids, is hardly satisfactory since no reason has been found why friction should play any other part than the altogether unimportant part which it plays in the case of waves.

It is, however, only in its application to actual fluids that the theory is unsatisfactory. If it be cut adrift from its origin, and be considered as a branch of abstract mathematics relating only to ideal matter having the properties assigned, it occupies the place of one of the most advanced as well as the most important branches of philosophy. It has been partially viewed in this light since the middle of the last century, when Euler and Lagrange founded the modern theory, and the tendency so to regard it has greatly increased of late with the development of the theory. The greatest success, indeed the only real success, has been obtained by the rigorous development of the theory of the motions in a perfect fluid, as it is called, regardless of whether or not these motions take place in actual fluids. Certain of the motions are then seen to agree with the actual motions, and wherever this is the case the theoretical motions have taught many things about the actual motions, as, for instance, the trochoidal motion of the fluid elements in a wave, for which we might, otherwise, have groped for ever without apprehending them. It is, however, the observed motions of actual fluids which suggest the problems; and of course the greater and truer the knowledge of actual phenomena the more chance there is of success in the study of the ideal fluids. But what tends to retard its development and greatly to confuse the subject is the mixing up, with the rigorous reasoning, of surmises as to the behaviour of actual fluids, as, for example, that the non-divergence of a stream of water when flowing from a pipe into a large vessel is owing to an actual opening having been formed in the fluid; a surmise which is at once negatived by the fact that the same phenomenon occurs in the case of air in which such discontinuity is impossible. The present work is in the main free from such surmises, and such as there are, are not the work of the author, but even these he would have done well to have omitted.

In his description of the methods by which the equations of motion are obtained the author has included (Art. 12) a very important method first given by Maxwell, which method is given at greater length in Note A at the end of the volume, otherwise he has followed previous writers as far back as Laplace. Considering its difficulty, the fundamental reasoning is, on the whole, well put. But there is a considerable amount of vagueness attending the author's use of the term *particle*. Having rightly defined fluids as being such "that the properties of the smallest portions into which we can conceive them divided are the same as those of the substance in bulk," he proceeds to reason about a particle as though it were a discrete quantity, the position of which is defined by some point, thus ignoring the fact that, according to his definition, the same particle of fluid may at one time be a sphere, at another a filament of indefinite length, or a sheet of indefinite breadth. This vagueness appears to have led him into error in Art. 11.

Art. 8 on the equation of continuity seems to be unnecessarily bare of explanation. There used to be an impression that, as the name implied, the equation of continuity did in some mysterious way involve the condition that the fluid should be continuous in space. Thomson and Tait, however, have in Art. 191 of their volume effectually dispelled this notion. They say:—

"As there can be neither annihilation nor generation of matter in any natural motion or action, the whole quantity of matter within any space at any time must be equal to the quantity originally in that space, increased by the whole quantity that has entered it, and diminished by the whole quantity that has left it. This idea, when expressed in a perfectly comprehensive manner for every portion of a fluid in motion constitutes what is called the *equation of continuity*, a needlessly confusing expression."

The meaning of this can be nothing less than that the equation of continuity has nothing to do with continuity in space; for certainly there is no creation or annihilation of matter amongst the stars, probably fluids, and yet we should hardly consider them continuous in space. As this Art. 191 stands the last sentence is erroneous, and is certainly calculated to increase the confusion. To render it true, the term *fluid* must be understood *continuous fluid*. In deriving the equation, the constancy of mass is certainly taken as an axiom, but that is not all; when it is said that the mass in a certain volume V is ρV, ρ is understood to be the ratio of the mass to the volume in a space, so small that it may be neglected as compared with V, at any point within V. And hence the assumption, fundamental to the equation of continuity, that the mass within V is ρV is equivalent to assuming that the matter is uniformly distributed through V, and therefore cannot be discontinuous. Nevertheless, it would have been better to have called the general equation the *equation of density*. But it is clear that this general equation was an afterthought, and that the name originated from consideration of water or an incompressible fluid, in the case of which the equation does not involve the density, and simply expresses space continuity within a substance of constant volume.

Another point of fundamental importance, on which a

remark is called for, is the proof of the permanence of the velocity potential. Mr. Lamb has offered a proof of this now historic theorem, which, if judged by the space it occupies, should be much simpler than the acknowledged proofs of Cauchy and Stokes. As no authority is cited, it would appear that this proof is here given for the first time. If so, the author has done himself great injustice in not examining or explaining his reasoning more closely. For, as it stands, it suggests the idea that he has ignored the fact that dx, dy, dz on the left of his equation, are integrals through a finite time, and hence, inasmuch as he has given no reason to the contrary, may be of a different order of magnitude from their initial values, da, db, dc, which appear on the right of his equation. If this is not so, it is a peculiarity of the motion of continuous fluid, and needs establishing, otherwise we might infer that two people who had once shaken hands could never after be so much as a mile apart. If this proof is found to be unsound, it is an unnecessary blemish in the book, for even if true, it would not replace the more elaborate, but much more physically instructive, proofs given by Stokes and Thomson, which the author has given further on in the book.

These remarks only carry us into the second chapter. The rest of the book, with the exception of the last chapter, is devoted to the account of what has been done in the way of integrating the equations of motion, and this may be taken as the purpose of the book.

This part of the theory, which is now very extensive, has almost all been developed within the last fifty years, and most of it within a much shorter period. It is the work of the very ablest mathematician, and is of the highest and most difficult kind, and in general incomplete. It was only to be found in isolated memoirs in various languages. The collecting, abbreviating, and arranging this into a systematic treatise has been no ordinary task, and the result shows that, in addition to his mathematical power, the author must possess the gift of compiling. One of the most striking features of the book, considering the variety of sources from which the matter was collected, is the uniformity of the notation. There is, however, one departure from this which is important, although evidently an oversight. The term *stream-lines*, carefully defined in Art. 28, as applicable only to steady motion, is freely used throughout the book in the sense of *lines of motion*, as applied to cases in which the motion is not steady.

The advance which has been made of late years has not been by the discovery of any general method of integrating the equations of motion, but by the discovery of certain general relations between the motion within certain regions of space, and the shape and motion of the boundaries to those regions. The steps in the discovery of these kinematical relations are principally due to Green, Stokes, and Helmholtz, but they have been generalised and elaborated by Thomson and Maxwell, and to these latter the present method of expression is due. An extremely lucid account of these relations is given in Chapter III., by which the author has cleared his ground for the treatment of such integrations as have been effected. These comprise many cases of steady flow, the method being that of the stream-line function first given by Stokes, but afterwards reduced to a geometrical form by Maxwell, and largely applied by Rankine. They also comprise cases of vortex motion treated by Helmholtz's well-known method, and the theory of waves, as worked out principally by Stokes, Green, and Rankine. Only one chapter of the book is devoted to elastic fluids, and this, under the shadow of Lord Rayleigh's complete work, does not call for special comment.

The last chapter is on viscosity, and is taken from Prof. Stokes's paper on this part of the subject. Although this paper has been published thirty-three years, this is the first treatise in which any adequate account of its very important contents has appeared in a general treatise.

Throughout the book the various steps are carefully ascribed to their different authors, a very difficult task, and one in which the author appears to have been generally successful. There are, however, two instances of failure which call for notice. Equation 10, Art. 29, is known by modern French writers as Bernoulli's theorem ("Théorème de Daniel Bernoulli, Bresse," vol. ii. p. 25). Example 11, Art. 97—The fact that the contraction from a canal projecting inwards is ½ was proved long ago and the results verified by Borda.

In respect of diagrams Mr. Lamb's book might certainly have been improved. The great difficulty in the study of the subject is to obtain a conception of the lines of motion, and in this, diagrams such as those given by Rankine, Maxwell, and Sir William Thomson, are invaluable. The graphic method of obtaining the lines of motion developed by Maxwell and Rankine, has led to most important steps, but without diagrams it is as impossible to form a conception of this method, as of the lines of motion themselves.

The omission in this respect, as well as a tendency to reduce verbal explanations, would have shown without the examples at the end of the volume, that the author has been influenced by a desire to adapt the book to the requirements of the mathematical tripos, in which desire he has certainly succeeded. Whether it is well to introduce students to such a difficult, complex, and imcomplete subject in such a concise, not to say cut and dry form, is a question which the author probably did not feel it necessary to consider. He has, however, by the numerous references throughout the work, and in the table of authorities at the end, done all in his power to put the students in the way of consulting the original works. This is aid of which students will do well to avail themselves, for nothing can equal work from the master's hand, and however carefully the general features may have been studied, the reading of such papers as those of Stokes, Rankine, and Helmholtz cannot fail to shed, what may be called, the light of life over the whole subject.

OSBORNE REYNOLDS

THE INTERIOR OF GREENLAND

Meddelelser om Grönland, udgivne af Commissionen for Ledelsen af de geologiske og geographiske Undersogelser i Grönland. Forst Hefte. (Copenhagen, 1879.)

SO large an amount of interest has been awakened during recent years concerning the nature of the interior of the vast island of Greenland, that the publication of this first instalment of the researches carried on under the auspices of the Danish Government will be

welcomed by geographers and geologists all over the world. The work is written in the Danish language, but a *résumé* in French, by M. F. Johnstrup, enables readers unacquainted with the former language to become possessed of the interesting facts contained in the volume. The work contains four memoirs of great interest: an account of the expedition upon the inland ice, made by Lieut. Jensen in 1878; a record of the astronomical and meteorological observations made during this journey; notes on the geology of the west coast of Greenland, by M. Kornerup; and remarks upon the plants collected by the last-named explorer, by M. Lange.

In the year 1870 Prof. Nordenskjöld, setting out from the vicinity of Disco Bay in company with Dr. Berggren, was able to penetrate to a distance of thirty miles into the interior, at which point the continental ice was found to attain a height of 2,200 feet. Starting from the neighbourhood of Frederikshaab, in South Greenland, Lieut. Jensen traversed a distance of forty-six miles over the continental ice. Here he found, as did Dalager, who made a similar attempt from the same point in 1751, that a number of islands of rock (Nunatakker) rise above the general level of the great sea of ice, and upon these rocky islets no less than fifty-four species of plants were collected.

The observations of most general interest, however, which were made by this expedition, were those which relate to the condition and movements of the great sheet of ice that covers the interior of the island. We cannot do better than give the *résumé* of these observations, which is furnished by M. Johnstrup; it is as follows:—

1. At a distance of 75 to 76 kilometres from the shore, the continental ice attains a height of 1,570 metres (5,115 feet), and must be of considerable thickness, since its inclination to the east from the Isblink of Frederikshaab averages only 49'.

2. On that part of the continental ice which has been explored even at a great distance from the shore, are found many "Nunatakker," which influence to a great extent the movement of the ice, in some cases actually bringing about a reversal of the direction.

3. The surfaces of dislocation resulting from the movement of the ice are almost vertical in the midst of the continental ice, but they incline at the edge and near the "Nunatakker," where the slope of the ground is great, and the upper parts of the ice, in consequence, move more rapidly.

4. The crevasses are partly perpendicular, partly parallel to the direction of the movements, following the nature of the inequalities of the rocky bed, and in places where the ice takes a fan-like disposition, both radial and tangential crevasses are observed.

5. Around the "Nunatakker" and the rocks near the shore, the surface of the continental ice is impregnated with fine rocky *débris* (sand and clay) which are brought there by tempests, and which brooks carry from a distance to the cavities of the continental ice. The masses of clay thus collected give rise to the pyramids of ice which near the Isblink of Frederikshaab, attain an elevation of nearly 60 feet.

6. Moraines of different form are found on the continental ice, especially near the "Nunatakker," and they must be referred to the classes of ground "moraines and terminal" moraines. They frequently form curved or semi-circular lines, and inclose well-rounded masses of stone of no great magnitude, which in their advance fall into the crevasses.

Next in interest and importance to the investigations upon the continental ice of Greenland, we must regard the new facts on the geology of the few portions of the country uncovered by the great ice mantle, with which this work furnishes us. A geological map of the West Coast of Greenland from Godthaab to Tingingnertok shows the rocks exposed along the coast and in the islets which rise above the great ice-sheet to be mostly composed of gneiss with some mica-, talc-, and hornblende-schists, and occasional patches of granite.

New proofs of the gradual elevation going on in past times on the West Coast of Greenland are furnished in the work before us. Five sets of raised-beaches are described occurring at heights of 28, 57, 94, 192, and 326 feet above the sea-level respectively. On the other hand there is clear evidence that the land is, at the present time, slowly subsiding, the extent of this movement being shown to have been at Lichtenfels from 6 to 8 feet since the year 1789.

The work we have been noticing is illustrated with several valuable maps and plates, together with numerous woodcuts; and the succeeding parts will be looked forward to with much interest by those who desire to know more concerning that veritable *terra incognita*, the interior of Greenland.

OUR BOOK SHELF

A History of the Tin Trade. By P. W. Flower. (London: George Bell and Sons, 1880.)

THE author, who is well known as one of the largest manufacturers of tin plates, and also as having introduced into this country the French method of decorating tin plates by lithographic printing, has in this volume collected numerous interesting facts in connection with the early history of the manufacture in South Wales, and, what is of more value, has reprinted those parts of the scarce work of Andrew Yarranton, "England's Greatness," 1677, that refer to his journey into Saxony for the purpose of learning the method of tinning sheet-iron. With these are associated extracts from other not very well known works, translations of the accounts of tin-plate making published at various times in the last century by Réaumur, Diderot (in the "Encyclopédie") and Jars, and those of Parkes, 1818, and Ebenezer Rogers, 1857, the latter from the *Transactions* of the South Wales Institute of Engineers. No notice, however, is taken of the later and more complete account published in Percy's "Iron and Steel." An introductory chapter on the metallurgy of tin, and a subsequent one on the modern manufacture of tin plate, are exceedingly feeble. The former is derived from such sources of information as Dodd's "Manufactures in Metal" and the "Beauties of England and Wales," and the latter, though containing matter that may interest those who are acquainted with the details of the process, will not convey much information to those who are not. The final portion of the volume deals with economic details and statistics; the latter of some elaboration, but from four to six years after date, and the prices in different European seats of manufacture are represented by prices current in 1872-73-74. There are several curious errors which can scarcely have been expected to be found, as, for instance, the "Lamb and Flag" brand on tin ingots is said to be the stamp of the

Duchy of Cornwall; vitriol is the fume given off by heated sulphur; and the refinery in the tin-plate forge is only a melting-furnace. Altogether the author treats the South Wales forge process, one of the most subtle and delicate in the whole range of iron metallurgy, somewhat scantily.

H. B.

Mathematical Tables, chiefly to Four Figures. First Series. By James Mills Peirce, University Professor of Mathematics in Harvard University. (Boston, U.S.: Ginn and Heath, 1879.)

THIS is a well-arranged and clearly printed book of forty-three octavo pages. Besides four figure logarithms of numbers and of circular functions, and the circular functions themselves, it contains a table of logarithms of hyperbolic functions, occupying three pages, Gaussian logarithms of sums and differences, inverse circular functions (the argument being the log. sine, &c.), and a special table for finding the logarithms of circular functions of small angles, which is to be used by reducing the angle to minutes, and then adding its logarithm to a logarithm given in the table. There is no table of antilogarithms, but it is not needed, as the logarithms of numbers extend over more than a complete cycle, beginning with the number 100, and ending with 1999, so that the differences between successive logarithms are always small. A saving of space, without loss of utility, has been obtained by carrying the proportional parts only as far as 5 instead of to 9 as usual. This involves subtraction for 6, 7, 8, and 9, but the quantity to be subtracted is so small that the operation can be performed mentally. The sixteen pages of "Explanation of the Tables," including a page and a half on Hyperbolic Functions, are remarkably clear and good.

J. D. E.

Eight Months in an Ox Waggon. By E. F. Sandeman. (London: Griffith and Farran, 1880.)

MR. SANDEMAN has written a most interesting volume on his experience in South Africa. His party made their expedition to the Transvaal in an ox waggon. It is the story of their adventures, during the time they were hunting there, that is told in this volume. The book is, however, by no means a diary of the daily doings in the Transvaal. It abounds in reminiscences of Boer life, and accounts of the natural history of the country. In the latter respect Mr. Sandeman has shown that he is a good observer. We can only give a few extracts. Speaking of ant-bears, he says:—

"The holes of the ant-bear are sometimes five or six feet deep, and large enough to engulf horse and rider; but as they are generally conspicuous, they do not prove so dangerous as the smaller holes of the mere-cat, a pretty little animal between a rat and a stoat, found all over South Africa."

The various changes in the bird and insect-life in the Transvaal, as the day passes on, seems to be very much marked and curious. "As the heat of the day comes on, the game of all descriptions retires to the shade, and is neither to be seen nor heard, and the air is full of gorgeous insects of every size and colour, from the large butterfly, flitting from reed to reed, to the sphinxes and sand-flies, whose movements as they dart and glance through the sunlight are too quick for the eye to follow. Darting after these, and glancing like little bolts of shiny gold or silver, set with emeralds and rubies, are innumerably brilliantly plumaged small birds, who again retire into the reeds when the butterflies shut up their wings as the heat of the sun ceases to warm them into activity. But the cooling atmosphere is far from being tenantless; for, as the sun goes down, myriads of clear-winged long-bodied flies swarm up from the ground, and after these there dart out from their hiding-places of the day a devouring crowd of black-birds with white tails, who gobble up the flies by the dozen. A large kind with gold feathers in their wings also assist at the banquet; and a smart little wagtail has a larger share perhaps than either of the others, for he is quicker in his movements, and never misses his dart. When these go to bed later on, owls, night-hawks, bats, crickets, frogs, and jackals, combine to break the stillness of the night with their harsh discordant cries and croakings."

Farther on in the book we have a long account of how a honeybird led the author and his friends to find honey. From the description one must think this bird had reasoning powers almost human. Throughout the book are descriptions of the scenery of the country. We only quote one paragraph:—

"The scenery became wilder as we advanced. The hills were loftier and more broken up, and here and there covered up with thick brushwood. The veldt itself was strewn with quartz rocks, and rugged boulders. The streams were full of beautiful quartz pebbles worn smooth by the constant friction. Many of the rocks have streaks of pure iron in them, and on every side are relics of the volcanic action, which must have formed the greater part of the Transvaal."

The book is written in a simple and attractive style. It will be of considerable interest to naturalists and to those who may meditate a similar hunting expedition in the Transvaal. We would recommend it as an interesting and instructive record of a holiday. It contains a large, useful map of the Transvaal and the surrounding territories.

The Countries of the World. By Robert Brown, M.A. (London: Cassell, Petter, Galpin, and Co., 1879.)

THE present volume of "The Countries of the World" is devoted to Polynesia, Australasia, Malaysia, and Japan. The people who inhabit these islands having been fully discussed in another volume, there is only a brief sketch of them given here. The author, in his compilation, takes us first through the Polynesian islands, gives a general idea of the plants and animals peculiar to them, short accounts of the mode of government and the present state of the country. All this is done in a pleasant and interesting manner. New Zealand, Australia, and Japan are treated in the same way. Our Australian colonies are described more fully. The numerous illustrations throughout the book will be a great attraction to it. They are very well done.

LETTERS TO THE EDITOR

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

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

Light of Webb's Planetary Nebula (DM. + 41° 4004)

THE recent discovery by the Rev. T. W. Webb, that the star DM. + 41° 4004 is a planetary nebula, and the attention which has consequently been attracted to this object, induce me to send herewith the result of a measurement of its light made at the Harvard College Observatory. Observations are in progress upon the light, dimensions, and spectra of all known planetary nebulæ visible in this latitude. To avoid the repetition of similar errors, two or three observers take part in the work, and each makes only one series of observations upon the same nebula in a single evening.

The photometric measurements are made by throwing the image of a star out of focus to such an extent that its intrinsic brightness becomes apparently equal to that of the nebula which is simultaneously observed with the same eye-piece. Each determination consists in six comparisons made alternately inside and outside of the focus of the auxiliary telescope through which the star is seen. The light of the nebula is expressed by the

magnitude of a star, the light of which, if diffused over a circle one minute of arc in diameter, would be equal in brightness to that of the nebula.

The star employed as a standard in the present instance was *α Cygni*. The comparisons were made upon three evenings, and three observers took part in the measurements. The number of determinations is six. If we assume the magnitude of *α Cygni* to be 1·7, as in the *Durchmusterung*, that of the nebula is 4·6 on the system just explained. The average deviation of the separate results is 0·4, and the probable error of the mean 0·2. The scale of stellar magnitudes here adopted is that of Pogson, in which the ratio of light corresponding to one magnitude is that the logarithm of which is 0·4. Accordingly, it appears that the brightness of *α Cygni* would be equal to that of the nebula, if the light of the star were diffused over a circle 3′·8 in diameter.

In the position angle 140°, the diameter of the nebula is about 11″, and the diameter perpendicular to this is about 8″. The border of the nebula is not sharply defined, and the fainter light around it is not very regularly distributed about its central portions. In a smaller telescope it would probably look smaller and more nearly circular.

From the measured dimensions and brightness of this nebula, its total light may be computed. The result is that, according to these observations, we receive 590 times as much light from *α Cygni* as from the nebula. Hence, regarding the nebula as a star, its magnitude may be expressed by $1\cdot7 + \frac{2\cdot77}{0\cdot4}$, or 8·6. The magnitude assigned to it in the *Durchmusterung* is 8·5. This close agreement must of course be regarded as accidental.

Like most of the planetary nebulæ observed here, this nebula shows a faint continuous spectrum, not due to the light of the sky, in addition to the lines denoting its gaseous character. This continuous spectrum is largely due to the nucleus.

EDWARD C. PICKERING

Cambridge, U.S., January 24

Electricity of the Blowpipe Flame

COL. ROSS's experiment on the above subject seemed of such importance that I thought it advisable to repeat it, and it may be of interest to some of your readers to hear of the result and of the way in which my experiment was conducted.

A compass in a closed box, to prevent the influence of air currents, was placed close to a brass Herapath blowpipe, and after the position of the needle was noted the gas was lighted and air was blown through the flame; no deflection of the needle was observed. As the compass is an old one and there was probably some friction on the pivot, it was replaced by a piece of magnetised watch-spring attached to a mirror, and suspended in a glass case by a single silk fibre; this apparatus being placed on a stone slab, light from a lamp was reflected from the mirror on to a screen. The arrangement was so delicate that the needle was set in oscillation by the movement of the iron rod connecting the blowpipe with the treadle; so, to avoid any possible disturbing cause, the air was supplied by water pressure from a copper gas holder. When the jet was brought near the needle, the flame being either in the magnetic meridian or at right angles to it, not the least movement of the spot of light was perceived, although the screen was at a distance of about eight feet from the mirror.

As this result is so much at variance with that of Col. Ross, it would be interesting to know exactly how his experiment was performed.

HERBERT M'LEOD

Cooper's Hill, February 4

Triassic Footprints

IN the *Quarterly Journal* of the Geological Society for August last there is an interesting notice by Mr. Sollas, accompanied by a figure, of a set of footprints from the Triassic beds of South Wales. These footprints Mr. Sollas says he has compared with those of the emu taken in modelling-clay; and so complete was the agreement that, other considerations out of the question, he would not have felt much hesitation in declaring for the avian, and indeed ratitous, character of the animal that produced them; but that because no remains of birds have occurred in the trias of the south-west of England, while those of reptiles have, he refers them to either *Thecodontosaurus* or *Palæosaurus*.

I wish, therefore, to call attention to the fact that in these footprints there is shown that character of the crossing of one leg over the other, and of turning out the toe, which persons who have kept poultry may have noticed as conspicuous in the walk of the domestic fowl; that is to say, it places the foot, not directly forward, but across the opposite leg, turning the toe well out. Now this is distinctly shown in the relative positions of these Triassic footprints. The first, or lowermost in the figure, is that of the right foot, and the toes point to the right; the next (2) is that of the left foot, and crosses the median line of the animal's path, and the toe of this (for only the middle one remains unobliterated), points well to the left; the third, being that of the right foot, crosses the median line in the same way, its toes pointing well to the right; but the fourth (left), though it thus crosses, has not the toe turned out, because the animal at that point began to bend its course to the right hand.

This track is thus, I venture to say, one made by the jaunty step of the light-limbed bird, and not by the slouching stride of the heavy-limbed dinosaur, even if this kind of reptile did (as has not yet, notwithstanding its ornithic affinities, been shown) walk erect, and exclusively on two legs; and I am induced to trouble you with these remarks, because just twenty years ago (*Quart. Jour. Geol. Soc.*, vol. xvi. p. 328) I contended that the existing *Ratitæ* and other wingless (or, more accurately, flightless) birds are the direct, and but little altered, descendants of those which inhabited Triassic continents in the southern hemispere, of which one portion, that formed by Australia and New Zealand, has been preserved in complete, and other portions, such as South Africa and South America, in less complete isolation since that remote period; and it seems to me that the footprints figured by Mr. Sollas furnish very satisfactory evidence of the case.

SEARLES V. WOOD, Jun.

Martlesham, near Woodbridge, January 30

Rainfall in the Tropics

MY studies on the distribution of rain on the earth have often caused me to regret our want of knowledge about the quantity of water falling on the oceans, especially in the tropics. The observations on the continents and large islands are very apt to mislead us as to what takes place on the open sea. As there seem to be very great difficulties about observing rain-gauges at sea, I have thought it would be possible to gain some insight into the matter by placing rain-gauges on the smallest and lowest islands to be found on the ocean, the meteorological conditions of which differ but very little, if at all, from those of the ocean. In the Pacific such islands are to be found in plenty; in the Atlantic I would especially recommend the island of St. Paul ¾° N. and 29¾° W.; in the Indian Ocean, the Southern Maledives, the Chagos, and Keeling Islands, &c.

The rain-gauges for this purpose should be made of strong metal, the lower part, instead of the ordinary glass measuring-vessel, being also of metal. Such rain-gauges could be put on islands, especially uninhabited, and taken up and the amount of water fallen measured after some months, or even a year or more. The measurement would be but a rough one, as the evaporation could not be strictly accounted for, and we would certainly know very little as to the distribution of rain during the year; but with all these drawbacks, even an approximate knowledge of the quantity of water falling in strictly oceanic climates, far from the disturbing influence of land, would be very important for meteorology. Even a few figures as to the total annual rainfall in parts of the ocean, which are for some months included in the "doldrums," and those where the trade-winds blow steadily the whole year, would very much increase our knowledge, more than a great number of observations taken on mountainous islands, where local conditions modify the quantity in the extreme.

I refrain from further practical details, as these will be better provided for by British meteorologists and seamen, in case they should accept my suggestion.

A. WOEIKOF

St. Petersburg, January 21

Mountain Ranges

THE reply which Mr. H. B. Medlicott has made to me in NATURE, vol. xxi. p. 301, seems only to obscure rather than set aside or remove my objections. In the second sentence it is said that I "take geologists to task for not making their descriptions to fit in with my delineation of purely superficial features." But my complaint was based, not on my delineation, but on a trigonometrical survey; and it was caused by a description—not of

the geology, but of the physical geography of India, in connection with a map of its hill ranges, that has nothing geological about it. It is in this expressly geographical part of the manual that I find the greatest range of snowy peaks in the world omitted from a geographical notice and delineation of the Himalaya. I did not allude at all to geology.

Mr. Medlicott contends that the omission was due to the irrelevancy of the great range to the matter in hand. But how can a great range of the Himalaya be irrelevant to a geographical description of that mass, or to a special map of the hill ranges of India? And why should a prominent and leading feature be treated as a mere incident? In fact the omission was plainly due to the survival of an old error or "antiquated theory," which confused the snowy peaks seen from the Indian plains for the most part with the water-parting of the Sanpu and Ganges basins, although the latter really forms a distinct but parallel range further to the north. In these days a clear understanding of the superficial or geographical aspects of the mountains on the frontier of India cannot be overrated. The statesman, the warrior, and the trader alike stand in need of it; and misleading or confused representations of the subject may become of serious moment. The ignored range is indeed to a great extent the limit of the Tibetan Plateau and of the Chinese Empire, the relations of which with India are rapidly rising into importance.

Mr. Medlicott's appeal to "the great gneissic axis" is not less unfortunate than the argument which he derives from "irrelevancy." If "the great gneissic axis" divides on the west of the Sutlej, it may be presumed to be intact on the east of that river, where in consequence it would be the more entitled to delineation and notice. But the only parts of the Southern Himalaya inserted in Mr. Medlicott's map of the Hill Ranges, are the Pir Panjal and Dhauladhar, on the west of the Sutlej. Is there any ground for identifying "the great gneissic axis" with the Northern Himalaya, which alone is delineated east of the Sutlej, in preference to the Southern Himalaya which is omitted? It is enough to say that neither of those ranges has been sufficiently explored, to admit of a general conclusion on the subject. Therefore it is fair to add that even geologists must refrain for the present from accepting Mr. Medlicott's dictum in that respect.

Mr. Medlicott's penultimate sentence baffles my best efforts to understand it. It seems to be meant to be applicable somehow to the region between the Indus and Sutlej.

In conclusion I can find no good ground for treating the views of geographers and geologists as wide apart, merely because a great geographical fact has been neglected in an important geological work; and I hope that the omission will be rectified in future editions.

TRELAWNY SAUNDERS

On Halley's Mount

PERMIT me to mention two suggestions which have been made with reference to the article "On Halley's Mount" in NATURE, vol. xxi. p. 303, viz. :—

1. That some mention should have been made therein relative to Dr. Halley's official investigations (*vide Phil. Trans.*, vol. xvii. p. 960, 1693).

2. That it was *not* at Dr. Halley's private expense[1] that the "Principia" was published, although it was in consequence of his urgent persuasion that Newton produced his great work (*cf.* Preface to the "Principia").

It may be remarked that there is a biographical sketch of Edmund Halley in Mr. Crookes's *Monthly Journal of Science* for February, and that the Astronomer-Royal has signified his hearty approval of the idea of the proposed monument in St. Helena.

THE WRITER OF THE ARTICLE "ON HALLEY'S MOUNT"
2, Eastern Villas, Anglesea, Gosport

"A Speculation Regarding the Senses"

IN a letter bearing this title (NATURE, vol. xxi. p. 323) your correspondent, "M.," while indulging in a most extraordinary "speculation," observes that it is "not without some encouragement in actual fact." He then adds: "The ascertained facts of *clairvoyance* and *mesmerism* are what I have more especially in view," &c. Now, whatever may be the case with clairvoyants, I think, to quote from "M.," that it must certainly "require some peculiar state of mental calm" to enable a man, when writing in a journal professedly scientific, thus quietly to assume the truth of all the astounding class of phenomena to which he alludes as "ascertained facts." Clairvoyants, spiritualists, *et hoc genus omne*, often complain that scientific men are arrogant in their treatment of, or allusions to, the alleged marvels of the modern *séance;* and if we have regard to the jaunty manner in which Dr. Carpenter rides his favourite hobby along "the high *priori* road," I do not deny that the spiritualists have sufficiently good ground for complaint. But let them not meet arrogance with arrogance, or speak about facts which, at the best, are highly doubtful as facts which have been "ascertained."

My object, however, in writing this letter is not controversial. I desire merely to represent to "M.," and any other of your readers who may believe in the alleged phenomena of clairvoyance, that it is their duty to have these "facts" properly sifted, examined, and published. I have myself taken a good deal of trouble to investigate the subject, and, while meeting with a vast amount of humbug, have also met with one or two things that I am unable satisfactorily to explain. I therefore desire to prosecute my researches in this direction, without either bias or prejudice, should I be able to meet with suitable material. If "M." and his friends are right, and if I should satisfy myself that they are so, I should give a wide publicity to my methods and my results. If the phenomena should admit of repetition, I should have them witnessed and attested to by a selected number of the leading scientific men of the day. It would then be time for "M." to speak about such "facts" as "ascertained."

Here, then, is a fair offer by "a man of science" to investigate any or all of "the powers of darkness" without any feelings of animosity against them. Will any clairvoyant or spiritualist who really believes in his own belief supply me with an opportunity of so doing? Any letters addressed to the care of the Editor of NATURE will be forwarded to me. F.R.S.

Perforated Stones in River Beds

TRAVELLING some months ago among the Cumberland lakes, I was walking with a friend in advance of our conveyance through a narrow road, when my attention was suddenly arrested by the presence of some interesting shells and stones on the window-sill of a peasant's cottage. Stopping to admire them, or rather having taken some of them up in my hand, the woman of the house—an intelligent person—came out, whereupon I apologised for my seeming rudeness, and asked where she got them. She at once accepted my apology, and added that they, pointing to the shells and stones, were often looked at by other travellers. She further added that they were common enough in the Derwent River hard by, and she made no difficulty at all about accepting sixpence for the two of them I selected.

Now as I have travelled a good deal in the public service and otherwise, and seen many mountain and other streams in my day, without ever meeting any of these perforated stones, I would like to know if they occur elsewhere, and if so under what circumstances. The Derwent, a comparatively small and gentle stream, flows, as we all know, through the beautiful valley of Borradale into the pretty lake of the same name, near Keswick. I do not know anything of the geology of the district, but there are slate quarries and lead mines in the vicinity, and one of my stones partakes indubitably of the former quality. The other is as clearly a piece of granite, and if water be the sole tunnelling agent in these substances, both well illustrate the truth of the old Latin prase, "Gutta cavat lapidem, non vi, sed sæpe cadendo."

Another thing that struck me in connection with them was the extraordinary likeness of one of them, at least, to the stone axes or hatchets (I forget just now the technical name) figured by Sir John Lubbock in his "Prehistoric Times." This was so striking and obvious that, holding up the specimen, I said to my friend—a gentleman connected with the Press—"Surely Lubbock must have made a mistake, and taken one of these for a prehistoric implement." Further observation only tends to confirm this first impression, and I shall be glad to hear if any similar doubt has occurred to others on sight of these objects. I will also be anxious to hear if they are as common in the Derwent or other rivers as this woman's language would imply, and I will otherwise feel obliged for such information respecting them as the courtesy or curiosity of your readers may enable them to supply.

Warrington WM. CURRAN

Politics and Science

THE Duke of Somerset, after "considering all the oppressions that are done under the sun," writes about them all,

[1] As inferred from Whewell's "History of Inductive Sciences."

whether limited monarchy, aristocracy, or democracy, in much the same dissatisfied and despairing tone in which the Preacher of old did. But he concludes his book with drawing comfort from a source which his predecessor of old pronounced impossible. He says :—

"There is yet one branch of human progress which we may contemplate with unmixed satisfaction, and that is, the progress of science, both in its discoveries and its adaptations to the convenience and civilisation of mankind. It may be hoped that the acquisitions of science may become an enduring benefit to the world, not to be again obliterated and lost amid the political convulsions to which society may be subjected.

"To this progress the scientific men of every country may contribute, whether they live under a despotism or under a constitutional government. The pursuit of truth for its own sake is the noblest occupation of the human mind, and from this pursuit it seems probable that mankind will reap the richest reward."

A fairer comment from a more qualified and disinterested writer was never made upon the motto of this journal—

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

W. O.

Scientific Jokes

YOU can hardly expect *all* your readers to see through the jokes at p. 337 of your last number. I instance only two out of many.

"The energy of heat is made up of heat and temperature"! This may set some earnest but ignorant students to find *how* Joule's Equivalent depends on temperature: and it would be well to warn them.

"Profs. Ayrton and Perry have developed a theory of terrestrial magnetism . . . which coincides well with facts." Here the reader should have been told that Rowland has proved that, according to this theory, the moon would have been repelled into the profundity of space, and the greater part of the earth's surface, including its atmosphere, torn off by the enormous electric forces involved. G. H.

Stags' Horns

CONCERNING the disappearance of cast horns, the theory that stags retire to secluded spots, about the time for shedding their horns, mentioned by B. W. Barton in NATURE, vol. xxi. p. 325, may be perfectly correct where the animals have woods to go to, but this opinion cannot hold good with the thousands of reindeer that frequent the barren lands of the north-east part of America; yet it is rare to find on these "barrens" the *shed* horn of either buck or doe, although the latter drop their horns in May or June, when at or on their way to their far north summer quarters.

As far as I have observed, the new horns of the male reindeer (in the wild state) do not begin to grow until weeks after the old ones have dropped off, and there is no danger of one stag "disturbing" another, when *all* have their horns in the tender velvety stage; in fact, no animals can be less pugnacious than these fine creatures are during eight months of the year.

2, Addison Gardens, South Kensington, Feb. 7 J. RAE

Apropos of the question of stags' horns, I have just come upon the following in Miss Bird's "Life in the Rocky Mountains."

Describing the so-called "Parks" of the Rocky Mountains as "high-lying valleys large and small, at heights varying from 6,000 to 11,000 feet," she says, "Parks innumerable are scattered throughout the mountains. . . . They always lie far within the Foot Hills. . . . Hundreds can only be reached by riding in the bed of a stream, or by scrambling up some narrow cañon till it debouches on the fairy-like stretch above. These parks are the feeding-grounds of innumerable wild animals, *and some, like one three miles off, seem chosen for the process of antler-casting, the grass being covered for at least a square mile with the magnificent branching horns of the elk.*" P. 122. B. W. S.

"Song of the Screw"

PROF. TAIT has inadvertently attributed to the late lamented Prof. Clerk Maxwell (NATURE, vol. xxi. p. 321) an effusion of mine consisting of a synopsis of Dr. Ball's Treatise on Screws, which appeared in NATURE, vol. xiv. p. 30, under the above title.

As a very humble poet, the occurrence of such a mistake has satisfied my highest ambition; and I feel like a second Chatterton.

J. D. EVERETT

The Post Office and the Telephone

PRAY allow me to correct an important misprint which has occurred in the last paragraph of the abstract of my address which you were good enough to insert in your last number. I said that the Post Office did not wish to restrict or in any way to interfere with the use of the telephone; our only object was to prevent the establishment of a particular branch of Post Office telegraph business *without*, not *with*, its licence or consent.

General Post Office, February 9 W. H. PREECE

KARL VON SEEBACH

GEOLOGISTS will learn with universal regret of the death, after a painful illness, of the distinguished Professor of Geology at Göttingen, Karl von Seebach. Although Prof. von Seebach was still a young man at the time of his death, he had already made his mark in science, and his career promised a distinguished future. Von Seebach's earliest studies were devoted to stratigraphical geology and palæontology, and he devoted much time to the preparation of a geological map of the kingdom of Hanover, and to his earnest labours much of the excellence of this map is due. The result of Prof. von Seebach's studies of the stratified rocks of Hanover are embodied in a number of separate memoirs and in his well known treatise "Die Hannoverischer Jura."

During his later years Karl von Seebach's studies were devoted to wider questions, and the investigation of volcanic phenomena occupied his attention. He visited the island of Santorin and wrote an important work on the eruption of 1866. He also published several interesting memoirs on the volcanoes of Central America, a district which he visited in 1865. Geological science has sustained a heavy loss by his early death.

ARTHUR JULES MORIN

THE serious illness of General Morin to which we alluded in our last number, was followed by his death at Paris on Saturday, February 7, in his eighty-fifth year. Arthur Jules Morin was born at Paris, October 17, 1795. He entered at an early age the famous École Polytechnique, but was summoned from his studies during the fatal campaign of 1814 to assist in the defence of Paris, and rendered good service in the brigade of artillery. At the conclusion of peace he devoted four years to practical studies in military engineering at the École d'Application of Metz, and entered the army as lieutenant in a pontoon regiment. His military career was marked by a rapid and regular promotion through the different grades, terminating in his appointment as an Artillery General of Division in 1855.

General Morin's reputation rests however chiefly on his achievements in the peaceful departments of physical research, as well as on unusual executive abilities in the same connection. As an investigator his attention was directed almost entirely to the solution of problems in mechanics. In a remarkable series of memoirs presented to the Academy at Paris, during the years 1833–1835, Morin gave the results of exhaustive experiments on friction, and established the three general laws of this part of mechanics, viz. :—Friction is proportional to the pressure exerted by a body on the supporting surface; depends on the nature and smoothness of the surfaces in contact, but not on their superficies; and is independent of the rapidity of the motion. Equally well-known is his ingenious apparatus for determining the laws of falling bodies, in which a pencil attached to a falling weight, describes a curve on a perpendicular cylinder, rotating alongside the path of the descending body. The parabolic curve obtained by this simple but exact contrivance,

demonstrates most perfectly the proportionality of the spaces described to the squares of the times employed in their description. In this connection should also be mentioned his valuable inventions of the dynameter of rotation, and the dynametric crank. In 1853-1854, Morin communicated a most valuable series of experimental results on the resistance of building materials, by means of which he established several important principles of practical application in the solution of architectural problems. Among less prominent researches, mention should be made of those on gun-cotton (1849), on the production of carbon monoxide in rooms heated by iron stoves (1869), and on the preservation of flour (1870).

As an author, General Morin is best known by his two works "Leçons de Mécanique pratique" and "Résistance des Matériaux" (1853); as well as by able reports on various technical and military inventions referred to him by the French War Department and the Academy of Sciences.

General Morin's executive abilities have long been appreciated and utilised at Paris. After occupying for some time the chair of mechanics at the Conservatoire des Arts et Métiers, he was appointed director of this important establishment in 1849. Under the thirty years of his *régime* the efficiency and influence of the Conservatoire has been vastly increased and strengthened, until it has become the chief auxiliary in elevating and educating the artisan classes of the French capital. In 1855, General Morin occupied the difficult and trying position of president of the commission for the first Universal Exhibition held at Paris. In 1862 he was elected president of the French Society of Civil Engineers. Since 1858, he has been a grand officer in the Legion of Honour. He was elected a member of the French Academy of Sciences in 1843, as successor to Coriolis in the section of mechanics, and has always maintained an influential position in the actions of that body.

T. H. N.

PRE-HISTORIC MAN IN JAPAN[1]

MR. MORSE seems to claim for the shell-mounds lately investigated by him at Ômori (wrongly spelled Omori throughout his monograph), a small village a few miles from Yedo, an antiquity as high as that of the Danish kitchen-middens. I cannot help thinking the conclusion a hasty one, or, at least, not warranted by the facts set forth in the monograph in question. The shell-mounds are therein described as situate about half a mile from the shore, and the principal heap is stated to be some ninety metres in length by about four metres in breadth. It is now, I believe, completely swept away.

These mounds consist for the most part of shells, little, if at all, distinguishable from what are still to be found in abundance along the shores of the Gulf of Yedo, mixed with fragments of pottery, implements of stone and horn, clay ornaments and "tablets," together with bones of the monkey, bear, deer, dog, wild boar, and of man, the human bones or their fragments being nearly as numerous as those of the remaining mammals. Of the eighteen lithographed plates with which the monograph is embellished, fifteen are devoted to the delineation of fragments of pottery, and one cannot but regret that some of this space was not used for drawings of the bones and shells, especially of such of the latter as are stated to belong to extinct species. A figure, too, of the right lower jaw of the "large baboon-like ape" alleged to be "certainly unlike anything found in Japan to day," and supposed to belong to a species of cynopithicus (*sic*), would have been a most welcome addition. The fragments of pottery, of which drawings are given, do not tell us much. A coarse ware, with not very dissimilar ornamentation, is not hard to meet with in country villages, and inferior specimens of the well-known "banko" faience are commonly adorned with lines, strokes, dots, and "hatchings," that bear no little resemblance to those delineated in Mr. Morse's figures. The drawings and descriptions of the stone implements do not help us towards pronouncing upon their antiquity. The distance of the shell-mounds from the shore is in no way remarkable, and does not of itself prove any change of level since the period of their accumulation. Clear evidence, however, but of a very different nature, may be found in the neighbourhood of Yedo and Yokohama, of alternate elevations and depressions of the land, and it is probable that at the present day the waters of the Gulf of Yedo are slowly receding. Remains and traces of shell-heaps of quite modern date are common enough in the provinces of Musashi and Sagami, and doubtless elsewhere also, at a considerable distance from the shore, even far inland. I am inclined to believe that the dog is not indigenous to Japan, but has been introduced from China. The Japanese name "inu," indeed, seems to be connected with the Chinese word for dog "Kiuen" (cf. Greek κύων, Latin canis).[1] Lastly, the "adzuma," or eastern region of the main island was probably peopled chiefly by an Aino race, up to the fourteenth or fifteenth centuries. Yedo was not founded before the close of the sixteenth century. Legend, indeed, tells us that Nikkô was "opened" by the Buddhist saint, Shôdô shônin, in the eighth century, and that shrines were erected there towards the middle of the ninth century; but it seems probable that up to at least as late as the fourteenth century the country east of the Hakoné Pass was principally inhabited by an aboriginal race.

Upon these grounds, and in the absence of materials for instituting a comparison between the mound-shells and recent forms, I should hesitate to assign a higher antiquity to the Ômori heaps than the thirteenth or fourteenth century, and it seems to me more probable that they were the work of an Aino race than of contemporaries of the builders of the Danish middens. The question of cannibalism I have not space to discuss. We know so little about the Ainos and their customs that it is impossible to say whether these might or might not explain the occurrence of human bones in the heaps without loading the memory of a docile and gentle folk with the odious charge of anthropophagism.

Some of Mr. Morse's statements require considerable modification. The chronicles of Japan do not run back for 1,500 years, or for anything like that period. The legends run back, it is true, much farther, some millions of years indeed, but the oldest Japanese book extant, the "Kojiki," a mere collection of myths, was compiled in the eighth century of our era. The art of writing was introduced from China, hardly earlier than the sixth century, and the annals of Japan up to quite recently presented such a mixture of fact and fable that they are of but small historical value. I must add that the statement in the preface that "there is no other country in the world where so great a number of gentlemen interested in archæology can be found as in Japan," is to me a most surprising one.

The lithographs are excellent, and the paper and typography are good; but surely Mr. Morse will hardly please his Japanese friends by patting them upon the back, as if they were clever savages, because they have performed the not very extraordinary feat of making paper with European machinery, and under European superintendence or instruction, and the still more insignificant one, for some ten or fifteen years familiar to the native compositors of a dozen printing offices in Yokohama, of printing a few score pages of English with tolerable clearness and accuracy.

FREDK. V. DICKINS

[1] "Memoirs of the Science Department, University of Tokio, Japan," vol. i. part i. "Shell-mounds of Omori." By E. S. Morse, Professor of Zoology, University of Tokio, Japan. Published by the University of Tokio, Japan. Nisshusha Printing Office, 2539 (1879).

[1] Dog's flesh is still eaten in some provinces.

THE STUDY OF EARTHQUAKES IN SWITZERLAND

ALTHOUGH much has already been done for the investigation of earthquakes, it must be admitted that yet more remains to be done, and that we are very far from what might be considered as a scientifically organised system of observations of earthquakes. Therefore all lovers of science will be much pleased to see that the sixty-first meeting of Swiss Naturalists, which was held in 1878 at Bern, appointed a special commission for the study of this important subject. The Commission, which consisted of Prof. Forster, of Bern, as president, Prof. Albert Heim, of Zurich, as secretary, Professors Amsler, of Schaffhausen, Forel, of Morges, Hagenbach, of Basel, Soret, of Geneva, and M. Billwiller, Director of the Statistical Board of Zurich, chose the telluric Observatory at Bern as its central board, and, after having put itself into communication with foreign observers, it began with the elaboration of a scheme for the organisation of a wide system of observations on earthquakes in Switzerland.

The scheme elaborated by the Commission is to provide two or three chief stations (Bern, Basel, and, if possible, Geneva) with first-class seismometers, and then to organise a wide net of second-class stations provided with simpler instruments. As to the latter three different apparatus were proposed, and will be submitted to experiment. Prof. Amsler's seismometer is a pendulum, provided at its extremity with a pencil which draws a line on a blackened paper when it is set in motion by a shock of earthquake; the time of the shock is determined by connecting the pendulum with a clock which is stopped by means of an electrical current as soon as the pendulum is set into motion. The apparatus of Prof. Forster is the common mercury seismometer, but the usual cup with mercury is replaced by two Y-like glass tubes, the upper branches of which are directed to the four chief points of the horizon. Finally, the seismometer of Prof. Hagenbach is the simplest one; it consists of three hollow metallic cylinders with heavy tops, which are placed vertically like skittles; on a simple plank, when the plank is brought into motion by a shock, the cylinders fall down, and show the direction of the shock (rolling being prevented by a layer of sand which is strewn on the plank), and as they are of different sizes, it is only the smaller one which falls when the shock is feeble, and all three when the shock is a strong one. We do not know what results might be attained by means of the cylinders, but we fear that the pendulum and the mercury seismometers will prove far more difficult to manage, and that they will give less satisfactory results than might be expected. In every case these seismometers will be submitted to a thorough trial before being introduced into practice, and Prof. Forster has already constructed a special apparatus for trying them. A thick plank, 150 lbs. weight, is suspended in a room on three strings, and, the seismometer being placed on it, shocks of various intensity are communicated to the plank by means of a heavy lead-pendulum; moreover, we daresay that an earthquake will not be long in coming to tell what is the practical value of the new instruments.

Besides, the Commission has taken steps to interest the public in this class of observations, and Prof. Heim has just published a pamphlet on the nature and causes of earthquakes, and on the means of observing them without instruments. This pamphlet, which will be translated into French by Prof. Forel, will be sent to all members of the Swiss Society of Naturalists and of the Alpine Club, as well as to the meteorological and telegraphic stations and to the editors of all Swiss newspapers. Further, special leaves, containing each a series of questions on the chief features of an earthquake, are printed, and they will be sent in great quantities throughout Switzerland. The whole country is divided into seven regions, each member of the Commission being intrusted with one of them; and as soon as the newspapers announce an earthquake, the member of the Commission in whose region it has occurred immediately sends the printed leaflets with questions to all persons who might give any information about it. All information is represented on a map and inscribed in a special book, another book being used for collecting all information about former earthquakes.

Such are the important steps taken up to the present by the Commission, and we hope that soon a widely-spread organisation will afford us detailed and accurate information on all earthquakes in Switzerland.

THE HISTORY OF VESUVIUS DURING THE YEAR 1879

PROF. JOHN PHILLIPS, in his admirable monograph on Vesuvius, has given a history of the mountain from the earliest times to the end of the year 1868. Palmieri, in his detailed description of the eruption of 1871-72, continued the history to the end of the latter year; and in NATURE, vol. xix. p. 343, the present writer has described the comparatively uneventful life of the volcano from 1873 to the end of 1878. The past year, although unmarked by any special and paroxysmal disturbance, has furnished facts not unworthy of record.

It will be remembered by readers of the former article on the subject, that at the conclusion of the great eruption of 1872, a vast abyssmal crater, 250 metres deep, and nearly as many in diameter, was left in the great cone of Vesuvius. After three years of comparative rest, during which carbonic acid, sulphurous acid, and ultimately hydrochloric acid, were evolved from fumeroles in the bottom and sides of the crater, a deep chasm opened on December 18, 1875, from which dense volumes of smoke issued. At night the smoke could be seen to be illuminated by the reflection of the light emitted by the molten lava within. A small eruptive cone was soon formed over a portion of this chasm, which increased in energy, and emitted small quantities of lava. On the night of November 1, 1878, the lava which had spread itself over the floor of the crater of 1872, rose to the lowest portion of the edge of the crater, and commenced to flow down the great cone in a north-westerly direction, towards the Atrio del Cavallo. The secondary cone rose to a height of about 20 metres, and exhibited a fair amount of dynamic activity when I visited it on December 29, 1878 (*v.* p. 344, *loc. cit.*).

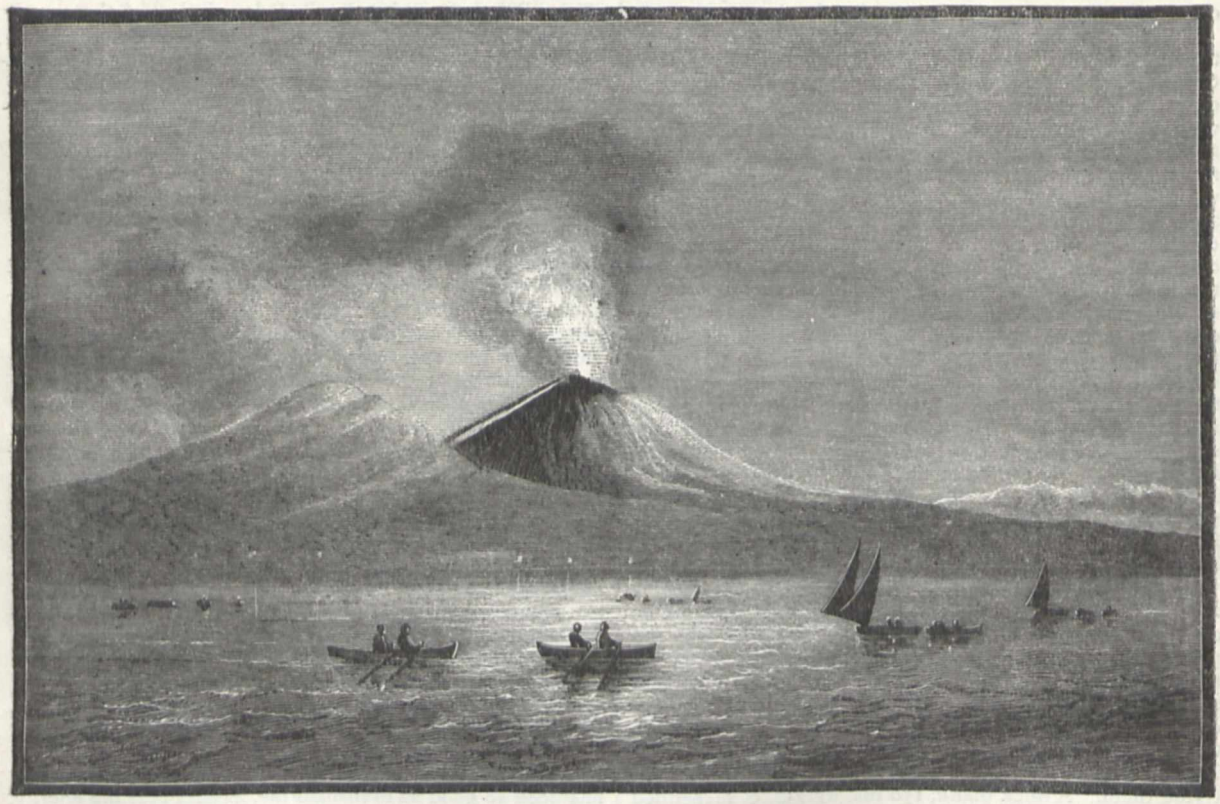
During 1879 small lava streams appeared from time to time on the sides of the great cone, sometimes flowing a little distance downwards in a north-westerly direction, and occasionally towards the north-east. Prof. Palmieri, in a MS. account of "Il Vesuvio nel 1879," with which he has been so good as to furnish me, asserts that the energy is markedly greater at the time of the new and full moon. On December 17 the energy increased considerably, and a small stream of lava flowed down into the Atrio del Cavallo. When I saw the mountain during the last days of the year it emitted great volumes of smoke, but there was no lava flowing, and but slight illumination of the smoke at night. Towards the 11th of this month, however (new moon), the energy increased, and on the 13th I ascended the mountain, and witnessed a considerable augmentation of activity.

We reached the observatory at 11 a.m., when we found that a tramontana, which was blowing strongly at the foot of the mountain, was here so violent that it was questionable whether it would be advisable to attempt the ascent. Moreover, the temperature of the wind was − 3° C. (26·4° F.), and it blew with intermittent gusts of great violence. However, the guide determined to make the attempt, but he asserted that it would be impossible to ascend the cone by the usual path which proceeds nearly due west from the observatory, as the wind was

blowing from the north-west, and we should be more or less in the teeth of it. Accordingly we bore to the south-west, so as to get the mountain between us and the wind. Even thus the ascent was very trying; violent gusts of wind sometimes caught us, and volcanic sand and small stones were blown across our path. On arriving at the summit I saw that the small cone, which, when I had seen it a year before, was no larger than an iron furnace, had in the course of the year increased both in bulk and height. It now reaches to a height of more than fifty feet above the rim of the great crater, and very large masses of cinders have accumulated around it. Moreover, it has almost filled up the great crater of 1872 by masses of lava and scoriæ. When the crater gets quite filled up, and the throat of the small cone choked with lava, we may look for a grand paroxysmal outburst like that of 1631 or 1872.

The cone of November, 1878, was giving off dense volumes of white steam and reddish smoke. Its dynamic activity was considerably greater than it had been the year before, and large masses of scoriæ were ejected to a considerable height at frequent intervals. The lava surged up within the throat of the cone very frequently, from the sudden disengagement of vapours within the seething mass. Near the base of this cone a small hole, apparently about five feet in diameter, had opened to give vent to lava, the great pressure of which had prevented it from rising high in the cone, and had caused the latter to give way at the point of least resistance. Two streams had recently flowed from this; a small one towards the south-west had not reached the rim of the crater; it was red-hot, not more than two inches beneath the surface, but we ran over it with no worse result than scorching our boots. The other stream—the main stream of December 17, 1879—(*vide* the accompanying woodcut) had flowed towards the north-west, and had found its way into the Atrio del Cavallo.

As we watched the lateral *bocca*, the lava within it



became furiously agitated; it was thrown up three or four feet above the opening, *exactly in every respect resembling small geysers which I have seen at Reykir, and at Haukadalr in Iceland;* and presently the liquid mass filled completely the *bocca*, and flowed over as a very fluid stream along the course of the lava of December 17. By the time we reached the Observatory again, the stream, which was about twenty-five feet wide, was seen to have flowed over the rim of the crater; by ten o'clock the same evening it had flowed half way down the great cone, and by 1 A.M. the next morning it had reached the Atrio del Cavallo, presenting an appearance almost precisely similar to that of the stream of December 17. Dense clouds of vapours marked the course of the stream; a good deal of hydrochloric acid was disengaged; and the icy tramontana in blowing over the liquid mass was converted into an unbearably hot furnace-breath. The next day (January 14) the energy of the mountain appeared to have slackened; and on the morning of the 15th a good deal of snow fell, and the course of the lava stream was well shown by a jet black line through the snow.

The lava is very leucitic, and is somewhat similar to that of 1871. The fumeroles have afforded copious sublimations of chlorides and sulphates, in which the spectroscope has revealed the presence of lithium and thallium. The gases evoked nearest to the centre of activity are sulphurous acid and hydrochloric acid. Carbonic acid still appears in some of the remoter sources of emanations.

Prof. Palmieri, in the MS. to which I have alluded above, writes as follows:—"This long and mild eruptive period, in which Vesuvius has become a mere imitator of Stromboli, will not in our opinion come to an end without displaying more decided activity. The whole history of Vesuvius, though its greater eruptions only have been chronicled by ancient writers, may be divided into periods of activity, with occasional phases of violence, and short

intervals of rest. And the greatest eruptions have generally indicated the last phase of long periods of moderate activity, periods that escaped the notice of the early writers. The true history of Vesuvius could not have been written until after the establishment of the present observatory. The seismograph of the observatory gives the most accurate indications of the eruptive attempts (*dei conati eruttivi*) of the mountain and of the degree of its dynamic activity."

Two other facts require to be alluded to before we close the history of Vesuvius in 1879. The one is the alleged discovery by Prof. Scacchi of a new element in the yellow and green incrustations found on the lava of 1631. The former of these he believes to be vesbiate of aluminium, the latter vesbiate of copper. The element is named *Vesbium*, from an old name of Vesuvius mentioned by Galen. The subject requires further investigation before we can assert with any confidence that a new element has been discovered.

The second fact is that the Vesuvius railway, from the base to the summit of the cone, more than 1,000 feet, with an average slope of 32°, has been commenced, and is progressing thus far favourably. The work is slow, but labour is cheap; we saw fifteen men dragging a single beam of wood up the cone. We are inclined to regard the whole thing as a very hazardous commercial undertaking. For to begin with, if the company charges 20 lire for each ascent, it will be long before a fair interest can be paid on the original cost and the working expenses. Moreover, the property is insecure, a stream of lava on the south-west side of the cone would destroy the line at once, and a violent earthquake would throw all the machinery out of gear.

G. F. RODWELL

THE CRAYFISH[1]

"COMMON and lowly as most may think the crayfish, it is yet so full of wonders that the greatest naturalist may be puzzled to give a clear account of it." These words from von Rosenhof, who in 1755 contributed his share to our knowledge of the animal in question, are cited by Prof. Huxley in the preface to the careful account of the English crayfish and its immediate congeners, which forms the latest volume of the International Scientific Series. The book is not designed for "general readers," those somewhat luxurious but presumably intelligent persons for whom so much scientific knowledge is chopped and spiced at the present day. It is, as we gather from the author's statement, intended as an introduction to serious zoological study, for those who will turn over its pages, crayfish in hand, and carefully verify its statements as to details of structure with scalpel and microscope. To these and also to those who are already well versed in crustacean anatomy, the book will have great value and interest; to the latter more especially, as showing how in the careful study of one organism we are "brought face to face with all the great zoological questions which excite so lively an interest at the present day," and as an exhibition of that "method by which alone we can hope to attain to satisfactory answers of these questions."

A crayfish is treated in this volume from the point of view of "science," and in the first pages we have some excellent observations (recalling earlier remarks of the author's in the same sense) directed to clearing up that mystery which good people will insist on throwing around that ever-more-widely-heard term. "Common sense," says Prof. Huxley, "is science exactly in so far as it fulfils the ideal of common sense; that is, sees facts as they are, or, at any rate, without the distortion of prejudice, and reasons from them in accordance with the dictates of sound judgment. And science is simply common sense at its best, that is, rigidly accurate in observation, and merciless to fallacy in logic." In the preceding quotation Prof. Huxley is (in a legitimate and intelligible way) using the word "science" in place of "that quality of mental activity by which science is produced." Immediately afterwards he speaks of science as the product of certain mental operations, in a passage which possesses great beauty whilst setting forth fundamental but neglected truths as to the source and scope of human knowledge. "In its earliest development knowledge is self-sown. Impressions force themselves upon men's senses whether they will or not, and often against their will. The amount of interest which these impressions awaken is determined by the coarser pains and pleasures which they carry in their train or by mere curiosity; and reason deals with the materials supplied to it as far as that interest carries it, and no farther. Such common knowledge is rather brought than sought; and such ratiocination is little more than the working of a blind intellectual instinct. It is only when the mind passes beyond this condition that it begins to evolve science.

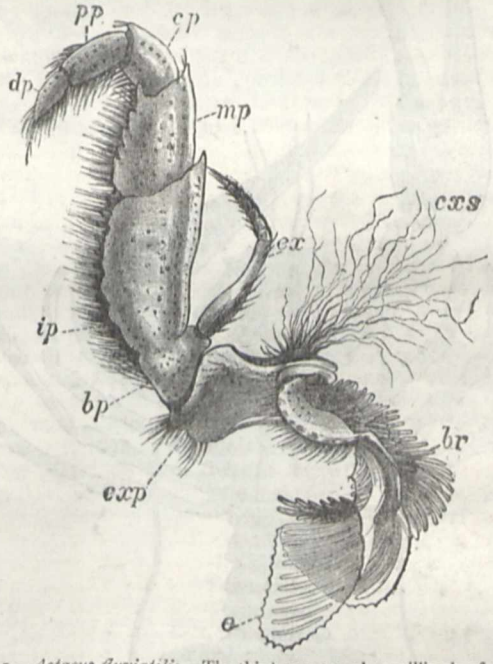


FIG 1.—*Astacus fluviatilis*.—The third or external maxillipede of the left side (× 3). *e*, lamina, and *br*, branchial filaments of the podobranchia; *exp*, coxopodite; *exs*, coxopoditic setæ; *bp*, basipodite; *ex*, exopodite; *ip*, ischiopodite; *mp*, meropodite; *cp*, carpopodite; *pp*, propodite; *dp*, dactylopodite.

When simple curiosity passes into the love of knowledge as such, and the gratification of the æsthetic sense of the beauty of completeness and accuracy seems more desirable than the easy indolence of ignorance; when the finding out of the causes of things becomes a source of joy, and he is accounted happy who is successful in the search, common knowledge passes into what our forefathers called natural history, from whence there is but a step to that which used to be termed natural philosophy, and now passes by the name of physical science.

"In this final state of knowledge the phenomena of nature are regarded as one continuous series of causes and effects; and the ultimate object of science is to trace out that series, from the term which is nearest to us, to that which is at the farthest limit accessible to our means of investigation.

"The course of nature as it is, as it has been, and as it will be, is the object of scientific inquiry; whatever lies beyond, above, or below this, is outside science. But the philosopher need not despair at the limitation of his

[1] "The Crayfish: an Introduction to the Study of Zoology." By T. H. Huxley, F.R.S. (London: Kegan Paul, 1880.)

field of labour; in relation to the human mind nature is boundless; and though nowhere inaccessible, she is everywhere unfathomable."

It is, then, with the object of arriving at a satisfactory conclusion as to the crayfish's place in nature, and to educe from the study of it such conclusions as may tend to throw light on the place in nature of other living things, that the reader is supposed to enter upon the consideration of the facts which Prof. Huxley lays before him.

No pains have been spared in the illustration of the text—the woodcuts (eighty-one in number) reflecting great credit both on the artist for his skill, and on the publisher for his enterprise. We have, after a general disquisition on the natural history of the crayfish (by no means the least interesting in the book), two devoted to

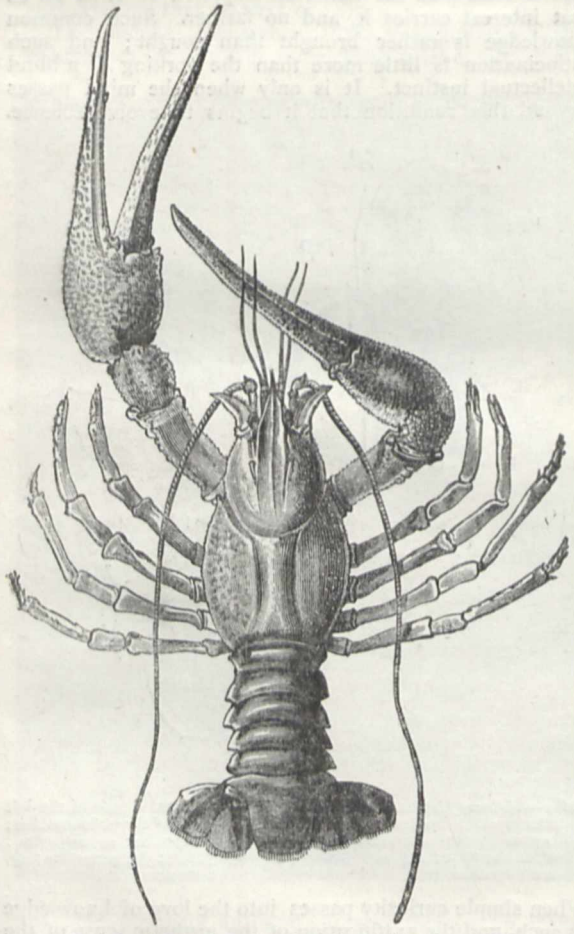


FIG. 2.—*Astacus leptodactylus* (after Rathke, ½ nat. size).

the consideration of the crayfish as a mechanism—in fact its physiology. Here a good deal of the anatomy is given and considered from the point of view involved in the question "What does it do?" Then we have the morphology of the English crayfish—the structure and development of the individual minutely set forth, even each joint of each leg, and each tuft on each gill, and each group of hairs, being described and figured. We are enabled by the courtesy of the publishers to reproduce one of these highly-finished engravings representing the most fully-developed of the crayfish's limbs (Fig. 1), and some others which give a fair notion of the excellence of the illustrations of Prof. Huxley's book.

To this follows a chapter in which the English crayfish is compared in a variety of points with crayfishes of other lands, such as those of Russia (Fig. 2), of Australia (Fig. 3), and of North America (Fig. 4), with lobsters and prawns, and it is explained how the amount of likeness and difference between these various but closely similar animals may be expressed by the method of classification in groups. Finally we have a chapter on the geographical distribution of crayfishes, and the facts therein narrated, together with those adduced in the previous chapter, enable the author to sketch the probable pedigree of crayfishes, that is, to *refer them to their causes*, viz., to the action of such physical agencies as flowing rivers, land and climatic barriers, brought to bear upon successive generations of the offspring of *marine* lobster-like ancestors which had a wide distribution in the earlier tertiary and later mesozoic periods, and before taking to fluviatile life had separated into two dis-

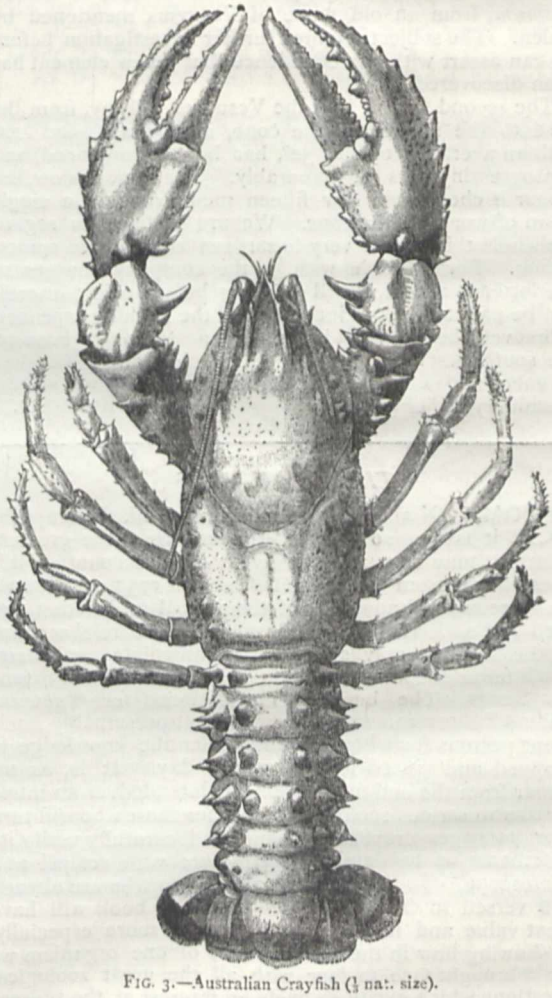


FIG. 3.—Australian Crayfish (⅓ nat. size).

tinct races characterised by differences of form, the one giving rise to the crayfish of the northern hemisphere (the Potamobiidæ), and the other to the crayfishes of the southern hemisphere (the Parastacidæ).

The novel portion of this book (novel at least to those who do not study the transactions of learned societies) is that in which Prof. Huxley details the very interesting results which he has obtained by a minute examination of the gills attached to the bases of the legs and sides of the body in all crayfish and allied forms. Three series of these gill-plumes may be distinguished according as they are attached to the leg, to the joint-membrane, or to the side of the body (Fig. 5). An ideally perfect crayfish would have all three series complete on each ring of the body in the branchial region (including the region occupied by the three pairs of maxillipedes and

the five pairs of walking and nipping legs). But no such realisation of the ideal can be found in Astacine nature, any more than in that of the higher Catarrhines. In some crayfish more or less of the leg-gills are suppressed; in others, the body-gills; in others, the joint-gills; and so ringing the changes on the combination of these elements, it is possible to construct clearly-distinguished groups amongst the crayfishes of many climes, which at first sight seem to differ very little from one another. Further, Prof. Huxley shows that crayfishes and lobsters differ from prawns, shrimps, and crabs, in having villous gills instead of laminated gills, in being "trichobranchiate" in place of "phyllobranchiate."

It will probably not be welcome news to some of our readers that the English crayfish is in all probability not entitled to the current title of *Astacus fluviatilis*. This name appears to belong to a larger species, sometimes called *A. nobilis*, hardly distinguishable from the English one, which in France lives side by side with it. The smaller crayfish, which alone occurs in England, is known as *A. torrentium*. This specific title will, it is to be feared, have to be adopted, although it by implication casts a slur upon the River

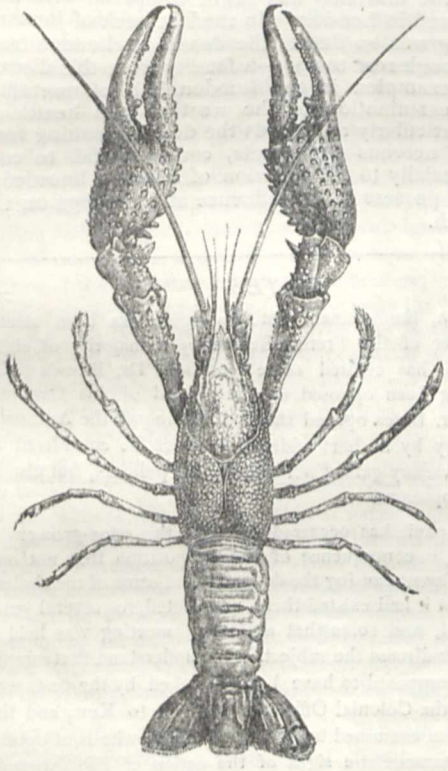


FIG. 4.

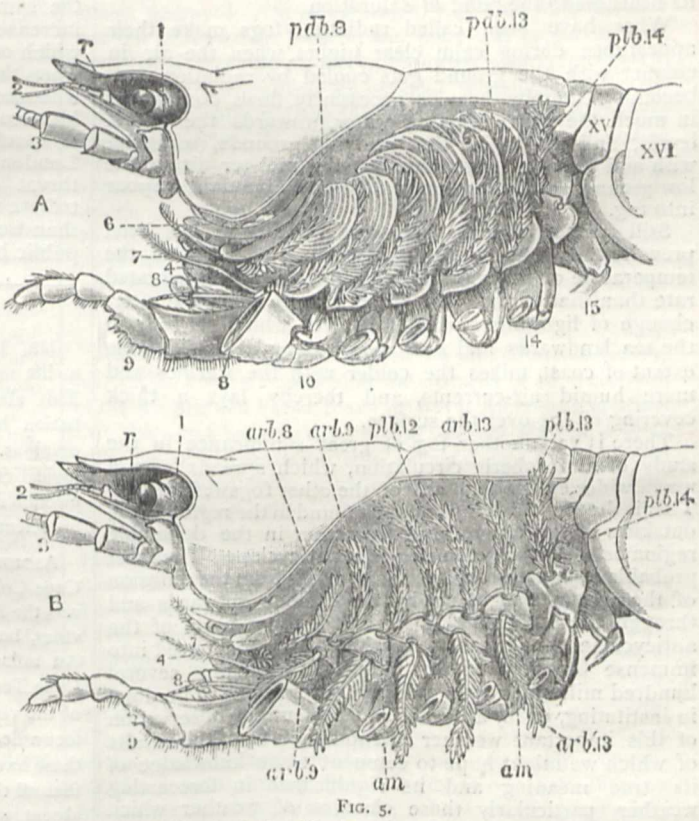


FIG. 5.

FIG. 4.—*Cambarus clarkii*, male (⅓ nat. size), after Hagen. FIG 5.—*Astacus fluviatilis*.—In A, the gills, exposed by the removal of the branchiostegite, are seen in their natural position; in B, the podobranchiæ are removed, and the anterior set of arthrobranchiæ turned downwards (× 2): 1, eye-stalk; 2, antennule; 3, antenna; 4, mandible; 6, scaphognathite; 7, first maxillipede, in B the epipodite, to which the line points, is partly removed; 8, second maxillipede; 9, third maxillipede; 10, forceps; 14, fourth ambulatory leg; 15, first abdominal appendage; xv., first, and xvi., second abdominal somite; *arb.* 8, *arb.* 9, *arb.* 13, the posterior arthrobranchiæ of the second and third maxillipedes and of the third ambulatory leg; *arb'.* 9, *arb'.* 13, the anterior arthrobranchiæ of the third maxillipede and of the third ambulatory leg; *pbd.* 8, podobranchiæ of the second maxillipede; *pbd.* 13, that of the third ambulatory leg; *plb.* 12, *plb.* 13, the two rudimentary pleurobranchiæ; *plb.* 14, the functional pleurobranchiæ; *r*, rostrum.

Isis. *A. fluviatilis* has red tips to its legs and a rostrum which differs by a notch or two from that of *A. torrentium*. Further, and this is very curious, *A. torrentium* never has been found to be infested by that very interesting parasite (more interesting even than the crayfish itself), the crab-leech, Astacobdella, or Branchiobdella, whilst it is quite abundant on the *A. fluviatilis*, at any rate in some rivers (*e.g.*, the Saale, in North Germany).

A. fluviatilis is largely eaten in France, attaining to the very respectable size of 5 inches or so in length, whilst our smaller *A. torrentium* is neglected from this point of view. We can recommend it, however, when boiled in salt and water, as nearly if not quite equalling the prawn.

The poisonous properties of the flesh of crayfish might perhaps be considered as justly falling within the scope of the first chapter of Prof. Huxley's treatise. As in the case of many mollusca and some true fishes, there appears to be a substance present which acts as an irritant poison upon the human organism, and to its action some persons are more liable than are others, whilst certain conditions of the crayfish seem to favour the development of a large amount of this poisonous body. A case was recently reported in a French medical journal, of the poisoning of six persons who partook of a dish of crayfishes—in one case with fatal result.

E. RAY LANKESTER

FOGS

THERE are fogs and fogs,—from the one extreme of the dry fog of continental meteorologists which merely blurs the sky with a bluish-tinted mist and shears the sun of its brilliancy as it nears the horizon, so that the eye can look on its disk undisturbed, to the other extreme of our genuine London fog which at times condenses to a consistency so thick as to give point to the sketch in *Punch* some years ago, representing a street-boy springing into the air, exclaiming "I am monarch of all I survey."

Fogs appear under widely different conditions. Thus the waters of the Arne occasionally appear for some distance after issuing from their icy cavern, like a steaming

torrent of heated water. In this case, the fog which is seen to rise from the river is caused by the cold water condensing the vapour of the warmer air above it, which at the time happens to be near the point of saturation. Similarly, the Mississippi, which flows directly from colder into warmer latitudes, is often enveloped in mists or fogs. On the other hand, when the waters of a river are considerably warmer than the air over them, the vapour rising from them is condensed into fog by the colder air through which it ascends; and in such cases the fog will be the denser in proportion to the stillness of the air and its nearness to the point of saturation.

What have been called radiation fogs make their appearance during calm clear nights when the air in contact with the ground gets cooled by radiation, and becoming thereby heavier necessarily flows downwards in much the same way as water, towards the lowest levels, and floods all the low-lying grounds, mingling with and diffusing itself through the moister air of the low grounds, and condensing its more abundant vapour into fog.

Still further in such calm cold weather as has been prevalent for some weeks in the south of England, the temperature of the land falls at a greatly more accelerated rate than that of the sea. When this happens the interchange of light airs and light breezes which set in from the sea landwards and *vice versâ* along a considerable extent of coast, mixes the colder with the warmer and more humid air-currents, and thereby lays a thick covering of fog over the surface.

There is yet another fog of great significance in the study of atmospheric circulation, which spreads over a much wider extent than any of the other fogs referred to. This is the fog which is frequently found in the region of the outskirts of the anticyclone, or rather in the debatable region between the cyclone and the anticyclone. The most probable explanation of it is that it arises from the diffusion of the vapour brought up by the cyclone outwards and through the colder and drier air of those parts of the anticyclone contiguous to it, where it is condensed into immense breadths of fog frequently stretching several hundred miles in length. Much yet remains to be done in instituting, even, an exact and systematic observation of this important weather phenomenon from the results of which we might hope to come at some knowledge of its true meaning and its significance in forecasting weather, particularly those changes of weather which terminate long tracts of fine dry weather.

Now if we examine the weather charts from new year's day to the present time, it is seen that the south-east of England has been constantly either within anticyclones or under their immediate influence, the centres of which kept shifting to and fro over a rudely shaped quadrilateral marked off by Corunna, Sligo, Copenhagen, and Bucharest. During nearly the whole of this time, London has been within the belt of fog and mist which continuously, or discontinuously, has been skirting the margin of these anticyclones. At the same time the air has been unusually calm. Thus at Greenwich for the four weeks ending January 31, the mean daily horizontal movement of the air was only 144 miles, being 182 miles less than the average; and during the five foggy days in the last week of January the daily movement of the air was 269 miles under the average.

Hence, then, the fogs which London has had in common with the south of England and parts of the continent opposite, have been intensified by the low temperatures and still atmosphere bringing from time to time their contributions of radiation fogs and other fogs, still denser, drifting ever and anon through the heart of the city from the adjoining sheets of salt and fresh water. The last touch in the production of the very worst character of these fogs was doubtless given by the smoke of London, in the manner explained by Sir John Herschel in his "Meteorology," whereby each particle of soot acting as an insulated radiant, collects dew on itself, and sinks rapidly down through the fog as a heavy body, thus giving to these fogs their yellow thick consistency and the suffocating and unwholesome sensation experienced in breathing them.

In the weekly reports of the Registrar-General for December, 1873, several deaths are certified as having been more or less directly caused by the extraordinarily dense fogs which then prevailed; and in one of the reports it is remarked that "In the large provincial towns, where the same cold weather was unaccompanied by fog, the increase in the mortality was slight compared with that which occurred in London." In the last week of January, when the fog was so dense, the deaths in London from whooping-cough rose to 193,—a fatality from this disease hitherto unexampled in the London bills of mortality. A careful examination of the weather and health of London, particularly as regards the deaths resulting from throat and nervous complaints, could not fail to contribute materially to the diffusion of a better knowledge than we yet possess of the influence of these fogs on the public health.

NOTES

DR. BROCA, the eminent anthropologist, has been elected a life member of the French Senate by a majority of eight. This election has created some sensation, Dr. Broca's nomination having been opposed on the ground of his Darwinist opinions. Dr. Broca opened the last meeting of the Anthropological Society by a short address, in which he considered his election as a victory gained not only by his political, but also by his scientific opinions.

ALMOST a panic has occurred amongst the wine-growers of Cape Colony, in consequence of the supposition that not only was the *Phylloxera* causing the destruction of some of the choicest vines, but that it had existed there, undetected, for several years. An influential, and somewhat animated, meeting was held at Cape Town to discuss the subject. We understand that samples of the vines, supposed to have been attacked by the pest, were forwarded to the Colonial Office and sent on to Kew, and that these have been examined by Mr. McLachlan, who is of opinion that all the characteristic signs of the action of *Phylloxera* are absent, and that nothing is shown to induce uneasiness in the minds of South African wine-growers on this score. The samples had been packed in the worst possible condition for minute examination; but according to a report in a Cape paper, Mr. Roland Trimen, of Cape Town, had examined samples submitted to him on the spot, and pronounced a similar opinion. Some of the vines are undoubtedly in an unhealthy condition, from unexplained causes. It is to be hoped our Cape colonists will not allow panic to take possession of them, and, under its influence, rush into extremes. It is probable that some of the South European nationalities that have carried the absurdity of panic to its highest limit—to the extent of confiscating a bouquet of wild flowers in the hands of unsuspecting ramblers—unwittingly permit the importation of "contraband" vines to a large extent.

ACCORDING to the report of the French Phylloxera Commission, the pernicious insect has spread in a deplorable manner during the last two years, in spite of all measures to the contrary. The black patches on the maps of the Commission, and which represent those districts over which the plague has a complete hold, must be enlarged year after year. Great hope was placed in snow, but it proved futile, inasmuch as snow must cover the ground for at least forty-five days to destroy the insects, and nowhere has the snow lasted so long as that. About one-quarter of the French wine-growing districts are now destroyed. All disinfectants prove useless, and it seems hopeless

to attempt to arrest the progress of the plague. Prof. Raynal of Poitiers proposes, as a last remedy, the radical destruction of all vineyards situated at the boundary of the infected districts, and the establishment of a "neutral" zone.

THE Chair of Chemistry in the newly established Agricultural College of Berlin, is to be filled by Prof. H. Landolt, of Aix-la-Chapelle, well known by his exhaustive studies on the relations between the optical properties of bodies and their chemical constitution. His wide experience in saccharimetry has likewise led to his simultaneous appointment as director of the Chemical Laboratory established at Berlin by the German *Verein für Rübenzucker-Industrie*. Prof. Landolt is succeeded in the Polytechnic of Aix-la-Chapelle by Prof. A. Classen, who has recently published two favourably-received laboratory manuals on Qualitative and Quantitative Chemistry.

IT will be a surprise to many to learn, the *Gardeners' Chronicle* tells us, that General Munro, C.B., whose decease occurred on the 29th ult., had claims on the respect of his countrymen as a learned botanist as well as a distinguished soldier. He contrived to combine with his military duties such a knowledge of general botany and horticulture, and so close a study, so searching an investigation of the characters, affinities, nomenclature, and classification of grasses, as to have been for many years the most trustworthy referee in that difficult order. With the exception of a monograph on the Bamboos in the *Transactions* of the Linnean Society, General Munro found time to publish but little. That monograph, however, affords sufficient evidence of his ability, industry, and profound knowledge of his subject. It was elaborated, we believe, in one of the intervals of active service. When, two or three years since, he retired from the army and established himself near Taunton, he at once commenced a general monograph of the whole order. This was intended to form one of the monographs in the series of such works now being issued in continuation of the *Prodromus* by MM. Alphonse and Casimir de Candolle. To the abiding loss of botany this monograph remains incomplete. It is to be feared that a long time must elapse ere any competent monographer will take upon himself the irksome labour of elaborating such a work.

M. BERROT, the director of the École Normale Supérieure died at Paris on February 3, at the age of fifty-six.

THE *Photographic News* informs us that Prince Leopold is a good chemist and has a practical knowledge of photography.

THE fragments of the 38-ton gun destroyed for experimental purposes in the bursting-cell in the proof-grounds, Government Marshes, adjoining the Royal Arsenal, Woolwich, on Tuesday last, have all been recovered, and are found to number about 120 pieces. They have all been marked, and are being washed and arranged for inspection. The two projectiles were taken from the sand-butt in front of the gun, both broken in pieces, and it is evident from the appearance of the bore that they broke up before leaving the gun, the marks of the rifling being in parts quite effaced. The muzzle end of the steel tube, about 3 feet in length, is intact, with parts of the wrought iron super-coil remaining attached, and a singular appearance is presented by the rearmost end of this fragment, the steel having been violently rent and incurved as though a shot or lighter fragment, moving faster than itself, had overtaken it and struck it with considerable force. The crusher gauges fixed on both projectiles have been recovered, but give no positive data respecting the pressure produced by the explosion. A very great pressure had been expected, and the copper crushers had consequently been subjected to a pressure of thirty-five tons to the square inch before being inserted in the plugs. This pressure was not exceeded in the explosion, and the only apparent deduction arrived at of importance is that a strain which would not be alarming in the powder chamber has sufficed to burst the gun at the spot where its thickness and strength suddenly diminished.

THE publication is announced of a magnificently illustrated "Iconographical History of the Orchid," by M. E. de Puydt, Secretary of the Royal Society of Agriculturists at Mons.

THE *New York Herald* publishes a despatch from Havannah, of date January 28, stating that the recent earthquake was felt in San Diego, Santiago de las Vegas, Pinar del Rio, Cienfuegos, Mariel, and other places. The small town of San Cristobal was almost destroyed. On January 24, at 7.45 P.M., an earthquake was felt at Karlsruhe, Rastadt, and Spier. It appears to have consisted of three different shocks, the direction being from west to east, and the duration about ten seconds. The shock was also felt in Durlach, Mühlburg, Daxlanden, Eggenstein, Sollinger, Lenkenheim, Weingarten, Hittenheim, Philippsburg. The commotion was very great, principally in Pletteersdorf, close to Rastadt, where the inhabitants were so frightened that they left their houses. It appears that in the vicinity of Spier a second shock was felt on the 28th, from 3 to 4 A.M. A severe shock of earthquake occurred in the Kurrum Valley, Afghanistan, on the 8th inst. Smart shocks of earthquake were felt at Sion, in the Valais, on Saturday week.

AT a recent meeting of the Boston Society of Natural History, Mr. F. W. Putnam remarked on the character of the shell-heaps of the Atlantic and Pacific coasts of North America, and stated that there had been received at the Peabody Museum a small collection of articles taken from rude dolmens (or chambered barrows, as they would be called in England), recently opened by Mr. E. Curtiss, who is now engaged, under his direction, in exploration for the Peabody Museum. These chambered mounds are situated in the eastern part of Clay Co., Missouri, and form a large group on both sides of the Missouri River. The chambers are, in the three opened by Mr. Curtiss, about 8 feet square, and from 4½ to 5 feet high, each chamber having a passage-way several feet in length, and two in width, leading from the southern side, and opening on the edge of the mound formed by covering the chamber and passage-way with earth. The walls of the chambered passages were about 2 feet thick, vertical, and well made of stones which were evenly laid without clay or mortar of any kind. The top of one of the chambers had a covering of large flat rocks, but the others seem to have been closed over with wood. The chambers were filled with clay which had been burnt, and appeared as if it had fallen in from above. The inside walls of the chambers also showed signs of fire. Under the burnt clay, in each chamber, were found the remains of several human skeletons, all of which had been burnt to such an extent as to leave but small fragments of the bones, which were mixed with the ashes and charcoal. Mr. Curtiss thought that in one chamber he found the remains of five skeletons, and in another thirteen. With these skeletons there were a few flint implements and minute fragments of vessels of clay. A large mound near the chambered mounds was also opened, but in this no chambers were found. Neither had the bodies been burnt. This mound proved remarkably rich in large flint implements, and also contained well-made pottery and a peculiar "gorget" of red stone. The connection of the people who placed the ashes of their dead in the stone chambers with those who buried their dead in the earth-mounds is, of course, yet to be determined.

HER MAJESTY'S Consul at Hakodate, Japan, states in his just published report that a botanical garden has been started at that place. The matter originated with private individuals as the suggestion of a foreign lady, but the Kaitakushi, or Colonisation Department, has taken the matter in hand, and has started a public garden. In order to give it the character of a public

undertaking, every ward in the town was induced to work there one whole day, in addition to the regular workmen employed. The paths were smoothed by the singing girls and others, and finally all the officials took part in constructing the Fusiyama of the garden, without which no Japanese garden is complete.

As evidence of the enlightened condition of the Japanese as compared with their neighbours in China, it is interesting to learn from the *Hiogo News* that the duplex system of telegraphy with the Morse instrument has been in successful working for some months past on one of the longest of the Government lines, that between Yokohama, Kobe, and Nagasaki.

THE *North China Herald* understands that the investigations made by Mr. Chaloner Alabaster, H.M.'s Consul at Hankow, into the ancient religions and philosophies of China, have led him to the discovery that there is a very evident connection between them and modern masonry.

THE *Jahrbuch der Erfindungen*, by H. Gretschel and G. Wunder, 1879, does not profess to deal with the whole of the wide field of science. It discusses especially the progress of chemical technology, and of chemistry, which occupy nearly a half of the book; then, with the chief acquisitions of physics, and analyses several important works in astronomy and meteorology. The departments of chemistry and of physics are the best; without attempting to render science popular, the *Jahrbuch* of MM. Gretschel and Wunder gives a good scientific summary of the work accomplished, and it will be most useful for those who, without being specialists in chemistry and physics, wish to have trustworthy information as to the progress realised in these branches during the year.

WE have had occasion during the past year (NATURE, vol. xix. p. 398) to describe in detail the novel and interesting chemical industry, created by Prof. C. Vincent of Paris, which consists in the manufacture of methyl chloride from beet-root vinasses. The ingenious inventor has sought to increase the applications of the final product of his manufacture, hitherto confined to the production of methylated aniline colours and artificial cold, and has discovered a profitable and valuable employment for it in the extraction of the odoriferous principles of flowers for use in perfumery. For this purpose the gaseous methyl chloride is thoroughly purified by passing it through concentrated sulphuric acid, and then liquefied by strong pressure. The liquid chloride is introduced into the apparatus containing the flowers, and after remaining a few minutes in contact with them, passes into another apparatus where a vacuum has been produced. A rapid vaporisation followed by a renewed condensation brings the chloride back to its original state, while the odoriferous principles in company with waxy and fatty extracts are left behind. They are entirely freed from the latter and obtained in a high state of purity by simple treatment with cold alcohol. Apart from the ease and rapidity of the new method, it seems to cause much less change in natural perfumes than has hitherto been the case in distilling the flowers with water. The new process has already been mounted on a scale for treating a ton of flowers daily.

THE Emperor William has recently conferred the Order of the Red Eagle on Prof. Heeren, of the Hanover Polytechnic, Prof. Hattendorf, of the Polytechnic at Aix-la-Chapelle, and Professors Roth, Websky, and Wichelhaus, of the University of Berlin. Most of these decorations are in recognition of special services in developing the mineral resources of the country.

WE have received, as the first publication of the Willughby Society, a reduced photolithographic reproduction of Tunstall's "Ornithologia Britannica," edited by Prof. Alfred Newton, F.R.S. Other works in hand for the Society are Sir Andrew Smith's papers in the *South African Journal* and "Report" of his Exploring Expedition, and Defontaine's "Mémoire sur quelques nouvelles Espèces d'Oiseaux des Côtes de Barbarie" from "Hist. de l'Acad. des Sciences," 1787. The Secretary of the Society is Mr. F. Du Cane Godman, 10, Chandos Street, Cavendish Square, W.

M. W. DE FONVIELLE writes us that the works for disincumbering the Loire of ice at Saumur are progressing favourably. It is estimated that on February 7 not less than 50,000 cubic metres of ice blocks were exploded and sent adrift with the current. M. Varoy, the Minister of Public Works, has communicated to his colleagues in council despatches announcing that no danger is to be now apprehended from the impending swelling of the Loire. One of the greatest difficulties in demolishing the ice-blocks was the small quantity of water in the river, but owing to the change of weather, the Loire is swelling rapidly. One of the peculiarities of the Saumur ice-blocks is the difference of colour exhibited. Some of them, impregnated with a minute sand, and produced in the bottom of the stream, are coloured yellow, others are perfectly transparent; a large number formed in the Vienne are magnificently coloured azure blue, and many are white and opaline, owing to a large number of air bulbs which obscure the transparency.

A VERY favourable report was presented at the annual meeting, yesterday, of the Royal Microscopical Society. The total number of Fellows is now 575; improvements have been made in the library, several additions have been made to the collection of instruments and objects, and it was proposed to enlarge the journal of the Society.

THE report read at the recent annual meeting of the Birmingham Natural History and Microscopical Society showed that although the number attending the meetings during the past year had, from various causes, been somewhat smaller than usual, the work of the Society had been, on the whole, very satisfactory, resulting in the discovery of many rare animals and plants, and of four species of animals new to Great Britain. The finances of the Society were in a flourishing condition. It was announced that about 700*l.* had been expended on the library and apparatus since the establishment of the Society in 1858. We believe a special meeting of this Society will shortly be held to consider the propriety of creating a new class of Members, to be called Associates, consisting of intelligent youths of from fifteen to twenty one years of age, who are interested in natural history. This is a step quite to be commended. Prof. Huxley has accepted the office of honorary vice-president of this Society.

A SPLENDID stalactite cavern has just been discovered in the Adams Valley (Moravia), which is celebrated for its numerous natural beauties. A peasant from the village of Sloup had the courage to penetrate into one of the numerous creeks which are found in the caves near Sloup. When he had reached the end of the creek he lit a candle, and to his astonishment found himself in a picturesque stalactite cavern measuring some 40 metres in width and length and some 25 metres in height. Stalactites of 1 or 2 metres in length descended from the ceiling, and mighty stalagmites arose from the ground like a forest of stone fir trees. The peasant announced his discovery to the Mayor of Proskowitz (the district town), who also visited the cavern and gave orders for enlarging the entrance and providing it with a gate, &c.

A LETTER from South Africa states that companies have been formed in Griqualand West and Natal to prospect for gold in Sikukuni's country, where it is known to exist.

THE additions to the Zoological Society's Gardens during the past week include two Thars (*Capra jemlaica*), six Impeyan Pheasants (*Lophophorus impeyanus*) from the Himalayas, three Horned Tragopans (*Ceriornis satyra*) from the South-East

Himalayas, a Temminck's Tragopan (*Ceriornis temminckii*) from China, a Spotted Turtle Dove (*Turtur suratensis*) from India, presented by H.R.H. the Prince of Wales, K.G.; two Black Lemurs (*Lemur macaco*) from Madagascar, presented by the Rev. G. P. Badger, D.C.L., F.Z.S.; a Sykes's Monkey (*Cercopithecus albogularis*) from East Africa, presented by Miss Mabel Beale; a Sambur Deer (*Cervus aristotelis*) from Malacca, presented by Mr. W. H. Stevenson; a Stanley Crane (*Tetrapteryx paradisea*) from South Africa, presented by Capt. Edward Jones, R.M.SS. *Conway Castle;* a Wood Owl (*Syrnium aluco*), European, presented by Mr. W. Addison; a Kittiwake Gull (*Rissa tetradactyla*), European, presented by Mr. H. R. Bower; a Hairy-nosed Wombat (*Phascolomys latifrons*) from South Australia, deposited.

OUR ASTRONOMICAL COLUMN

THE HARVARD COLLEGE OBSERVATORY.—We have received the Thirty-fourth Annual Report of the Director of this Observatory, presented to the Visiting Committee on December 5. Prof. Pickering notifies that the subscription of 5,000 dollars a year for five years, suggested in his previous Report, for relieving the immediate needs of the Observatory, more especially with regard to the publication of accumulated work, has been completed through the liberality of some seventy ladies and gentlemen, who have thus shown their interest in the establishment, an example of scientific zeal, we may say, by no means unique in the United States, nor indeed in the history of the Harvard Observatory; it may be remembered that the beautiful plates illustrating Mr. G. P. Bond's great work upon Donati's comet (Harvard *Annals*, vol. iii) were contributed by a few citizens of Boston and vicinity. The success attending the subscription has enabled both the equatorial and the meridian circle to be actively used during the year, the former frequently through the night. Photometry is still made the prominent feature in the work; vol. xi. of the *Annals* will contain the results of over 25,000 photometric observations, principally made with the large equatorial; amongst them are measurements of the outer satellite of Saturn, *Japetus*, on 101 nights in the autumn and winter of 1878-79, which, with similar observations on twenty-eight nights in the previous year, will furnish a determination of the law followed by this satellite in its changes of brightness. Another work of some extent, in the same direction, was commenced in 1879, viz., a determination of the light of all stars visible in the latitude of Harvard College; a preliminary catalogue has been formed containing all the stars in the Uranometries of Argelander and Heis, and in Behrmann's Atlas, with the stars of the *Durchmusterung* to the sixth magnitude inclusive. Most of the stars being inconspicuous objects, Prof. Pickering remarks, there would be much loss of time in identifying them in the field of a photometer mounted on an ordinary stand. This he avoids by observing them in the meridian as with a transit-instrument. "The photometer consists of a horizontal telescope pointing to the west, and having two objectives. By means of two prisms mounted in front of the telescope the pole-star is reflected into one object-glass, and the star to be measured into the other. The cones of light are made to coincide by a double-image prism, the extra images being cut off by an eye-stop. The star to be measured is thus seen in the same field with the pole star, with the same aperture and magnifying power." Errors to be apprehended in the use of the Zöllner photometer and other instruments, when the comparison is made with an artificial star are by this means eliminated. Of the work with the meridian circle, the observation of eight thousand stars in the zone + 50° to + 55° undertaken by the Observatory, and which has occupied Prof. Rogers during the greater part of eight years, was completed on January 26, 1879, and is mentioned as one of the largest astronomical undertakings which have been carried to completion in the United States; some years, it is added, will still be required to finish the reductions and publication of this work. The General Catalogue, 1874·75 (in vol. xii.) will be issued shortly, over two hundred pages being in type. Vol. xi., to which we have alluded, will be distributed in the course of the present year.

It will be seen from this summary of the contents of Prof. Pickering's Report that the Harvard College Observatory is fully maintaining the high reputation it acquired under the management of his predecessors, and the discrimination with which the subjects to which attention is directed are chosen, so as to avoid unnecessary or useless duplication of work, is not the least important point to be remarked. If this should hardly appear to apply to the proposed determination of the light of naked-eye stars, it must be remembered that the previous determinations of Argelander, Heis, &c., were made from eye-estimation, not by photometric instruments.

THE MINOR PLANETS IN 1880.—The specialty of the *Berliner astronomisches Jahrbuch* is well known to be the ephemerides of the small planets, which at the expense of a great amount of labour Prof. Tietjen has for many years kept up so nearly to our knowledge of these bodies. In anticipation of the appearance of the volume for 1882, these ephemerides applying to the year 1880 have just been circulated amongst observers. In addition to fifty-nine accurately computed ephemerides about the times of opposition of as many planets, there are approximate places for every twentieth day of the first one hundred and ninety-nine of this numerous group, excepting only *Dike* and *Scylla*, for which adequate material for calculation does not exist. Only two out of the number approach the earth during the year, within the distance 1·0, viz., *Ariadne*, in the middle of May, distance 0·923, and *Procne*, in the middle of August, distance 0·996.

That *Dike*, No. 99, should be still adrift, notwithstanding it was discovered as far back as May, 1868, is not perhaps a matter for surprise, considering that M. Borrelly, when he detected it, did not estimate its magnitude over 13·14, though it was within ten degrees from the perihelion. *Scylla* was observed for a fortnight in November, 1875, and may have been in opposition during the last autumn, though not found: from the elements in the *Annuaire* for 1879, it would not appear to be identical with No. 206, discovered by Prof. Peters at Clinton, N.Y., on October 13, 1879, and only observed for three or four days.

A GREAT COMET.—Dr. Gould, in charge of the Argentine National Observatory at Cordoba, telegraphs thus from Buenos Ayres to Prof. Peters, the editor of the *Astronomische Nachrichten*:—"Great comet passing sun northwards;" the telegram was received at Kiel on the 5th inst. The ocean cables may in future prevent such a surprise as was experienced in these latitudes on the sudden appearance of the huge comet of June, 1861, which, rising rapidly in declination and passing the sun, as Dr. Gould describes the new one, was observed simultaneously or nearly so, throughout Europe, with a tail upwards of 100° in length. The astronomical phenomena of the present year which admit of prediction, do not offer any feature of special interest, and a large comet will therefore come the more opportunely.

PHYSICAL NOTES

TWO researches on singing condensers, such as that employed in Varley's telephone, have lately been published. M. R. Chavannes, in the first of these, maintains that undulatory currents produce no sounds in such condensers; that intermittent currents are absolutely necessary. M. Trève has shown, in the second, that a pressure exerted upon the leaves of the condenser sufficient to drive out the air from between them will destroy the production of the tones; and that if the condenser is placed in an exhausted chamber it ceases to emit sounds.

IT will be remembered that in 1876 Prof. Rowland discovered the magnetic effects of electric convection. M. Lippmann has discussed, in a recent number of the *Comptes Rendus*, the converse case of the ponderomotive force exercised upon material bodies charged with electricity by the relative motion of a magnet.

CAST-IRON MAGNETS are now being made of a superior quality by M. Carré, who publishes in the *Revue Industrielle* an account of his process. A soft and very slightly carburetted metal is melted in earthen crucibles. Just previous to running into the moulds 10 to 15 per cent. of steel filings are added. In order to produce a metal which will stand tempering at a cherry-red heat, there is added either 1 to 1·5 per cent. of nickel, with 0·25 per cent. of copper, or 2·0 per cent. of tin and 0.5 per cent. of copper.

AN "acoustico-electrical kaleidoscope," the invention of M. Michelangiolo Monti, is mentioned in *Les Mondes*. It consists of a microphone used in conjunction with an induction-coil and a Geissler tube, and is, like Edmunds's phonoscope, which it

resembles, intended for the optical study of sounds. A complete description of the instrument is not, however, given.

ACCORDING to Herr H. Schwarz, an admirable cement for glass, and one which completely resists the solvent action of water, may be prepared by the following process: From 5 to 10 parts of pure, dry gelatin are dissolved in 100 parts of water. To the solution about 10 per cent. of a concentrated solution of bichromate of potash is added, and the liquid is kept in the dark. When articles joined by means of this cement are exposed to the light the gelatine film is acted upon by the chemical rays, the chromate being partially reduced, and the film of cement becomes extremely tough and durable.

THE "meter" devised by Edison for his system of domestic electric lighting depends upon the electro-deposition of copper upon an electrode in a branch circuit whose resistance bears a known ratio to that of the circuit of the user, the movable copper electrode being weighed at stated intervals in order to gauge the consumption. There is also in the "meter" a most ingenious contrivance whereby if any consumer draw too largely on the supply the armature of an electromagnet in the circuit is attracted and "cuts out" the transgressing consumer, actually fusing up the only remaining metallic connection!

LIPPMANN'S principle that if by mechanical means we deform a mercury surface, an electrical liberation is produced which tends to arrest the movement of the mercury, has led M. Debrun to contrive an apparatus (*Jour. de Phys.*, January) in which mercury is admitted in drops, with acidulated water between, down a conical tube, into a vessel arranged as a Florentine receiver (giving separate outflow to the two liquids). The upper and lower masses of mercury are connected with platinum wires, which take their polarity, and a current is found to proceed in the direction of the globules. With a tube 0·30 m. long, 2·5 mm. diameter at top, and 1 mm. at the lower part, and containing at least twenty mercury globules, and not more than thirty-five, the electromotive force is about 1·4 volts, giving decomposition of water with Wollaston points. Only 2 kg. of mercury are expended in the hour. Letting the mercury flow twenty-four hours, M. Debrun was able to silver strongly a five-centimes piece. Several experiments may be made with the apparatus; thus, if the poles are disconnected the mercury flows slowly and difficultly, but when they are connected it flows very rapidly.

A NEW galvanic battery with circulating liquid, described by Signor Ponci in *Natura* (3, p. 402, 1879), has the following form:—Rectangular lead channels, beak-shaped at one end, are so placed over one another in slanting position that the beak of the first is over the broad end of the second, and so on. In each channel is an amalgamated zinc plate, and above this a carbon plate insulated from it by two rings of caoutchouc; the carbon plate is perforated under the beak of the lead channel above. The lead channels have wires, and the carbon plates, at their upper ends, binding screws, with which they are alternately connected. By means of a caoutchouc siphon a solution of chromate of potash is conducted through the system (200 gr. $K_2Cr_2O_7$, 21 water, 11 commercial muriatic acid; for long use 3 to 6 litres water and 100 to 150 ccm. muriatic acid may be added to each litre of the solution). A battery of 99 such elements gives a light-arc equal to that of a battery of 60 Bunsens, and is constant in duration.

THE following reaction, proposed by M. Jorissen, for discovering very weak traces of morphine, is reported by M. Donny (*Bulletin* of Belgian Academy) to be very sensitive. The morphine is treated first with sulphuric acid, then with ferrous sulphate; a nearly colourless liquid is thus obtained, but on letting it fall drop by drop into concentrated ammonia, a very intense blue-purple coloration is immediately produced.

GEOGRAPHICAL NOTES

AT the meeting of the Geographical Society on Monday evening, the Earl of Northbrook announced, amidst great applause, that Colonel Gordon had been elected an Honorary Corresponding Member, and at the same time passed a high eulogium on his character and his services in Egypt and elsewhere. Major-Gen. Sir M. A. S. Biddulph, K.C.B., who commanded a column in the last Afghan campaign, afterwards read a paper on the eastern border of Pishin and the basin of the Loras. The country dealt with had never previously been examined by Europeans, all our information having been derived from native sources, and consequently the particulars so laboriously collected by Sir M. Biddulph, with the aid of the survey officers acting under him, will prove of the utmost value to cartographers. He mentioned several instances in which our present maps are entirely wrong, specifying one in which the position of a place would have to be shifted fifty miles. A peculiar characteristic of the country examined was the existence of long plains in the valleys, which rendered movement comparatively easy, another being the great number of water-partings. The basin of the Loras,—a name given to all streams in that region,—consists, in fact, of a curiously involved system of mountain ridges, about which Sir M. Biddulph furnished much valuable topographical information.

AT a committee meeting of the German African Society at Berlin, at which Dr. Gerhard Rohlfs was present, it was resolved to recommend Dr. Stecker to continue the expedition to Wadai, by way of Mursuk, Bornu, and Adamauk, as on this route he will travel under the protection of the Khedive of Egypt. According to the opinion of Dr. Rohlfs it is beyond all doubt that the Turkish government will fully compensate the Society for the loss sustained through the attack upon the expedition.

THE *Vega* left Port Said on the 6th inst., and may be expected to reach Naples to-day.

THE new number of the *Annales de l'Extrême Orient* contains, among other matter, a paper on the languages and literature of Java, by Prof. P. J. Veth, President of the Dutch Geographical Society, notes on recent Dutch explorations in New Guinea, and some remarks on Lieut. Delaporte's work, entitled "Voyage au Cambodge."

MR. ALEXANDER FORREST contributes to the December number of the *Victorian Review*, published at Melbourne, a very interesting, though somewhat brief account of his explorations during his recent journey from Perth, West Australia, to Port Darwin, in the Northern Territory. We believe that Mr. Forrest is very sanguine that large tracts of the fertile country which he has discovered will shortly be taken up and occupied by settlers.

THE last number of the *Proceedings* of the Asiatic Society of Bengal contains a paper on the exploration of the Great Sanpo River of Tibet, by Major-General J. T. Walker, which is illustrated by a map. Capt. W. E. Gowan also furnishes a translation from the Russian of the geographical information regarding the Kirghiz Steppes and country of Turkistan, afforded by the Book of the Great Survey.

WRITING to *Les Missions Catholiques* from Landana, in Congo, Père Carrie supplies a few particulars respecting Mr. H. M. Stanley's expedition from the west coast, about which the International African Association has been remarkably silent. Mr. Stanley, it appears, has with him fourteen white men, one Arab, two natives of Sierra Leone, and sixty-one men from Zanzibar, whence a large additional number are shortly expected to arrive in charge of a European. Père Carrie adds that Mr. Stanley has already established a station at Noki, some miles above Mboma. He has with him a number of wooden houses all ready for erection at various points as he advances into the interior.

AS the result of fifteen years' research into the archæological riches of Hainault, M. Théodore Bernier has just published (Mons: H. Maneraux) a volume entitled "Dictionnaire Géographique, Historique, Archéologique, Biographique, et Bibliographique du Hainault."

IN connection with Mr. G. J. Morrison's paper on the Grand Canal, read before the Geographical Society on January 12, much interest attaches to a letter in the *North China Herald*, from its Tientsin correspondent, whose experiences are about eighteen months later. Being desirous of going to Tê-chow, in Shantung, he made the journey by the Grand Canal. The water in the Pei-ho at the time was higher than it had been for nearly ten years, but the Canal had risen but slightly, the water coming mainly from the streams to the south-west. On the second day, however, a sudden rise was apparent, the water wanting but an inch or two of overflowing. Still little effort was made to guard against danger; a few weeds or *kao-liang* (millet) stalks covered with earth, or simply a few shovels-full of earth in many cases, were the only defence against the rising water. To the west of the Canal was a vast expanse of flooded country, stretching for 100 miles or more. At one place where the bank was weak,

piles were being driven and an embankment of earth and weeds was being made, while at another point, much exposed to the force of the wind and water, a number of old grain junks had been drawn up in line against the bank to break the force of the waves.

THE just published *Bulletin* of the Société Normande de Géographie contains a note of some interest on Algeria, by M. E. Masqueray, whose address on the same subject is promised in the next number.

THE United States Government are about to despatch a party of military and naval engineers to examine the various routes proposed for an inter-oceanic ship-canal across the Isthmus of Panama.

THE February number of *Petermann's Mittheilungen* contains two important papers on South American travel. Herr Fr. von Schenck describes a journey he made in 1878 in Antióquia, in the United States of Columbia, and another long paper gives an account of the travels of Messrs. Rogers and Ibar in South-West Patagonia in 1877, to which are added the journals of A. de Vicuna, in 1782, and J. H. Gardiner in 1867.

WE have to record the death of M. Capitaine, the editor of *L'Exploration*, at the early age of forty. M. Capitaine had been in former years a surgeon in the national navy, and has written numerous papers on subjects of geographical interest.

ON A NEW ACTION OF THE MAGNET ON ELECTRIC CURRENTS[1]

THE statement that "the mechanical force which urges a conductor carrying a current across the lines of magnetic force, acts, not on the electric current, but on the conductor which carries it," has often been a puzzle to students of electricity. Experiments have been made at various times to prove that the statement is not correct, but have hitherto uniformly resulted in failure. Mr. E. H. Hall working under the direction of Prof. Rowland believes himself to have been more fortunate than his predecessors, and describes an experiment which apparently proves a permanent effect of a magnet on the distribution of currents in a system of wires. As Mr. Hall promises a more extended investigation we shall describe his experiment as much as possible in his own words without comment or criticism.

The following experiment had apparently been formerly tried by Prof. Rowland, but without success :—

"A disk or strip of metal, forming part of an electric current, was placed between the poles of an electro-magnet, the disk cutting across the lines of force. The two poles of a sensitive galvanometer were then placed in connection with different parts of the disk, through which an electric current was passing until two nearly equipotential points were found. The magnet current was then turned on and the galvanometer was observed, in order to detect any indication of a change in the relative potential of the two poles."

No such change could be observed and Mr. Hall now repeated the same experiment substituting a piece of gold leaf, mounted on glass to the metal strip. Experimenting as above he obtained on October 28 a decided deflection of the galvanometer needle.

"This deflection was much too large to be attributed to the direct action of the magnet on the galvanometer needle, or to any similar cause. It was moreover a permanent deflection and therefore not to be accounted for by induction."

Some rough quantitative experiments were tried with the result "that with a given form and arrangement of apparatus the action on the Thomson galvanometer is proportional to the product of the magnetic force by the current through the gold leaf. This is not the same as saying that the effect on the Thomson galvanometer is under all circumstances proportional to the current which is passing between the poles of the magnet. If a strip of copper of the same length and breadth as the gold leaf but ¼ mm. in thickness is substituted for the latter the galvanometer fails to detect any current arising from the action of the magnet, except an induction current at the moment of making or breaking the magnet circuit." A. S.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THERE will be an examination for at least one open scholarship in Queen's College, Oxford, on April 6 and following days. Papers will be set in Physics, Chemistry, and Biology (Comparative Anatomy and Physiology, the study of the Animal Kindom). No candidate will be expected to offer more than two of these subjects. There will also be a practical examination in one or more of the above subjects, if the examiners think it expedient. Candidates are requested to signify by letter to the Provost, *not later than March* 1, their intention of standing, and to state at the same time the subjects they propose to offer.

M. JULES FERRY has published a report stating that the development of primary instruction in France has progressed in proportion to the subsidies made by the public treasury for this purpose, and which we noticed in one of our previous numbers. In the fifty years from 1827 to 1877 the number of public schools has been increased in the proportion of 100 to 175, and the number of pupils from 100 to 182.

SCIENTIFIC SERIALS

American Journal of Science and Arts, January.—Prof. Stockwell here gives a detailed account of the principal periodic inequalities in the motions of the moon arising from the oblateness of the earth.—Prof. Leconte contributes further ideas on the glycogenic function of the liver. He represents that waste tissue is not burned or changed into final products at once, but circulates as incombustible matter dissolved in the blood, is carried to the liver, and there prepared for final combustion and elimination. Only thereafter does it unite with O to form CO_2 and H_2O.—Dr. Nichols proposes an optical method for measurement of high temperatures; it corresponds to one of three methods proposed by M. Crova, who, however, ignored the serious practical difficulties, especially in the varying values of the emissive and absorptive capacity of different bodies.—The first results from a new diffraction-ruling engine (which appears to be a very perfect piece of work) are given by Mr. Rogers.—Mr. Hill's electrodynamometer for measuring large currents has been noticed in our columns, also Mr. Todd's observations on solar parallax from the velocity of light.—Mr. Levison describes certain curious electrolytic phenomena capable of exhibition to an audience.—Prof. Marsh describes new characters of Mosasauroid reptiles, Mr. Whitfield new fossil crustaceans from the upper Devonian rocks of Ohio, and there are also geological papers on the Henry Mountains and the Wappinger Valley limestone.

Annalen der Physik und Chemie, No. 1.—Among the original matter in this number we note a chemical monograph of the mica-group, by Herr Rammelsberg; accounts of a new condensation or absorption-hygrometer, by Herr Matern, of some phenomena of phosphorescent light produced by electric discharges, by Herr E. Wiedemann, and of the phenomena, in polarised light, of a plate of magnesium-platinum cyanide, cut at right angles to the optic axis, by Herr Lommel; a paper by Herr Korteweg, proving that, by the theory of dielectric polarisation, volume-changes of a dielectric body under the action of an electric force may be anticipated and calculated; one by Herr Edlund, controverting Helmholtz's views as to the cause of electric currents produced in flow of liquids through tubes; and one by Herr Herwig, defending his conclusions regarding the electric conductivity of mercury vapour. We also note valuable papers (communicated to Academies) on the conductivity of iron for heat, by Herr G. Kirchhoff and Herr Hansemann; on the differences of the two electric states, by Herr Mach and Herr Doubrava; and on a direct measurement of the work of induction, and a determination therefrom of the mechanical equivalent of heat, by Herr von Waltenhofen.

THE *Journal of Anatomy and Physiology, Normal and Pathological*, vol. xiv., part 2., January.—Dr. A. H. Young, the intrinsic muscles of the marsupial hand (pl. 7), and on the myology of *Viverra civetta*.—Mr. W. R. Williams, the anatomy of the knee-joint.—Dr. D. J. Hamilton, development of fibrous tissue from the hepatic parenchyma in cirrhosis of the liver (pl. 8).—Dr. P. McBride, contributions to the pathology of the internal ear (pl. 9).—S. G. Shattock, a new bone in human anatomy, together with an investigation into the morphological significance of the so-called internal lateral ligament of the human lower jaw.—Dr. G. T. Beatson, the disease called sturdy in sheep, in its relation to cerebral localisation.—Dr. J. Carmichael, two cases of lesions of the temporo-sphenoidal lobe of the brain, with pathological examination by Dr. D. J. Hamilton (pl. 10).—Dr. Osler, two cases of striated myo-sarcoma of the kidney.—Dr. G. A. Gibson, the sequence and duration of

[1] By E. H. Hall, Fellow of the Johns Hopkins University (*American Journal of Mathematics*, vol. ii. p. 287).

the cardiac movements (pl. 11).—Prof. Turner, the fœtal membranes of *Oreas canna* and notes on the dissection of a second negro.—Dr. Anderson, a new abnormality in connection with the vetebral artery.—Dr. J. G. Garson, case of the development of wool on the cornea of a sheep.—Notices of books.—List of grants in aid of scientific investigation made by the British Medical Association.

THE *Archives des Sciences Physiques et Naturelles* (November and December, 1879).—These parts contain the following papers:—Meteorological recapitulation of the whole year 1878 for Geneva and the Great St. Bernard, by Prof. Plantamour.—Analysis of some recent works relating to the topography and the constitution of the moon (second part), by M. Rapin.—On the periodic movements of the soil as indicated by air-bubble levels, by Prof. Plantamour.—Essay on chemical mechanics, founded upon thermochemistry, by M. Berthelot.—Account of the sixty-second meeting (at St. Gallen) of the Swiss Society of Naturalists, on August 10-12, 1879.—On a portable and registering limnimeter, and observations made with it at the Peilz tower near Vevey, by M. E. Sarasin.—On the theory of joints in botany, by M. Clos.—Note on *Capsella rubella*, Reut., by M. Vetter.—Tables of meteorological observations made at Geneva observatory and on the Great St. Bernard during October and November last, by Prof. Plantamour.—Note on the "Elementary Treatise of the Qualitative Analysis of Mineral Matter," by Albert Ditti.—On the health of the pupils at the Lyons Lyceum, by Dr. H. Dor.—New researches on the quantitative determination of chromatic vision, by Drs. Dor and Favre.—On the historical evolution of the colour sense, by Dr. Dor.—Researches on the action of low temperatures on the germinative faculties of seed-grains, by C. de Candolle and Raoul Pictet.

THE *Verhandlungen der k.k. geologischen Reichsanstalt zu Wien* (Nos. 13 and 14, 1879).—From these parts we note the following papers:—On the flora of the clay of Preschen, by H. Engelhardt.—On the living analogies of the late-tertiary marsh-strata and of the melanopsis-marl of south-eastern Europe, by Th. Fuchs.—On the environs of the Adamello mountains and on the development of the Perm formation between Val buona Giudicaria and Val Camonica, by G. Stache.—Report of a geological excursion to the Herzegowina, by A. Bittner.—Numerous book-notices.—On the slate of Velhota, by J. Kusta.—On the Strypa river district in Galicia, by Dr. E. von Dunikowski.—On the plants of the Cipris-slate of northern Bohemia, by H. Engelhardt.—On the strata penetrated by the main shaft of the Société de Carbonages de Bohème between Königswerth and Grasseth, near Falkenau on the Eger, by the same.—On the eruptive formations and the relief of the district of Christiania, by Dr. E. Reyer.—On the Wieliczka mine, by C. M. Paul.—On the brachipoda fauna of the oolites of Balin near Cracow, by L. Szajnocha.

Bulletin de l'Académie Royale des Sciences de Belgique, No. 11, 1879.—On a convenient means of distinguishing artificial from natural butter, by M. Donny.—On elimination (third and fourth note), by M. Mansion.—Theory *à posteriori* of elimination between two algebraic equations, by the same.—New reactions enabling to characterise very small quantities of morphine, by M. Jorissen.—On certain combinants of binary algebraic forms, by M. Le Paige.

THE *Revue Internationale des Sciences* (October, 1879), contains the following papers:—On the fauna of the depths of the sea, by Prof. A. Pagenstecher.—On lichens, by Prof. Reess.—On the adaptation and the mimetism in Turbellariæ, by Paul Hallez.—On the development of parrots, by Max Braun.—The part further contains the usual reviews, book notices, and scientific news.

THE *Verhandlungen des naturhistorischen Vereins der preussischen Rheinlande und Westfalens* (36ter Jahrg. i., 1879), contain but few papers of importance:—On the theory of the double refraction of light, by E. Ketteler.—Materials for an arachnida fauna of Japan, by F. Karsch.—On the occurrence of fossil bones near the Unkelstein on the Rhine, by G. Schwarze.—On the chemical cause of the poisonous action of arsenic, by Herr Binz.—On hannayite, newberyite and sillimanite, by Prof. vom Rath.—Several geological papers and reports of minor interest, by the same.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, February 5.—"On the Epipubis in the Dog and Fox." By T. H. Huxley, Sec.R.S.

In 1871[1] I gave a brief description of a structure which I had observed in the dog, in the following terms:—

"In the myology of the dog, the insertion of the tendon of the external oblique muscle of the abdomen presents some interesting peculiarities. The outer and posterior fibres of this muscle end in a fascia, which is partly continued over the thigh as *fascia lata*, and partly forms an arch (Poupart's ligament) over the femoral vessels; by its inner end it is inserted into the outer side of a triangular fibro-cartilage, the broad base of which is attached to the anterior margin of the pubis, between its spine and the symphysis, while its apex lies in the abdominal parietes. The internal tendon of the external oblique unites with the tendon of the internal oblique to form the inner pillar of the abdominal ring, and is inserted into the inner side of the triangular fibro-cartilage. The *pectineus* is attached to the ventral face of the cartilage; the outer part of the tendon of the rectus into its dorsal face; but the chief part of that tendon is inserted into the pubis behind it. This fibro-cartilage appears to represent the marsupial bone, or cartilage, of the Monotremes and Marsupials."

The only reference to this statement which I have met with is by Prof. Macalister, in his "Introduction to the Systematic Zoology and the Morphology of Vertebrate Animals" (1878), p. 265:—

"Prof. Huxley describes a fibro-cartilaginous 'marsupial' above the pubis, from whose anterior surface the pectineus arises. I have failed to satisfy myself of its existence as a constant structure in many dogs, in the common and Bengal foxes, in the dingo, jackal, *Canis pallipes*, and wolf."

The wording of this passage does not make it quite clear whether the writer has not found the structure in any case, but does not mean to deny that it may occur occasionally in the various *Canidæ* he mentions; or whether he has found it occasionally, but not constantly, in all or some of them.

Under these circumstances it may be desirable to publish the fact that, having recently dissected, for purposes of comparison, a male and female fox and a male and female dog, I have not had the slightest difficulty in demonstrating the existence of the structure which I described in 1871, in all four. And the only phrase which appears to require modification in that description is the use of the term fibro-cartilage. I do not remember whether, formerly, I submitted the structure to microscopic examination or not; but in the specimens lately examined, notwithstanding the firmness and density of the triangular plate, it contains no true cartilage cells, but is entirely composed of fibrous tissues which lie parallel with one another in the middle of the plate, while, at the thickened edges, they become closely interwoven.

A comparison of this triangular fibrous plate in the fox, with the "marsupial" bones of *Phalangista vulpina*, shows that the fibrous plate in the former animal exactly answers to the basal part of the "marsupial" bone in the latter. It may properly, therefore, be termed the *epipubic ligament*, and must be regarded as a structure of the same order as the rudimentary clavicle and the rudimentary hallux of the *Canidæ;* that is to say, as the remains of an organ which was fully developed in the ancestral forms of that group.

It is interesting to remark, in connection with this interpretation of the facts, that, in the existing *Thylacinus*, which presents so many curious points of resemblance to the dogs, the epipubis is not ossified. As, however, the *Canidæ* have certainly existed since the eocene epoch, there is no likelihood of the existence of any direct genetic connection between the dogs and the Thylacines. The existing carnivorous *Marsupialia* have evidently all proceeded from ancestral forms, characterised by the possession of a thumb-like hallux, a peculiarity which is presented neither by the dogs, when they possess a hallux, nor by any other carnivora with pentadactyle hind feet. Moreover, the early birth of the young and the development of a marsupium in the female, are evidences of the departure of the existing Marsupialia from the direct line by which the Mammalia have advanced from the ornithodelphous type. That the ancestors of all mammals possessed bony or cartilaginous epipubes is, I think, highly probable, but it does not follow that they had the marsupial method of bearing and nourishing their young.

[1] "Manual of the Anatomy of Vertebrated Animals," p. 417.

Chemical Society, February 5.—Mr. Warren De la Rue, president, in the chair.—It was announced that a ballot for the election of Fellows would be held at the next meeting of the Society (February 19).—The following papers were read:—Note on the assumed formation of ozone by the atmospheric oxidation of phosphorus, by C. T. Kingzett. The author criticises a paper recently read on the above subject by H. McLeod, and contends that his arguments fall to the ground because he has made a mistake in calculating the results of his experiments.—Contributions from the laboratory of Tôkiô, Japan, by R. W. Atkinson; II. On persulphocyanate of silver. When this yellow salt is boiled with water it turns black; a mixture of sulphide and undecomposed persulphocyanate being formed in proportions which vary with time, temperature, and the quantity of free acid present, at the same time cyanogen disulphide is probably formed.—On methylated dioxethylenamines, by H. F. Morley. The author has prepared, by the action of mono and dimethylamines on glycollic chlorhydrin, mono- and di-methyldioxethylenamine, and analysed their platinum salts.—Note on igasurin, by W. A. Shenstone. The author has prepared this substance, obtained by Desnoix, and finds it to be a mixture of brucine and strychnine.—On some reactions of tertiary isobutylic iodide, by L. Dobbin. By prolonged shaking with a 12 per cent. solution of hydrocyanic acid or water at the ordinary temperature, trimethyl carbinol was obtained; by the action of zinc oxide at 15° isotributylene was formed; no isodibutylene could be separated. The author has also studied the action of sodium on tertiary isobutylic iodide. Isobutylene, isotributylene, and hydrogen were formed with small quantities of a hydrocarbon not absorbed by fuming sulphuric acid.

Zoological Society, February 3.—Prof. Flower, F.R.S., president, in the chair.—Capt. W. Vincent Legge, R.A., exhibited and made remarks upon some specimens of the Little Ringed Plovers of India and Ceylon.—A communication was read from Dr. G. Hartlaub, F.M.Z.S., containing the description of a new species of Heron, obtained in Mohambo in Northern Madagascar, which he proposed to name *Ardea rutenbergi*.—Mr. Oldfield Thomas read a note on a specimen of *Myoxus elegans*, Temminck, which had been obtained by Mr. H. Pryer, near Yokohama, Japan.—A communication was read from Mr. H. N. Moseley, F.R.S., containing the description of a new species of Simple Coral, which he proposed to call *Desmophyllum lamprosteichus*.—Prof. F. Jeffrey Bell gave an account of *Palæolampas*, a new species of irregular Echinoidea, which presented, among others, the following archaic points:—(1) The rows of pores were completely parallel, and extended regularly to the ambitus; (2) some of the pores exhibited an elongation indicating the appearance of the connecting grove; (3) the outer row of each pore-series was continued uninterruptedly to the actinistome; and (4) two of the ocular pores retained indications of their primitively double character.—Messrs. C. J. Danford and E. R. Alston read a paper on the mammals of Asia Minor, Part II., in which they added certain species to their former list, and described a new species of Vole, under the name of *Arvicola guentheri*.—Mr. Sclater exhibited and made remarks on a fifth collection of birds from Duke of York Island and its vicinity, which he had received from the Rev. George Brown, C.M.Z.S. Four species were described as new, and proposed to be called *Megalurus interscapularis*, *Pœcilodryas æthiops*, *Munia melæna*, and *Rallus insignis*.

Physical Society, February 7.—Annual *conversazione*.—The museum of King George III., the Wheatstone Laboratory, and other halls of King's College were occupied by a fine display of physical apparatus and artistic furniture, including numerous relics of Sir Charles Wheatstone. There was a large number of ladies and gentlemen present, and during the evening selections of music were played by the Musical Association of the Royal School of Mines. The apparatus was peculiar to the whole range of physical science, and was furnished in part by the college and in part by the various instrument-makers and electric engineers of the Metropolis. The Telephone Company and the British Electric Light Company contributed telephones and electric lamps, and Herr Faber exhibited his ingenious speaking-machine.

Meteorological Society, January 21.—Mr. C. Greaves, president, in the chair.—Dr. Tripe read the Report of the Council for the year 1879, which showed that the Society was in a very satisfactory condition. Eighty-four new Fellows have been elected, and the total number at the end of the year was 473. The great local differences in temperature and humidity require to be more accurately ascertained than they are at present, and this remark applies not only to sea-side places, but also to inland districts in their relation to hills and valleys. It is with a view to obtaining better knowledge on this subject that the Council have instituted a new class of stations of a third order, to be termed "Climatological," at which observations of temperature, humidity, cloud, and rainfall are taken daily at 9h A.M. only, with certified instruments, the thermometers being in Stevenson screens, so that the observations of temperature at the different stations may be strictly comparable. The total receipts for the year were 799*l.* 6*s.* 9*d.*, and the expenditure 621*l.* 19*s.* 5*d.*, leaving a balance in favour of the Society of 177*l.* 7*s.* 4*d.*—The President then delivered his address, in which he advocated a more attentive inquiry by the students of meteorology into the subject of hygrometry. The appearance and disappearance of moisture, its diffusion, its origin in and withdrawal from the vaporous form, were matters which could now be readily defined through the increased supply of good observations, especially those so widely circulated by the Meteorological Office, and those recorded by the observers of the Meteorological Society. In furtherance of this object he produced a digest of all the observations published by the Meteorological Office for the year 1879, a year of abundant moisture, and one which could hardly fail to afford traces of the constancy or inconstancy of beds of moisture, if they were permanent anywhere, or of their coming and going viewed substantially as to their own existence, rather than as borne by the force of the wind, or acted on by the power of the air in its baric relations. The preparation of this digest from the hygrometric elements for 1879 proved such a laborious work that, being still incomplete and wanting the customary corrections for the various observations, he refrained from comments and deductions and gave the digest itself for the use of any students who might desire to work at the subject. The tables contained the calculated dewpoint, vapour-tension, relative humidity, and thermometric dryness throughout. These various and full data exhausted all the aspects of humidity in its vaporous state, and would supply means for a thorough study of the British climate in a year of maximum humidity.—The following gentlemen were elected the Officers and Council for the ensuing year:—President: George James Symons, F.R.S. Vice-Presidents: Edward Ernest Dymond, Charles Greaves, F.G.S., Rev. William Clement Ley, M.A., Capt. Henry Toynbee, F.R.A.S. Treasurer: Henry Perigal, F.R.A.S. Trustees: Sir Antonio Brady, F.G.S., Stephen William Silver, F.R.G.S. Secretaries: Robert Henry Scott, F.R.S., John William Tripe, M.D. Foreign Secretary: John Knox Laughton, F.R.A.S. Council: Arthur Brewin, F.R.A.S., William Ellis, F.R.A.S., Rogers Field, B.A., Frederic Gaster, Joseph Henry Gilbert, F.R.S., William John Harris, M.R.C.S., Baldwin Latham, F.G.S., Robert John Lecky, F.R.A.S., Hon. Francis Albert Rollo Russell, Richard Strachan, Henry Samuel Tabor, George Mathews Whipple, F.R.A.S.

Anthropological Institute, January 27.—Anniversary Meeting.—Mr. Edward B. Tylor, D.C.L., F.R.S., president, in the chair.—The following gentlemen were elected to serve as Officers and Council for the year 1880:—President: E. B. Tylor, F.R.S. Vice-Presidents: Hyde Clarke, John Evans, F.R.S., Prof. W. H. Flower, F.R.S., Major-Gen. A. Lane Fox, F.R.S., Francis Galton, F.R.S., Dr. Allen Thomson, F.R.S. Directors and Honorary Secretaries: E. W. Brabrook, F.S.A., W. L. Distant, J. E. Price, F.S.A. Treasurer: F. G. H. Price, F.G.S. Council: Lt.-Col. Godwin Austen, J. Beddoe, F.R.S., Prof. George Busk, F.R.S. C. H. E. Carmichael, M.A., W. Boyd Dawkins, F.R.S., Sebastian Evans, LL.D., A. W. Franks, F.R.S., Prof. Huxley, F.R.S., A. H. Keane, B.A., A. L. Lewis, Sir J. Lubbock, Bart., M.P., R. Biddulph Martin, The Earl of Northesk, F.S.A., Prof. Rolleston, F.R.S., F. W. Rudler, F.G.S., Lord Arthur Russell, M.P., Rev. Prof. Sayce, M.R.A.S., Alfred Tylor, C. Staniland Wake, M. J. Walhouse, F.R.A.S.—The President delivered his annual address, in which he gave an outline of the progress of anthropological science during the last forty years, with special reference to the work now being done in Germany.

Entomological Society, anniversary meeting, January 21.—J. W. Dunning, M.A., F.L.S., vice-president, in the chair.—The following gentlemen were elected as officers and council for the ensuing year:—President, Sir John Lubbock, Bart., M.P., F.R.S.; Treasurer, E. Saunders, F.L.S.; Librarian, F. Gru[illegible],

F.L.S.: Secretaries, R. Meldola and W. L. Distant; other Members of Council: H. W. Bates, F.L.S., W. Cole, J. W. Dunning, M.A., F.L.S., F. du Cane Godman, F.L.S., O. Salvin, F.R.S., H. T. Stainton, F.R.S., S. Stevens, F.L.S., and J. J. Weir, F.L.S. In the absence of the president, an address was read by J. W. Dunning, vice-president, and the meeting terminated with the usual vote of thanks to the officers.

Photographic Society, January 13.—J. Glaisher, F.R.S., president, in the chair.—Mr. Leon Warnerke having at the previous meeting described all actinometers hitherto used, now read a paper on a new actinometer, designed by himself; it is based upon the retention of light by a phosphorescent substance. In this case calcium sulphide being the medium chosen, an ingenious apparatus has been constructed, in which is a disk of this phosphorescent material, hermetically sealed between glasses, and revolving over this is another disk containing a series of small holes where increasing layers of coloured gelatine, with figures upon them, produce increasing opacity, and the last number seen before the figures become invisible, indicates the intensity of light at the moment. A contrivance is also introduced by which, after using, any remaining luminosity is extinguished by letting red or green light pass on to the disk containing the phosphorescent material. This actinometer is found to perfectly register the value of candle, gas, or any other light possessing actinic power, however small.

Victoria (Philosophical) Institute, February 2.—A paper on recent Assyrian and Babylonian research, illustrated by maps and specimens, was read by Mr. Hormuzd Rassam; in which, after sketching the route which a traveller would take from Aleppo by Diarbekir, Mossul, and Baghdad to Nineveh, he gave a full account of his exploration in Nineveh and Babylon, with a description of the different ancient sites existing there at present.

VIENNA

Imperial Academy of Sciences, December 18, 1879.—The following papers were read:—On the changes produced by chemical change of muscle-substance in polar excitation by the electric current, by Dr. Biedermann.—On the method and data of phyto-phylogenetic research; on researches of the kind in the Island of Skye; and on the phylogeny of Pinus, by Prof. v. Ettinghausen.—On the action of phosphonium-iodide on sulphide of carbon, by Dr. Jahn.—On the synthesis of biguanide, by Dr. Herth.—Report on searches and excavations during the past year (in Moravia, Lower Austria, and Krain).—On a new viviparous species of *Ungalia* from Peru, by Dr. Steindachner.—Geological observations in the Island of Chios, by Herr Teller.

PARIS

Academy of Sciences, February 2.—M. Edm. Becquerel in the chair.—The following papers were read:—On some applications of elliptic functions, by M. Hermite.—On a linear differential equation of the second order, by M. Gylden.—Complement to recent note on the deformation of substances, by M. De Saint Venant.—Experiments on the compression of gaseous mixtures, by M. Cailletet. Compressing in his apparatus 5 vol. carbonic acid and 1 vol. air he easily liquefies the former. On carrying the pressure to 150 or 200 atmospheres, the meniscus of liquefied acid, concave and quite distinct, becomes plane, loses distinctness, and is gradually effaced, till at length the liquid wholly disappears, the tube being then, apparently, filled with a homogeneous matter, which resists all further pressure, like a liquid. On diminishing the pressure the liquid suddenly appears again, at a constant pressure for determinate temperatures (132 atm. at +5·5°, 110 atm. at 19°, &c.). This disappearance of liquid cannot be due to heat liberated in compression, for the tube was immersed in water keeping a constant temperature, and the compression was slow. It seems that at a certain pressure the liquid and gas are dissolved in each other. M. Cailletet tried to test this by colouring the CO_2 with iodine, but this, attacking the mercury, masked the phenomenon. (The supposition that the disappearance of liquid is only apparent, he disproves.)—Evolution of inflorescence in Gramineæ (2nd part); types of structure of the primary rachis; order of appearance of the first vessels, by M. Trécul.—M. Gaudin submitted a method of dividing masses of ice, viz., placing on them a flexible tube of lead or alloy of tin and antimony, of small calibre, connected with a steam boiler, and open at the end to let the water of condensation out. It penetrates into the ice by its weight and heat. The trenches thus made are kept from closing by means of boards, and charges of dynamite may be put into them.—On the theory of linear differential equations, by M. Mittag-Leffler.—Remarks on the new metals of gadolinite and samarskite, by M. Delafontaine. He regards *ytterbium*, *decipium*, and *philippium* as definitively acquired for science; *scandium* he cannot speak of; *mosandrum* should be eliminated; *samarium* requires more proof; the characters of the yellow oxide, *philippine*, are those of M. Soret's earth X and the *holmine* of M. Cleve; the latter name, therefore, should not be retained.—Artificial reproduction of scorodite, by MM. Verneuil and Bourgeois. Iron wire is treated with a concentrated solution of arsenic acid in a sealed tube, heated to 140°–150°; it gets covered with grey gelatinous matter (a mixture of amorphous arseniate of sesquioxide of iron and arsenious acid in small crystals); this matter gradually disappears, being transformed into scorodite. The authors hope to get erythrine, annabergite, and some other hydrated arseniates thus.—On the anatomical characters of blood peculiar to intense and extreme anæmia, by M. Huyem. In what he calls *aglobulie intense* (the globular richness varying from 2,000,000 to 800,000), he notes that crystals form in the dried blood, like those of dried lymph; and in the fresh blood he finds white globules with coloured contents, and still retaining amœboid contractility (such are also found in lymph). In *aglobulie extreme* (800,000 to 450,000 globules) there are elements like the red nucleated globules of oviparous animals. In all cases the white globules are much more numerous and smaller than in normal blood. In anæmia, then, the blood becomes in some sort lymphatic, *i.e.*, it is formed of a mixture of blood properly so called and lymph.—Researches on the movements of the uterus, by M. Polaillon. A registering apparatus and manometer were connected with the enlarging instrument sometimes introduced into that organ. The author calculated the specific force of the uterus to be about 178, and therefore very much below the force of striated muscles in man, which is about 1087. Uterine contraction produces a regular movement without shock, and remarkable for its length, nearly two minutes (contraction and relaxation together; the former being the shorter). Violent respiratory movements raise the pressure considerably.—A note from M. Macagno treated of the composition of the air in different parts of Palermo; another, of the production of tannin in leaves of sumac; he finds leaves at the upper extremity of the stem richer in tannic acid than those at the base. The quantity of acid diminishes as the plant grows older.

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