THURSDAY, JANUARY 8, 1880

THE TECHNICAL UNIVERSITY QUESTION

THE correspondence which has appeared during the month of December in the columns of the *Times* concerning the question of a Metropolitan Technical University, has revived a question upon which we have more than once spoken in these columns, and of which we shall hear more hereafter. It is quite evident that the promoters of the City and Guilds of London Institute for the Advancement of Technical Education meet with many great and unforeseen difficulties in the way of pushing into execution their laudable project for applying some of the vast funds they have inherited from the Trade Guilds of the past to the purpose of promoting the elevation of trade by science. It is equally evident that they will not abandon their projects without a very considerable effort, especially now that the pressure of public opinion is beginning to bear upon the question and to aid them in their demand. No one probably denies or doubts the legal right of the City Companies to the funds which have thus come down to them. Probably also no one denies or doubts that the law-making power which gave them these legal rights can take them away and can force them to hand over, if need be, to the advancement of Technical Education at large, the wealth which they have ceased to apply to the advancement of Technical Education within their own borders. Two years ago a very definite scheme in this direction was launched by the provisional Committee appointed by some of the Guilds. Recognising the moral obligation upon them to use their funds for the advancement of their respective industries, some dozen out of the eighty City Companies agreed to devote a certain yearly sum for this purpose. They even went so far as to invite a number of distinguished men of science to write reports on the best way of attaining the ends in view, and eventually they embodied their suggestions in a report which was characterised by two main propositions: firstly, to establish local technical schools which should be accessible to artisans; secondly, to found a central institution, chiefly for training technical teachers and scholars of exceptional promise. This was two years ago; and in the mean time so little has been done, that some of those who have taken an active part in the earlier stages, begin to be impatient at the little substantial progress made.

A note of dissatisfaction of this nature was heard at the beginning of the month of December, and gave rise to the discussion in the *Times*, to which we have alluded. To understand the merits of the controversy it will be necessary to go back to the beginning. The correspondence arose out of some remarks made by Prof. Huxley when presiding at the meeting of the Society of Arts on December 3, at which a paper on apprenticeship was read by Prof. Silvanus Thompson, of Bristol, and to which a paragraph was devoted in NATURE, vol. xxi. p. 139. Prof. Thompson's paper, which appeared in the *Journal* of the Society of Arts for December 5, and which has been reprinted in pamphlet form, was devoted to a discussion of the relation between apprenticeship and technical education; and after laying down the general principles of a scientific and rational system of apprentice training, pointed out that the "lower technical," or "industrial" training which is needed for the forming of good workmen, cannot exist in any effective degree until there is some provision made for the higher technical training analogous to that of the great technical schools of Germany and France, which would qualify a superior class to become on the one hand foremen and masters, and on the other teachers in technical schools. In short, Prof. Thompson's argument was that there could be no growth of technical schools for the artisan without a central technical university to train teachers for such schools.

In the discussion which ensued Prof. Huxley made some pungent remarks upon the delays which had arisen over the project of the Guilds and Companies of the City of London, who had consulted him some time back concerning their proposal to found a Central Institution or Technical College, and who, two years ago had empowered him to make known their good intentions. It was time, he thought, that those good intentions bore fruit. It would be an utter scandal if one shilling were asked for out of the general revenue for this purpose, at least so far as London was concerned, for the Livery Companies were in possession of the enormous funds inherited along with the ancient traditions of the crafts from the old Guilds of London, which were established to aid their respective trades—funds which they were morally, if not legally, bound to apply to the advancement of Technical Education.

Prof. Huxley's remarks were not, however, suffered to pass unchallenged. In the *Times* of December 9 Mr. J. H. Crossman condemned Prof. Huxley and those who act with him as somewhat impatient and hasty in their proposals.

To this letter Prof. Huxley replied a few days later in a most admirably conceived and no less successfully worded letter. What had been proposed was simply the establishment of local technical schools accessible to the artisans, and a Central Institution chiefly for the training of teachers and of scholars of exceptional capacity; and he added the very pertinent query: "Do the Livery Companies of London intend to carry out any general scheme of Technical Education such as that adopted by their own Committee, or do they not?"

Mr. Owen Roberts, one of the Honorary Secretaries of the City and Guilds Institute, replied to the point raised by Prof. Huxley's letter, asking whether he was aware of the negotiations which had been going on between the City and Guilds Institute, and the Lords Commissioners of the Exhibition of 1851, for a piece of land on the South Kensington estate as a site for a central institution, and stating that the only reason why these negotiations had not been definitely concluded, was that lately the Commissioners had put forward certain requirements, as a condition of their grant of a site, which the Livery Companies have not considered to be consistent with their independence of action. Hence the regretted delays, which had not, however, debarred the Institute from proceeding with one very important section of its work, namely, the promotion of local schools for artisans.

Following hard on Mr. Roberts's letter, there appeared in the *Times* of December 27 a communicated article

giving a careful and detailed history of the various schemes considered by the City and Guilds Institute, which may be broadly stated as being three in number. The first of these schemes, proposing to build a central institution upon a site on the Corporation lands on the Thames Embankment, has been dismissed as essentially too costly. The second, the proposal to obtain a site from the Commissioners of the South Kensington Estate, is in abeyance since the ancient free "spirit" of the Companies leads them to regard as distasteful either that the Commissioners should be directly represented on the managing body of the Central Institution, or that, as an alternative, the chief scientific bodies of the nation should have the right of being represented on it. The third scheme, which apparently does not stand a much better chance of success than its predecessors, though having many points in its favour, was a proposal to buy the palatial mansion built by Baron Grant at Kensington, with its seven acres of ground, and convert it into a building for a Central Institution by slight but suitable alterations in its interior arrangements, thus obtaining capital laboratories and lecture theatres. But the unreasoning outcry raised against the site simply because it was in the west, and not in some equally inaccessible situation in the north or in the east, has been so loud in its tones that we believe the project has virtually been abandoned. At least so the semi-official article in the *Times* would lead us to imagine. Prof. Huxley has, however, had a last word on the matter. He cannot quite agree in the view that the guarantees asked by the Lords Commissioners are so unreasonable as the Livery Companies think them. In his second letter of the 29th ult. he says that if he is rightly informed, they amount to being guarantees firstly of sufficiency and permanency of endowment, and secondly of proper government; the desire of the Commissioners in reserving the right of nominating two or three members of the governing body being merely that they may insure the presence amongst the representatives of the city magnates that small number of "educational experts." To which Mr. Roberts quietly rejoined that educational experts differed considerably in the advice they tendered, and that the principal point of objection lay in the proposal that the two or three persons nominated by an exterior authority should be the only permanent members of a governing body the majority of whom were continually going off by rotation.

It is not our place to pronounce judgment upon the conflicting views which have been maintained concerning the conditions imposed by the Commissioners in their offer of a site. If Prof. Huxley's information is correct, it is hard to see how or why the independence of the Guilds, or of the Institute they have founded, should be impaired by the presence on the governing body of such men as, say, Mr. Lyon Playfair, or Mr. Mundella, or perhaps even Prof. Huxley himself. If, on the other hand, the Livery Companies have some further knowledge or insight than Prof. Huxley has, it would certainly be well if they would explain what it is that is incompatible with their ancient liberties, and would suggest some alternative course, which, while reserving them all reasonable liberty of action, should attain the ends for which guarantees are desired.

The most painful aspect of the whole controversy is one which does not come to the surface in this correspondence, but which is nevertheless a very real one. There is a large section of the outside public who take a deep and increasing interest in the question of technical education, and who have watched the present scheme from its first inception with something more than curiosity. They cannot understand that any body of men really intending to carry out a project such as that which was made public two years ago could permit such endless delays, such interminable cross-purposes, such haggling over different schemes, as have been lately witnessed. They begin to fear that all these things are done with a purpose, and that the delays are interested, and the rival schemes manufactured to serve some less noble end. Whether such persons are right or wrong, all these whispers would be at once silenced by a few unmistakable signs of real progress, such as we have looked for in vain. The public knows well enough that the organisation of the City Guilds *as they are* is a blot upon an intelligent community; that they have ceased in all but name to represent the trades for the sake of which and out of which they arose. It knows full well that their unfathomed funds are not applied to the purpose of elevating and improving their respective crafts, whatever else they may be applied to. And it is quite prepared to say with emphasis when the moment arrives that if reform does not come from within it must come from without. The first step, if such measures must come, will doubtless be the appointment of a Royal Commission of Inquiry. What the second might be he must be bold who would predict.

The announcements made two years ago were hailed as a note of progress, indicating the probability that wiser counsels would prevail, and that the needed reform was to be brought about quietly and harmoniously from within. But the project for founding a Central Technical College is as far from realisation as ever, and the hopes raised have been sorely disappointed. Men of scientific habits and of business aptitudes are alike getting tired of the endless delays and fruitless negotiations that have taken place. And there are, we suspect, many who, on learning how one scheme after another has fallen through for want of unanimity of purpose to carry it out, will be quite ready to think that it was not without good cause that Prof. Huxley asked: *Do the Livery Companies of London intend to carry out any general scheme of Technical Education such as that adopted by their own Committee, or do they not?*

OSTEOLOGY OF MAN

Catalogue of the Specimens Illustrating the Osteology and Dentition of Vertebrated Animals, Recent and Extinct, contained in the Museum of the Royal College of Surgeons of England. By William Henry Flower, Conservator of the Museum. Part I. *Man.* (London: David Bogue, 1879.)

IT is now twenty-five years ago since Prof. Owen, the then Conservator of the Museum of the Royal College of Surgeons, completed the last volume of the catalogue of the osteological collection. Since that time the additions to the Museum have been so numerous and

valuable that the original catalogue has ceased to fulfil the requirements of the collection, and the preparation of a new catalogue has become necessary.

Prof. Flower, the present Conservator, has undertaken this task, and the first fruit of his labours is now before us. In this volume he has catalogued the specimens, 1,312 in number, which illustrate the development of the human skeleton, the osteology of adult man, the dentition of man, and the crania and other parts of the skeleton illustrating the osteological characters of the various races of men. This volume is, therefore, from the extent and variety of the collection, and from the methodical way in which the numerous measurements are recorded, an important contribution to physical anthropology.

In the introductory chapter Prof. Flower describes the method he has pursued in obtaining the measurements of the crania, and he explains the meaning of a number of terms, mostly introduced by Paul Broca, into craniology.

The measurements which he records are taken with especial reference to the determination of the circumference of the cranium, its length, breadth, and height and the relations of these to each other ; the length from the anterior margin of the foramen magnum, on the one hand to the fronto-nasal suture, and on the other to the most projecting part of the upper alveolar arch, from which the alveolar index is deduced ; the height and width of the nose ; the height and width of the orbit ; and the cubic capacity of the cranium. The capacity is expressed in cubic centimetres and the other measurements in millimetres.

In measuring the length of a skull craniologists are in the habit of taking the longitudinal diameter between the prominence at the root of the nose called the glabella, and the most projecting part of the occiput behind, a measurement which has the advantage of giving the absolute length of the cranium between its two most extreme points. Prof. Flower, however, does not follow this method, but prefers to take the length from the most projecting part of the occiput behind, to a point situated immediately above the projection of the glabella, to which Broca has given the name ophryon. This point is in the centre of a line drawn across the narrowest part of the forehead, which separates the face from the cranium. He has selected this point anteriorly, in preference to the glabella, on the ground that the glabella is properly a part of the face, and that it may vary much in development, without occasioning any alteration in the essential form of the cranium. Similarly in taking the horizontal circumference of the cranium he passes the tape line, not over the prominence of the glabella, as is customary with craniologists, but above it, around the supra-orbital line. Mr. Flower therefore entirely excludes this well-known prominence from his measurement of the cranium.

But in excluding the glabella from the cranium, on the ground that it belongs to the face, he does not appear in his measurements of the face, to have made provision for including the glabella, so that in these measurements a feature which gives a very decided character to the anterior region of the head is left out of consideration. This seems to us to be a defect, for if such a mode of mensuration were generally adopted, skulls possessing great projections in the glabellar and supraciliary regions, such as the well-known Neanderthal skull and the crania of the generality of the Australian aborigines would not have, what undoubtedly constitutes one of their most salient and characteristic features, represented in a table of their dimensions, and the relations of their extreme length and breadth to each other, as expressed by the latitudinal cephalic index, would not be fully brought out.

It may, however, be argued that, by including the glabella in the longitudinal diameter and in the horizontal circumference, a portion of the cranial wall which lies superficial and owes its extent of projection to a subjacent air-containing space—the frontal sinus—and not to the brain cavity, is made to appear as if it were an essential part of the box containing the brain, and that the size of the cavity of that box is made to seem therefore to be greater than it really is. But to this it may be replied that the capacity of the cranial box, as capable of being deduced from external measurements, is affected, even when the glabella and supraciliary ridges are left out of consideration, by other causes, such as variations in the thickness of the diplöe and the development of ridges for muscular attachment.

The only reliable mode of ascertaining the capacity of the cranium is by actual measurement of what it can contain, and not by calculations based on the external dimensions of its walls. The longitudinal diameter of the cranium ought in our judgment to express the actual length of the skull between its two extreme anterior and posterior points, to whatever cause it may be due. The special mode of taking the length of the cranium, adopted in this Catalogue, is to be kept in mind in comparing, not only the length of the crania but their latitudinal and altitudinal indices, with the corresponding measurements recorded by those craniologists who take the length of the skull between its two most extreme points.

The several measurements have been made and recorded with that care and precision which characterises all the anatomical work done by Prof. Flower. To obtain reliable evidence of the cubic capacity, one of the most difficult and important measurements to procure, many thousands of experiments have been made to ascertain the best process, and some of the crania have been gauged several times over. The material used has been mustard seed, with which the brain cavity has been filled to its maximum and the quantity of the seed has then been taken with the choremometer designed and constructed by Mr. Busk.

In addition to the measurements recorded of the individual crania, the author has given a valuable table in which he summarises the general results that have been obtained from the examination of the skulls of the different races. This table shows clearly that after making allowance for variations in individual skulls, yet that the different races of mankind possess in the configuration and dimensions of their skulls certain tangible characters which may be expressed by distinctive terms. Thus, to select a few examples adduced by the author, from the races which are probably unmixed. The Veddah race of Ceylon is dolichocephalic, orthognathous, with the orbital and nasal apertures moderately wide in proportion to the height (*mesoseme* and *mesorhine*), and with the capacity of the cranium small (microcephalic). The Australian race, again, whilst dolichocephalic, and microcephalic as

regards the dimensions of the cranium, is prognathous, platyrhine, and microseme in the measurements of the face. The now extinct Tasmanian race was, like the Australian, prognathous, platyrhine, microseme, microcephalic, but in the relations of the length to the breadth of the cranium not dolichocephalic but mesaticephalic, *i.e.*, between dolichocephalic and brachycephalic. The Bushmen, whilst mesaticephalic, platyrhine, microseme, microcephalic, are, as regards the upper jaw, not prognathous, but orthognathous. The Bush crania differ in an important manner from their near geographical neighbours the Kaffirs and Zulus, which, though platyrhine in their nasal relations, are dolichocephalic and megacephalic in their cranial dimensions, mesognathous as regards the projection of the upper jaw and mesoseme in their orbital dimensions. The skulls of the African Negroes are dolichocephalic, mesocephalic, prognathous, platyrhine, and mesoseme; whilst the Andamanese, of which the Museum possesses a remarkably good series, are brachycephalic, microcephalic, mesognathous, mesorhine, and megaseme. As regards the Australian and the dark races with frizzly hair dolichocephalism and prognathism, with small or moderate cranial capacities prevail, except in the Bushmen and the Andamanese. The prevailing characteristics of the races inhabiting Europe, North Africa, and South-West Asia are a moderate latitudinal index, a moderate orbital index, a low alveolar index, a low nasal index, and a high cerebral capacity. In the Mongoloid races again the orbital index is usually high, the cranial capacity variable, whilst in its dimensions the skull ranges from brachycephalism in the Siberians and Peruvians to extreme dolichocephalism in the Eskimo. The jaw may be either orthognathous or prognathous.

The study of this Catalogue is essential to all who are interested in physical anthropology, but more especially to those who may be engaged in working with the craniological collection in the Museum of the Royal College of Surgeons of England.

OUR BOOK SHELF

The Village Life. (Glasgow: Maclehose, 1879.)

THIS is a volume of poems intended to picture various phases of Scottish village life. It is beyond our province to criticise the quality of the poetry, but it deserves some notice at our hands for the prominence given throughout to the most recent scientific doctrines, especially that of evolution. With the latest teachings of science in this direction the author appears to be thoroughly acquainted, as is evidenced especially in the two poems on "The Schoolmaster" and "The Doctor." It seems to us a noteworthy fact in the progress of science that its latest developments should form so prominent a feature in a work so purely literary, as a series of poems. The author himself, while he has evidently a tenderness for the old beliefs and bygone customs, still, cannot help showing how strong is his leaning to the revelations of the science of to-day. We venture to think that the anonymous author's presentation of the latest results of scientific investigation ought to reassure those who dread that science and poetry cannot co-exist, that the spread of science and the increase of scientific knowledge will leave no room for the exercise of the poet's fancy. If ignorance is a necessary condition for the exercise of this function, it is quite safe to predict that there is no chance of the poet's occupation ever being gone. Let us suggest to the author of the "Village Life," as a subject to try the mettle of his fancy and the extent of his knowledge, the "Lake Dwellers." We think the present volume is likely to afford a quiet pleasure to many readers, and as a specimen of the versification and to show how clearly and musically the author can put a puzzling problem, we give the following quotation from the poem on "The Doctor":—

"Search as we may, no trace is found
Of how the man-ape was transformed
Into the man with speech and creed;
We know not how he shed his hair,
Or shortened his fore limbs and rose
On back-bone straight, with head thrown back,
With arched foot, and supple knee;
Or by what process came the hue
Of his now soft and hairless skin,
Its brown, its red, its jetty black,
Its yellow, and the tints between;
Or how the straight and flattened nose,
Developed from the monkey's face,
The jaw prognathous, square or thin;
And above all how speech began—
How first the inarticulate,
Long-armed, broad-chested, roaring clan
Of men-apes, out of shouts and cries,
Formed syllables and meaning words;
How, from the jarring harsh discords
Of brutal sounds there broke instead,
Liquid utterances, replies,
Sweet conversation, grave debate?—
A vast development, so great
And splendid that the tail-less ape
At once became the planet's lord,
A god in reason, as in shape.

The Doctor hoped that searchers keen,
Might find before the glacial age
Some traces of an earlier stage—
Man Pliocene or Miocene—
A skull, or skeleton that showed,
The type improving from the ape;
Some form revealing how a broad
Divergence intellectual,
May come from trifling change of shape;
That showed complete, a reason why
The glorious art of speech arose;
How shortened arm, and thickened thigh,
Deepened the chest, enlarged the lung;
The larynx and the mouth and nose
Transforming with the breast and brain,
Became sonorous, and the tongue
Shaped simple words, they grew amain
To language musical, and song.
But though the search is deep and long,
And evolutionists await
With eager hope, the early 'brave'
Emerging from the brutal state;
He comes not from his ancient grave;
His grave is lost; his fossil bones
No geologic era owns."

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.*]

Artificial Diamonds

THE fate of the Glasgow diamonds, as recorded in NATURE, vol. xxi. p. 203, reminds me of an adventure of my own that happened about ten years ago, and is likely to be repeated by

others. For showing the popular class-room experiment of burning phosphorus in oxygen, I was in the habit of using a little cup of chalk made deeper and with smaller rim than the brass cups usually made for the purpose. The object of this was to limit the too rapid outburst of combustion. I noticed that a cup which had been used several times was coated on the inside with a hard, glassy enamel, which I supposed to be phosphate of lime. To test this, the cup was thrown into some hydrochloric acid and dissolved bodily, but I found at the bottom of the beaker an insoluble residue of crystalline particles. What were these? Could it be possible that the carbonic acid driven off by heating the chalk had, on reaching the heated phosphorus, become dissociated, its oxygen combining with the phosphorus, and its carbon thrown down as veritable diamond? To test this startling theory, I collected the particles and rubbed them between a glass pestle and mortar. They appeared hard enough to scratch the glass, but were too small for further examination. To obtain a better supply, I dissolved some phosphorus in bisulphide of carbon, pounded some chalk and made it into a paste with the solution, then filled a porcelain crucible with this and fired the mass by heating it over a Bunsen burner. It blazed magnificently, throwing out eruptive jets of flame. Here, in the absence of surrounding oxygen, the carbonic acid had every opportunity of becoming dissociated or reduced by the heated phosphorus. The residue was treated with hydrochloric acid, and this time I found at the bottom of the beaker quite a respectable quantity of crystalline grains. These left unmistakable scratches on the glass pestle and mortar, and seemed to make some fine scratches on an agate pestle and mortar. I next examined them under a microscope, and found that they were more like pebbles than crystals, so much so as to suggest another theory of their composition and origin, viz., that they were miniature chalk flints formed by the fusion and aggregation of the siliceous cuticles of fossil diatoms, or such-like organisms of which chalk appears to be in some degree made up.

To test this, I precipitated some pure carbonate of lime, soaked it with the solution of phosphorus and fired as before, then treated with hydrochloric acid; when, alas! my *Eldorado* of dissociated carbonic dioxide melted into thin air as the effervescent liquid gradually cleared itself and showed no traces of crystalline residue.

W. MATTIEU WILLIAMS

Stonebridge Park, Willesden

Solar Phenomenon

ON the afternoon of the 18th ult., in company with Herr Lohse, of this observatory, I was occupied in adjusting a spectroscope attached to the 15-inch refractor. The sun was disappearing behind the ridge of the hill of Fare, about five miles distant. To utilise the last rays of the sun, I was directing the telescope on the gradually lessening segment of the sun's disk, while Herr Lohse was looking through the spectroscope. Under these circumstances it will be understood that we were both standing near the inner vertical surface of the drum-shaped dome, close to where it was lit up by the sunlight coming through the opposite vertical opening, which is 40 inches wide. It may be well to add that the dome is made of corrugated iron, painted slate-colour, the corrugations of the wall being vertical.

Under the impression that the sun had wholly disappeared, I looked at the inner wall of the dome to see if it was actually shaded by the distant hill.

To my great surprise, the still illuminated surface was crossed by a number of distinct, horizontal, black lines, which ascended at a uniform pace about a foot and a half in a second. The lines were, on an average, about ¼ inch thick, while the intervals may have been mostly some 2½ inches, but I do not think that the intervals were uniform. Herr Lohse, on turning from the spectroscope, also saw the lines; but while he feels sure that some of them terminated in points, I am under the impression that all the lines crossed the entire illuminated space.

The lines had a distinct quivering motion, which, combined with their uniform ascent, gave the whole phenomenon a most beautiful appearance. We both independently estimated the number of lines seen at about thirty, and the duration of the phenomenon at half a minute from the time when we first saw it. It was, however, certainly fully developed when first caught sight of. These lines seem to be closely allied to those repeatedly seen at the beginning or end of the total phase of a solar eclipse. See particularly *Astronomische Nachrichten*, Nos. 1,921 and 1,922, and "Le Soleil" (German edition), p. 301, *et seq.*

Some of the observers referred to speak of the lines as undulating; in this case it is difficult to say if the lines were quite straight or not, because of the corrugations of the surface on which they were thrown. My own impression is that they were straight except in so far as they were affected by the quivering before mentioned.

It would be remarkable indeed if this is the first time they have been seen at the daily disappearance or reappearance of the sun.

RALPH COPELAND

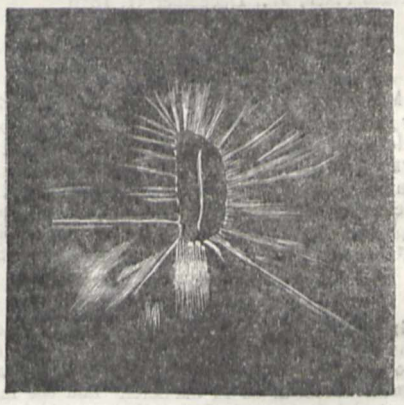
The Observatory, Dunecht, Aberdeen, December 23, 1879

Carbon and Water Figures

THE separation of clear water from a uniformly diffused mixture with soot is so remarkable that it seems worth attention, especially in connection with the behaviour of charcoal powder in water, which is always streaky after any amount of shaking.

For some months I have observed and recorded these figures, as shown in a large white basin of sooty rain water, which is left undisturbed for twelve to twenty-four hours; they only appear occasionally, perhaps once in a week, are not constant when formed, and are entirely destroyed by stirring or mixing the water. They always consist of lines, planes, or patches of *clearer* water, sometimes not containing certainly more than a quarter of the proportion of soot around them; no aggregation of sooty water, or soot, has ever been seen. These quasi-vertical planes are very thin, sometimes the clearest part as little as $\frac{1}{60}$th inch wide, and the extreme thickness $\frac{1}{20}$th, the other dimensions being ½ to 1 inch deep, and 1 to 5 long. Most usually only one plane appears, the azimuth of which is quite irregular; occasionally it is curved; sometimes a row of quasi-parallel planes or lines appear—once as many as six, at irregular intervals averaging ·8 inch; once a clear circular spot about 1½ inch across appeared.

The last form I found was by far the most complex, and is here given from a careful sketch.



The lines were not as thin as usual, only one or two being as little as $\frac{1}{30}$ inch wide. They were very bright, probably not containing ¼ of the average soot around them; the water was unusually dark. The central semicircular space was 3·6 inches long × 1·7 inch; when first seen this space was uniformly grey, but in a few minutes, after slightly disturbing the water, the bright sharp plane across it appeared, inclined at about 5° to vertical. Some of the other planes were inclined 15°. The most striking point was the sharp definition of the central space, all the lines ending abruptly at its regular outline.

The depth of these figures bears strongly on their cause. They are never at the surface, but usually on the bottom. The water is about 2 inches deep, and the upper limit of these planes is ¼ to 1½ inch from the top. In the above figure the lines or planes appeared to lie on the bottom, and to turn upwards at the edge of the central space, leaving it untouched, thus forming a bright edge to it. I have also, on disturbing water, seen apparently that a clear layer existed below a uniformly sooty surface.

The conclusions are, that water tends to separate from the finely divided carbon, in a clear bottom layer (or lines) of uncertain thickness (though lamp-black sinks if diffused in water), and that parts of this layer are (by convection?) turned

upward and form quasi-vertical planes. The points still to be settled are:—1. Why these layers when turned up should not re-mix with the general mass, if their separation is due only to gravity, especially when as thin as $\frac{1}{50}$ inch, or $\frac{1}{100}$ of their length? 2. Why a particular sharply-defined space in the above figure should be avoided by the lines? 3. Are the causes the same as those preventing the uniform diffusion of charcoal dust in water?

These figures are not due to any form of caustic curves, though mistaken for such at first sight, and therefore neglected.

W. M. FLINDERS PETRIE

Velocity of Light

IF you can spare the space please state that the corrected result for the velocity of light (NATURE, vol. xxi. p. 94) is—

299944 ± 50 kilometres,

or 186380 ± 33 miles per second.

A. A. MICHELSON

328, Fifth Avenue, New York, N.Y., December 17, 1879

The Word "Telegraph"

I HAVE recently had occasion to ascertain the period when the word "Telegraph" first came into use; the following may be of interest to your readers:—

It is not mentioned in Johnson's Dictionary, 1810, but it occurs in the edition of 1818. In that valuable work, Rees's "Encyclopædia," 1819, vol. xxxv., we find:—"The word telegraph, which is derived from two Greek words, τῆλε, at a distance, and γράφω, to write, was brought into use about 1793 or 1794, when the French Directory established machines of this kind for communicating intelligence between Paris and all the principal towns in France. The British Government soon after adopted the same measure, and it has since become very general." So that telegraph and semaphore are both of French origin.

In the grand French "Encyclopédie" of Diderot—1778—the word telegraph does not occur. WARREN DE LA RUE

73, Portland Place, W., December 31, 1879

The Lophiomys

As the oft-repeated statement (which originated with M. Alphonse Milne-Edwards) *that the roofed-in temporal fossa of the Lophiomys finds its parallel in certain reptiles alone* reappears in the pages of Messrs. Cassell's excellent "Popular Natural History" (see NATURE, vol. xxi. p. 137), it is high time that it should be modified in accordance with more recent anatomical investigations, which show that two *amphibian* genera, Pelobates and Calyptocephalus, participate in this singular abnormality.

Beddington Park PAUL HENRY STOKOE

Scorpion Suicide?

MR. F. GILLMAN'S note (vol. xx. p. 629) in favour of scorpion suicide carries with it its own refutation, as will be seen by examining the details of his cruel experiment. Given the "circle of glowing charcoal embers a foot or so in diameter," and the inference is that the central temperature of that circle would be well nigh "glowing" too; dropped into this fire-bound ring, the poor scorpion would at once be scorched nigh unto death, and to escape the ensuing agony, why does it not, then and there, commit suicide? No, "after vain attempts to get away," in each of which it is more and more scorched, if not absolutely burned in its head, its vital powers fail, and its last instinctive throe is to gather its limbs together as much as possible, away from the heat. The heat has killed it, and I defy Mr. Gillman, or any one else to prove that, in this experiment, the scorpion "pierces its head with its sting and dies" in consequence.

As our winter has set in, and the crickets had gone into winter quarters, I determined upon giving my scorpions an opportunity of doing the same, so, taking them into the garden, I emptied them into a hole. I only mention this to illustrate my remarks on change of colour in lizards, for, taking my scorpions into the sun, out of a comparatively dark room, each individual distinctly assumed a lighter hue on the way to the hole.

Peshawar R. F. HUTCHINSON

Strange Incubation in Fishes

Apropos of my note on strange incubation in fishes, I send you, *quantum valeat*, an extract from Mrs. Yelverton's *olla podrida* of travels, "Teresina Peregrina," vol. ii. pp. 15, 16: "His Highness (the Tumangong of Johore) had a splendid collection of orchids, which it seemed to gratify him to point out to me. I recognised many of them as my old friends, the acanthus-shaped denizens of the Cambogian forests, from whose urn-like leaves my people used to bring me down the little fish. This *boule-versement* of natural history may sound like a traveller's tale, but the explanation is simple.

"The aquatic birds often drop the spawn of the fish into the calixes (*sic*) of these beautiful parasites, which the next shower of rain turns into basins or pools of water, wherein the little fish first opens his eyes and receives its consciousness, probably believing firmly that it is the proper thing for a fish to live in a tree (so strong are early impressions), while all the rest of the world, fish, flesh, and fowl, view him with amazement.

"Many of our beliefs have not one whit more solid foundation than this fish's belief in the cornucopia of the orchid being a real fish-pond, because a few accidental fish got there through the slavering of some ill-mannered water-fowl." ! ! !

Peshawar, December 2, 1879 R. F. HUTCHINSON

FURTHER NOTES UPON THE PAPUANS OF MACLAY COAST, NEW GUINEA[1]

II.

OBJECTS of Art.—Specimens down to the simplest and commonest ornament were collected, or, at any rate accurately copied by M. Maclay, for the reason that the natives of Maclay Coast were still in the "Stone age"—a period which will soon belong to the past, and of which the relics are yearly becoming rarer and rarer. The implements as yet discovered by the Papuans, and upon which artistic skill has been expended come under two categories. 1. Fragments of flint, shells, and bones. 2. Chipped stones in the form of axes. The ornaments themselves may be divided into three classes. (*a*) Ornaments properly speaking, engraved, or drawn on their own account solely, and serving none other than a decorative purpose. (*b*) Ornaments and drawings demonstrating the first beginning of the figurative or ideal style of writing. (*c*) Ornaments, sketches, and carvings, which stand in relation to the superstitions and dark stage of religious ideas among the Papuans.

1. *Ornaments in the strict Sense of the Word.*—The salient character of most Papuan ornaments is that they are for the most part rectilinear, and for the reason that bamboo and reed, from which the majority of their utensils are made, are best adapted for such style of decoration, for it is, as Maclay has practically convinced himself, difficult to draw or scratch round and circular designs upon the substance, while straight lines, on the contrary, can be made with ease, the tools being sharp fragments of flint or shell. It is upon the bamboo receptacles for lime for betel chewing, but more especially upon the large comb which is worn by all men that their decorative skill is principally expended. That style of ornament which of necessity was adopted for articles of bamboo, is also applied to such as are of other material, *e.g.*, wood or clay, for the Papuan, in general with the rest of mankind, is influenced by laziness, for he lacks the energy to make trial of such designs as would be more suitable for the latter kind of material. Some of the designs, however, upon wood are of a curved and circular character, but these are difficult to make with such primitive tools as the Papuan possesses. A slight scratch with a piece of flint suffices to mark a line upon the epidermis of bamboo, while in the case of wood, strong pressure and tedious scraping or scratching are necessary to produce a superficial design. More trouble, moreover, is expended upon things made of wood, such as drums and canoes (*praus*).

That the want of variety in subjects of decoration does not proceed from lack of inventive power and skill is shown by the fact that directly after use was made of the

[1] Continued from p. 206.

sherds of glass bottles collected near Maclay's hut new refinements and variations were introduced into their wood ornamentation. As regards the pottery ware, since this is made by the women, and as the latter are wanting in artistic sense or in interest in their work, it is quite devoid of ornament.

2. *The Origin of the Development of Symbolic Characters.*—M. Maclay believes that he discovered by accident the use of an ideograph ("Ideenschrift") by the Papuans in a very rudimentary form. He noticed upon the façade of the *buambramra* of a neighbouring village a row of shields formed from the leaf-bladders of the sago-palm, on which rude figures, *e.g.*, fish, snakes, suns, and stars were painted in various combinations. Their meaning puzzled him for a long time, and from insufficient knowledge of the language he was for a long period unable to inquire about it. In the forests, too, he remarked similar enigmatical symbols carved upon the bark of the trees; also upon the sides of the praus which came from the Islands of Contentment. The riddle remained unsolved until the occasion of a feast, several months later, given in celebration of the launch of two large canoes on which the natives had been working for a long time, when a solution suddenly presented itself. Towards the end of the feast one of the younger guests jumped up, took a coal, and began to sketch a row of primitive figures upon a plank which lay near. These symbols had a great resemblance to those which Maclay had previously remarked upon the trees, canoes, &c., and were sketched in the following order. First came a representation of the two newly launched *praus*, drawn as though half upon the shore and half in the water; then followed a drawing of men carrying two pigs tied fast to a stake, victims doomed to be sacrificed for the feast. After these were represented, a row of large *tabir*, equivalent in number to the "covers" which had been served at the banquet, while the rear was brought up by a drawing of Maclay's canoe, conspicuous by its large flag, two large sailing canoes from the Archipelago of Contentment, and a number of smaller ones without sails, from the neighbourhood of Bili-bili. This group, which symbolised the various guests present at the feast, was drawn as a *souvenir* of the banquet, and Maclay saw it several months afterwards. Further observations have led M. Maclay to the conclusion that representations such as that just mentioned, are not to be regarded in the light of pictures or sketches, but as rudiments of a primitive ideograph — "primitive Ideenschrift" — a conclusion which has been borne out by later observations. M. Maclay was impressed with the variety in the representation of the commonest objects, which implies a very limited comprehension of drawing and renders it an utter impossibility for any other [than the artist?] to understand this primitive writing, or pictorial mnemonic medium. A man, for example, was actually represented by the same artist (1) as a rough human shape; (2) as a face with eyes and a large mouth; (3) as a comb[1] with a plume of feathers, and, lastly, as the "membrum virile," and it is very probable that there are many other symbols besides having an analogous signification. Besides the pictorial representations, the Papuans of Maclay Coast employ several mnemonic appliances to aid in remembering important events; for in every village may be seen suspended "in memoriam," various objects, such as bones, as a *souvenir* of a great feast, cocoa-nut shells, of a less important feast—no animal having been slaughtered on the occasion—a dry bunch of leaves or an empty basket, the former hung up by some friend in remembrance of a visit, the latter in which some present had been brought, being left behind as a hint for some gift in return. In every *buambramra* hang rows of the lower jaws of pigs and dogs, skulls of fish and of various marsupial animals, in remembrance of feasts, successful fishing and hunting parties, and visits of friends; serving thus as a veritable calendar of the events of past months and years.

1 "Kamm," a comb or crest.

3. *Sculpture in Wood.*—To this category belongs principally the fairly numerous quantity of carvings which, if not precisely as idols, may nevertheless be regarded as objects standing in a very intimate relation to the religious ideas of the Papuans. Such, under the common term, *Telum*, were seen by M. Maclay in nearly every village, and accurate drawings were made of no less than twenty-one of them, interesting as they were not only as specimens of the art of the stone age, but as affording many a guide to the relationship of the Melanesian races. A *Telum* consists of a human figure, of either sex, fashioned out of wood, or, more rarely, from clay. Nearly all wear peculiar head-dresses, and those of the male sex have the genitals of an enormous size. In a mountain village a *Telum* was discovered with the body of a man, but the head of a crocodile, for which a turtle served as a kind of cap, and in the same village another human figure was found which held with both hands a tablet covered with various symbols. In all figures the nose, as is the custom among the Papuans, is bored through, and every *Telum*, moreover, of which several may be found in each village, has its own special name. As for the significance of these wood-carvings, M. Maclay is not quite certain upon this point, although he is sure that they stand in some relation to the rudimentary religious conceptions (*Vorstellungen*) of the Papuans, for in some of the hill villages large stones even were seen to be honoured as *Telums*. If, on the other hand, we regard these representations from an æsthetic point of view, we shall be again forced to admit the artistic capabilities of the Papuans, their great perseverance, as well as the way in which simple decorations become transformed into bas-relief, and again from *alto relievo* into the complete figure; for in Papuan art of the "stone age," such a series of progressive steps is demonstrated in the completest manner.

Superstitions and their Resulting Customs.—With regard to "Tabu,"[1] this custom exists in New Guinea, but M. Maclay did not succeed in finding out any equivalent term for it in the Papuan tongue, though frequent examples of it could be recognised in the various restrictions put upon the actions of women in their relation to the men. For example they are forbidden to set foot within the *buambramra*, they are excluded from all feasts, and every dainty which they prepare for the latter, especially the principal drink, *Keu*, is forbidden to them as well as the children. The meeting places of the men, music, musical instruments, and even the mere hearing of the same is strict *Tabu* for the women, for as soon as the sound of one is heard in the neighbourhood, they and the children must instantly flee. To the repeated inquiry of Maclay as to the reason of the above exclusion of the women, the answer was invariably returned—"It would never do, for the women and children would fall ill and die."

Music and Song.—The performance on all instruments of music, which are collectively included under the term "*Ai*," is allowed to the men alone. They are as follows:—

The "*Ai-Kabrai.*"—This consists of a bamboo, about two yards and more in length, and about fifty millimetres in diameter, from which all the septa between the internodes have been removed so that the whole consists of a single long tube. This instrument is put into the mouth, and through its large orifice the performer blows, shrieks, or howls, the sound being audible in still weather at a distance of from two to three miles. The word "*Kabrai*"

1 Accounts of "*Tabu*" will be found in "Tylor's Researches into the Early History of Mankind," London, 1865, and in Captain Cook's "Voyage to the Pacific Ocean," Vol. i.i., p. 163, London, 1784. "This word" (*loc. cit.* p. 164) "is used to express anything sacred, or eminent, or devoted. Thus the King of Owhyhee was called *Eree-taboo*; a human victim, *Tangata-taboo*; and in the same manner, among the Friendly Islanders, Tonga, the island where the king resides, is named *Tonga-taboo*."—J. C. G.

is (in the Papuan dialect), the name of a species of parrot, with a loud screaming voice.

"*Munki-Ai.*"—This equally simple and ear-splitting instrument is made out of the shell of one of the smaller kinds of cocoa-nut (*Munki*), in which a hole is bored both in the side and in the upper end; a shrill piping tone being produced by blowing through the upper hole, and alternately stopping and leaving free the side one by means of a finger. This instrument is often elaborately and artistically ornamented.

"*Hol'-Ai.*"—This is a curved or straight wind-instrument, of the character of a trumpet, made out of the root of a kind of *Lagenaria*.[1]

The three just described are not strictly wind-instruments, as compared with those of a European model, but are rather of the character of a ship's speaking-trumpet, in that they are only used for strengthening the human voice, though the tunes produced are of extreme variety.

"*Orban-Ai.*"—This consists of a handle from which a number of perforated Orban-nut shells hang, each at the end of a cord. When this is shaken the shells strike against one another, producing a kind of rattling sound, which at times resembles the rustling of foliage caused by a breeze.

"*Okam.*"—This is a kind of drum made from a hollowed tree stem, over the upper end of which the skin of a Monitor lizard is stretched, while the lower end remains open.

For purposes of signalling, a triton-shell perforated at the side is used, and by this means the arrival or departure of the *praus* which come from Bili-Bili or the "Archipelago of Contentment" is made known.

All the above-mentioned instruments of music are *Tabu* to the women and children, being, like the wooden carvings, regarded as something sacred, and this to such a degree that M. Maclay had great difficulty in obtaining from their owners specimens for his collection.

The songs of the Papuans of Maclay Coast are of the very simplest, being confined to a few words which are perpetually repeated, sometimes in solo, sometimes in chorus. They are almost always improvised, the composition being prompted by the advent of guests, some occupation or other, or the most trifling events.

Under the common term "*Ai*" are included the feasts which are celebrated by the Papuans from time to time. The guests are summoned from the surrounding villages by a number of beats on the *Barum*, repeated at prescribed intervals, while the *Malassi* bring out the various utensils and instruments of music from the *Buamramra*. Baskets full of the root of the Colocasia (*Bau*), and the fruit of the Dioscorea (*Ajau*) are brought, of which a certain quantity is contributed by each male guest, and added to the general heap, each fresh arrival being greeted with applause. At length there arrives, bound to a stake carried by two men, and greeted with cries of joy, the principal object of the feast, a pig, richly decked out with the red flowers of the *Hibiscus*. The victim is laid on the ground, and, after a long oration from one of the Tamos, is despatched by a thrust of a spear in the armpit. As for dogs, which are not unfrequently eaten at feasts, they are slaughtered by being swung round by the hind legs and the head dashed against a tree trunk. Fowls, rats, the cuscus, and smaller marsupials are killed in the same manner. After the pig has been killed and the hair singed off over a large fire, it is placed on a number of banana leaves spread on the ground. In all the details of preparation for the feasts the Papuans show a remarkable appreciation of division of labour, for everything is done without noise or confusion. While the cooking of the various portions of food is taking place, the guests set about the brewing of their two favourite drinks, the *Munki-la* and the *Keu*. In order to make the first, green cocoa-nuts, after they have been stripped of their fibrous outer coating, are split down the middle by a single blow from a long stone implement, and the watery contents collected in a *Tabir*. The halves of the nuts having been distributed, each guest sets to work to shred the kernel with his *Jarur* into the bowl until the latter is filled to the brim with a whitish, gruelly mess. The second drink is thus made:—The fresh leaves of the *Keu*[1] plant, together with the young twigs, are chewed without further preparation, while the old and hard roots are previously softened by bruising with a stone. For this end all the young men play the part of living masticatory machines, their teeth fulfilling the function of millstones set in motion by the action of the "masseter" muscles. If one of them is tired out before the mass is soft enough, he forthwith spits it out into his hand, rolls it into a ball, and hands it over to a neighbour to finish the process. After having been duly masticated, the *Keu* is filtered by means of an apparatus consisting of two halves of a cocoa-nut shell, the upper of which, having an aperture in the middle, covered with some finely crushed grass, serves for a filter, while the lower receives the filtrate. To this latter, which is of a greyish-green colour, some water is added, and it is then left standing. Every *Keu* drinker has his own bowl reserved for this purpose alone, and carefully kept in his pouch, or *gun*. It consists of the shell of a small cocoa-nut, the inner surface of which is of a uniform greenish-grey colour, a result probably of the custom forbidding all cleaning of the interior, while the outer is decorated with various devices and coloured with a black pigment.

At length there rings over from the village, two or three short *Barum* tones, as a signal that the banquet is ready, and the *Keu* drinkers assemble, surrounded by the younger men. Each then rests his bowl in a shallow hole made by a lance in an area of ground previously cleared for the purpose, and into it the thick fluid is poured from the large *Keu* bowl. After a preliminary coughing and spitting, in order to clear out the mouth, each, in the order of seniority, or social standing, drinks his portion with many a grimace, as the infusion is very bitter; and in some instances, passes urine at the same moment. After this the guests proceed to eat, and when their hunger is appeased, the grated cocoa-nut infusion, *Munki-la*, is served round. If the pig is too small for all to partake of, only the men are allowed to eat of it, it being *Tabu* to the "Malassi," or youths, who will then on no account touch it, as they have the firm belief that if this rule be violated either illness or some calamity will inevitably overtake them. The feast is brought to a close by smoking and the chewing of Betel nut, and the "Siri" leaf. If, as is sometimes the case, there are not enough eatables for the feast, a supplementary banquet is held, the materials for which have to be first procured by an improvised fishing party. In order to keep the women and children from disturbing the guests when feasting, the musical instruments are brought into play, which, as before stated, is an infallible means of keeping them at a distance. Finally, as a *memento* of the feast, the lower jaw of the pig or dog which has figured on the principal dish is hung up in the *Buamramra*.

During the month of November and December, when the Papuans are less occupied in the plantations, certain other kinds of feast take place, of which at the first, called "*Ai-mun*," only the men are allowed to be present, while at the second, the "*Sel'-mun*," held in the villages, the presence both of women and children is permitted. At the *Ai-mun* very curious masked processions are formed, and here the *Aidogan*, a kind of *telum* consisting of numerous figures carved one over the other out of one

[1] A genus belonging to the order *Cucurbitaceæ*.

[1] According to Dr. Scheffer, director of the Botanic Garden at Buitenzorg, near Batavia, to whom they were submitted, the *Keu* plants brought by M. Maclay from Papua belong to two distinct species of the genus *Piper*, but neither of the two is identical with the *Kava* plant of Samoa. It is, moreover, doubtful even if this latter is really the *Piper methysticum*.

tree stem, play a conspicuous part, after having been brought, fresh painted, from the village to the feasting place. Sometimes there is even a migration of the revellers into another village, which generally results in a kind of sham fight between the two parties.

With regard to Betel chewing and tobacco-smoking, both these habits are very prevalent, and freely indulged in by the people inhabiting Maclay coast. Nevertheless, the *Areca* palm[1] is by no means abundant on the coast, being, with the exception of the "Archipelago of Contentment" and a few other spots, but seldom found in the villages. The process of Betel-chewing is as follows: The Areca nut having been first partly masticated, is then mixed with a little powdered lime, which is carried in a special box formed from bamboo or a calabash gourd, and, after being rolled in a Betel[2] leaf or two, is placed between the teeth and chewed. Although the tobacco plant, here called *Kas'*, is much cultivated, and flourishes well along the whole coast, the American tobacco, pressed flat into cakes, which Maclay had brought with him, was so much liked and prized, that he contributed a portion at almost every *Ai* feast. This, after being separated into its component leaves, was dried over a fire, torn into little shreds, and then rolled into cigarettes in green leaves, also previously dried at the fire. A single cigarette makes the round of a number of smokers. In smoking the Papuans swallow the smoke, and blow the rest through the nose.

As the *Keu* has soporific qualities, the Papuans have devised a means of keeping any one who has succumbed to its influence in a wakeful condition. The victim to its power betakes himself to a friend, who with a stalk of grass tickles the cornea and conjunctiva of his eyes until they become full of tears. This is repeated until the patient declares that he feels no longer sleepy. This operation is regarded as a very pleasant one, but "whether it always succeeds," remarks M. Maclay, "is another question."

J. C. GALTON

EPIDEMICS[3]

WE are now entering on our thirtieth session, and, I trust, with reason to believe that our progress is satisfactory, and our work such as to prove that the Society is fulfilling the main object for which it was founded. Though not one of the largest, it is certainly not one of the least active or important among the medical societies of the metropolis, whilst the cosmopolitan range of subjects embraced within the scope of its inquiry renders its proceedings of far more than mere local interest.

The *raison d'être* of this Society is the investigation and development of our knowledge of disease in motion. It involves much, for any disease where it spreads, whether among the people of a house, a ship, a village, a city, a province, or a continent, is an epidemic, and comes within the scope of our inquiry. Dysentery and malarious fevers are typically *endemic* diseases, but in India they may and do at times assume a dangerously epidemic character. But it is not meant that our inquiries should be restricted to mere epidemicity alone; we cannot advantageously study one phase of the natural history of disease and exclude others. There is so much in etiology, semeiology, and pathology both human and comparative that concerns our department of research that we may not ignore the means by which we gain the most important of all information to the epidemiologist—namely, the means of discriminating one form of disease from another. Therefore, though our proceedings will naturally refer mainly to epidemic disease, we shall thankfully receive and carefully consider all information that may tend in any way to throw light on the causal relations, and on the influences exercised by climate, season, locality, food, and occupation on the genesis and dissemination of all diseases, not excluding those of the lower animals, nor even of plant life. I might illustrate this by referring to the importance of discriminating between the different forms of fever that occur in India. It is well known that the greatest proportion of mortality in India is ascribed to fevers. The highest death-rate[1] was registered in Bombay, where it equalled 20·82 per 1000; in Madras the deaths of 469,241 persons gave a death-rate of 10·08 per 1,000. Both here and at Bombay, however, the mortality recorded was greatly aggravated by famine.

There is no doubt that, under the heading Fever, many deaths from other causes are recorded, and we may probably refer a large proportion of them to diseases of an inflammatory character affecting the thoraic or other viscera, or to complications involving inflammatory action elsewhere. In a vast country like India, where the population is so extensive, and the means of registration of necessity limited, often not under medical supervision at all, it is not to be expected that greater accuracy can be ensured; but, were it possible to discriminate among the various forms of disease returned as causing the mortality by fever, we should have a very different result from the present. One can hardly refer to this subject without expressing admiration at the great progress that has been made of late years in registration under the direction of the sanitary authorities of India, and confidence that it will continue to improve, and render the statistics more valuable even than they are now. Of course, where the registration of death is not subject to medical definition discrimination between the various forms of fever or other death-causes could hardly be expected; and therefore the example I have just given is hardly so good an illustration of what I refer to as typhoid, for which we have accurate medical statistics of our European troops in India. It is within my recollection that attention was first called to the existence of this form of fever in India, and yet there can be, I suppose, no doubt that it has always been there. It soon became generally recognised as a new discovery in India, and people wondered how it had escaped observation hitherto, whilst some perchance regarded it as a new disease. But it was just this power of discriminating observation that is so rare and so valuable that had been wanting; it was this that, exercised by Budd, Jenner, Stewart, Murchison, and others after them, established a new era in the nosology of fevers in England; and it was this, that, a little later, in India, discriminated between certain forms of remittent and enteric (*i.e.*, between malarious and specific) fevers, and that will, I hope, ere long further discriminate and rearrange the nosology of fevers in India and the tropics.

Now typhoid or enteric fever is an important cause of mortality among our young European soldiers in India; and it raises or suggests questions of great importance in regard to them—such, for example, as the right age, time, and seasons for sending them to India; to say nothing of the hygienic questions as to sanitary measures arising out of its causal relations. The Sanitary Commissioner's Report of 1877 says that out of 233 cases of typhoid, 92, or 39 per cent., proved fatal; the admission rate being 4·1 per 1,000 of strength. It moreover appears that 2·45 per cent. occurred at or under twenty-four years of age; 1·55 at twenty-five to twenty-nine; 0·99 at thirty to thirty-four; and a few or none above that age; showing that the disease tells most severely on the younger men—in this respect resembling typhoid in England. Again, Bryden, in his Report of the Statistical History of the European Army in India up to 1876 (published 1878),

[1] *Pinang* in the Malay language.

[2] *Siri* in Malay.

[3] Abstract of Presidential Address at the Epidemiological Society, delivered on November 5, 1879, by Sir Joseph Fayrer, K.C.S.I., LL.D., M.D., F.R.S.

[1] *Vide* Report of Sanitary Commission of the Government of India for 1877.

says: "It has no geography; and it is a matter of popular observation that no regiment or battery escapes enteric fever *in the first year*, whatever cantonment of India may be selected." "Out of seventy-three bodies of men two regiments and seven batteries only returned no case of enteric fever in the first year." And he gives the following analysis of 368 deaths that occurred between 1823 and 1876:—

Ages.	Total deaths.
24 and under	255
25 to 29	90
30 to 34	17
35 to 39	4
40 and upwards	2

Seventy-five of these deaths occurred within three years after landing in India, and 94 per cent. of the total were among men under thirty years of age. In a memorandum received only a few days ago Bryden says, out of 132 deaths from enteric fever in 1878, 90 occurred in men who had been under twenty-two months in India. All this shows that youth and the first year of service in India are the great predisposing causes.

Now is this the same disease as that which might be contracted in London, Dublin, Windsor, or elsewhere in a town or barrack? from a watercloset, drain, sewer, well, or, it may be, from a milk-can? I have little doubt that very frequently it is exactly identical; but I believe also that perhaps as frequently, or more so, it is not; and this, I believe, not in regard to young European soldiers only, but of the whole population of India. In short, I am, and long have been, of opinion that a form of fever exactly like European typhoid, except in its etiology, exists in India and other hot and malarious countries; and that it is due to climatic causes, not to filth or specific causes such as give rise to it in England and elsewhere, and recent reports from India and other parts of the world seem to show that this view is gaining ground.

Be it clearly understood, however, that I do not for a moment dispute the existence of genuine *filth* typhoid in India. The official returns, which cannot be gainsaid, and my own experience alike leave me in no doubt about it. But I do believe that many cases now recorded, and rightly recorded, as typhoid in India, are not caused by the same specific agency as that which gives rise to typhoid here, and also in India, where the necessary conditions are present. There are, in fact, two, perhaps more, forms of typhoid, or perhaps, I should say, different causes for a disease presenting the same phenomena, one being specific, the other climatic; if so, it is obviously very desirable to discriminate between them—not merely as a matter of nosological or pathological interest, but in regard to the hygienic measures that are necessary in either case. This question is of great interest to epidemiologists, and is just one of those subjects that should come within the scope of our inquiry. A remarkable instance occurred near London lately, where an *epidemic* of typhoid was traced to its origin along the track of a particular water-supply by a distinguished member of our Society. Our lamented colleague, Murchison, also traced a similar outbreak to contamination of milk by polluted water. The explanations of these outbreaks were exactly in accordance with these views, no doubt rightly held in Europe. Typhoid in India, however, would not always be similarly explained.

We know but little of the nature of the causes of epidemics such as cholera, or of malarious diseases, but we know something of what may be expected in regard to them, when and how they will appear, and how sanitary work may be made most effectually to avert, prevent, control, mitigate, or remove them; nor is it too much to say that we hope, if not to banish or stamp out, at all events still further to mitigate their ravages. This, I think, is warranted by experience, for certainly the past twenty years have witnessed great progress, and we already see that not only is the value of life increasing, but that the virulence of, and mortality caused by, epidemic disease are being controlled, whilst the vexatious and purposeless restrictions and restraints of quarantine are diminished if not altogether removed, in our dominions at least. Science that has enabled us to reduce the death rate among our troops from 17·9 to 8·56 per 1,000 in Europe, and from 69 to 17·62 per 1,000 in India, speaks for itself, and were there no other result this alone is a triumph such as has been achieved by no other department of knowledge. Pray do not suppose that I claim all this for Indian workers. We all know that these great steps in social and sanitary progress began here, but I do say that the torch then lighted has since been worthily and firmly borne in Indian hands.

This Society, young as it is, can remember the commencement of systematic sanitary work in the East, and may claim some share in the origination of the good work; for among its earlier members were some who advocated the study of epidemiology and hygiene in India. I cannot now stay to dwell on this, but I may say briefly in regard to its progress and work that until the sanitary department was formed, less than twenty years ago, comparative, I might almost say complete, ignorance on the subject of epidemics, and of the diseases that prevailed among the people, existed. An epidemic might carry off thousands, but we knew not where it commenced, where it ended, or what area it occupied. Now, thanks to the continued and careful statistics, we know all that and more, with fair accuracy, and are gradually collecting facts which make the study of epidemiology possible. Before organised sanitary work in India began our knowledge of the general population—nay, even of the European troops and prisoners—was most imperfect. Now, thanks to that department, and especially to Bryden, whose name cannot be too prominently mentioned in connection with the subject, we have, in his most elaborate and valuable statistical reports, facts and figures, as well as deductions, which deserve the closest attention. We have, in short, the most complete details of sickness and mortality in all classes over the whole of India. It is impossible, however much any one may differ from his conclusions, not to recognise the great value of his work, for these reports contain a vast and continued array of authenticated facts which will serve as a mine of information to epidemiologists; and there is every reason for believing that it is but an earnest of more, for if, as Bedford said, the circumstances of India were such as to favour the acquisition of knowledge in 1850, when the precise conditions of life of the population generally, and even of our troops and prisoners were imperfectly known, what must it be now when a system of observation, carried out by a body of trained observers under a head such as he contemplated, is in full and daily improving operation? One can only wish that, considering the magnitude of the work, it were more extensive still, and that observations, already of the greatest value, could be rendered still more so by being concentrated on certain limited areas so as to enable the inquiry to extend to details with a precision that at present can hardly be practicable. The results of epidemiological knowledge and sanitary work are seen in the effect already produced in reducing the mortality from cholera and other epidemics, and from malarial fevers. For instance, among our European troops, the circumstances of which are well known, there has been the following alteration in the general death-rate:—

1861 to 1865	9·02 per 1,000.
1865 to 1870	6·98 ,,
1870 to 1875	3·23 ,,
1875 to 1876	2·3 ,,
1876 to 1877	·84 ,,

And it can be shown from the same source (Bryden) that there is a similar reduction in the death-rate among native troops; and that, during the great cholera epidemic that prevailed in 1876, the death-rate among the civil population being 12·12 per 1,000 (it was the famine year), that of the European troops was 1·75 and of the native army 2·2 per 1,000. Also that in the death-rate of that great scourge of India—fever—there has been an equally happy result, as shown by the death-rate of a period of nine years—from 1868 to 1877—in the Bengal and N.W. Provinces gaols, as against a mean, in nine years ending 1867, of 22·41.[1]

	Per 1,000.		Per 1,000.
1859	13·76	1868	2·84
1860	49·19	1869	4·57
1861	38·14	1870	6·20
1862	30·81	1871	5·81
1863	25·44	1872	1·92
1864	29·96	1873	1·56
1865	7·65	1874	2·67
1866	5·23	1875	3·50
1867	3·12	1876	1·26
Mean ...	22·41	Mean ...	3·29

In India, as elsewhere, the purpose of epidemiological study is to observe accurately and to interpret the import of the facts—*i.e.* if possible, to elucidate the laws of which they are the expression,—and thus to form a scientific basis on which to direct sanitary work, which itself is the practical outcome of such observation, and concerns itself but little with theories. Those who have to do with it know how difficult it sometimes is to obtain *reliable* observations, such is the difficulty of excluding the bias of preconceived theory of the nature of the subject under investigation. Our Society, however, must hold the balance, and deal with theories as well as facts. No doubt the explanations sometimes are conflicting. Happily, in the practical mode of dealing with the question, there is not much conflict, and it is remarkable how little different is the action of those who hold opposite opinions on the causation of disease. As to the different views that are held in regard to fundamental questions regarding the genesis and diffusion of disease let us hope that we may, perhaps, here contribute something towards their adjustment.

In illustration of the state and progress of epidemiology in India I might select the history of any of the great epidemics that have occurred of late years, but it would be impossible, in the short space of time at my disposal, to do this completely. I shall, therefore, confine myself to a few remarks on cholera, as it, though far from being the most destructive, is the epidemic to which most interest attaches.

The theory that cholera is purely of Indian origin, and that wherever it may appear it is to be traced back ultimately to the delta of the Ganges, is disputed by some who see in history evidence that it had long been existing in other parts of the world, and that it was described by the earliest writers—Sanscrit, Greek, and Arabian. I may here just remark that the name "haida," or "haiza," used by Rhazes nearly 1000 years ago in describing the symptoms of cholera, is the same as that applied to it now by every Hindustanee-speaking native of India. As to its presence in India, from earlier periods we have descriptions by Correa, d'Orta, Bontius, and others, beginning from 1503. An epidemic of it in and about Goa in 1543, for example, is described by d'Orta, giving all the characteristics that distinguish an epidemic now. He calls it "moryxy" and also "haiza." It is described by a continuous chain of writers as occurring in various parts of India, in the interior as well as on the coast, up to the seventeenth century, when, after being quiescent during the later part of the eighteenth and early part of the nineteenth century, it broke out with great virulence in Bengal, and has remained there ever since, in what Bryden calls its endemic area, whence it spreads according to certain laws, which are being worked out with admirable patience and intelligence by this distinguished statistician. I cannot now trace the history of cholera in either East or West, nor refer even to the numerous authors who have described it. For full particulars on this subject I refer you to Inspector-General Dr. J. Macpherson's learned work, "The Annals of Cholera."

I need hardly insist that cholera is not a new disease, or that it did not, as by some supposed, make its first appearance as an epidemic in Jessore, in Bengal, in 1813; though no doubt since that period it has been more closely investigated and described. All seems to show that it is the same now as formerly, and that though we have gained much knowledge of its natural history of late years, yet we are as ignorant as our predecessors of its real nature. We have, thanks to sanitary measures, disarmed it of some of its terrors, and have diminished the mortality it caused; but as to treatment we have gained but little, though the empiricism of to-day is more scientific than it was in former days. We do not now burn our patients on the soles of the feet, tie ligatures round their limbs, or have recourse to other senseless barbarities; for we find that simpler and more rational methods are of greater avail, more or less according to the period of the epidemic at, and the promptitude with, which the remedies are applied. But we have learned that local causes have a potent influence, and that cleanliness, good air, *pure water*, and free ventilation are all powerful opponents of cholera; that we can predict its appearance and avoid it in certain places; and that it is not to be controlled by quarantine or sanitary cordons. And from the earnestness and intelligence with which the subject of its etiology is pursued, it is not improbable that sooner or later it too will be made out. We shall then be in a position to say, not only what it does or will do, but what it *is*. Meanwhile we must go on observing and investigating. It is satisfactory to know that we are daily learning, practically, better how to deal with it, and how to modify its cyclical intensity and avoid its ravages. For my own part, until I know something more of the *nature* of the cause—be it a material poison, aërial or telluric, a miasm, or a dynamic agency that so perturbs the vital energy, I cannot see my way to formulate a definite theory either of the nature of its origin or the method of its diffusion. I find the highest authorities at complete variance on the subject, and reposing faith in theories diametrically opposed to each other. Some explain all the phenomena by contagion—*i.e.*, communicability in some way of a *materies* or germ from one person to another. Cholera, they say, is the result of infection by a poison derived from the intestines, and water or air, but especially water, is the channel through, by, or in which the infective material is intensified and conveyed. These arguments are supported by an abundant array of facts, and have been maintained by men whose very names carry conviction. Others reject altogether this explanation; they insist that local influences are all-important, and deny that the spread of cholera is due to human intercourse, that there is any poison transmitted by the excreta, or that the disease is in any way communicable from one person to another. They admit the existence of a poison of some sort—a miasm or an influence, though of its nature they are ignorant. It is a subtle thing that travels in certain directions in obedience to certain laws, is influenced by atmospheric and telluric conditions, and where it finds certain local conditions, and the people prepared by them to submit to it, there cholera will prevail. They deny the efficacy of any enteric or specific poison in the water to produce it, though they attach the greatest importance to the purity of water from *all* organic contamination, impure water being one

1 Bryden's Report (1876), p. 157.

of the local conditions which, if added to crowding, filth, or other insanitary conditions and want of proper ventilation, is that *of all others* which favours cholera. Such are the principal theories of the disease as they are supported by fact and argument which appear convincing. Europeans, Americans, and some authorities in India maintain the contagious view, whilst high authorities in India adhere to the opposite theory, and declare roundly that the facts of cholera, in India at least, are altogether opposed to the contagion theory.

On the question of importation of cholera in the Punjab epidemic (1875-6) and its spread by human agency, Dr. Bryden, in his report, p. 308 (1876, published 1878), says :—"The assertion amounts to this. The Punjab is divided into thirty-two districts. Cholera was introduced into seventeen of these in 1875, and therefore it spread. Cholera was *not* introduced into fifteen districts, and therefore did not appear, or, if it was introduced, influences of which we know nothing stopped its propagation in these districts. Unknown causes prevailing in the one-half of the area are presumed to influence the human system so that it is capable of receiving cholera, and in the other to act universally as an antidote even to a cholera poison when introduced. This is what is offered as antagonistic to the theory which asserts that cholera is air-borne and is as far-flying as are the limits of natural areas. Primarily, these theories cannot be reconciled ; the one or the other is false. If cholera is spread only by the human being, the theory which shows it to be air-conveyed is untrue ; if cholera is spread solely as an aërial miasm, then the theory which recognises only the effects of human intercourse is unfounded. The most that is admitted by the advocates of the human theory is, that the subjection of cholera to meteorological agencies is absolute, and that these influences can, and do operate so as to do away altogether with the effects of the poison, although imported. They do not recognise the entity *minus* the human being. The antagonistic theory, while holding, as opposed to demonstrable fact, the statement that cholera moves only by human agency, may, if necessary, be extended in its scope so as to embrace the other ; that is to say, the inquiry is left open as to whether or not the cholera entity, after being aërially distributed, may be subsequently propagated or spread by man. In the theory which connects cholera solely with man there is no such extensibility. Human intercourse must explain every fact of spread and propagation, and nothing is left to the play of natural agencies. Human intercourse, giving the widest scope to the signification of the term, cannot pretend to account for any fundamental phenomenon displayed during the progress of epidemic cholera ; and, therefore, I assert the theory to be radically untrue as applied to the behaviour of cholera in India. I do not say that the above statement will hold true all over the world ; and, even as applied to India, the theory does not preclude the possibility that cholera may be conveyed by the human being. Naturally the recoil is to the opposite extreme. The bold statement that cholera is never spread over an area unless human agency intervenes, is apt to be met by the equally dogmatic statement that cholera is as pure a miasm as malaria, and as little amenable to the control of man.

In the present state of our knowledge we can only be guided by the inferences from well-ascertained facts and such laws as we have ascertained to be in constant operation, watching and carefully observing until we may, were it only by a process of exclusion, arrive at some deeper knowledge still. "So far," says the chief sanitary authority in India, "the history of cholera is full of enigmas and seeming contradictions, and though we have of late years collected many valuable data, and understood the importance of studying them on a broad basis, we know no more of the exact cause of the disease than our grandfathers did. We know that, whatever the cause may be, it flourishes in the midst of insanitary conditions of dirt and overcrowding, and especially of impure water, impure from whatever cause ; we know that it is liable to occur under certain conditions, and at certain times and seasons, and we should endeavour to extend that knowledge, and hope, as we do so, to arrive at the precise nature of the disease itself." But it may be well to remember that "expenditure of public money must take place only on observed facts and experience," not in accordance with theories. "It would be prejudicial to real sanitary work if opinions which have been promulgated in some parts of India, as to the cause of cholera being due *solely* to the state of the water-supply, were to take root."

It is most important that we should arrive at some definite conclusion as to the real nature of the disease, for it is impossible but that our conceptions on this subject must influence the sanitary measures that deal with it, and I believe the question must find its final solution in India, where the disease is always present in its endemic and seldom absent from the epidemic areas. The highest authorities—for both I have the greatest respect—differ *toto cœlo* on this subject. Is it that they are both right, though seemingly so opposed in their views? Like the knights who fought about the silver and golden sides of the shield, will they not change places, and find why they differed?

I would venture to suggest that in India the inquiry might be pushed with more detail in regard to individual cases and outbreaks in certain limited areas ; and that, on the other hand, one or more epidemiologists of European fame should be deputed to visit India and study cholera with the eminent men who have devoted so many years of close attention to it there. It might be, I believe it would be, that mutually they would gain from each other, and that those who went out would find their own views confirmed as to the disease in Europe—modified as to what they deemed it to be in India. Of one thing I am convinced, that simple truth is the object of their search ; and I feel sure that from such combined action the greatest benefit would result.

POPULAR NATURAL HISTORY[1]

JUDGING by the continuous stream of popular "Natural Histories," the demand for such books must be great. Messrs. Cassell have already published many volumes of the kind, some dealing with the whole animal kingdom, some with a single class ; they are now bringing out a series of volumes under the editorship of Dr. Martin Duncan, and in the mean time they present us with a single volume of a still more popular character by Dr. Perceval Wright. This book, as we are told in the preface, is intended for that large class of readers who, while they take an intelligent interest in the study of natural history, have but little taste for the technical details which would naturally form the bulk of a scientific manual on the subject. For this reason the space devoted to the several orders is roughly proportioned to the amount of interest generally felt in them. The mammalia occupy more than a third of the volume, the remaining orders of the vertebrata about an equal space, while the whole of the invertebrates are compressed into the space that remains—about one-fourth of that occupied by the vertebrates. The author tells us that his aim has been "to compile a story-book about animals, and at the same time in some degree to write a scientific manual." This is undoubtedly a difficult thing to do, and to do it thoroughly and in the best style would be a fitting life-work for a great naturalist. It would have to be done as a labour of love, not to the order of a publisher ; and the

[1] Animal Life ; being a Series of Descriptions of the Various Sub-kingdoms of the Animal Kingdom. By Perceval E. Wright, M.A., M.D., &c., Professor of Botany in the University of Dublin. With Illustrations. (Cassell, Petter, Galpin, and Co., London, Paris, and New York.)

illustrations should be of the very best kind, so as fully to exhibit the beauty, the variety, and the intricacy of nature.

The present volume lays no claim to such completeness; yet it is far superior to the mere popular natural history, inasmuch as it gives a considerable amount of accurate information both on the anatomy and physiology of the chief types of the animal kingdom, and on the geographical distribution of the chief families and genera of the higher animals. It also deserves great credit for the completeness of its review of the vertebrata, every well-established family group being referred to, and its more prominent characteristics usually described; so that, so far as this sub-kingdom is concerned, the book is a compendium of information well worthy of a place in the library of every natural history student. With the invertebrata a very different plan has had to be followed, only the more important orders being noticed, and a few typical forms selected for description and illustration; yet even here we are glad to meet with some account of the most recent discoveries among marine animals, and some illustrations which offer a welcome relief from the usual stereotyped forms of most popular works.

We shall best exhibit the character of Dr. Wright's volume by laying before our readers a few passages with their accompanying illustrations.

Under the mouse family (Muridæ) we have twenty species described or noticed, and these are illustrated by eight excellent figures. The beautiful illustration of the

FIG. 1. Harvest Mouse and Nest.

harvest-mouse nest building accompanies the following descriptive passage:—

"The Harvest Mouse (*Mus minutus*) is found probably all over Europe. It is not common in England, and is more frequent in Belgium. White, of Selborne, in writing to Pennant, says: 'They build their nests amidst the straws of the corn above the ground, and sometimes in thistles. They breed as many as eight at a litter, in a little round nest composed of the blades of grass or wheat. One of these I procured this autumn, most artificially platted, and composed of the blades of grass or wheat, perfectly round, and about the size of a cricket-ball, with the aperture so ingeniously closed that there was no discovering to what part it belonged. It was so compact and well-filled that it would roll across the table without being discomposed, though it contained eight little mice that were naked and blind. As this nest was perfectly full, how could the dam come at her litter so as to administer respectively a teat to each? Perhaps she opens different places for that purpose, adjusting them again when the business is over, but she could not possibly be contained herself in the ball with her young, which, moreover, would be daily increasing in bulk. This wonderful procreant cradle—an elegant instance of the efforts of instinct—was found in a wheat-field suspended in the head of a thistle.' The food of this little mouse consists of corn and grass seeds, insects, and earth-worms. Of insects it is very fond."

Of the ravages of another British species we have the following interesting account:—

"The Short-tailed Field Mouse (*Arvicola arvalis*) is found throughout Europe to Siberia. Small and insignificant as this animal appears to be, there is scarcely a species among the rodents more destructive to our fields, gardens, and woods. In the corn-field, the rick-yard, the granary, and in extensive plantations, its depredations are often severe, and even calamitous. Of the damage effected by a multitude of these animals we give a single instance. In the year 1814 the whole, both of Dean and New Forest, appeared to be largely stocked with mice; at least wherever the large furze-brakes in the open parts had been burnt their holes and runs covered the surface. Hayward Hill, a new plantation of about 500 acres in the Forest of Dean, was particularly infested. This inclosure, after being properly fenced, was planted with acorns in 1810, and in the following spring about one-third came up, the rest of the seed having been destroyed principally by mice. The young shoots of the natural hollies of the district, which had been cut down to favour the plantation, were not attacked by the mice in the following winter, though their runs were numerous. In the autumn of the succeeding year a large quantity of five years old oaks and chestnuts, with ash, larch, and fir, were planted in the inclosure. In the winter the destruction began, and numbers of the hollies, then two, three, or more feet in height, were barked round from the ground to four or five inches upwards, and died. In the succeeding spring a number of the oaks and chestnuts were found dead; and when they were pulled up it appeared that the roots had been gnawed through two or three inches below the surface of the ground; many were also barked round and killed, like the holly-shoots, whilst others, which had been begun upon, were sickly. The evil now extended to the other inclosures, and becoming very serious both in Dean Forest and the New Forest, cats were turned out, the bushes, ferns, rough grass, and other plants were cleared off to expose the mice to beasts and birds of prey; poisons in great variety were laid, and seven or eight different sorts of traps were set for them, some of which succeeded very well. These were, however, superseded by the plan of a ratcatcher, who, having been employed to capture the mice, had observed, on going to work in the morning, that some of them had fallen into wells or pits accidentally formed, and could not get out again, many of them dying from hunger or fatigue in endeavouring to climb up the sides. Such pits were therefore tried on his recommendation. They were at first made three feet deep, three long, and two wide; but these were found to be unnecessarily large, and after various experiments it appeared that they answered best when from eighteen to twenty inches deep, about two feet in length, and a foot and a half in width at the bottom, and only eighteen inches long and nine wide at the top, or so wide as would allow of the earth being got out of a hole of that depth, for the wider they were below and the narrower above the better they answered their purpose.[1] They were made about twenty yards asunder, or, where the mice were less numerous, thirty yards apart. Nearly 30,000 mice were speedily caught by this method in Dean Forest, and in the New Forest about 10,000 more. It was believed that a far greater number had been taken out of the holes either alive or dead by stoats and weasels, or by kites, owls, crows, jays, and magpies."

The following account of the Angler (*Lophius piscatorius*), a curious large-headed fish belonging to the family of the Lophiidæ, or fishing-frogs, and a native of our seas, is short, but clear and instructive:—"This curious fish has the head wide, and the mouth nearly as wide as the head; the eyes are large; the lower jaw, which is the longer, is bearded or fringed all round the edge, and both jaws are armed with numerous teeth; the body is narrow compared with the breadth of the head, and tapers gradually to the tail. The colour of the upper surface of the body is uniform brown, the under surface white, and the tail almost black. On the top of the head are three long filaments; of these, two are seated just above the muzzle, the other rises from the back of the head. These filaments are movable in all directions, especially the first, which, tapering like the finest fishing-rod, ends in broad, flattened, silvery tips.

"The angler is insatiably voracious, but it is a slow swimmer; it is formed, in fact, for taking its prey in ambush. It reposes on the soft mud or sand, in some favourable lurking-place, and, stirring up the mud with its pectoral fins, thus obscures itself in a murky cloud, beyond which appear its long filaments, and, especially the first, with its glittering tip, offering an attractive bait to other fish. Thus stationed, the creature quietly expects its victim. On rove the shoals of fish, eager in quest of food. They pass one after another in succession, till at length one espies the bait. Forward the fish darts, either to examine or seize the expected prize; but at that instant, aided by its broad, feet-like pectoral fins, the watchful angler springs up and captures its prey."

FIG. 2.—Angler (*Lophius piscatorius*).

The fishes are generally very well illustrated, and a large number of interesting species are described.

Passing on to the invertebrates, we come first to the insects, which form the weakest part of the volume; but this is perhaps of less importance as none but specialists feel any interest in the bulk of the forms; while their immense numbers and endless variety, their strange habits, and marvellous instincts can only be adequately set forth where ample space can be afforded them. We pass on therefore to the lower marine animals, and select as an example of the way they are treated a rare British species allied to the sea cucumbers, and named *Synapta duvernea*. It was discovered in the English Channel by M. Quatrefages, who thus describes it:—

"Imagine a cylinder of rose-coloured crystal as much as eighteen inches long and more than an inch in diameter, traversed in all its length by five narrow ribbands of white silk, and its head surmounted by a living flower whose twelve tentacles of purest white fall behind in a graceful curve. In the centre of these tissues, which rival in their delicacy the most refined products of the loom, imagine an intestine of the thinnest gauze, gorged from one end to the other with coarse grains of granite, the rugged points and sharp edges of which are perfectly perceptible

[1] This is the form adopted for the tiger-pits made by the Chinese in Singapore.

to the naked eye. But what most struck me at first in this animal was that it seemed literally to have no other nourishment than the coarse sand by which it was surrounded. And then when, armed with scalpel and microscope, I ascertained something of its organisation, what unheard-of marvels were revealed! In this body, the walls of which scarcely reach the sixteenth part of an inch in thickness, I could distinguish seven distinct layers of tissue, with a skin, muscles, and membranes. Upon the petaloid tentacles I could trace terminal suckers, which enabled the Synapta to crawl up the side of a highly-polished vase. In short this creature, denuded to all appearance of every means of attack or defence, showed itself to be protected by a species of mosaic, formed of small, calcareous, shield-like defences, bristling with double hooks, the points of which, dentated like the arrows of the Carribeans, had taken hold of my hands. If one of these Synapta is preserved alive in sea-water for a short time, and subjected to a forced fast, a very strange phenomenon will be observed. The animal, being unable

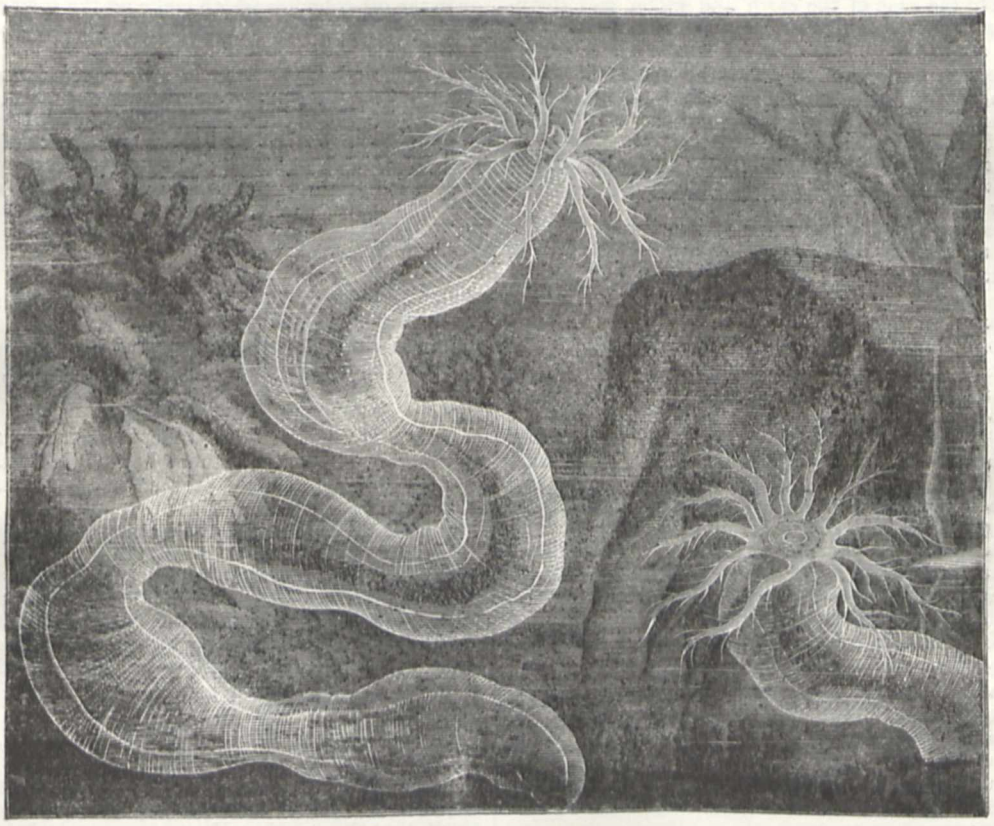


FIG. 3.—*Synapta duvernea.*

to feed itself, successively detaches various parts of its own body, which it amputates spontaneously."

Although most of the illustrations in this volume are very good, and some are good works of art, there are also several which are very poor, and quite unworthy of the text. This is especially the case among the smaller birds, several of which are unrecognisable. A few also have been wrongly named, representing very different creatures from those they are said to be. The most prominent defects of this kind are the figure of the Leucoryx antelope, which is named *Saiga tartarica*, and that of two humming-birds, which do duty for sun-birds. These oversights, which no doubt occurred in the London office, since they are far too gross to be imputed to the author of the book, should be corrected in another edition; and if the publishers will substitute better figures for those of the stone-chat, hedge-sparrow, dipper, Java-sparrows and some others which are barely recognisable, the work will be one of permanent use and interest, both as an illustrated manual of the families of the vertebrata and a popular introduction to general natural history.

A. R. W.

ON THE SECULAR CHANGES IN THE ELEMENTS OF THE ORBIT OF A SATELLITE REVOLVING ABOUT A PLANET DISTORTED BY TIDES[1]

THE investigation which forms the subject of this paper is entirely mathematical, and is therefore not of a kind to be easily condensed into a short account.

This paper is the fifth of a series (of which notices have from time to time appeared in NATURE) in which I have endeavoured to trace the various effects on the configuration of a planet and satellite, which must result from tidal friction—the tides in the planet being either a bodily distortion or oceanic. The investigations are, I think, not without interest as a branch of pure dynamics, but this side of the subject is too complicated to be made intelligible without mathematical notation, and it would occupy too much space to explain the methods of treatment.

There is, however, another side of the subject, which must, I think, attract notice, or at least criticism, and this is the applicability of the results of analysis to the history of the earth and of the other planets.

[1] An account of a paper by G. H. Darwin, F.R.S., read before the Royal Society, on December 18.

We know that no solids are either perfectly rigid or perfectly elastic, and that no fluids are devoid of internal friction, and therefore the tides raised in any planet, whether consisting of oceanic tides or of a bodily distortion of the planet, must be subject to friction. From this it follows that the dynamical investigation must be applicable to some extent to actual planets and satellites. For myself, I believe that it gives the clue to the history of the system, but of course an ample field for criticism is here opened.

The investigation is intended to be more especially applicable to the case of the earth and moon, and therefore, instead of planet and satellite, the expressions earth and moon are used.

The effect of tidal friction upon the eccentricity and inclination of the lunar orbit here affords the principal topic. The obliquity of the ecliptic, the diurnal rotation of the earth, and the moon's periodic time were considered in a paper read before the Royal Society on December 19, 1878, and which will appear in the *Philosophical Transactions* for 1879.

The present paper completes (as far as I now see) the main investigation for the case of the earth and moon, and therefore it is now possible to bring the various results to a focus.

It appears then that, when we trace backwards in time the changes induced in the system of the earth and moon by tidal friction, we are led to an initial state which is defined as follows:—

The earth and moon are found to be initially nearly in contact; the moon always opposite the same face of the earth, or moving very slowly relatively to the earth's surface; the whole system rotating in from two to four hours, about an axis inclined to the normal to the ecliptic at an angle of 11° 45′, or somewhat less; and the moon moving in a circular orbit, the plane of which is nearly coincident with the earth's equator.

This initial configuration suggests that the moon was produced by the rupture, in consequence of rapid rotation or other causes, of a primeval planet, whose mass was made up of the present earth and moon. The coincidence is noted in the paper, that the shortest period of revolution of a fluid mass of the same mean density as the earth, which is consistent with an ellipsoidal form of equilibrium, is two hours twenty-four minutes; and that if the moon were to revolve about the earth with this periodic time, the surfaces of the two bodies would be almost in contact with one another.

The rupture of the primeval planet into two parts is a matter of speculation, but if a planet and satellite be given in the initial configuration above described, then a system bearing a close resemblance to our own, would necessarily be evolved under the influence of tidal friction.

The theory postulates that there is not sufficient diffused matter to materially resist the motions of the moon and earth through space. Sufficient lapse of time is also required. In a previous paper I showed that the minimum time in which the system could have degraded from the initial state, just after the rupture into two bodies, down to the present state, is fifty-four million years. The time actually occupied by the changes would certainly be much longer.

It appears to me that a theory, reposing on a *vera causa*, which brings into quantitative correlation the lengths of the present day and month, the obliquity of the ecliptic and the inclination and eccentricity of the lunar orbit, must have considerable claims to acceptance.

It was stated that the periodic times of revolution and rotation of the moon and earth might be traced back to a common period of from two to four hours. In a previous paper the common period was found to be a little over five hours in length; but that result was avowedly based on a partial neglect of the sun's attraction. In this paper certain further considerations are adduced, which show that, while the general principle remains intact, yet the common period of revolution of the earth and moon must initially have been shorter than five hours to an amount which is uncertain, but is probably large. The period of from two to four hours is here assigned, because it is mechanically impossible for the moon to revolve about the earth in less than two hours, and it is uncertain how the rupture of the primeval planet took place.

But if tidal friction has been the agent by which the earth and moon have been brought into their present configuration, then similar changes must have been going on in the other bodies which make up the solar system. I will therefore make a few remarks on the other satellites and planets.

In the first place it is in strict accordance with the theory, that the moon should always present the same face towards the earth. Helmholtz, was, I believe, the first who suggested tidal friction as the cause of the reduction of the moon's axial rotation to identity with her orbital motion. It is interesting to note in this connection that the telescope seems to show that the satellites of Jupiter, and one at least of the satellites of Saturn, also have the same peculiarity.

The process by which tidal friction brings about the changes in the configuration of a planet and satellite is a destruction of energy (or rather its partial conversion into heat within the planet, and partial redistribution), and a transference of angular momentum from that of planetary rotation to that of orbital revolution of the two bodies about their common centre of inertia.

Now a large planet has both more energy of rotation and more angular momentum; hence it is to be expected that large planets should proceed in their changes more slowly than small ones.

Mars is the smallest of the planets, which are attended by satellites, and it is here alone that we find a satellite revolving faster than the planet rotates. This will also be the ultimate fate of our moon, because after the joint lunar and solar tidal friction has reduced the earth's rotation to an identity with the moon's orbital motion, the solar tidal friction will continue to reduce it still further, so that the earth will rotate faster than the moon revolves.

Before, however, this can take place with us, the moon must recede to an enormous distance from the earth, and the earth must rotate in forty or fifty days instead of in twenty-four hours. But the satellites of Mars are so small, that they would only recede a very short way from the planet, before the solar tidal friction reduced the planet's rotation below the satellite's revolution. The rapid revolution of the inner satellite of Mars may then, in a sense, be considered as a memorial of the primitive rotation of the planet round its axis.

The planets Jupiter and Saturn are very much larger than the earth, and here we find the planets rotating with great speed, and the satellites revolving with short periodic times. The inclinations of the orbits of Jupiter's satellites to their "proper planes" are very interesting from the point of view of the present theory.

The Saturnian system is much more complex than that of Jupiter, and it seems partially in an early stage of development and partially far advanced.

The details of the motions of the satellites are scarcely well enough known to afford strong arguments either for or against the theory.

I have not as yet investigated the case of a planet or star attended by several satellites, but perhaps future investigations may throw further light both on the case of Saturn, and on the whole solar system itself.

The celebrated nebular hypothesis of Laplace and Kant supposes that a revolving nebula detached a ring, which ultimately became consolidated into a planet or satellite, and that the central portion of the nebula continued to contract, and formed the nucleus of the sun or planet.

The theory now proposed is a considerable modification of this view, for it supposes that the rupture of the central body did not take place until it was partially consolidated, and had attained nearly its present dimensions.

I do not pretend, in these remarks, to have thoroughly discussed the cases of the other planets, and have only drawn attention to a few salient features; in the paper itself the subject is considered at greater length. It will, however, I think, be admitted that the theory agrees with some remarkable facts in the solar system.

G. H. DARWIN

THE SEXUAL COLOURS OF CERTAIN BUTTERFLIES

DR. SCHULTE, of Fürstenwalde, has called my attention to the beautiful colours which appear on all four wings of a butterfly, the *Diadema bolina*, when looked at from one point of view. The two sexes of this butterfly differ widely in colour. The wings of the male, when viewed from behind, are black with six marks of pure white, and they present an elegant appearance; but when viewed in front, in which position, as Dr. Schulte remarks, the male would be seen by the female when approaching her, the white marks are surrounded by a halo of beautiful blue. Mr. Butler, also showed me in the British Museum an analogous and more striking case in the genus Apatura, in which the sexes likewise differ in colour, and in the males the most magnificent green and blue tints are visible only to a person standing in front. Again with Ornithoptera the hind wings of the male are in several species of a fine golden yellow, but only when viewed in front; this holds good with *O. magellanus* but here we have a partial exception, as was pointed out to me by Mr. Butler, for the hind wings when viewed from behind change from a golden tint into a pale iridescent blue. Whether this latter colour has any special meaning could be discovered only by some one observing the behaviour of the male in its native home. Butterflies when at rest close their wings, and their lower surfaces, which are often obscurely tinted, can then alone be seen; and this it is generally admitted, serves as a protection. But the males, when courting the females, alternately depress and raise their wings, thus displaying the brilliantly coloured upper surface; and it seems the natural inference that they act in this manner in order to charm or excite the females. In the cases above described this inference is rendered much more probable, as the full beauty of the male can be seen by the female only when he advances towards her. We are thus reminded of the elaborate and diversified manner in which the males of many birds, for instance the peacock, argus pheasant, &c., display their wonderful plumage to the greatest advantage before their unadorned friends.

The consideration of these cases leads me to add a few remarks on how far consciousness necessarily comes into play in the first acquirement of certain instincts, including sexual display; for as all the males of the same species behave in the same manner whilst courting the female, we may infer that the display is at least now instinctive. Most naturalists appear to believe that every instinct was at first consciously performed; but this seems to me an erroneous conclusion in many cases, though true in others. Birds, when variously excited, assume strange attitudes and ruffle their feathers; and if the erection of the feathers in some particular manner were advantageous to a male whilst courting the female, there does not seem to be any improbability in the offspring which inherited this action being favoured; and we know that odd tricks and new gestures performed unconsciously are often inherited by man. We may take a different case (which I believe has been already advanced by some one), that of young ground birds which squat and hide themselves when in danger immediately after emerging from the egg; and here it seems hardly possible that the habit could have been consciously acquired just after birth without any experience. But if those young birds which remained motionless when frightened, were oftener preserved from beasts of prey than those which tried to escape, the habit of squatting might have been acquired without any consciousness on the part of the young birds. This reasoning applies with special force to some young wading and water birds, the old of which do not conceal themselves when in danger. Again a hen partridge when there is danger flies a short distance from her young ones and leaves them closely squatted; she then flutters along the ground as if crippled, in the wonderful manner which is familiar to almost every one; but differently from a really wounded bird, she makes herself conspicuous. Now it is more than doubtful whether any bird ever existed with sufficient intellect to think that if she imitated the actions of an injured bird she would draw away a dog or other enemy from her young ones; for this presupposes that she had observed such actions in an injured comrade and knew that they would tempt an enemy to pursuit. Many naturalists now admit that, for instance, the hinge of a shell has been formed by the preservation and inheritance of successive useful variations, the individuals with a somewhat better constructed shell being preserved in greater numbers than those with a less well constructed one; and why should not beneficial variations in the inherited actions of a partridge be preserved in like manner, without any thought or conscious intention on her part any more than on the part of the mollusc, the hinge of whose shell has been modified and improved independently of consciousness. CHARLES DARWIN

Down, December 16, 1879

NOTES

WE are much pleased to be able to announce that the Committee of the British Association for the Exploration of Socotra have secured the services of Dr. I. B. Balfour, Professor of Botany at Glasgow, as naturalist. Besides many other qualifications for the post Dr. Balfour has recently taken part in the execution of a similar piece of work as one of the naturalists attached to the station for the observation of the Transit of Venus at Rodriguez. Dr. Balfour will leave for Aden on the 9th inst., and proceed thence to Socotra.

M. PERRIER, the head of the French Survey, has been appointed a Member of the Academy of Sciences. It may be remembered that M. Perrier is a commander on the staff, and has just accomplished one of the greatest geodetic feats on record, the connection of the South of Spain with the Algerian province of Oran. M. Perrier is a supporter of M. Roudaire's scheme, and his appointment is considered likely to accelerate the work of the survey for the great Saharan Railway.

WE are pleased to see that a movement is on foot to erect an educational natural history museum in Perth, as a memorial to the late Sir Thomas Moncrieffe, president of the Perthshire Natural History Society. From a statement sent us by Dr. Buchanan White, we notice that the organisers have a rational idea of what such an institution should be, and their scheme is a comprehensive one, having in view the education of the citizens of the ancient burgh, as well as the collection of objects of natural history connected with the county. A generous citizen of Perth, Mr. Robert Pullar, offers 500*l.* of the 2,000*l.* which it is estimated the building will cost.

M. E. LEVASSEUR, a well-known French geographer, has invented an amusing and instructive geographical game, to which he gives the name of "Tour du Monde." It is played on a large terrestrial globe divided into 232 spherical rectangles, each of which has a number, corresponding to a number on a list,

indicating gains or losses, in accordance with the nature of the rectangle to which it belongs. The game is played with eighteen flags corresponding to the principal States of the world, from China, the most populous, down to Holland, the least populous. A brass slip, from pole to pole, contains eighteen holes, into which the flags are successively placed by the players at each revolution, commencing at the south pole and moving northwards. The gains and losses correspond with the nature of the facts indicated in the space above which a flag may stand when the globe stops revolving. Thus London counts thirty, Paris twenty, and so on, according to population. A coal-mine, a Manchester cotton factory, a grain centre, all count for gains; while meeting a Zulu or a lion in Africa, a storm in Atlantic or Pacific, a crocodile in the Nile, being caught in the Polar ice, &c., count for losses. Thus it will be seen, the new game is calculated to afford considerable excitement as well as instruction.

DR. B. W. RICHARDSON has been re-elected Assessor of the University Council of St. Andrew's University. This will be Dr. Richardson's third term of office.

WE last week referred to the new appointment to the Registrar-Generalship and the resignation of Dr. Farr. The following is Dr. Farr's dignified and temperate letter to Major Graham, the retiring Registrar-General:—"December 23.—Sir,—Having now heard from you that Sir Brydges Henniker is to be the new Registrar-General, and thus having lost all chance of being your successor, I shall be glad if the Lords of Her Majesty's Treasury will allow me to resign my appointment, and will grant me superannuation allowance to the extent of my full pay. I have served under you nearly forty years, I have taken with you three censuses, and I feel confident that I can leave my case in your hands.—(Signed) William Farr." The Government has possibly a complete justification to give for the appointment of Sir Brydges Henniker; if so, they should lose no time in making it public, as their treatment of Dr. Farr has roused universal indignation.

MR. EDISON publishes through the columns of the *New York Herald*, an elaborate and detailed account of his labours with his new form of electric lighting. Minutely describing the course of his studies, Mr. Edison says that he has made the discovery that the carbon framework of a small piece of paper is the best substance for incandescent lighting. A piece of cardboard, known in the trade as "Bristol," is cut, with a suitable punch, into strips in the form of miniature horseshoes, about 2 inches long, and one-eighth wide. A number of these strips are placed in a wrought-iron mould, separated from each other by tissue paper. The mould, after being well covered, is placed in an oven, where it is gradually exposed to a temperature of about 600° F., so as to allow the volatile portions of the paper to pass away. The mould is then removed to a furnace, kept there till it retains almost a white heat, and subsequently allowed gradually to cool down. On opening the mould, the charred remains of the cardboard must be taken out with great care, in order to prevent them from falling to pieces. They are placed in a small globe and attached to the wires connecting the generating machine. The next thing is to extract the air, by means of the pump, from the globe; that being accomplished, the globe is sealed, and the lamp is ready for use. It should be observed that the new lamp requires no complex regulating apparatus, such as characterised the earlier efforts. In fact, Mr. Edison finds that all previous labour in regard to regulators was practically wasted, and furthermore, that electricity can be regulated with absolute reliability in a manner precisely similar to that in which the pressure of gas is now produced. The system now adopted by Mr. Edison in connecting the wires admits of a given number of lights being extinguished without affecting those of other burners. In the same way as we would shut a certain number of gas burners and permit others to draw a supply from the meter, the electric light can be obtained or shut out. From the description now given it appears that the apparatus primarily used by Mr. Edison was in the shape of a large tuning-fork, constructed in a manner that both ends would vibrate when placed near the poles of the great magnet. Experience has demonstrated the impracticability of that apparatus, and it became necessary to search for other means. One experiment was made after another, which had the tendency to lead gradually to the adoption of the system now employed in the generating machine, and which Mr. Edison terms the Faradaic machine. It is briefly described thus:—Two upright iron columns 3 feet in height, and 8 inches in diameter, covered with coarse wire and resting upon a base, form the magnetic poles. Fixed on an angle, so as to admit a free revolution between the poles, is a cylindrical armature of wood, wound parallel to its axes with fine iron wire. This cylinder is made to revolve rapidly between the magnetic poles, and by means of a belt, driven by an engine, strong currents of electricity are generated in the wire surrounding the armature, and these currents are carried along the wires to the electric lamp.

A CHANGE has taken place in the French Ministry, and M. Freycinet, the Minister of Public Works, has been created Prime Minister by the President of the Republic. M. Varroy and General Farre, two pupils of the Polytechnic School, have been appointed to the Department of Public Works and War Office. It is known that M. Freycinet was educated in the same institution, which has never, since it was created in 1798, given at once so many Ministers to France.

IN the Annual Report of the Royal Botanical Garden at Calcutta for the year 1878–79, Dr. King confirms the opinion he has expressed in former reports regarding the unsuitability of the Para rubber plants for acclimatisation in some parts of India. He acknowledges that plants may be coaxed into growing in conservatories, but considers the species far too thoroughly tropical to withstand without protection the vicissitudes of the climate of Northern India. He says, "I believe it is useless to try it anywhere in India except in the south of Burmah or the Andamans, or perhaps in Malabar. Contrary to the experience with Para rubber, the Ceara Kina (*Manihot glaziovii*) promises well, and if the quality of rubber yielded by it in India proves to be good, its introduction will no doubt turn out of much importance. Seeds of a species of *Landolphia* yielding African rubber have been received at Calcutta from Zanzibar. Dr. King reports upon them as not looking very promising, but thought possibly some of them might grow. Seeds of the mahogany tree have been received at Calcutta in large quantities, and a large number of seedlings have been distributed. The cultivation of this valuable timber tree has been taken up by the Forest Department in the Government Plantation near Chittagong. Large quantities, also, of the seed and seedlings of the *Pithecolobium saman*, or rain-tree, have been distributed; and as the plant grows rapidly and seems to flower and seed freely, it may prove a valuable introduction to India.

THE annual prize of 25,000 francs (1,000*l.*), given by the King of the Belgians for works of a scientific character, is now offered for the year 1881. It will be awarded to the author of the best work on the means of improving sea-ports situated upon low and sandy coasts, such as the Belgian ports. Foreigners as well as Belgian subjects may compete, as the competition is an international one. The works must be sent to the "Ministère de l'Intérieur," at Brussels, before January 1 next. The prize will be awarded by a jury composed of four foreigners and three Belgians, all of whom are nominated by his Majesty.

A PRIZE is offered by the Governor of the Prussian province of Saxony for the best text-book of natural science and agricul-

ture. The exact title is as follows: "Lehrbuch der Naturwissenschaften und der Landwirthschaft zum Gebrauch beim Unterricht in den Ackerbauschulen und landwirthschaftlichen Winterschulen in Sachsen." The competing works must be sent to Dr. Julius Kühne, Professor at the University of Halle. The extent of the book is to be moderate, and should not exceed thirty sheets.

ON December 10, 1878, the first cremation was executed at Gotha. We announced the fact at the time. News from that town now states that during 1879 fifteen other cremations were performed. This is looked upon as an extremely satisfactory result for the first year in which the process may be chosen by and for anybody. The time for the complete incineration of the bodies was between one and a half and two and a half hours, therefore about two hours on the average. Besides Gotha, other German towns furnished subjects for cremation, such as Langensalza, Naumburg, Neustadt on the Orla, Leipzig, Dresden, Bamberg, Hanover, Breslau, and Vienna.

ONE of the *desiderata* of M. Leverrier has been fulfilled. A lectureship of astronomy has been created in Marseilles, and M. Stephan, Director of the Observatory, appointed as lecturer.

M. C. DETAILLE, of Paris, is organising in France, at the request of Lord Lindsay, a system of astronomical exchanges similar to that suggested in these columns by his lordship for England.

THE thaw set in in Paris about 4 P.M. on December 28, just when the partial eclipse of the moon was beginning. The temperature has been increasing almost without interruption. 14° Cent. in the sun has been reached, and 9° Cent. in the shade. The breaking up of the ice in the Seine took place on the 2nd, and was so sudden that it took the engineers by surprise. An immense number of boats have been wrecked, and have created obstacles to the flow of water and ice under the arches of the bridges. The consequence has been the total wreck of the wooden foot-bridge of the Invalides and the destruction of two arches of the stone bridge now building at a distance of a few paces down the river. So serious were the fears entertained by the authorities for the safety of the iron bridges that the traffic was prohibited during the whole of Saturday. The news from the mountainous parts of the Seine basin announce that an immense quantity of water is travelling towards the sea.

WHILE Paris and the whole of France have been recently covered with snow, in a period of exceptional cold, the weather has been comparatively very clement on the summit of the Pic-du-Midi and the snow rare. General Nansouty telegraphed privately as follows to M. Tissandier on December 24:—"We are in distress; we shall presently be unable to find enough snow to make water for the tea and the soup. Send us some snow if Paris has enough."

SINCE December 13 the temperature of Algiers has been that of spring, the temperature in the shade varying from 6° to 17°, and in the sun of 32° Centigrade; almost no cloud in the sky, and a magnificent sun shining all the day long.

M. W. DE FONVIELLE has just published a novel under the title of "Neridah" (Hachette and Co.), in which, with considerable ingenuity, he brings the tricks of spiritualistic mediums and the facts of electrical science to bear upon the development of the plot. The scene of the story is in England and India.

PROF. SCHÄFER will, on Tuesday next, January 13, begin a course of ten lectures on the Physiology of Muscle at the Royal Institution; and Mr. H. H. Statham will, on Thursday next, January 15, give the first of two lectures on Modern Architecture since the Renaissance; at the first Friday evening meeting of the season, January 16, Prof. Dewar will describe his "Investigations at High Temperatures." On Saturday, the 17th, Prof. T. Rupert Jones will give the first of three lectures on Coal.

THE officers and engineers appointed to proceed to Algeria for the survey of the Transaharan railway, are leaving Paris by batches. They take with them a number of aneroid barometers specially constructed, which will be verified frequently by boiling water with a hypsometer of verysimple construction.

THE earthquake in Switzerland on December 30, 1879, is exciting great interest in scientific circles, and arrangements are being made for accurately measuring the duration of future shocks. The occurrence of a shock at the beginning of the late phenomenal frost and of another at its close is too remarkable to escape notice. The oscillation of Tuesday, though felt at places so far asunder as Chambery and Berne, seems to have been most marked at Geneva, Lausanne, and in the mountains of Bex. At Grion, in Vaud, 3,500 feet above the sea-level, the oscillation lasted five seconds, and was accompanied by a rumbling sound as of subterranean thunder.

THE subject of the Wyatt-Edgell Prize Essay of the Sanitary Institute is "The *Range* of Hereditary Tendencies in Health and Disease," not the *Cause*.

THE programme for the meetings after Christmas of the Society of Arts has just been issued. Among papers to be read at the ordinary meetings between Christmas and Easter are:—January 21, "Domestic Poisons," by Henry Carr; January 28, "The Future of Epping Forest," by William Paul, F.L.S.; February 4, "Trade and Commerce with Siberia, *viâ* the Kara Sea," by Henry Seebohm; February 11, "The History of the Art of Bookbinding," by Henry B. Wheatley, F.S.A.; February 18, "The Euphrates Valley Railway," by W. P. Andrew; February 25, "The Art of the Silversmith," by W. Herbert Singer; March 3, "The History of Musical Pitch," by Alexander J. Ellis, F.R.S.; March 10, "Recent Advances in the Production of Lambeth Art Pottery," by John Sparkes; March 17, "Buildings for Secondary Educational Purposes," by E. C. Robins, F.S.A. In the Indian Section, Prof. Vambéry, the great Eastern traveller, has undertaken to read a paper on "Russia's Influence over the Inhabitants of Central Asia during the last Ten Years," and he has promised to come over from Buda-Pesth expressly for the purpose. The other papers to be read in this section, for which dates are fixed, are:—January 30, "Herat," by Col. G. B. Malleson. C.S.I.; April 2, "The Best Route for a Line of Railway to India," by Mr. B. Haughton, C.E.; May 7, "Agriculture in India," by Mr. Robertson, Superintendent of the Government Farm, Madras. In the Chemical Sections, Prof. Perry will read a paper on "The Teaching of Physics," on January 22. On February 12 there will be a paper on "Gas Furnaces and Kilns for Burning Pottery," by Herbert Guthrie, C.E. The course of Cantor Lectures during this part of the year will be on the "Manufacture of India-rubber and Gutta-percha," by Thomas Bolas, F.C.S. It will consist of six lectures, the first of which will be given on February 2.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. L. C. Piggott; a Common Ocelot (*Felis pardalis*), a Harpy Eagle (*Thrasäetus harpygia*) from Central America, a Black-tailed Parrakeet (*Polytelis melanurus*) from Australia, purchased; a Tamandua Ant-eater (*Tamandua tetradactyla*), two Naked-throated Bell Birds (*Chasmorhynchus nudicollis*) from Brazil, a Tuberculated Iguana (*Iguana tuberculata*) from South America, two Giant Toads (*Bufo agua*) from Savanilla, deposited.

OUR ASTRONOMICAL COLUMN

MINOR PLANETS.—The number of discoveries in the group of minor planets during the year 1879 is *twenty*, against *twelve* in the preceding year, so that there is no present indication that we are getting to the end of them. Elements more or less approximate have been calculated for seventeen out of the twenty new ones, but no one of the orbits has any peculiarity. We subjoin their ordinal numbers, names so far as published, discoverers and dates of discovery, with their magnitudes at the time.

192	Nausikaa	...	Palisa	...	Feb.	17	...	11
193	Ambrosia	...	Coggia	...	Feb.	28	...	12
194	Procne ...	...	Peters	...	March	22	...	10·5
195	Euryclea	...	Palisa	...	April	28	...	12
196	Philomela	...	Peters	...	May	17	...	10
197	Arete ...	...	Palisa	...	May	21	...	12
198	Ampella	...	Borrelly	...	June	13	...	11
199	Byblis ...	...	Peters	...	July	9	...	11
200	Dynamene	...	Peters	...	July	27	...	11
201	Penelope	...	Palisa	...	Aug.	7	...	10·5
202	Chryseis	...	Peters	...	Sept.	23	...	11
203	Pompeia	...	Peters	...	Sept.	27	...	11
204	Callisto ...	...	Palisa	...	Oct.	8	...	12
205	... ...	...	Palisa	...	Oct.	13	...	12
206	Hersilia ...	...	Peters	...	Oct.	15	...	11
207	... ...	...	Palisa	...	Oct.	17	...	12
208	... ...	...	Palisa	...	Oct.	21	...	13
209	Dido ...	...	Peters	...	Oct.	22	...	11
210	... ...	...	Palisa	...	Nov.	12	...	11
211	... ...	...	Palisa	...	Dec.	10	...	10·5

The elements will be found in Nos. 109-127 of the *Circular zum Berliner Astronomisches Jahrbuch*.

THE MELBOURNE OBSERVATORY.—The fourteenth Report of the Board of Visitors to the Observatory, presented to the Governor of Victoria, with the Report of the Government astronomer for the year ending June 30, 1879, has been received. The great reflector is stated to be in capital working order, but unexpected difficulties have been met with in placing the results of work with it before the astronomical public, this work consisting mainly of drawings of nebulæ in Sir John Herschel's catalogue. Fifty-four of the smaller nebulæ and clusters contained in it have been observed and compared, and the great majority found to agree well with the Cape descriptions. "Some, however, have considerably changed, whilst others are completely altered in appearance." Five nebulæ described by Herschel have not been found after careful search. The drawing of the great nebula around η Argus made in March, 1875, still accurately represents its appearance. Observations of the trifid nebula No. 4355 were made on ten nights for comparison of those by Holden and Trouvelot with the Washington refractor. Stress is laid upon the need of a transit-circle of increased capacity, and it is understood that the Government propose a vote for this purpose.

THE BIELA COMET METEORS.—Contrary to what had been anticipated by more than one astronomer who has given special attention to the subject, from present information it would appear that the earth passed the descending node of Biela's comet at the end of November last, without encountering any portion of the meteoric swarm, which, in November, 1872, was moving in its orbit. The earth would reach the node on the morning of November 28, or perhaps earlier; the comet attains its least distance from our track thirty-two hours after its nodal passage, or, with Michez's orbit of 1866, in about heliocentric longitude, 67° 19′.

URANOMETRIA ARGENTINA.—Within the last week we have received this very important work from the Director of the Cordoba Observatory, Dr. B. A. Gould. Some account of it was lately given in this column from an article in the Buenos Ayres *Standard*, but we shall revert to it at an early date. Its publication will form an epoch in southern sidereal astronomy.

THE CLOSE BINARY 85 PEGASI.—We learn from Mr. Burnham that his recent measures fully establish the physical connection of the close components of this star. A mean of five nights' measures gives:

1879·46 ... Position 284°·6 ... Distance 0″·75.

The earlier mean result being:

1878·7 ... Position 274°·0 ... Distance 0″·67.

For the stars A and C Mr. Burnham finds:

1879·9 ... Position 28°·7 ... Distance 15″·40.

BIOLOGICAL NOTES

A BLIND ISOPOD.—For some years past, Prof. Forel, of the Academy of Lausaune, has been engaged in investigating the animal forms to be met with in the great depths of the Lake Leman. These researches have been published from time to time since 1869 in the *Journal* of the Vaudois Society of Natural History, and the series is apparently brought to a close in the recently published number of the journal in which he sums up the general results, and enumerates no less than seventy-six species of animals described as discovered in the Lake at depths of from 100 to 300 metres. Among these is one new blind form, closely related to our own very common fresh-water Isopod called *Asellus aquaticus*. When drawn up from the water it is found constantly associated with *Niphargus puteanus*. It is of a whitish colour, through which the brownish-coloured alimentary canal is easily perceptible. When placed in an aquarium it lives but a short time. The organs of vision are only rudimentary. The species comes near to *A. cavaticus*, and has been named by H. Blanc *A. forellii*.

NOTES ON CRUSTACEA.—Dr. P. P. C. Hoek of Leiden has published some very interesting results of his investigations among the smaller crustacean forms made at the Netherlands Zoological Station. One series of notes are devoted to the anatomy and systematic descriptions of the species of Caprellidæ met with, viz., *Podalirius typicus*, Kröyer, *Caprella linearis*, Lin., and *Leptomera pedata*, Abilgaard. Another series treats of several species of Corophidæ. Those met with were: *Corophium crassicorne* (Hoek confirms Norman's statement that the *C. Bonellii* of Bate and Westwood is the female of this species); *C. longicorne*, *Cerapus difformis*, *Podocerus falcatus*, *Orthopalame Terschellingi*, nov. gen., nov. sp. (this new genus belongs to the sub-family Podocerinæ), and *Amphitoe littorina*. A third series is devoted to an account of *Orchestia cavimana*, Heller, found by Dr. Noman at Zalt-Bommel, a town in the province of Gelderland. It is more than 80 kilometres from the sea; the water is not brackish, but the amphipods were not even found in the neighbourhood of a stream, but in a walled-in garden some slight distance therefrom, in a corner of which, under some flower-pots, and while in search for onisci, the species was taken. It would appear to be the same as the one described by Heller as found on Olympus by Dr. Kotschy, at a height of some 4,000 feet, in moist spots in the neighbourhood of a spring. Mr. Noman found the species in the same locality again in August last (1879). The distribution of some of the other species of *Orchestia* is also referred to. Series four treats of some insufficiently-known Gammaridæ, such as *Atylus swammerdammi*, *Calliopius lævisculus*, *Melita obtusata*, *Cheirocratus brevicornis*, n. sp., *Ampelisca æquicornis*. Series five gives some short anatomical remarks on Gammaridæ. These researches are illustrated by six plates, and form portion of the *Reports* of the Netherlands Zoological Station.

PTYALINE AND DIASTASE.—Physiologists have differed in opinion as to the action of the gastric juice on ptyaline and on diastase. While some hold that the saliva is destroyed in the gastric juice, others maintain that it continues, in the stomach, its action on starch. Recent researches by M. Defresne (*Comptes rendus*) appear to throw light on the subject; they prove, on the one hand, that the saliva is paralysed in pure gastric juice, whereas with mixed gastric juice, containing only organic acids, saccharification proceeds as well as in the mouth. Ptyaline, then, like pancreatine, is an excellent reagent for demonstrating the difference between mixed and pure gastric juice. The latter, as M. Defresne has proved, owes its acidity to hydrochloric acid, combined doubtless with leucine; the former to organic acids, probably combined also with azotised matters. Ptyaline and diastase, therefore, are not two identical substances, from a physiological point of view. Ptyaline saccharifies the starch in mixed gastric juice, as well as in the mouth; it is only paralysed an instant in pure gastric juice, and then recovers its action in the mixed gastric juice and in the duodenum. Diastase or maltine is irrecoverably destroyed in hydrochloric solutions or in pure gastric juice, and after having passed into the mixed juice it is profoundly altered; for, if it still dissolves starch, it no longer saccharifies it.

EXISTENCE OF THE CHAMOIS IN THE ABRUZZI.—A recent communication of Mr. C. J. Forsyth-Major to the *Bulletin* of the Club Alpino Italiano, records the occurrence of the Chamois (*Rupicapra tragus*) on the Gran Sasso d'Italia in the Northern

Abruzzi. Mr. Forsyth-Major made an expedition into this district with the object of identifying the so-called "Chamozzo" of the inhabitants, and ascertained that this animal, now nearly extinct, was either the chamois of the Alps or a closely allied form. At Isola del Gran Sasso he was shown the horns and skin of an example shot in 1878. The present existence of the chamois so far south in Italy, although mentioned in several works, has not been previously authenticated.

MOVEMENT IN THE LEAVES OF CONIFERS.—Dr. Maxwell Masters (Linnean Society, December 4) has called attention to the contrasts to be drawn between the leaves of the spruce firs (*Picea*) and those of the silver firs (*Abies*) as regards their arrangement, relative position, form, relative size, and internal structure, as described by Bertrand, MacNab, Chatin, and others. The leaves of the silver firs are endowed with a power of motion in virtue of which they are raised or depressed. On the other hand, the leaves of the spruces are comparatively motionless. In those cases where the leaves have the power of movement there is usually a well-marked layer of "palisade cells" which are absent in the motionless leaves. This circumstance has led Dr. Masters to correlate the differences before alluded to with varying degrees of functional activity, and with the adaptations manifested to secure as far as possible to each leaf an equally favourable amount of exposure to light, &c. The very remarkable movements of revolving nutation observable in the "leader shoots" of many conifers during their season of active growth were mentioned as having been investigated by him and the rotation duly registered on a disk.

GEOLOGICAL NOTES

CRUSTACEA IN THE OLD RED SANDSTONE.—The occurrence of eurypterid crustaceans of the genus *Pterygotus* in the Tilestones of Herefordshire and Worcestershire, and in the Old Red Sandstone of Forfarshire, has long been well known. These organisms have been regarded as characteristic of that section of geological time in the British area represented by the Ludlow and Lower Old Red Sandstone formations. Murchison used their presence in the Arbroath flagstones as an argument for placing these strata in his "Lower" division of the Old Red Sandstone, while on the other hand he argued from their absence in the Caithness flagstones and from the dissimilarity of the fishes, that these northern deposits must be of later age. He therefore classed the great flagstone series of Caithness and the Orkney Islands as "Middle" Old Red Sandstone, thus bringing this series of formations into correspondence with his favourite threefold classification of the Devonian system. Recently, however, in the first part of his memoir "On the Old Red Sandstone of Western Europe," published in the *Transactions of the Royal Society of Edinburgh*, Prof. Geikie has pointed out that the contrast between the fish fauna of the Arbroath flagstones, or the ancient basin which he terms "Lake Caledonia" and that of the northern basin or "Lake Orcadie," is by no means so marked as Murchison believed, and that the characteristic *Pterygotus*, on which the author of "Siluria" laid so much stress as an Upper Silurian and Lower Old Red Sandstone type, occurs on several horizons and at different localities in the Caithness and Orkney basin. An important discovery confirmatory of the extension of these crustacea into the northern area has recently been made by Mr. James Linn in the course of the Geological Survey of Elginshire, now in progress. From the valley of the Spey he has obtained numerous fragments of what must have been a remarkably large *Pterygotus*, though the specimens so far found hardly admit of specific identification with the *P. anglicus* of Forfarshire. *Pterygotus* has thus been discovered in Orkney, Caithness, and on the Moray Firth, not only over an extensive geographical area, but throughout a wide vertical range of strata. These crustaceans must evidently have had a considerable and prolonged development in the waters of the northern basin of the Lower Old Red Sandstone period.

SALSES OF MOUNT ETNA.—As the result of his recent observations among the mud volcanoes of Paternò on Etna, Dr. A. von Lasaulx gives the following conclusions:—1. The Salses arise from the association of gaseous volcanic emanations with spring-water traversing easily soluble strata in which common salt, gypsum, lime, and other salts occur. 2. The carburetted hydrogen escaping in connection with the salses is produced by the same volcanic emanations with the co-operation of these strata. 3. The so-called eruptions of the mud-volcanoes are merely the squeezing out under pressure of the dissolved and loosened parts of strata, that are disturbed and dislocated by underground movements.

NEW JURASSIC REPTILES.—Prof. Marsh announces in the *American Journal of Science* the arrival at Yale of numerous remains of reptiles from the Jurassic deposits of the Rocky Mountains. He finds that they belong to several distinct groups and throw considerable light on forms already described from the same horizon. Among them he briefly describes a new genus under the name of *Camptonotus*, most nearly allied to *Laosaurus*, and forming with it a distinct family, the *Laosauridæ*. The name of the genus is taken from the fact that, as in *Laosaurus*, the sacral vertebræ are not co-ossified, while some of the other vertebræ even in the same specimen have their neural arches so completely united to the centra that the suture is nearly or quite obliterated. The known remains of *C. dispar* indicate, according to Prof. Marsh, a herbivorous animal about eight or ten feet high. Another species, about three times as large, is named *C. amplus*. One of the largest reptiles yet known (*Brontosaurus*) has recently been brought to light from the same region. It probably belongs to the *Sauropoda*, but has a sacrum composed of five thoroughly co-ossified vertebræ. Fresh specimens have been obtained throwing much new light on the structure of *Stegosaurus*. This dinosaur was covered with huge dermal plates, some of which ranged from two to three feet in diameter. The remains of a much smaller reptile, about the size of a wolf, apparently also a Dinosaur, and probably carnivorous, are included in a new genus, *Cœlurus*.

GEOGRAPHICAL NOTES

NEWS has been received of Herr Carl Boch, on his return to the coast after his travels in the centre of Borneo. He has been up the Klintjouw River as far as Longwai, and thirty miles beyond where no European has yet penetrated. There is, however, but little to see, and the dead silence of an almost uninhabited forest prevails beyond Longwai. The birds of this district, with five or six exceptions, are the same as those found in the highlands of Sumatra. Herr Boch has made some very interesting observations on the inhabitants of those districts, of which he is preparing an account. The Dyaks of the interior are far more wild and savage than those of the coast, and are not, as a rule, partial to seeing strangers, but appear to offer them no harm in times of peace. They are, however, veritable "head hunters," and talk about it in a very free and easy manner. The Rajah, with whom Herr Boch had dealings, had a collection of six, taken from Dyaks of another tribe, not in open fight, but by treachery when they were asleep. A more interesting race, also head hunters, however, and still further removed from civilisation, are the Orang Poonan, or forest people. With these strange border-beings, who construct no houses, but live in the open forest, Herr Boch seems to have made himself quite friends, and regards them as good and honest people—always excepting the little eccentricity in the matter of heads. They are not dark, but fair, and of a yellowish complexion, and as they have allowed Herr Boch to take sketches of both sexes, these will doubtless afford much further interesting information. He proposes now to cross the island from east to west, coming out at Band-jermassing.

A CORRESPONDENT supplies us with the following translation of a letter from Dr. Gerhard Rohlfs, concerning his recent journey in Africa, which may interest our readers. The letter addressed to a German friend, is dated Benghasi, November 10: "When you receive these lines I shall no doubt be in Italy, and, therefore, back in Europe. Your last letter of July 9 I received at Kufra, when I was free again, and already on my return journey. . . . I hope that Stecker, my young companion, will again take up the expedition. The Sueya have partly returned our property, part they are still going to return, and part the Turkish Government will compensate us. If Stecker proceeds by way of Sella and Mursuk, he will probably not encounter too many difficulties. I may communicate to you the statistical fact that the distance between Battifal and Taiserbo is about 400 kilometres. We travelled over this distance in exactly 100 *consecutive* hours, certainly a great feat. Thus we cleared more than 90 kilometres per day. It must be remembered that this was done on foot and on camels, then it will be appreciated. We hardly slept at all, only in the evenings and mornings we

rested for awhile. But then who would have thought that Kufra lies 1½° more to the south than is indicated on the maps? that Kufra is the largest oasis but one of the Sahara? that of all oases Kufra contains the largest *uninterrupted* areas of arable land. Are there *uninterrupted* areas at Fesan extending over 200 kilometres? Or at Tuat, or at Tafilet? No! And everywhere the finest water. There may be about 1,000,000 palm trees in the oasis, and if Kufra is otherwise poor as regards variety of species of plants, it is all the richer in numbers of plants of one and the same species. I have not reached Wadai on my tour. Thus I have not even been able to reach the basis upon which my operations were really to begin. But it is not my fault. I have the consciousness of having fully done my duty."

THE King of Sweden has expressed his wish that after the *Vega* has reached Naples Prof. Nordenskjöld and Lieut. Palander should, on their trip overland, visit several geographical societies on the continent. At Copenhagen they are to rejoin their ship, and with it proceed to Stockholm.

AT the last meeting of the Halle Geographical Society, the President, Dr. Kirchhoff, announced the formation of a geographical union amongst the students at that University, this being the first union of the kind. It is hoped that the students at other universities will imitate this commendable example. Later on at the same meeting Dr. Lilienfeld read a highly interesting paper on the South African diamond fields which he visited last year.

DR. OSCAR LENZ writes from Tetuan, under date of November 27, as follows:—"I arrived at Tangiers in excellent health. After having made excursions from this place in all directions, I travelled to Tetuan, which is highly interesting and situated most beautifully, and which was particularly attractive to me in a geological sense. For several days past I have been trying to start in a southerly direction for the Shishuaun district, which has never before been visited by a Christian, but I have not yet obtained permission from the Caliph; it is stated that the inhabitants are in open revolt against the Sultan, also that the Kabyl tribes are extremely fanatical and will not tolerate any Christians in their country. Between December 4 and 8 I expect again to be at Tangiers, from which place I shall send a detailed report of my interesting journey to the African Society. Then I shall prepare for a prolonged sojourn in the interior. About New Year's Day I hope to be at Fez."

THE January number of *Petermann's Mittheilungen* contains a detailed account, by Prof. Veth, of the Dutch expedition to Sumatra. He gives a statement of the literature relating to Sumatra previous to the expedition, a sketch of its programme, the results of Schouw Santvoort's expedition, and those of his own and Hassel's journeys in Rawas, Lebong, and Lemun, concluding with a sketch of the important Balang Hari river. A fine large map of part of Sumatra accompanies the paper. This is followed by a paper on the Sanpu river of Tibet, with a map from English sources. There is also a narrative of the recent voyage of the Dutch vessel, *Willem Barents* to the Barents Sea, also with a map, which is followed by one of Dr. Emin Bey's valuable narratives, describing his journeys between the Victoria and Albert Nyanza in 1878. We are glad to see from the monthly summary that the publication of the narrative of Baron von Der Decken's travels in East Africa, 1859-65, has at last been concluded.

A GRANT of 4,000*l.* has been made by the Minister of Public Instruction at Paris, to the French Committee of the International African Association, in order to enable them to establish two stations similar to those which the Belgian expeditions are about to found in Eastern Africa. One of these will be placed in the Ogowé region, and will probably be under the command of M. Savorgnan de Brazza, already well known for his explorations in that quarter. It is expected that the other station will be established in Usagara, on the eastern side of the continent. It had previously been proposed that M. de Brazza should lead an expedition from the Gaboon towards Lake Chad, and it is not impossible that there may be some further modification of the present projects.

IN the letters which, after long delays, have at length reached the London Missionary Society from Ujiji, Mr. Hore gives some account of his explorations on Lake Tanganyika and its adjacent rivers. In March apparently he explored the coasts of Ujiji, Ukaranga, and Ukawendi, and the Malagarasi and Kibwe rivers. At the end of April he started on another voyage, during which he visited Uguhha and explored the mouth of the Lukuga River; this he declares is the veritable outlet of the lake. Mr. Hore descended the river in a canoe as far as where the Mitwanse—now swept away—used to be, and landed at Stanley's farthest. He then walked for six hours, and mounted the Kijanka ridge, which is farther down the river than Stanley places it. He slept there, getting the latitude by stars and good bearings; and from above where he landed he had a glorious bird's-eye view of the river far into Urua. He states that the so-called Lukuga Creek is a wide and very swift river. With regard to Uguhha, Mr. Hore says that, by general consent, it is the gateway from Lake Tanganyika to the west.

THE new number of the Geographical Society's periodical contains only one paper, Capt. A. H. Markham's account of his Arctic cruise of 1879, in the Barents Sea; it has been rendered inordinately long by the introduction of many pages of irrelevant matter. It has, however, a redeeming feature, in that it is illustrated by two useful maps.

THE new *Bulletin* of the Belgian Geographical Society furnishes some interesting information in its "Chronique Géographique," more particularly in regard to the various expeditions of the International African Association, from which we gather that another expedition will before long leave Zanzibar for the interior. It is especially worthy of note, however, that no information is allowed to leak out respecting Mr. H. M. Stanley's proceedings on the Lower Congo, on which subject and his plans the Central Committee maintains a discreet silence.

WE have received Parts 9, 10, and 11 of the new edition of Stieler's Hand Atlas.

PHYSICAL NOTES

WE learn that Mr. Edison is attempting to construct a portable electric lamp which shall, including the constant battery employed to generate the current, be no larger than an ordinary moderator lamp.

THE *Scientific American* states that the story of Edison's telephone having been used over 2,000 miles of line is incorrect; the messages were transmitted over the greater part of the line by telegraph, and only over the last few miles in Pennsylvania by telephone.

A MEASURING polariscope, specially adapted for examining the angles between the optic axes of crystals upon the plan suggested a few months ago by Prof. W. G. Adams, has been constructed by Herr E. Schneider, and is described in Carl's *Repertorium*.

THE study of the spirit level has been continued by M. Plantamour. He has shown that the bubble of very accurately adjusted levels is continually moving; indicating a continual gently rising and falling of the earth's crust.

A SINGULAR phenomenon of atmospheric electricity during a snow storm was observed at Cherbourg on November 20, by M. Delamare. At about half-past five in the evening the snow-flakes fell so quickly that it was perfectly dark. M. Delamare, walking along under the shelter of his umbrella, heard a faint buzzing sound as of insects flying around, and at the same moment observed a pale luminous "brush" proceeding from the extremity of each of the ribs of his umbrella. On extending his finger towards one rib the brush-discharges ceased, and he received a continuous stream of faint sparks. It would be interesting to learn whether the handle of the umbrella was of ivory or any material of specially good insulating properties.

M. GUÉBHARD has recently shown an elegant method of procuring iridescent rings in a permanent form. These rings, which are, like Newton's rings, due to interference giving rise to the "colours of thin plates," differ however from Newton's rings in reversing the order of the colours, that corresponding to greatest thickness being at the centre. M. Guébhard drops a little collodion on to the surface of mercury. It is drawn out on all sides into a thin film of iridescent hue, which when hard may be floated off on to paper. Ten years ago the writer of this note similarly fixed on paper iridescent films obtained by dropping mastic varnish on to the surface of water. M. Guébhard produces similar rings, though of no permanency, with drops of volatile mineral oil on the surface of mercury, or even by the film of moisture condensed from the breath. At the meeting of the *Société de Physique* of Paris, on December 5, these experiments were shown by pro-

jection upon the screen; and M. Guébhard awakened a lively interest when he proceeded to show that such films, especially the fleeting films condensed from the breath, may exhibit phoneidoscopic properties. The various vowels being pronounced so that the breath impinges on the surface of the cooled mercury, rings are obtained having certain forms more or less strongly characteristic of their different qualities of tone.

THE influence of temperature on tuning-forks (which are now such valuable aids to research), has been lately investigated by Herr Kayser (*Ann. de Phys.* No. 11), and by the method of observing the alteration of the difference of phase of two forks with the temperature. The forks were furnished with mirrors and the Lissajous figures observed with a telescope. These results were arrived at: 1. The vibration number of a tuning-fork is, between 0° and 30°, a linear function of the temperature. 2. The influence of temperature is greater, the higher the tone of the fork, and with similarly arranged forks, the variation of the vibration number is about proportional to the square root of that number. 3. With moderate variations of temperature, such as occur in a room, the temperature affects the vibration number in the second place of decimals. 4. The co-efficient of elasticity of steel increases between 0° and 30° with the temperature.

OBACH proved, a few years since, that alloys of the metals proper, such as lead and tin, potassium and sodium, and sodium amalgam, conduct a current, without being decomposed. Herr Elsässer has recently (*Ann. der Phys.* No. 11) experimented with combinations of metals with the half-metallic elements antimony and bismuth, passing a current through the fused alloy in a glass tube with electrodes of gas carbon. There was here also no decomposition. The author notes that the transition from these compound conductors of the first class to the electrolytes, is no sudden one. Between the two groups are substances, which at a low temperature conduct without decomposition, but at a high one, and even partly before they melt, are electrolysed, *e.g.* copper and silver sulphides, and the sulphides of lead, nickel, iron, bismuth, tin, and antimony. To this middle class, also, may be added a number of compounds, which have not hitherto been electrolysed, probably because they are so difficult to fuse (such as the oxides of tin, iron, and chromium); the electrolytes proper do not conduct without being electroiysed; and to this class belong especially the haloid compounds of the metals, which are not decomposed in the solid state because they are insulators; whenever they begin to conduct, being fused, they are decomposed. Lastly there is a fourth class of compounds, which in general do not conduct, either with or without decomposition.

AN experimental determination of the indices of refraction of some liquefied gases has been lately made by Herr Bleekrode (*Ann. der Phys.* No. 11). He used the method of Faraday's tubes, but observed the liquefied gas with a microscope in a small vessel with plane parallel sides having mirror plates. Only cyanogen, carbonic acid, and ammonia, were thus successfully examined, and the average numbers obtained for these were, severally 1·320, 1·163, and 1·314. The method is also useful for compounds which are liquid at ordinary temperature, but difficult to examine on account of their inflammability. Thus, the author applied it to zinc-ethyl, obtaining the number 1·489. *A propos* of the index of carbonic acid, Herr Bleekrode has some interesting remarks on liquid inclosures in certain minerals. In another paper he hopes shortly to give the indices of most of the other liquefied gases, his experiments on which were, in part, accomplished with Cailletet's compression apparatus.

THE somewhat doubtful name *Audiphone* has been given by Mr. Rhodes of Chicago to an instrument to improve the hearing powers of the partially deaf. We understand that it consists essentially of a flat flexible disk of resonant metal furnished with a handle, like a palm leaf fan and capable of being adjusted in curvature by means of a cord and a tightening clamp. The edge of the disk is to be pressed against the upper front teeth while its concave surface is presented towards the speaker to receive the sounds. The vibrations thus taken up by the disk are transmitted through the teeth and bones of the skull to the auditory nerves. This would appear to be a more practical instrument than the megaphone of Mr. Edison, of which nothing has been heard of late, or the apparatus recently explained by M. Paul Bert to the *Académie des Sciences*. Mr. J. Samuelson of Liverpool, exhibited the Audiphone at the late *soirée* of the associated scientific societies held in the St. George's Hall.

PROF. C. S. HASTINGS of the Johns Hopkins University has contributed to the current number of *Silliman's Journal* an important paper on "Triple Objectives with Complete Colour Correction." He controverts the opinion of Prof. Harkness expressed in a preceding number of the journal that the focal plane of a system of lenses does not correspond to the minimum focal distance.

IT is stated that a new photographic process has just been discovered in Japan by an inventor whose name is not given. One of the substances employed in the manufacture of Japanese lacquer has the property of becoming almost as hard as stone under the action of light. A slab covered with this material and duly exposed behind a photographic "negative" for some twelve hours, was afterwards scraped, and rubbed with spatula and brush, leaving the hardened portions raised in low relief, and capable of being used as a block for printing.

OUR contemporary, the *Electrician*, announces the startling discovery of an electric divining-rod, "whereby paying deposits of gold, silver, and copper can be positively indicated, and their exact location pointed out." This "discovery" is of course a trans-Atlantic one, but, "strange to say, it does not emanate this time from Menlo Park, though Mr. Edison may of course have pre-invented it many years ago!"

IN the *Institutes of Akbar*, whose reign over a considerable part of India extended from 1560 to 1600, are found the following directions for the artificial freezing of water. Into two parts of water is thrown one part of dry powdered nitre. In this mixture a small stoppered silvered jug containing pure water is stirred about briskly for a quarter of an hour, when its contents will be found to be wholly or partially frozen.

SCIENTIFIC SERIALS

Journal of the Royal Microscopical Society, vol. ii. Nos. 7 and 7*a*, contains:—Transactions of the Society.—W. H. Gilburt, On the morphology of vegetable tissues (Plates 22 and 23).—J. Beck, On the structure of the scale of a species of the genus Mormo.—Prof. E. Abbe, On new methods for improving spherical correction, applied to the construction of wide-angled object-glasses.—H. E. Forrest, On the anatomy of *Leptodora hyalina* (Plates 24 and 25).—Dr. H. Stolterfoth, On a new species of Eucampia.—John Mayall, jun., On an immersion stage illuminator, and on aperture measurements of immersion objectives expressed as "numerical aperture."—J. W. Stephenson, On a table of numerical apertures showing the equivalent angles of aperture of dry, water immersion, and homogeneous immersion objectives, with their respective resolving powers, taking the wave-length of line *E* as the basis; $a = n \sin. w$, n = refractive index, and $w = \frac{1}{2}$ angle of aperture.—The record of current researches relating to zoology, botany, and microscopy.—Bibliography.—Proceedings of the Society.—The editor announces that the Society has obtained the assistance of Mr. T. Jeffery Parker, Mr. A. W. Bennett, and Prof. F. Jeffrey Bell in the production of the journal.—No. 7*a* is a supplementary number containing the index to vol. ii., List of Fellows of the Society, &c.

Proceedings of the Boston Society of Natural History, vol. xx. part 2, November, 1878, to April, 1879.—Dr. H. A. Hagen, Larvæ of insects discharged through the urethra, and On birds swarming after white ants.—Dr. S. Kneeland, Traces of the Mediterranean nations in the Northern Ocean.—Dr. H. A. Hagen, Remarks on white ants.—President Bouvé, Remarks on the death of Dr. J. B. S. Jackson.—Prof. N. S. Shaler, Evidences of a gradual passage from sedimentary to volcanic rocks in the Brighton district.—Dr. H. A. Hagen, Flies from a petroleum lake.—W. O. Crosby, Occurrence of fossiliferous boulders in the drift of Truro, Cape Cod.—Dr. S. Hunt, On the pre-Cambrian rocks of Great Britain.—W. H. Patton, Synopsis of the New England species of Colletes.—J. S. Kingsley, Notes of North American Decapoda.—W. P. Crosby, A possible origin of petro-silicious rocks.—B. D. Halsted, The American species of Characeæ. The author enumerates eight species of Nitella, one of Tolypella, and nine of Chara, one of which, *C. robbinsii*, from Rhode Island, is described as new.—Dr. C. S. Minot, Growth as a function of cells, and On certain laws of histological differentiation.—Rev. G. F. Wright, The kames and moraines of New England.—Mr. W. Upham, Glacial drift of Boston and vicinity.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 18, 1879.—"On the Histology of *Hydra fusca*." By T. Jeffery Parker, B.Sc., Lecturer on Biology in Bedford College, London, and Demonstrator in the Royal School of Mines. Communicated by Prof. Huxley, Sec.R.S. (From the Biological Laboratory of the Royal School of Mines.)

The following is an abstract of the paper:—The correctness of Kleinenberg's view of the relations of the muscular fibres was proved by longitudinal sections of ammonic bichromate specimens, in which the fibres were obtained *in situ* in direct connection with the attenuated inner ends of the ectoderm cells.

No interstitial tissue could be made out in the thinnest sections of the tentacles; this tissue, therefore, cannot be the exclusive source of the nematocysts.

A distinct supporting lamella was clearly made out between the muscular layer and the endoderm.

The endoderm is shown to be, in all probability, ciliated throughout. Sections of osmic acid specimens showed each cell to bear one, two, or three, long, flagelliform cilia.

The active amœboid movements of the endoderm cells during life is strongly insisted on, the pseudopodial processes given off from them sometimes almost or entirely obliterating the digestive cavity.

It is suggested that the dark irregular granules found in the endoderm cells are food particles derived from the alimentary canals of the Entomostraca devoured. In one instance a diatom frustule was seen to be imbedded in a cell. Hydra thus, unlike most Metazoa, exhibits what Metschnikoff calls a "parenchymatous" mode of digestion.

Nematocysts are proved to occur here and there in the endoderm.

PARIS

Academy of Sciences, December 29, 1879.—M. Daubrée in the chair.—M. Faye presented the *Annuaire du Bureau des Longitudes* for 1880, which contains, *inter alia*, tables of refractive indices, densities of minerals, dilatations of metals and crystalline bodies, all known gases, with formulæ, &c., data of thermochemistry, a map of lines of equal magnetic declination for France and neighbouring localities, and a work on statistical geography.—Note on the different branches of kinematics, by M. Resal. M. Mannheim has recently introduced the expression *kinematic geometry*; this branch dealing with motion independently of forces and times. It is not simply the geometrical part of kinematics as studied hitherto.—On some applications of elliptic functions, by M. Hermite.—On hydride of copper; reply to M. Wurtz, by M. Berthelot.—On the heat of formation of gaseous hydrate of chloral; reply to M. Wurtz, by M. Berthelot.—On the butyric ferment (*Bacillus amylobacter*) in the coal epoch, by M. van Tieghem. Examining numerous silicified rootlets of coniferæ from the coal strata, he finds signs of the same process in destruction of tissues as now; development of *Bac. am.* in the organs, either in the form of slender jointed filaments, or inflated rods each with a terminal spore, or innumerable free spores, amid homogeneous silica or ranged against the cuticle or vessels.—On the oxidation of alcohol by ammoniacal bioxide of copper, by M. Letellier. He heated the mixture at 180° in a sealed tube; the blue liquor becomes colourless, and the alcohol is changed into acetic acid.—On a property of certain functions similar to algebraic functions, by M. Picard.—On the impossibility of the algebraic relation $X^n + Y^n + Z^n = 0$, by M. Lionville.—On the determination of the elements of a vibratory movement; measurement of the phase, by M. Mercadier.—On a new electric burner, by M. Perruche. The "candle" part consists of three carbons, two being cylindrical (0·004 m. diameter) and applied to each other, the other of square section (0·005 m. a side), and placed in the angle formed by the first two. The cylinders are in pivoted brass holders, between brass plates, brought together by a spring. The holder of the square carbon is also capable of oscillation, and this carbon is held by a spring in contact with the others, while no current passes, but, when the current begins, takes its separate position. It is regulated by an iron lever and electro-magnet in circuit.—On a new phoneidoscopic process by coloured rings, by M. Guébhard. A development of his experiment of producing coloured rings by breathing on a surface of impure mercury. He shows the characteristic figures of the principal vowel sounds. They prove that the vocal emission in uttering these sounds does not present merely the longitudinal vibratory state of a cylindrical column (as indicated by manometric flames, &c.), but a very complex vibratory state at right angles to the direction of propagation, and whose influence cannot be negligible in the final wave. This has an obvious bearing on the sensibility of telephonic plates, which are affected by multiple centres of percussion.—Action of permanganate of potash on cyanide of potassium, by M. Baudrimont. This generates much nitrite and little urea in an alkaline medium, while much urea is formed if the medium tend to acidity by addition of SO_3HO. The greatest proportion of urea results from mixture of cameleon and cyanide in equal equivalents in presence of an excess of sulphuric acid.—Action of hydracids on isoprene; reproduction of caoutchouc, by M. Bouchardat. Isoprene behaves to hydracids like valerylene, fixing one or two molecules of acid and giving identical or isomeric compounds, with very similar properties; only isoprene (unlike valerylene) furnishes with dissolved acids an elastic polymer.—On the structure of sudoriparous glands, by M. Ranvier.—Alterations of cutaneous nerves in a case of congenital ichthyosis, by M. Leloir.—On the locomotion of insects and of arachnida, by M. Carlet. Insects of slow pace, and with equidistant legs, rest on a sustaining triangle formed of the two extreme legs on one side and the middle leg on the other, while they move the three other legs. In arachnida the polygon of sustentation is formed by the first and third leg on one side and the second and fourth on the other.—On the presence of diamond in an ophitic rock of South Africa, by MM. Fouqué and Lenz.

VIENNA

Imperial Academy of Sciences, October 16, 1879.—The following among other papers were read:—On the physiological regeneration of the ciliated epithelium of the trachea, by Dr. Drasch.—On the solubility of mixtures of chloride of sodium and chloride of calcium at different temperatures, by Herr Schönach.—On a species of configuration in the plane and in space, by Herr Kantor.—On the causes of severe winters in Europe, by Herr Wolz.—Researches on the rain-conditions of Austria-Hungary, by Herr Hann.—Contributions to a monography of the genus Megalodus, with special reference to the mesozoic forms, by Prof. Hörnes.—A new chemical photometer by means of mercury oxalate, for determining the intensity of ultra-violet rays, and contributions to the photo-chemistry of mercury chloride, by Dr. Eden.

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