THURSDAY, FEBRUARY 7, 1884

## *JURASSIC ROCKS UNDER LONDON*

ON two previous occasions[1] the attention of the readers of NATURE has been directed to the facts which have been revealed by deep borings in search of water under London. In the first of these communications it was shown how completely the predictions of geologists, as to the nature, succession, and thicknesses of the different strata under London had been verified ; and in the second the question of the possibility of finding workable coal-seams beneath the metropolitan area was discussed at some length.

Quite recently, however, a new boring has been put down within the London Basin, which has made known so many new facts of surpassing interest to the geologist, and has at the same time furnished them with new data, tending to modify their former conclusions on some important problems, that it may be well to recur to the subject in the pages of this journal, and to give a short account of these remarkable discoveries.

The growing wants of the town of Richmond in Surrey have caused the local authorities of that place to seek an augmentation of their water-supply by carrying to a much greater depth a well which had some years ago been put down into the Chalk. This has been done by boring by Mather and Platt's flat-rope system, the work being done under the direction of Mr. C. Homersham, C.E., and at the present time a depth of 1308 feet has been attained. Not only is this well actually a few feet deeper than the famous well at Kentish Town, which was carried 1302 feet beneath the surface, but, commencing as it does near the level of the Thames, it reaches, reckoning from the Ordnance datum line, a level more than 150 feet lower than that of any well hitherto sunk within the London Basin.

Up to the present time only insignificant supplies of water have been obtained, but it is to be hoped that as the work is carried on this spirited enterprise may meet with the success it so well deserves. To the student of London geology it has already afforded a number of facts of wonderful novelty and interest.

The succession of strata found in this well was as follows :—

| | | feet |
|---|---|---|
| | Made ground and gravel ... ... | 10 |
| Tertiary, 243½ feet | London Clay... ... ... ... ... | 160 |
| | Woolwich and Reading Series ... | 60 |
| | Thanet Sand... ... ... ... ... | 23½ |
| Cretaceous, 888½ feet | Chalk with flints / Grey Chalk / Chalk Marl ... ... ... | 671 |
| | Upper Greensand... ... ... ... | 16 |
| | Gault ... ... ... ... ... ... | 201½ |
| | Neocomian (?) ... ... ... ... | 10 |
| | Great Oolite ... ... ... ... ... | 87½ |
| | New Red Sandstone and "Marl" | 60 + |

The lines indicate unconformable breaks in the series of strata, and the lapse of enormous periods of time between the deposition of the beds which they separate.

Down to the base of the Gault the order and thicknesses of the several formations was exactly what would be predicted by any geologist conversant with the details of London geology. Some very interesting facts concerning the divisions of the Chalk strata under London have, however, been made out for the first time by the study of the admirable series of "cores" brought to the surface during these boring operations.

But it is with respect to the strata found lying beneath the Gault that the greatest amount of interest has been excited among geologists.

The Gault clay has at its base the usual band of phosphatic nodules, the so-called "coprolites," and beneath this was found a series of beds, ten feet in thickness, the nature of which is peculiar, while their age is somewhat problematical.

These beds appear in fact to consist of materials derived from the wearing away of the rocks on which they repose, but include fragments of other rocks evidently brought from a distance. They contain many "derived fossils," greatly fractured and waterworn, but very few of its organic remains are of the age of the deposit itself, and serve to fix its geological age. From a consideration of the whole of the evidence in this case, however, this series of rocks, ten feet in thickness, may be referred with considerable probability to some part of the Neocomian period. Unfortunately the typical Lower Greensand was wholly wanting, and the expected supplies of water from this source were therefore missed.

But immediately beneath this peculiar and somewhat puzzling stratum, deposits of great interest to the geologist were encountered. They consisted of thick beds of oolitic limestone, with some subordinate beds of clay, fuller's earth, and sandstone, the whole having a thickness of 87½ feet. A few fossils, for the most part very imperfect, were found in the limestone, but one of the clay bands, when carefully washed, proved to be veritable "El Dorado" to the palæontologist. It was seen to be crowded with specimens of Brachiopods, Bryozoa, Echinoderms, and other organisms, all of them in the most exquisite state of preservation. It is evident that these organisms which flourished upon the floor of the sea were killed and overwhelmed by a sudden influx of muddy sediment. The species found in this interesting bed of clay, which is only six inches in thickness, are similar to those which occur in the Bradford Clay of Wiltshire, and the Calcaire de Ranville of Normandy. It is evident, therefore, that the deposit which contains them is of the age of the Great Oolite. These great oolite strata are found to rest directly on the Trias,—the Inferior Oolite, Lias, and Rhætic being absent.

Now no strata of the age of the Lower Oolites were before known to exist under the London Basin, though it is but fair to remember that Mr. Godwin-Austen, in his celebrated essay on the probable existence of coal under London, distinctly pointed out the possibility of the existence of such deposits.

In the boring which in the year 1878 was put down at Messrs. Meux's Brewery in the Tottenham Court Road some anomalous strata about 64 feet in thickness were found lying between the Gault Clay and the Devonian rocks in which that boring terminated. From some obscure casts of fossils detected in these beds, they were, at the time of their discovery, referred to the Neocomian.

[1] See NATURE, vol. xvi. p. 2, and vol. xxv. pp. 311, 361.

But a careful re-examination of the question shows that, like the beds above described at Richmond, they certainly belong to the Great Oolite, though they were deposited under shallower water conditions than their equivalents at the latter place, and were perhaps, in part at least, of estuarine origin.

The Trias is another formation which has not hitherto been certainly detected under London. It is true that some geologists think that the rocks reached in the Kentish Town and Crossness borings belong to that formation, but this identification is disputed by some very eminent authorities. Although no fossils have been found in the red and variegated strata of the Richmond boring, yet their mineral characters are such as to leave scarcely any room for doubt that they belong to some part of the "Poikilitic" or New Red Sandstone system. They consist of coarse and fine grained sandstones, often exhibiting false-bedding, which alternate with red and variegated clays or "marls." It will be of great interest to geologists if it can be determined upon what member of the Palæozoic rocks these Triassic strata repose.

The result of the deep boring at Richmond is to show that while the water-bearing strata of the Lower Greensand do not extend so far northward as Richmond, other unexpected deposits do exist beneath that town. During portions of the Triassic and Jurassic periods the great Palæozoic ridge, stretching between the Mendips and the Ardennes, was in part or wholly submerged, and thus we find deposits of these ages along its flanks. The relation of the Great Oolite under the central and southern metropolitan district are strikingly similar to those of the Lower Oolite in the Boulonnais. Taking into consideration the proved thickness of the Upper and Middle Oolites in the "Wealden boring" at Battle, we most be prepared to find the Palæozoic axis, with its possible coal-beds, at a considerably greater depth beneath the surface in the southern half of the London Basin than had hitherto been anticipated.

Although no beds of Middle Oolite age have as yet been found under the London Basin, yet, that strata of this period were originally deposited there, we have a very interesting and curious proof. Among the beds of the Lower Greensand of the North Downs, between Sevenoaks and Farnham, we often find deposits consisting of such coarse materials as almost to merit the name of conglomerates. These consist in great part of waterworn fragments of hard and sub-crystalline rocks, evidently derived from the great Palæozoic ridge lying to the north. Mingled with these pebbles are great numbers of excessively eroded but sometimes still recognisable fossils evidently washed out of beds of Lower and Middle Oolite age. The former, as we have just showed, have now been detected under London; but such is not the case with the latter, which may not improbably have been wholly removed by denudation before the deposition of the Cretaceous strata.

In one of the articles referred to at the commencement of this notice, it was pointed out that not only might coal be found at workable depths under London, but that, when discovered, this coal would probably be of the anthracite variety. Now although no beds of coal have hitherto been found in place beneath the metropolis, yet the Richmond boring has yielded striking and unmistakable evidence as to the presence and nature of the coal-seams under the London Basin. In several of the deposits pebbles of coal-measure sandstone with fragments of anthracite have been detected. From this interesting fact it may be justly inferred that while the beds in question were being deposited on the flanks of the old Palæozoic ridge, portions of that ridge consisting of Carboniferous strata and containing seams of anthracite rose above the level of the sea and yielded the fragments mentioned. That the source of these fragments was not very distant may be inferred from the brittleness of anthracite, which certainly could not have travelled far. Thus at last the prediction of geologists has been verified, and coal has been found under London, though as yet unfortunately not *in situ*.

JOHN W. JUDD

## MENTAL EVOLUTION IN ANIMALS

*Mental Evolution in Animals*. By G. J. Romanes, M.A., LL.D., F.R.S., &c. With a Posthumous Essay on Instinct, by Charles Darwin. (London: C. Kegan Paul & Co., 1883.)

IN the present volume Mr. Romanes redeems a part of the promise which he gave us in his "Animal Intelligence." He traces in its main outlines the development of mind in the lower animals. The other part of the promise, to follow the course of mental development in man, will be fulfilled in another work. We think it well that the author has thus divided his task. Each division is of sufficient magnitude to require a separate volume; and though as an evolutionist Mr. Romanes would of course maintain the continuity and identity of the process of mental evolution from its first obscure manifestations in the lower grades of animals up to its highest present point of attainment in civilised man, he would probably allow that the two stages of the process, the sub-human and the human, are sufficiently differenced by the difference in the degree of complexity of the factors involved. To this it may be added that the detailed study of each of these two stages of mental life requires a body of knowledge of its own, a special modification of psychological method, and a particular kind of psychological interest.

In the present work the author has to face a much more difficult task than that which he undertook in his earlier volume. This no doubt had its difficulties. For in what we call the "observation" of mind, whether in our fellow-men or in the lower animals, a process of inference is involved; and when the action to be psychologically interpreted is far removed from the ordinary types of human action, this process is one of peculiar difficulty. But in the earlier work inference or interpretation played a subordinate part. Here, however, it becomes the main problem. In order to connect the facts ascertained and to present a systematic view of mental life as a whole, we must have clear notions respecting the nature of mind in general, as well as of its several phases, which we mark off by the names of the faculties perception, imagination, &c. It is not too much to say that in carrying out the task of tracing the evolution of mind in the lower region an inquirer needs to combine the special aptitudes of a naturalist with those of a psychologist.

Readers of the earlier writings of Mr. Romanes are well aware that he possesses a considerable skill in psychological analysis; and the present volume amply justifies the high expectations in this respect which his other works had excited. He shows acuteness and now and again subtlety. But ingenuity is invariably kept in check by that too uncommon quality, sound common sense. He does not strain after originality, but rather takes pleasure in affiliating his views on the doctrines of recognised masters of the science. The reader has throughout the conviction that the writer has a disinterested enthusiasm for his subject, and cares much more for adding to the store of well-ascertained truth than for adding to his own reputation as a contributor to this result. In all this he seems to have caught something of the spirit of his favourite master, Charles Darwin, of whose valuable work in animal psychology the present volume is to so large an extent a continuation.

At the very outset Mr. Romanes has to face a question which makes unusual demands on the inquirer's sobriety of judgment. What are we to include under the head of mind? How far down in the zoological scale can we confidently maintain that mind is to be found? And by what criterion are we to ascertain its presence? The student of psychology need not be reminded that even competent writers have grown confused in seeking to demarcate the area of mental phenomena, whether as presenting themselves in connection with a single organism, or with the sum of organic beings. A trained psychologist like G. H. Lewes used the terms "sensibility" and "sentience" in a way that left his readers perplexed as to whether he was speaking of a psychical phenomenon properly so called, that is, a mode of feeling, or simply of a physiological phenomenon, actions of the nervous system or nervous processes. Mr. Romanes has steered clear of this confusion. He rightly criticises Lewes's use of the term "sensation," and confines it to its proper subjective signification. Mind being thus coextensive with feeling or states of consciousness, the author proceeds to lay down a criterion for ascertaining its presence in any given case. It is as follows:—"Does the organism learn to make new adjustments, or to modify old ones, in accordance with the results of its own individual experience?" Otherwise expressed, it is the manifestation of choice, choice being proved by "the antecedent uncertainty of adjustive action." In laying down this test, however, Mr. Romanes is careful to point out its imperfections. "It is not rigidly exclusive, either, on the one hand, of a possibly mental character in apparently non-mental adjustments, or, conversely, of a possibly non-mental character in apparently mental adjustments." That is to say, it is a rough test sufficient for practical purposes, and eminently in accordance with the dicta of common sense.

After a brief account of the structure and function of nerve-tissue, and of the growing complexity of nerve-structures as evidenced by the double result, compounding of mental elements and compounding of muscular elements, the writer proceeds to discuss what he terms the root-principles of mind. He has already told us that the criterion of mind is choice. He now considers what is involved in the simplest type of choice. Being a mental quality, it must have its physiological correlative. This the author takes to be what he variously calls "the power of discriminating between stimuli *irrespective of their relative mechanical intensities*," the power of "selective discrimination," of "discriminative excitability," &c. It is illustrated by the capability of a sea-anemone which had been surrounded by a turmoil of water, after a time of expanding its tentacles on contact with a solid body. This implies the discrimination of qualitatively unlike stimuli. Each of the organs of special sense has as its function "the rooting out, selecting, or discriminating the particular kind of stimulation to which its responsive action is appropriate." This power of discrimination is regarded as the root-principle of mind. This doctrine has a certain resemblance to the theory of Mr. Spencer and Dr. Bain, that the feeling of difference is the fundamental mode of consciousness. But the author is very explicit in saying that the discrimination he speaks of is a physiological and not a psychological property. Indeed, he allows that it manifests itself in plants, that is to say, much lower down in the scale of organisms than mind can be supposed to reach. It may, however, occur to the reader that the property is not even peculiar to organic structures. Does not a piano manifest just this selective discrimination (to qualitatively unlike stimuli) when its several strings pick out and resonate to the appropriate vibrations of a composite mass of sound? And is it not easy to conceive an artificial mechanism showing such discrimination in a far higher degree than the lower grades of animals? It may be urged, further, that what choice, as previously defined by Mr. Romanes, requires as its correlative is a germ of *conscious* discrimination. A new adjustive action, not provided for by the inherited nervous structures, seems to involve some vague consciousness of a difference between the new and the old, the exceptional and the usual, circumstances. Mr. Romanes might not improbably meet these difficulties by saying that in calling this physiological discrimination the root-principle of mind he simply means to single out the most important property of nerve-structures, the development of which up to a certain point is an antecedent condition of the appearance of mind or consciousness. But even then it would be hard to see why this was exclusively erected into the root-principle of mind to the disregard of another property, retentiveness or memory, which Hering and others have shown to be a property of all organic structure, and the importance of which, indeed, the author seems to allow later on in his work.

In order to complete the author's account of the physiological conditions of mind it is necessary to add that he supposes consciousness to arise when the time occupied by the nervous process, or the interval between sensory stimulation and muscular action reaches a certain magnitude. Mere complexity of nervous actions does not involve consciousness, as we may see in the case of highly compound reflexes. To use the author's graphic language, consciousness involves as its immediate physiological condition a ganglionic "friction" or "state of turmoil." This increase of time "implies that the nervous mechanism concerned has not been fully habituated to the performance of the response required." As more complex organisms are evolved, and the stimuli playing on them become in consequence more varied, this insufficiency of mechanical arrangements and consequent rise of gang-

lionic friction become more and more marked, and the insufficiency is met by the activity of the higher centres in "focusing many and more or less varied stimuli," which function involves a higher manifestation of the aptitude of discrimination, and as a consequence of this a psychical accompaniment or consciousness.

The author now proceeds to sketch out his general scheme of mental evolution by the aid of a somewhat elaborate diagram. By this last, which is of a tree-like form, we see how out of excitability, the distinguishing property of living matter, there arises, by a double root, contractility, the property of nerve-fibres, and discrimination, the property of nerve-cells, first reflex action, then conscious or voluntary. In branch-like appendages of the stem are represented the successive grades of intellect on the one side, and emotion on the other. To this are added at the sides two finely graduated scales giving the products of emotional and intellectual development. Opposite the numbered divisions of these scales appear the names of those classes of animals, species or larger groups, in which the particular products first distinctly present themselves. Finally the corresponding stages of mental development of the human individual are appended in a parallel scale. It is only fair to Mr. Romanes to say that in thus seeking to mark out by definite stages or levels the progress of mind in the animal series, he is fully aware of the impossibility of assigning hard and fast lines of demarcation. His psychological knowledge tells him that the several faculties, sensation, perception, &c., are not absolutely distinct one from another, but involve common psychical functions. And his clear sense of the limits of our insight into the mind of the lower animals keeps him from dogmatically asserting that a particular faculty or product of mind is not present below a certain zoological level.

Having thus mapped out his ground, Mr. Romanes goes on to investigate its several divisions in detail. The order of treatment is as follows:—(1) sensation, (2) perception, (3) pleasures and pains, memory and association of ideas, (4) perception, (5) imagination, (6) instinct, (7) reason, (8) animal emotions. This does not seem a very good logical arrangement of the subject, or one which grows naturally out of the diagram. It appears, moreover, to make too much of the intellectual side of the animal mind, and too little of the emotional. This strikes one in the cursory treatment of pleasures and pains along with memory, &c., and in the somewhat meagre review of the emotions in the final chapter. The same thing is seen, too, in the elaborate discussion of instinct, in which the highly interesting emotional element in the phenomenon is hardly touched on.

But it is, perhaps, ungracious, in view of the interesting and valuable material with which the author here supplies us, to complain of what he has not given us. To touch on only one or two points of interest, the account of the development of the several varieties of sensation from their simplest rudiments is full and instructive. The fundamental fact in memory, namely, retentiveness, is clearly seized, and it is satisfactorily shown that different grades of memory, *e.g.* mingling of traces of past sensations with present ones, recalling of absent sensations by association, precede the apparently simple but really complex act of perception.

The facts brought forward in proof of the existence of imagination, that is the power of mentally picturing absent objects, even low down in the scale of animals, are interesting and conclusive. The presence in dogs, horses, asses, &c., of what the author calls the third degree of imagination, where the image is not suggested by external objects present at the time, is ingeniously maintained by the facts of dreams, delusions, and evidences of prolonged anticipation, *e.g.* of the stable by the homeward-journeying horse, and recollection, *e.g.* of the lost master or mistress by the pining dog.

The *pièce de résistance* in the volume is, as we might expect, the discussion of the perplexing subject of instinct. To this no fewer than eight chapters are devoted. Here Mr. Romanes shows himself at his very best. We see that he has mastered the wide range of facts involved, and keeps the many varieties of the phenomena steadily in view. We see, too, that he has pondered long and well on his facts, reading what has been said by others on the subject of his meditation. Finally we recognise his thorough sobriety of judgment, freedom from one-sidedness and from everything like speculative extravagance. Mr. Romanes begins by showing that instinct is clearly marked off from reflex action, not merely by the degree of its complexity, as Mr. Spencer says, but by its accompaniment of consciousness. Then he proceeds to illustrate perfect instincts, in which the actions are perfectly adapted to the circumstances of life for the meeting of which the instincts exist, and imperfect instincts, in which the adjustment to the circumstances of the animal's life is less perfect.

This prepares the way for the main problem, the explanation of the origin and development of instinct. There have been two chief theories propounded to meet the case. On the one hand, G. H. Lewes, and also with him apparently Wundt and others, conceive of instinct as a kind of "lapsed intelligence" analogous to the effect of habit as operating during the development of a single human life. Just as we come to do things in a mechanical and semi-conscious way as the result of having frequently done them with full consciousness, so actions of the lower animals carried out with conscious design at first may, as the result of long continuance in succeeding generations and the operation of the principle of heredity, ultimately become instinctive. In opposition to this view, a more humble origin has been assigned to the phenomenon. According to this theory, instinct does not involve intelligence in any stage of the action. Its origin is mechanical. The germ of instinctive action is due to accidental variations which have become fixed and perfected by natural selection. With this view we may take that of Mr. Herbert Spencer, that instincts grow out of reflex actions when these reach a certain degree of complexity, and only involve consciousness in their later stages of development. Mr. Romanes combines these different theories. He allows a certain weight to Mr. Spencer's hypothesis as serving to explain the lowest type of instinctive action occupying the border land between reflex and instinctive actions proper, that is those accompanied by consciousness. But fully developed instincts can only be accounted for by the principle of variation and natural selection, and by that of lapsed

intelligence. In the first place, what the writer calls primary instincts, including those of many low animals and certain instincts of higher animals, *e.g.* incubation, arise by the action of the first cause. This is proved by the fact that purposeless habits, tricks of manner, *e.g.* the trick of barking round a carriage showing itself in certain varieties of dogs, occur and are inherited. In the second place, secondary instincts, including many of those of the higher animals, *e.g.* dread and shunning of man, or other enemies, were originally intelligent actions, and illustrate the principle of habit or lapsed intelligence. This proposition, again, is established by showing first, that "intelligent adjustments when frequently performed become automatic in the individual, and next that they are inherited till they become automatic habits in the race," *e.g.* in the tendency of certain breeds of dogs to "beg."

In combining both these principles in his theory of instinct, Mr. Romanes follows his master, Mr. Darwin, and he has derived much assistance from the valuable essay on instinct by that writer, which was written for the "Origin of Species," but, having been withheld from that publication for want of space, now appears for the first time as an appendix to Mr. Romanes' volume. But the author has elaborated the theory sketched out by Mr. Darwin. More particularly he has illustrated at great length how the two causes may combine. He shows how on the one hand, primary instincts may come to be put to better uses by intelligence, and, on the other hand, secondary instincts may be modified and put to better uses by natural selection. The effects of domestication illustrate most clearly this conjoint action of the two principles. With respect to the comparative importance of the two causes, Mr. Romanes seems inclined to look at natural selection as the chief agency, intelligent adjustment being regarded as an auxiliary agency, the chief function of which is to supply to the controlling principle of natural selection an additional class of variations which are from the first adaptive. Mr. Romanes supports his theory by a cumulative chain of argument of very great strength, and he orders the successive steps of it in such a way as to make the reader feel its full force. His main positions seem to us unassailable. The only point we feel inclined to criticise is the limitation of the action of intelligence in the instincts of animals low down in the scale. The author appears to argue on general grounds that these must to a large extent be due to the working of natural selection. But the facts of intelligent modification of instinctive actions cited by him, *e.g.* in the case of the constructive actions of bees, &c., appear to show that the animals concerned possess a considerable measure of genuine sagacity. And while it is no doubt difficult, as the author remarks (p. 191), to attribute to an animal so low down in the scale as the larva of the caddice fly a power of consciously reasoning, it seems, on the other hand, hard to understand how, by the mere play of natural selection unaided by any rudiment of conscious discrimination and adaptation of means to ends, this little creature could have acquired the habit of either lightening its floating case by attaching a leaf to it or weighting it by attaching a small stone according as it becomes too heavy or too light. But the author shows himself so completely the master of his subject, that the reader feels disposed to accept his conclusions in the very few instances in which his individual judgment leans the other way.

JAMES SULLY

## OUR BOOK SHELF

*An Introduction to the Study of Heat.* By J. Hamblin Smith, M.A. (London: Rivingtons, 1883.)

THOUGH the author states in the preface that "he has endeavoured in this book to explain the elementary facts connected with the theory of heat so far as a knowledge of them is required by the University of Cambridge in the general examination for the ordinary B.A. degree," it will be found that he has succeeded in producing a book which is not only admirably adapted to help a student who is preparing for this or any other elementary examination, but which, from the simple nature of the language and the clearness of the descriptions, may be read with advantage by those who have no examination to pass, but who may wish to understand something of the science of heat for its own sake.

The text is composed of short numbered paragraphs, in each of which the author deals with one new fact only, a plan eminently adapted to save the student confusion. These paragraphs may be taken as model answers to imaginary examination questions.

Over two hundred questions are given on those parts of the subject, such as expansion, calorimetry, conductivity and hygrometry, which admit of being put in simple numerical form. Many of these are essentially exercises in arithmetic, and must irresistibly remind the reader of the unlikely questions which he used to have to answer at school. In the questions on thermometers, for instance, an observer seems to have noted the sums, differences, products, &c., of the readings of every kind of thermometer in his laboratory, without noticing what those readings were, and then, when too late, to have met with the necessity of finding from his observations the temperatures which the instruments actually indicated. However, though observations of such a kind are rarely made, the exercises which they furnish will of necessity make those who work them out absolutely familiar with the fundamental principles of the subject.

C. V. B.

## 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 insure the appearance even of communications containing interesting and novel facts.*]

### The Ear a Barometer

AT a time when I frequently went between Peterborough and London by the Great Northern Railway express trains, I found that the sudden compression of the air produced on entering a tunnel was not only perceptible by the ear, but even unpleasant, and that this unpleasant sensation remained till the open air was reached, when it suddenly ceased. Of course it was natural to suppose that the noise was the primary cause, but I satisfied myself that this had nothing to do with the effect, for on swallowing after entering the tunnel the sensation ceased, but recurred in the opposite sense on leaving the tunnel, when a second operation of swallowing removed it. This showed clearly that what was observed was real.

As far as I remember there was, as measured by the sensation, an increase of pressure, at first sudden, and then gradually rising for a second or two on entering, and a corresponding gradual and sudden decrease on leaving a tunnel.

I did not at the time have the opportunity of taking an aneroid with me to measure the amount of the compression, but intended to try an air thermometer which I thought would be more

sensitive to a sudden change of pressure than even the most delicate aneroid.

It is strange that so few people have noticed this sensation in the ears; besides Mr. Horace Darwin I do not know of any one who I may say has been disturbed by it.

During the gale on the 22nd and 23rd inst. it occurred to me to try whether I could get an idea of the pressure that could be felt by the ear. My room faces west, and the wind was beating against the windows; so after shutting the door I opened one of the windows suddenly during a furious gust, at which a small gas-flame bobbed nearly out, and the same instantaneous sensation was plainly felt. On shutting it again the gas-flame started up, but the inverse sensation was not perceptible. The gas-flame stood at apparently the same height with the window shut or open. Its movements were simply due to the starting and stopping of an extra draught in the chimney. On examining the meniscus at the top of the column in a mercurial barometer, the change of pressure was plainly visible, not by a rise and fall of the whole column, but by a change of curvature which was very marked when the window was opened during the stronger gusts. A pocket aneroid showed the same thing perfectly, rising, as far as I could judge, about 1/150 inch in general, but during one very furious blast 1/20 inch; on that occasion only did the shock on the ears seem at all comparable with what I remember to have felt in the tunnels.

It is not necessary to wait for a gale in the right direction to test the ears. I found that if a friend charged the door with his whole strength, much the same compression was produced as by the average gusts of wind. Of course the compression will depend partly on the contents of the room, which were, in the case in question, about 2500 cubic feet.

It is probable that the change of pressure noticed by the ear is greater than that shown by the barometer, for the in tantaneous effect on the gas flame was enormous, while the permanent action was barely perceptible; on the other hand, the aneroid showed a permanent displacement with only a very slight recoil. The greater mobility of the gas doubtless corresponds to the great sensibility of the ear.

If the actual change of pressure felt by the ear is 1/150 inch, which corresponds to a change of level of six feet, it might be expected that a sensation would be observed on running up or down stairs. This I have not noticed, the change of pressure being so gradual.

I need hardly add that descending a mine at the high speeds common in the collieries is most painful to me, and is only rendered bearable by continuously swallowing.

The very great and apparently unrecognised difference that there seems to be in the sensibility of the ears of different individuals may be an excuse for occupying so much of your valuable space with what is in other respects a long and uninteresting letter.

C. V. BOYS

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## The Remarkable Sunsets

IN NATURE for December 20, 1883, Dr. James Macaulay has collected (pp. 176, 177) some recorded instances of the wide distribution at former periods of volcanic dust. Perhaps the following may be worth adding. It is to be found in that extraordinary repertory of curious information and suggestion, the "Philosophical Notes" to Darwin's "Botanic Garden" (part ii. 3rd edition, 1791, p. 167).

W. T. T. D.

The Rev. Mr. Sterling gives an account of a darkness for six or eight hours at Detroit in America, on October 19, 1762, in which the sun appeared as red as blood, and thrice its usual size; some rain falling covered white paper with dark drops like sulphur or dirt, which burnt like wet gunpowder, and the air had a very sulphureous smell. He supposes this to have been emitted from some distant earthquake or volcano (*Phil. Trans.* v. liii. p. 63).

In many circumstances this wind [the Haimattan] seems much to resemble the dry fog which covered most parts of Europe in the summer of 1780, which has been supposed to have had a volcanic origin, as it succeeded the violent eruption of Mount Hecla and its neighbourhood. From the subsidence of a white powder, it seems probable that the Haimattan has a similar origin, from the unexplored mountains of Africa. Nor is it improbable that the epidemic coughs which occasionally traverse immense tracts of country may be the products of volcanic eruptions; nor impossible that at some future time contagious miasmata may be thus emitted from subterranean fissures in such abundance as to contaminate the whole atmosphere and depopulate the earth (Darwin's "Botanic Garden," part ii. 3rd edition, 1791, p. 167).

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WE had the sunset display again to-night, but the after-glow was much less prolonged, suggesting that the stratum of dust and crystals is slowly settling down. But repeated flashes of lightning and peals of thunder, in a place where storms, at the usual time of year for them, are very infrequent, seem to suggest also the question whether the ash is not brought within the sphere of rain-clouds rather by loss of electricity than the influence of surface-gales. At the same time the large fluctuations of pressure seem to tell, on the contrary, that the whole column is affected to unusual altitudes. Since I have been a reader of journals I have seen nothing more enthralling in its interest than the contributions made, week by week, to NATURE on this subject from all parts of the world. It marks an era in observation from which we may hope great things in the future.

Bregner, Bournemouth, February 2 HENRY CECIL

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REFERRING to the latter part of Mr. Hawell's letter in NATURE, January 24 (p. 285), there seem to be several different ways in which volcanic dust might affect the temperature, and though all of them seem likely to have but small effect, the quantities they affect are so vast that a very small percentage may form a very considerable quantity.

1. The volcanic gases would form at first a stratum much warmer than would be natural to the heights at which they would rest, and would thus retard the outward flow of heat from the earth.

2. The volcanic dust, forming an unusually high stratum of opaque matter, would intercept rays from the sun that would be otherwise lost to the earth.

3. The volcanic dust would act as a screen to prevent the earth losing heat by radiation, while it would also (4) act as a screen to prevent the sun's rays reaching the earth; but in so doing would make the dust stratum warmer, and so would aid cause No. 1.

The indirect effects, as influencing evaporation and condensation, and the formation of clouds, are probably greater than the direct, but are more difficult to analyse.

December 3.—I have noticed that December 3 was generally remarkably cloudy. Here, however, it was conspicuous as the day on which all the most marked features of the sunsets culminated. At 4.45 the green and pink glows covered the western half of the sky, and the rest of the sky was filled with a purple glow of like character, while the crescent moon was green. These glows had to a great extent faded at 5; and though the phenomenon lasted late, I can give no more details, as I took no notes, not being able to give it continuous attention.

37, The Square, Ripon, January 28 W. W. TAYLOR

## Christian Conrad Sprengel

SPEAKING of Christian Conrad Sprengel's discoveries, Dr. H. A. Hagen says (NATURE, vol. xxix. p. 29):—"In Germany these discoveries were well known to every naturalist during the whole century. Certainly between 1830 and 1870 at every university in Prussia the same facts were taught as well-known facts of the highest importance, and of course known by every student." From the complete want of papers relating to the facts observed, and the theories proposed by Sprengel in the German botanical and entomological periodicals published before the time of Darwin, strangely contrasting with the profusion of such papers in modern botanical literature, one might have been led to a very different conclusion, viz. that Sprengel had fallen into almost complete oblivion in Germany also, and that hardly any professor in any of the universities of Prussia and of Germany in general duly appreciated and taught his discoveries before Darwin's time. And this, I think, is really the case. Certainly at the University of Berlin in 1841, neither Lichtenstein, in his lectures on zoology, nor Kunth in those on botany, ever spoke of Sprengel and his work, nor did Erichson in his course on entomology. At the University of Greifswald, in 1842, the professor of natural history, Hornschuch, never mentioned Sprengel's discoveries. In 1848 my brother, Hermann Müller, began the study of zoology and botany at the University of Halle, where he never heard of Sprengel, with whose work

he became acquainted only much later through Darwin's books. Thus it appears that between 1840 and 1850, in three at least of the six universities of Prussia, Sprengel's work had fallen into the most complete oblivion. Now it is improbable in the highest degree that the several professors of natural history in these universities should have ceased, unanimously and at the very same time (1841) to teach what, between 1830 and 1840, they had taught "as well known facts of the highest importance." Hagen's statement, therefore, needs some further proof before it can be accepted.

If in Germany Sprengel's discoveries had been "well known to every naturalist during the whole century," the opinion that his treatise had been unduly neglected until it was, as it were, re-discovered by Darwin, could never have prevailed, as it appears to do, among German botanists, and Prof. Eduard Strasburger could never have written the following lines, with which I may appropriately conclude this letter: "Until 1860 and some years afterwards in any catalogue of old botanical books, the work of Conrad Sprengel, published in 1793, 'Das entdeckte Geheimniss der Natur im Bau und in der Befruchtung der Blumen' might be found at the price of about 15 sgr. (1*s.* 6*d.*), and I myself bought it there at that price as a curiosity, for the sake of its strange title. In the 220th catalogue of Friedlander (1873) the price of the same book is 3 thlr. 20 sgr. (11*s.*) This rise in the price of Sprengel's book shows very strikingly the change through which in the meantime it has passed in our appreciation. For only during the last ten years, after it had remained *wholly unnoticed* for nearly seventy years, the old book has come to be duly valued. It was Charles Darwin, who by his excellent book on Orchids . . . revived the questions treated by Sprengel" (*Jenaer Literatur Zeitung*, 1874, article 140.)

FRITZ MÜLLER

Blumenau, Santa Catharina, Brazil, December 15, 1883

### Diffusion of Scientific Memoirs

PROF. TAIT appears to have misunderstood my object in writing the letter published in your issue of January 24 (p. 287). It refers distinctly to his letter of December 27, and not directly to the review which began the correspondence. In that letter Prof. Tait stated publicly that he had not received certain publications of the Cambridge Philosophical Society. I desired, as secretary, to explain that it was not due to the neglect of the officers of the Society. He also says:—"NATURE would do a real service to science by collecting statistics as to the numbers of different centres . . . at which the *Transactions* of various scientific societies were freely accessible in 1883 (say) and also in 1853." It was in my power to give the statistics for "*Transactions* or *Proceedings* or both" for the year 1883; in answer to part of Prof. Tait's suggestion I did so. There is no reference in my letter to the year 1854, so that Prof. Tait is not correct in stating (NATURE, January 31, p. 311) that the question between us is, "What was the state of matters in 1854?" The year 1869 was the earliest for which, with the data ready to hand, I could obtain the numbers, I therefore gave statistics for that year in addition; I had no knowledge of what may have been the case in 1854, and I said nothing about it. Prof. Tait referred to a malady and suggested a cure. I merely wished to show that the cure had already been applied. My remarks were addressed solely to that point, and were not "beside the question." Prof. Tait, in your last issue, has an elaborate argument to prove that about one-third of the centres receiving publications receive *Proceedings* only. In this he is entirely mistaken. At present the number of such centres is 6; in 1854 it was 0. The history of the case is as follows. Until the year 1843 the Cambridge Philosophical Society published no *Proceedings*. Between that year and 1864 short accounts of the papers read and of the discussions were published in the *Phil. Mag.*, and separate copies were supplied to the Society. In 1864 these were collected, and form vol. i. of the *Proceedings*. At the time they were not circulated separately; circulation was given them in the *Phil. Mag.* In that year the arrangement with the *Phil. Mag.* came to an end, and notices of the same kind were printed by the secretaries and distributed to *resident Fellows*. Almost without an exception all the important papers published by the Society appeared in the *Transactions*. There was no need therefore to circulate *Proceedings*, and it was not done. This practice was continued up to 1876, when the second volume of the *Proceedings* was closed, and a new system begun. Thus up to 1876 *all centres* receiving publications *necessarily received Transactions*, and as a matter of fact nothing else. A few copies of vols. i. and ii. of the *Proceedings* have since been issued. Vol. iii. of the *Proceedings* was commenced in 1876, and both it and succeeding volumes contain in full the shorter or the less important communications made to the Society, as well as abstracts of matter published in full in the *Transactions*. Vols. iii. and iv., then, of the *Proceedings* have, as a general rule, been sent with the *Transactions*, and the centres have usually, since 1876, received both. Within the last few years, however, 6 centres have been added to the list which receive the *Proceedings* only. Thus in 1883 (omitting the honorary Fellows) 114 centres received *Transactions* only, or *Transactions* and *Proceedings*, in most cases the latter, and 6 received *Proceedings* only; while *in* 1853 *all the publications distributed were Transactions*. I do not pretend to know what the number of centres was at that date, and my first letter made no direct reference to it. Nothing in that letter, however, supports the arguments adduced by Prof. Tait to prove that "it follows from Mr. Glazebrook's data that the number of centres in 1854 must have been about 40 only."

R. T. GLAZEBROOK,
Secretary of the Cambridge Philosophical Society

Cambridge, February 4

### Brooks' Comet

I SEND you a sketch of Brooks' comet, in which an attempt is made to represent a remarkable change which took place in the comet about January 13. On that evening the well-defined and almost circular envelope which is represented in the figure was entirely wanting when the comet was seen on previous occasions. The nucleus was much more condensed and star-like than at any time before. The envelope was of nearly uniform brightness, with a perfectly defined outline, which was easily measured. It seemed to be produced by two fan-shaped emanations from the nucleus, which, curving backward toward each other, met at the outer edges, leaving a darker elliptical space on each side of the nucleus, the space on the north side being the darker, and the preceding fan-shaped portion having an extension on the north side. A line drawn through the middle of the dark spaces would be perpendicular to the axis of the tail.

The diameter of this envelope was 1′ 20″, while the diameter of the outer nebulous envelope, as far as it could be readily traced, was about 6′ 9″. The spectroscope showed a bright continuous spectrum, which was surprisingly strong in the red, which completely masked any lines. As the comet had not been seen here for several days previous to the 13th, this appearance may have been of considerable duration. Clouds prevented another view until January 17, when the inner envelope had entirely lost its sharp outline, and the following portion had disappeared, leaving a corresponding dark space, while the preceding portion had increased its angular dimensions and revolved through an angle of about 60°.

This is the appearance it presented, though the change may have occurred in a very different manner. The 26-inch equatorial did not bring out any additional details. The distance from the following side of the nucleus to the outer edge of the inner envelope was about 32″, whereas it had been 40″ on the 13th, taking half the diameter of the envelope on that occasion to represent the corresponding measurement on the 17th.

A very marked increase in the length of the tail of the comet occurred between December 27 and 28. For about one-third of its length the tail was broad and fairly uniform in brightness; from the middle of this broad portion issued two long bright streams, one being longer and brighter than the other. The total length was about 4°.

W. T. SAMPSON

Naval Observatory, Washington, January 19

### "Mental Evolution in Animals"

THE appearance of Mr. Romanes' new book with the above title reminds me of a reference in his work on "Animal Intelligence" to an observation of my own. I have intended for at least twelve months past to write you about the matter, but as Mr. Romanes' new book is practically a continuation o his former work, you will probably not conclude that I have procrastinated too long.

On page 251 of "Animal Intelligence" Mr. Romanes quotes my story of a skate in the Manchester Aquarium. The fish in

question, unable to seize a morsel of food lying in the angle formed by the glass front and bottom of the tank, "raised himself into a slanting posture, the head inclined upwards and the under surface of the body towards the food," and, by waving his fins, caused a current in the water which lifted the food straight to his mouth. Mr. Romanes adds that this observation is practically worthless "from the observer having neglected to repeat the conditions in order to show that the movements of the fish were not, in their adaptation to these circumstances, purely accidental."

I quite agree with Mr. Romanes that such observations should be tested in every possible way, and I should have been only too glad to repeat the conditions of this and other observations had I been able to do so. The fact is, however, that as neither the directors nor the curator of the Manchester Aquarium were willing to call in the aid of those extra attractions which you London people seem to have successfully employed in the case of the Westminster institution, the Manchester Aquarium came to an untimely end, and thus my observations were cut short. There are, however, two comments which I should like to make. On p. 351 of "Animal Intelligence" (the coincidence in the numbering of the respective pages may help the reader's memory), Mr. Romanes quotes a story by Mr. J. S. Hutchinson concerning a Polar bear at the "Zoo." A bun was thrown into a pond, and fell "at the angle" beyond the reach of the bear. The animal thereupon "commenced stirring the water with its paw, so that it established a sort of rotatory current which eventually brought the bun within reach." This story was communicated to Mr. Romanes privately, and my skate story was published in your columns four years before Mr. Romanes published his book (see NATURE, vol. xix. p. 160). No repetition of the conditions is mentioned in the case of the bear, yet Mr. Romanes speaks of the story as "a most remarkable observation." In justice to Mr. Romanes I must add that he appears to accept the bear story as a proof of intelligence in that animal because it corroborates a similar story communicated to Mr. Darwin by another observer. I feel, however, that I have a right to back my skate against either of the bears named, for the following reasons. Had I repeated the conditions in the case of the skate with precisely the same result, it would have appeared as though the skate acted in obedience to inherited habit, or instinct, and even the similar conduct of the bears suggests this inference in their case. On the other hand, had a second trial with the skate failed, it would not have been proved that the first case was accidental, and therefore not the result of a "happy thought" on the part of the skate; for it might still have been contended that the skate, like a man, might display presence of mind on one occasion, and not on another, and the chief interest of the incident lies in the assumed spontaneity of the action. Finally, if Mr. Romanes will reflect upon the attitude of the fish as described in my narrative, I think he will see that the movements could not be "purely accidental." For, from the position of the skate's eyes, it follows that, when in the slanting posture described, he *could no longer see the food*. Yet he opened his mouth and adroitly caught it, the waving of the fins and the opening of the mouth being necessarily rapidly consecutive actions. This fact seems to me to show that he *expected* the food to rise in the way in which it did rise.

F. J. FARADAY

Manchester, January 21

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YOUR correspondent seems to think that I had some particular spite against his skate, and quotes my indulgence to a bear as proof of inconsistency. But the two cases are very different. Even apart from the unconscious corroboration to which he alludes (and which as evidence of a fact I consider better than even verification by the same observer), we must remember that the stirring of water for a long time in the same direction with its paw is not quite so habitual an action on the part of a bear as is the ordinary swimming movement on the part of a skate. As for any difficulty which the skate may have had in seeing the food approach its mouth, surely the fact of its opening its mouth when the food was near enough to grasp is no better evidence of design than of accident. In either case, under the conditions, and more especially the "attitude," described, the seizure of the food at the proper moment can only be ascribed to the sense of *smell*, which in the skate is so highly developed. Lastly, why does your correspondent begin by saying that verification would have been desirable, and end by arguing that it would have been of no use? Even if the experiment had failed on repetition, he says, his inference would not thereby have been negatived. If this is so, assuredly there would have been no object in repeating the conditions. I once told a terrier to fetch me the ace of hearts from a pack of cards, and he did it. I happened previously to have known that the ace of hearts was the top card. Suppose I had repeated the experiment fifty times, and the dog had every time brought the wrong card, should I have been justified in attributing the first success to a "happy thought"?

GEORGE J. ROMANES

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## The Storm of January 26

I SEND you inclosed particulars of the great storm of January 26 and 27 as observed at Newport, opposite Dundee. Another observer six miles to the north-east of Newport took readings which corresponded almost exactly with those at Newport for the fall, but were thirty to forty minutes later for the rise. They were as follows, being reduced and corrected:—

| Hour | Inches | Hour | Inches |
|---|---|---|---|
| 2.15 p.m. Saturday, | 28·429 | 11 p.m. Saturday, | 27 385 |
| 3.15 ,, ,, | 28·218 | 11·15 ,, ,, | 27·385 |
| 4.15 ,, ,, | 28·036 | 3 a.m. Sunday, | 27·665 |
| 6.15 ,, ,, | 27·834 | 6 ,, ,, | 27·922 |
| 8.15 ,, ,, | 27·598 | 9 ,, ,, | 28·143 |
| 10.15 ,, ,, | 27·406 | 11 ,, ,, | 28·230 |

Dundee, January 30

DAVID CUNNINGHAM

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## Ozone at Sea

DURING my voyage hither from London in the *Maranoa*, viâ the Canal, and calling at Malta, Aden, and Colombo, I was surprised at the low values for ozone as registered by Moffat's tests, which I pinned to the "uprights" in Stevenson's thermometer screen. I tried periods of exposure varying from half an hour to twenty-four hours, and the highest value noted was but 5·6 for eight hours (scale 0 to 10). The test papers, however, were always tinted, more or less, sometimes to 3·0 in half an hour, whereas tests exposed at the same time and examined when eight hours had elapsed, only gave 4·6. At Ben Nevis and Fort William, and in the moorlands of Staffordshire I have recorded far higher ozone values than at sea under the same force of wind and like periods of exposure. From my long experience of these tests I cannot consider them satisfactory; but in the absence of a more reliable method I would strongly suggest that they would give results more intercomparable if uniformly exposed for an agreed hourly period, especially at the various land stations.

CLEMENT L. WRAGGE

Adelaide, South Australia, December 22, 1883

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## Meteor

AT 9.55 p.m. on Sunday, January 27, I saw a meteor start from a point in Taurus, near to Saturn, and fall vertically a distance of 20°, and then burst with a brilliant flash, giving off several colours that almost instantaneously died away. The meteor was visible about three seconds, and increased greatly in brightness from the time first seen until it burst. It was the most brilliant meteor I ever saw, and its greatest brightness much exceeded that of Venus.

E. HOWARTH

Museum, Sheffield, February 5

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## Ravens in the United States

OUR Natural Histories say *Ravens* are common all over the United States, but I have never met any one who was aware of having ever seen one. Are they common in Westchester County, near the Hudson, and confounded with crows?

New York, January 11

MANHATTAN

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## Unconscious Bias in Walking

THE thought has occurred to me that "unconscious bias in walking" may be the result of inequality in the length of the lower limbs caused by the manner in which young children are carried. Each person appears to nurse solely on one arm; I think the right is more frequently employed. I have noticed when a child is held in the arm the side which is nearer the nurse appears to be in a somewhat cramped and unnatural position, the leg more or less bent, while the outer side is comparatively straight and free. Would not this, while preventing the full play of the muscles of the inner leg, tend to arrest to some extent its

proper development at a time when growth is very rapid, and thus cause that difference in the length and strength of the limbs remarked by your correspondents? SARA S. OWEN

4, Soames Street, Grove Park, S.E., February 2

## ON THE HEIGHT OF THE AURORA BOREALIS

IT is with pleasure that I respond to the invitation of NATURE to give an account of the work of the Danish Meteorological Station, which was maintained, under the international scheme, at Godthaab in Greenland, in 1882–83, and of which I had the honour of being the chief. I intend, in the present article, to confine myself to the aurora borealis.

The results, which have been obtained from calculations of the height of the aurora borealis in the temperate zone, which lies south of the so-called auroral belt, all agree in fixing the minimum height of the aurora very high, as the auroræ seem to be confined to the part of the atmosphere where its density is only a fraction of that at the surface of the sea. However different the value may have been of the heights of the auroræ observed outside their true zone, the average of the minimum heights is hardly under two hundred kilometres. On the other hand, the observations in the Arctic regions show that the auroræ may descend to much lower elevations above the earth's crust, and that they may even reach down into regions of the atmosphere where the density is about the same as on the surface of the sea.

Dr. S. Fritz has thus, at Ivigtut in South Greenland, in February and March, 1872, measured auroræ the lower edges of which were only from 50 to 200 metres above the level of the sea, while in nearly every monograph of the aurora borealis cases are cited in which the auroræ appear to have reached much further down in the atmosphere. I may further mention some instances, which have, by the bye, not been made public before, observed by the eminent zoologist, Prof. Steenstrup, and which he has permitted me to publish here.

During Prof. Steenstrup's sojourn in Iceland, 1839-40, he saw, on several occasions, auroræ which hid the top of the mountain Esia, some 600 metres in height, lying behind Reykjavik. He further states that he has seen auroral streamers between the masts of a ship, in such a manner that they disappeared where there were sails, and reappeared where the space was free. The Professor asserts even that on one occasion, on January 28, 1840, when walking between Reykjavik and Bessastad with the chief magistrate, Herr Tvede, and Judge Jonasson, he, as well as these two gentlemen, saw auroral streamers appearing *between themselves*. The phenomenon was not a solitary one, but occurred three or four times during this walk, and in spite of the pedestrians keeping about a yard from each other.

Although many estimates of the low descent of auroræ in the Arctic regions may have been due to optical illusions, specially through irradiation, one cannot, even from a casual observation of this magnificent phenomenon, but come to the conclusion that, while some auroræ lie in the same great, indefinable distance from the observer as those observed in the temperate zone, there are others whose whole appearance has the character of being a phenomenon of a purely local nature. During our stay at Godthaab this point had my special attention, as it appeared to me of importance to demonstrate by measurements as accurate as possible whether this subjective impression answered to the true facts.

To this end the Danish international station at Godthaab, 64° 10′ 36″ N. lat. and 51° 40′ 0″ E. long., has, during October and December, 1882, effected a series of measurements. The site of the station was particularly suited for the solution of the problem, as it lies just at the northern border of the great Arctic auroral belt, *i.e.* in a place where the auroræ appear with all the peculiarities which distinguish them in their true zone.

The distance between the two points of observation, separated by the Godthaab Fjord, was 5·8 kilometres, and the direction between them coincided with the magnetic meridian. The two instruments used for the measurements, exactly similar in construction, were arranged as universal instruments. Instead of a telescope, a tube was employed, which had in one end a small opening, and in the other a metal cross of very fine wires. In order that the errors in the observations should not affect them very much, measurements were only made in the vertical plane between the two points of observation. The placing and reading of the instruments were effected by means of pre-arranged fire-signals, and only those measurements of which the reading signals were instantaneously answered, and for which the time of reading exactly coincided, were recorded. Only the lower edges of the auroral bands were measured, as these are nearly always the most clearly defined.

We have, during our evenings of observation, measured the height of thirty-two auroral bands. The subjoined figures, showing the result of these, demonstrate that the lower edge of the band certainly descends very low. Thus of the thirty-two auroræ measured by this method ten only had a parallax under 1°, for six the parallax was between 1° and 2°, four had a parallax of between 3° and 4°, two one between 5° and 6°, four one between 7° and 8°, while we measured six of 10°, 14°, 15°, 17°, 86°, and 143° respectively.

Leaving the auroræ whose parallax was under 1° out of the calculation, I have found the following heights for the other twenty-two lower edges:—

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | ... | 67·81 kilometres. | ... | 12 | ... | 7·43 kilometres. | |
| 2 | ... | 59·60 | ,, | ... | 13 | ... | 6·16 | ,, |
| 3 | ... | 54·73 | ,, | ... | 14 | ... | 5·28 | ,, |
| 4 | ... | 46·94 | ,, | ... | 15 | ... | 3·72 | ,, |
| 5 | ... | 45·04 | ,, | ... | 16 | .. | 3·69 | ,, |
| 6 | ... | 38·09 | ,, | ... | 17 | ... | 3·22 | ,, |
| 7 | ... | 29·81 | ,, | ... | 18 | ... | 2·87 | ,, |
| 8 | ... | 19·14 | ,, | ... | 19 | ... | 1·99 | ,, |
| 9 | ... | 9·76 | ,, | ... | 20 | ... | 1·96 | ,, |
| 10 | ... | 9·40 | ,, | ... | 21 | ... | 1·35 | ,, |
| 11 | ... | 7·67 | ,, | ... | 22 | ... | 0·61 | ,, |

The three heights of 1·99, 2·87, and 3·22 kilometres belong to the same aurora as that whose edge was measured at an interval of two minutes between each measurement. The two auroræ of 1·35 and 0·61 kilometres stood both above the fjord between the observatories. From the southern one they were seen at an altitude of 13°·6 and 30°·3 respectively above the northern horizon, while at the northern station they were 80°·5 and 7°·25 respectively above the southern horizon. These two and the above-mentioned third, the height of which was measured three times, had the appearance of curtains with large folds, or of bunches or wreaths of streamers lying close together, separated by darker, faintly-shining spaces, but connected below through a common band. The others were bands or arcs without radiating streamers. The edges measured were all nearly at right angles with the magnetic meridian. Only the height of those edges which were distinctly defined, and whose course did not deviate greatly from perpendicularity on the magnetic meridian, were measured.

I must further, as regards the small height of the auroræ observed at Godthaab, state that not only three observers besides myself, but even a student as conversant with auroral phenomena as Herr Kleinschmidt, all agree that auroræ were seen *below the clouds* on several occasions during the winter of 1882-83. On this point we do not entertain the least doubt.

In conclusion I will describe some observations made on several occasions during our stay at Godthaab of the peculiar type of the aurora known as phosphorescent auroral clouds.

On September 21, 1882, Herr C. Petersen, one of my

assistants, observed, at 9.45 p.m., an aurora appearing as a lustrous green light behind the nearest hills. The top of the mountain, "Sadlen," 1200 metres in height, was distinctly seen *above* the lustrous plane. The phenomenon rapidly disappeared. At 10.45 a light was seen in the south, which resembled that of dawn, and contracted into a faint shining cloud, oblong in shape, which oscillated slowly before the mountains "Hjortetakken" (1200 metres) and "Store Malene" (800 metres) at a distance of 8 to 12 kilometres from the station. The tops of the two mountains were distinctly seen *above* the luminous cloud, while at times small but intense spots of light developed themselves in it. When the cloud, at 11.45 p.m., had moved in front of the mountain "Lille Malene," the light became more intense, and had the appearance of a lustrous white cloud of smoke rolling up the hill to north-east. When the cloud travelled over the hill, the light became yellow, and was bordered by a coloured rim. At 11.10 it shot three faint red streamers up towards the zenith, and then the whole disappeared.

The following phenomenon was observed by the writer of these lines:—On November 14, 1882, at 6 a.m., I observed an auroral band without streamers through Vega, the Great Bear, and the Twins, while another stood parallel with this further west. From the "Store Malene" I now saw a peculiar shining white cloud descend into the fjord below. It descended in long, straight, shining bands. In a few minutes the mountain in question, as well as "Hjortetakken" were completely hidden in the cloud. A little further east the cloud possessed greater intensity, while on the plain at the foot of the hill on which the observatory stands, two luminous gatherings were seen, which seemed to rest on the snow, with a strongly phosphorescent light. These two gatherings, which were at first isolated, now came in contact with the above described cloud with long luminous bands radiating from the latter. By opening the slit of the spectroscope as much as possible and simultaneously keeping foreign light from the eye, I beheld the auroral line faintly but clearly defined. The cloud now began to disappear without oscillation, when suddenly a number of horizontal openings formed in it, through which the mountain stood forth. In the next second all had disappeared.

I admit that, as regards the last described phenomenon of the lustrous cloud, it might be explained as being caused by the reflex of the auroræ which were simultaneously visible; but such an explanation is not applicable to the one first described. It would be very interesting to learn if other observers have noticed this form of the aurora.

ADAM PAULSEN

Copenhagen

## *THE EFFECTS OF THE WEATHER UPON DEATH RATE AND CRIME IN INDIA*

SOME time ago a very interesting series of articles, by Mr. Buchan, upon the connection between certain meteorological conditions and the zymotic diseases, as illustrated by the mortuary returns of the London district, appeared in NATURE. Happening to have undertaken, at the request of the provincial superintendent of census operations, certain investigations concerning the life statistics of the population of the North-West Provinces and Oudh, just about the time when Mr. Buchan's articles appeared, it occurred to me that it would be worth while to see whether any similar concomitant variations of meteorological conditions and causes of death could be detected in India. The results arrived at are so curious, and at the same time so definite, that I think they may be of interest to readers of this journal.

At starting, however, it should be observed that, though the mortuary returns of the province with which I am connected are probably the best in India, they are still very far from complete. The agency employed for registration is that of the village *chaukidár* or watchman, who is supposed to take note of all births and deaths which occur in his village (aiding his memory, if necessary, by variously cut notches on a stick) and to report these weekly at the nearest police station. From such an agency nothing like an exact account of the causes of death can be expected; hence in the detailed tables given below I have confined my attention to the four most obvious causes—small-pox, cholera, suicide, and wounds. Even as regards the number of deaths registered a considerable defect may confidently be anticipated, owing to lapses of memory on the part of the *chaukidár*. This defect has been found by Dr. Plauck, the Sanitary Commissioner, to amount to about 20 per cent. of the whole on the average of a large number of cases personally examined by him in various parts of the province. The proportion thus obtained is confirmed by a comparison of the deaths actually registered with the death rate arrived at in the last census report. During the five years, 1878-82 (the only ones for which complete returns are obtainable), the deaths registered appear, from figures supplied by Dr. Plauck, to have numbered 7,311,013. The average population during the five years having been about 45,000,000, this gives an annual death rate of 32·5 per thousand. Now in Mr. White's report on the census of 1881 it is shown that the distribution of the population according to age, and the observed death rate among certain tribes and castes suspected of practising infanticide, and therefore placed under strict police surveillance, point to 40 per mille as the probable rate of mortality for the general population. The unrecorded deaths therefore amount on the average to 7·5 out of 40, or 19 per cent. of the total—almost exactly the same defect as Dr. Plauck arrived at by his personal investigation of special cases.

It follows that, though the returns collected by the rude illiterate agency employed are not strictly accurate, the totals arrived at probably on the whole bear a nearly constant proportion to the true number of deaths, the population dealt with being sufficiently numerous to eliminate any individual peculiarities of the agents.

The death rate varies enormously from year to year, as may be seen from the table of the total number of deaths recorded, here given in full :—

*Number of Deaths from all Causes Registered in the North-West Provinces and Oudh during the Five Years* 1878–82

| Year | Jan. | Feb. | March | April | May | June | July |
|---|---|---|---|---|---|---|---|
| 1878 | 137,161 | 140,173 | 143,760 | 157,326 | 136,867 | 120,767 | 91,677 |
| 1879 | 75,387 | 62,837 | 71,874 | 87,302 | 100,040 | 83,802 | 73,120 |
| 1880 | 116,366 | 72,030 | 69,250 | 72,534 | 76,622 | 78,200 | 56,502 |
| 1881 | 95,226 | 91,011 | 97,829 | 124,831 | 115,683 | 86,083 | 81,609 |
| 1882 | 114,220 | 92,472 | 96,596 | 107,628 | 119,714 | 114,382 | 122,110 |
| Total | 538,360 | 458,523 | 479,309 | 549,621 | 548,926 | 483,234 | 425,018 |

| Year | Aug. | Sept. | Oct. | Nov. | Dec. | Annual total |
|---|---|---|---|---|---|---|
| 1878 | 113,701 | 120,607 | 138,997 | 127,656 | 93,032 | 1,521,724 |
| 1879 | 131,702 | 196,135 | 429,115 | 369,390 | 233,795 | 1,914,499 |
| 1880 | 74,127 | 87,618 | 91,218 | 99,459 | 93,264 | 987,190 |
| 1881 | 86,316 | 109,837 | 181,519 | 180,683 | 151,846 | 1,402,473 |
| 1882 | 151,779 | 159,604 | 156,065 | 128,040 | 122,517 | 1,485,127 |
| Total | 557,625 | 673,801 | 996,914 | 905,228 | 694,454 | 7,311,013 |

The deaths recorded average a little under a million and a half per annum, but in 1880 they were less than a million, and in 1879 nearly two millions. In that disastrous year one district or county, that of Aligarh, lost nearly half a million of its po lation. The chief difference between 1879 and 1880, from the meteorological

point of view, was that in 1879 the monsoon rains were unusually heavy, while in 1880 they were so scanty that for a long time grave apprehensions were entertained of another famine, like that which followed the drought of 1877. The year 1877 (which does not appear in the table) was an extraordinarily healthy one, but the effect of the scarcity produced by the drought of that year is seen in the high mortality of the first six months of 1878.

The first rough generalisation suggested by the table is that dry years are healthy and wet ones unhealthy. That this is generally true is well known to residents in the country. Among the natives also I have heard it said that one must choose between health *plus* famine and abundance *plus* fever. It would nevertheless be false to infer that in India mortality is due to rain ; for we have only to compare the figures for the several months to see that on the average, and in almost every single year, the month in which fewest deaths occur is July, which happens to be just the rainiest month of the twelve. Rain is no doubt one of the indirect causes of death ; but it seems to produce unhealthy effects by increasing the humidity of the air and hastening the growth of rank vegetation, which, decaying at a time of the year when the air is almost perfectly still over the Indian plains, produces that noxious condition of the lower atmospheric strata known by the name *malaria*. Compared with the deaths from malarial fevers, those due to cholera, small-pox, and other epidemics count almost as nothing. Hence, though these epidemics have their particular seasons of maximum and minimum, their effect is completely hidden in the general mortality table under the great annual variation which culminates in October and November.

Besides rainfall, atmospheric humidity, and wind velocity, other meteorological causes which presumably have some effect upon health are the mean temperature and the daily range of temperature—the last, according to the prevalent opinion amongst Indian medical men, who are fond of attributing almost every ailment to nocturnal chills, being a most important cause. The next table gives approximate monthly mean values of all these meteorological elements for the North-West Provinces and Oudh, exclusive of the Himalayan districts, which are very sparsely populated.

*Mean Values of Certain Climatological Factors in the North-West Provinces and Oudh*

| Month | Mean temp. | Daily range of temp. | Relative humidity | Rainfall | Wind velocity per diem |
|---|---|---|---|---|---|
| | ° | ° | % | inches | miles |
| January ... ... | 59 | 28 | 62 | 0·8 | 54 |
| February ... | 64 | 28 | 57 | 0·5 | 71 |
| March ... ... | 75 | 29 | 46 | 0·3 | 83 |
| April ... ... | 85 | 32 | 37 | 0·2 | 90 |
| May ... ... | 90 | 28 | 43 | 0·7 | 93 |
| June ... ... | 91 | 20 | 52 | 3·8 | 108 |
| July ... ... | 85 | 14 | 75 | 11·4 | 95 |
| August... ... | 84 | 14 | 77 | 9·5 | 80 |
| September ... | 83 | 16 | 74 | 6·6 | 70 |
| October ... | 77 | 27 | 62 | 1·3 | 47 |
| November ... | 67 | 32 | 55 | 0·1 | 35 |
| December ... | 60 | 30 | 61 | 0·2 | 40 |
| Year... ... | 77 | 25 | 58 | 35·4 | 72 |

Before proceeding to estimate the relative effects of these factors upon the death rate, it will be found convenient to convert the totals given in the first table into mean rates per annum. The mean number of deaths per annum for each million of population is 32,493, and this number is distributed over the months as follows, when the months are all reduced to the same length :—

| Jan. | Feb. | March | April | May | June |
|---|---|---|---|---|---|
| 2351 | 2201 | 2093 | 2480 | 2397 | 2181 |
| July | Aug. | Sept. | Oct. | Nov. | Dec. |
| 1855 | 2435 | 3040 | 4352 | 4083 | 3025 |

It has already been pointed out that the effect of the rainfall upon health is very indirect, and therefore need not be taken into account here. The relative effects of the other factors in the second table may be calculated approximately by the formula—

$$d = \alpha t + \beta r + \gamma h + \delta v.$$

Here $d$, $t$, $r$, $h$, and $v$ respectively denote the variations of the death rate, the mean temperature, the range of temperature, the relative humidity, and the wind velocity each month from their mean annual values. From the twelve equations of this form, furnished by the monthly means, we get the following most probable values for the coefficients, viz. :—

$$\alpha = 79{\cdot}7 \qquad \beta = 113{\cdot}6$$
$$\gamma = 43{\cdot}4 \qquad \delta = -35{\cdot}6$$

If there be any approach to truth in the assumed proportionality between the variations of the death rate and of these climatological elements, it therefore appears that a mere rise of temperature within the limits observed produced comparatively little effect, one degree of increase in the mean temperature increasing the deaths about 80 per million per month, or rather less than one per thousand per annum. The variations of the diurnal range have a much greater effect, while the change of the death rate due to varying humidity is even less than that due to temperature changes.

The relation between the death rate and the movement of the wind is inverse, the proportionate increase of deaths being 35·6 per million per month for a decrease in the velocity of the wind amounting to only one mile in twenty-four hours. In the months of October and November, when so-called *malarial* diseases attain their maximum, the air is almost absolutely still ; and there can be very little doubt that if a moderate breeze were occasionally to spring up at this time of the year, so as to dissipate the *malaria*, or at all events mix it with good air from other districts or from above, the effect would be an immediate decrease of the death rate.

As regards special causes of death, I have already stated that I have confined my attention to those cases in which the *chaukidár* may be trusted to make a correct diagnosis. Small-pox, a disease now happily almost banished from Europe, but still carrying off many thousands of victims annually in India, is one of these almost unmistakable causes. The average number of deaths from this disease during the five years was 59,240, distributed as follows :—

| Jan. | Feb. | March | April | May | June |
|---|---|---|---|---|---|
| 3195 | 3830 | 6611 | 12,561 | 13,790 | 9140 |
| July | Aug. | Sept. | Oct. | Nov. | Dec. |
| 4855 | 1924 | 742 | 366 | 536 | 1690 |

The deaths from this cause, numerous as they are, are fewest in the months when the general mortality attains its maximum. The meteorological causes which favour the spread of small-pox appear to be heat, drought, and possibly also an unusually high wind velocity, the solid particles which constitute the contagion being presumably blown about by the wind. The relative effects of these may be roughly computed from the totals for each quarter, using the formula—

$$n = N + \alpha t + \beta (100 - h) + \gamma v ;$$

$n$ being the recorded number of deaths in any month ; $N$ the number that would occur under the hypothetical conditions of a still, saturated atmosphere at 0° F. ; and $t$, $h$, and $v$ standing for the temperature, humidity, and wind velocity respectively. The coefficients thus found are $\alpha = 91$ ; $\beta = 237$ ; $\gamma = 97$ ; the condition most favourable to the propagation of small-pox appearing therefore

to be dryness. The number $N$, for the unattainable conditions assumed, comes out negative.

Another disease which the village watchman may be trusted to recognise in most instances is cholera. Cases of severe diarrhœa are doubtless frequently returned as cholera, but this does not sensibly impair the value of the registers, since the two diseases are usually prevalent about the same time. The mortality from cholera is subject to an annual variation quite as distinct as that of small-pox, but there are two maxima, in April and August, with a slight diminution between these months. The averages for the five years are :—

| Jan. | Feb. | March | April | May | June |
|---|---|---|---|---|---|
| 317 | 338 | 1304 | 9027 | 6541 | 6344 |
| July | Aug. | Sept. | Oct. | Nov. | Dec. |
| 5735 | 8129 | 4839 | 4665 | 1514 | 426 |

From the records of the army, police, and jail departments, extending over a longer series of years, it appears that the maximum mortality from cholera usually occurs in the rainy season. The secondary maximum in April becomes the principal one in this table on account of the excessive prevalence of cholera in April 1880. This epidemic was popularly attributed to the immense number of Hindu pilgrims assembled at the great religious fair of Hardwár, the disease having been caught from some infected persons in the crowd and spread abroad over the country as the pilgrims returned to their homes. The Sanitary Commissioner with the Government of India, however, does not accept this view, but seems to attribute the disease or its dissemination to some occult atmospheric influence. Whatever may ultimately prove to be the nature of the disease, there can be little doubt that in the North-West Provinces it is to a great extent dependent upon heat and moisture, being almost unknown in the cooler months of the dry season. To estimate the relative effects of these two atmospheric conditions, we may employ the formula—

$$n = N + \alpha t + \beta h;$$

the letters having similar significations to those mentioned with the previous formula. Combining the months in groups of four, commencing with December, we get three equations which give the following approximate results :— $\alpha = 281$ ; $\beta = 45$; $N = -20{,}076$. The principal effect is that due to high temperature ; while at the temperature assumed for $N$—zero F.—that number comes out negative. That is to say, in a perfectly dry atmosphere cholera would disappear at a temperature considerably above freezing, about 70° F., in fact, if we may judge from these tables. In the cold weather months, indeed, cholera never assumes epidemic proportions in the North-West Provinces ; but when the poison, whatever it may be, is widely disseminated, as in the beginning of 1882, after the great *mela* or religious fair at Allahabad, it remains nearly quiescent, manifesting itself only in a few sporadic cases until the commencement of the hot weather in April, when it breaks forth with alarming rapidity.

Deaths by violence are also, as a rule, unmistakable. In the Sanitary Commissioner's tables two causes of death are given which both come under this head—suicide and wounds—the latter presumably including only the results of murder and manslaughter, as there are separate headings for accidents and wild beasts. The average numbers of these deaths recorded each year are—

| | Jan. | Feb. | March | April | May | June |
|---|---|---|---|---|---|---|
| Suicide ... | 105 | 109 | 196 | 268 | 246 | 248 |
| Wounds ... | 105 | 94 | 105 | 119 | 125 | 128 |
| Total ... | 210 | 203 | 301 | 387 | 371 | 376 |
| | July | Aug. | Sept. | Oct. | Nov. | Dec. |
| Suicides ... | 246 | 242 | 269 | 250 | 151 | 100 |
| Wounds ... | 132 | 154 | 145 | 135 | 115 | 98 |
| Total ... | 378 | 396 | 414 | 385 | 266 | 198 |

Both series exhibit a distinct annual variation, notwithstanding some irregularities which would probably disappear if we had larger numbers to deal with, and in both the phases are similar, the minimum being reached in the middle of the cold weather, and the maximum in the hot season and rains. Both forms of death by violence are, in fact, manifestations of the same cause, irritability of temper ; for suicides in India are, as a rule, not the result of a fixed melancholia, three-fourths of the cases being those of young married women, who, finding life unbearable under the daily and hourly sting of the mother-in-law's tongue, end it at last by jumping down a well.

The monthly totals given in the last table may be approximately represented by the formula—

$$n = \alpha (t - x) + \beta h,$$

since they seem to depend both on temperature and humidity. In this formula $x$ would be the temperature at which crimes of violence would disappear. Grouping the months in fours, commencing with November, we get three equations which give $\alpha = 7{\cdot}2$, $\beta = 2{\cdot}0$, and $x = 48{\cdot}4°$ F. Crimes of violence in India may therefore be said to be proportional in frequency to the tendency to *prickly heat*, that excruciating condition of the skin induced by a high temperature combined with moisture. Any one who has suffered from this ailment, and knows how it affected his temper, will readily understand how the conditions which produce it may sometimes lead to homicide and other crimes. And any one who has been in India in the cold weather and seen to what an abject condition the ordinary native is reduced by a temperature of 60° or so can believe that there is probably some truth in the arithmetical result above given, that about 48° crimes of violence would disappear, for at such a temperature nobody would possess a sufficient store of energy to enable him to commit crime of any graver description than petty larceny.

S. A. Hill

## *ALGÆ*[1]

THE new work of Dr. Agardh, forms the third part of a series of monographs of algæ, two parts of which have already appeared. The first part contains the genera Caulerpa, Zomaria, and certain groups of Sargassum ; the second contains the Chondariaceæ and Dictyoteæ. The Ulvaceæ form the subject of the present monograph. This work should have special interest for algologists, from the circumstance that in it the author has expressed his views, and the reasons on which they are founded, concerning the much-debated question whether Bangia, Porphyra, Goniotrichum, and Erythrotrichia belong to the Florideæ or to the Ulvaceæ. The fact that Dr. Agardh still retains them among the Ulvaceæ is a sufficient proof that he is not convinced by the perusal of Dr. Berthold's work (noticed in NATURE, vol. xxvii. p. 385), and the statement of the latter that they belong to the Florideæ.

Dr. Agardh discusses the subject at some length, calmly and dispassionately ; and, considering his immense experience in the study of algæ, his opinion is deserving of much consideration. It may be as well to give the reader some idea of the arguments upon which the author has grounded his opinion. He relies principally, it will be seen, upon the assumed difference of the reproductive organs in the Ulvaceæ and in the Florideæ, namely, on the sporidia endowed with motion (zoospores) in the true Ulvaceæ ; and on the antheridia, cystocarps, and tetraspores of the Florideæ ; the antheridia and cystocarps being considered by Thuret and others as sexual, the tetraspores as asexual.

[1] "Til Algernes Systematik." Nya bidrag af J. G. Agardh (Tredje afdelningen). Lunds Årsskrift, tom. xix.

Dr. L. Rabenhorst's "Kryptogamen-Flora von Deutschland, Oesterreich, und der Schweiz." Zweiter Band : "Die Meeresalgen Deutschlands und Oesterreichs." Bearbeitet von F. Hauck. 4—6 Lieferung. (Leipzig : Eduard Kummer, 1883.)

Dr. Agardh points out that the organs with powers of motion, observed by Derbès and Solier, are scarcely to be referred to the Florideæ, because in their eruption from the plant, as well as in their movements, they have an appreciable analogy with the organs of Prasiola, described by the author in a new species, *P. cornucopiæ* (see Table III., fig. 74, *e*, *f*, *g*).

On the other hand, Dr. Agardh shows that the chief consideration which induced some algologists to remove Bangia and Porphyra from the Ulvaceæ to the Florideæ was derived from the quaternate division of the cells, which was thought to be analogous to the quaternate division of the tetraspores in the Florideæ. He points out that Janczewski and Thuret had observed that it was not tetraspores, but octospores, which resulted from the division in Porphyra; and he calls attention to the fact that the so-called octospores are themselves repeatedly divided into new generations of tetraspores and octospores, in the same manner as the cells or cell-contents in Prasiola, Tetraspora, Palmella, Monostroma, Ulva aureola (*Ilea fulvescens*), and some species of Enteromorpha divide; thus showing an analogy with these plants rather than with the Florideæ.

The author observes that if the organs of Porphyra be considered analogous with the tetraspores of the Florideæ, these organs, according to some authors, should possess different functions, the tetraspores being deemed neutral in the Florideæ, but the octospores sexual in Porphyra. If, he says, those organs which in Porphyra are called antheridia agree with the antheridia of the Florideæ; if, also, those 4-partite organs which constitute spores are to be compared with the tetraspores of the Florideæ; there still remain in Porphyra and Bangia no organs which can be considered identical with the capsular fruit of the Florideæ. If, therefore, those organs which form the principal characteristic of the Florideæ are absent, it is evident that Bangia and Porphyra are far inferior to the Florideæ, and that very distant affinities must be sought for them. Moreover, if those organs which are neutral in the Florideæ become sexual and female in Porphyra, this rather seems to indicate divergence than affinity.

With regard to Bangia, Dr. Agardh observes that the filaments of this plant growing together in patches, as already observed by Dillwyn and others, always vary in thickness and in appearance, and that this difference of appearance may have suggested the idea that they were of various kinds (male and female filaments). According to Dr. Agardh, these differences are merely differences of age; and the so-called special organs are to be considered rather as different states during the evolution of the fructification, than as distinct organs.

Reviewing the statements of different algologists with regard to the fructification of these plants, the author shows from their published works that much difference of opinion existed among them. Thus, according to Derbès and Solier, those organs in Bangia which they considered as male are said by them to be endowed with lively motion; while Thuret and Reinke, referring to the same organs, say that they are motionless. Again, the author observes that Janczewski, alluding to the octospores of Porphyra, says that they have an amœboid motion; Thuret, on the contrary, states that they are motionless.

After quoting Thuret's description ("Etud. Phyc.") of the processes of fructification in Porphyra, Dr. Agardh cites the following passage referring to the antheridia: "La division s'arrête plus tôt pour les spores et se prolonge davantage pour les antheridies; mais il n'y a pas de différence fondamentale dans le procédé. On en a la preuve dans les cas anormaux, déjà mentionnés par M. Janczewski, ou le contenu d'une même cellule primitive se change, partie en spores, partie en corpuscules mâles." So remarkable does this statement appear to Dr. Agardh that he quotes it also in the note to p. 26, where he thus comments on it: "Quomodo ii, qui hoc observarunt, sibimetipsis persuaserint eam partem contentus, quæ organis perhibitis fœmineis constaret, sub stadio evolutionis paulo posteriore in organa mascula non transmutaretur, mihi non liquet."

Leaving this subject to the consideration of algologists, the more general features of the work may now be noticed.

Dr. Agardh arranges the Ulvaceæ under the following genera: 1, Goniotrichum; 2, Erythrotrichia; 3, Bangia; 4, Porphyra; 5, Prasiola; 6? Mastodia; 7, Monostroma; 8, Ilea; 9, Enteromorpha; 10, Ulva; and 11, Letterstedtia.

Of these genera Mastodia and Letterstedtia are natives of the Southern Ocean. Ilea, of which one species only is known, *I. fulvescens* (*Ulva aureola*, C. Ag.), is a small tubular plant which grows at the mouths of some Swedish rivers. The cells of which it is composed are arranged in series of fours, as in Prasiola, but the colour is dusky as in Dictyota.

The other genera, of which many species are natives of these shores, will have more interest for British algologists. *Prasiola marina*, Crouan, which Dr. Agardh unites with *P. stipitata*, has been recently found in Scotland and in Devonshire; and the *Ulva calophylla* of Greville, and *Ulva crispa*, have been removed to Prasiola.

Of the twenty species of Monostroma, five, namely, *M. bullosum*, *M. laceratum*, *M. quaternarium*, *M. latissimum*, and *M. wittrockii* have been found on our coasts. To these Dr. Agardh adds another species, *M. lactuca* (*U. lactuca*, C. Ag.), which he considers identical with *M. undulatum* of Thuret, and probably with *M. pulchrum*, Farlow, of the east coast of North America. While thus transferring the specific name *lactuca* to a Monostroma, the author excludes it from Ulva, where it has been a sourse of confusion.

With regard to Porphyra, Dr. Agardh agrees with Dr. Greville in considering *P. linearis* as a distinct species; and he mentions *P. amethystea* as a native of England. Harvey had stated that the latter had been found on the west coast of Ireland, but the plant appears to have been unknown to him, and has not been found until recently, when Mr. G. W. Traill met with it on the east coast of Scotland. The arrangement of the cells in the plant is very beautiful.

In accordance with the views of most algologists, *P. vulgaris* and *P. laciniata* are united by the author; but he has changed the name of the plant to *P. umbilicalis* ("L. Sp.," ed. 2, 1633), of which he describes several forms. In his views of the structure of this alga, Dr. Agardh is at issue with Janczewski and Thuret. The last-mentioned authors state that the vegetative structure of the plant is always monostromatic, and that it is in the fruitful parts only that the cells are arranged in two series. Dr. Agardh, on the contrary, says that the alga is at all times distromatic. A reference to Plate II., fig. 61, *t*, will show that the two strata seen in the transverse section do not exhibit that subdivision of the cells which constitutes the fruit.

Dr. Agardh agrees with M. le Jolis in removing the *Ulva linza* of Harvey to Enteromorpha, where it takes the name of *E. linza*. Of Ulva, seven species only are enumerated. Under *U. rigida* there are no fewer than twenty-four synonyms. While, however, the author deserves thanks for clearing away so many reputed species, he describes many forms of this very generally distributed alga.

Enough has now been said to show the interest this work should have for algologists. It is illustrated by four plates, beautifully executed, containing 124 figures. Although the title is Swedish, the work is written in Latin.

Of Rabenhorst's "Kryptogamen-Flora," Nos. 4, 5, and 6 of Part II., in which the marine algæ are described by M. Hauck, have recently appeared. Numbers 4

and 5 treat of the Florideæ, which are concluded in the sixth part. Then follow the Phæophyceæ; but before touching on these, a few points relative to some of the Florideæ call for observation.

M. Hauck tells us that in Gelidium the cystocarps are of two kinds—(1) those in which the placenta is basal, and have consequently only one series of gemmidia; (2) those in which the placenta is central, on both sides of which the gemmidia are placed. M. Hauck does not seem to be aware that the former were long ago separated by Dr. Agardh from Gelidium, under the name of Pterocladia, the typical species of which is *Pt. lucida*, a very common alga in the Southern Ocean. The *Gelidium capillaceum*, described at p. 190, is a true Pterocladia, and has been described as such by M. Bornet under the name of *Pt. capillacea*. M. Hauck mentions this name among the synonyms of *G. capillaceum*, and at p. 191, fig. 82, he gives us copies of M. Bornet's figures of the cystocarps of this plant, and also of Gelidium; thus showing the characteristic differences between the two algæ; it is therefore surprising to find that M. Hauck still retains the old name of the plant, and places it under the genus Gelidium.

The cystocarpic fruit of *Dasya punicea*, apparently unknown in the Adriatic, was found on our southern coast as long ago as 1859. Before that time a specimen bearing cystocarps was collected by Miss Catlow in Jersey, and Dr. Harvey gave to it the provisional name of *Dasya catlowviæ*. There is considerable difference in the aspect of the plants which bear cystocarps and those which bear stichidia; so much so, that they have been taken for distinct species. British specimens of this plant are much larger than those of the Adriatic.

M. Hauck describes the tetraspores of *Melobesia corallina* as "zweitheilig," and he refers to Solms' "Corallinenalgen des Golfes von Neapel," Table III., fig. 23. Now, on turning to this figure in the work of Graf Solms, it will be seen that the tetraspores are 4-partite. It is true that they have been described by MM. Crouan and Areschoug as dipartite, but, according to the observations of M. Rosenoff in his very interesting "Récherches sur les Melobésiées," p. 45, there seems good reason to believe that, although tetraspores are often found divided into two parts only, the complete number is four.

With regard to *M. macrocarpa*, M. Hauck is apparently right in uniting it with *M. pustulata*, and also in considering *M. corticiformis* as a synonym of *M. membranacea*.

In a former number of his work, M. Hauck had stated that the tetraspores of Nemaleon were unknown. They had, however, been described by Dr. Agardh in "Sp. Gen. et Ord. Algarum," vol. ii. p. 417, and again in the "Epicrisis," p. 507; but the author did not, in either work, state in which species he had found them. Some uncertainty, therefore, existed on this point; and Thuret was of opinion that up to his time there had been no trustworthy record of the discovery of the tetraspores of Nemaleon. It would have been easy to solve the doubt by an appeal to Dr. Agardh, who is always ready and willing to impart information, but no one seems to have thought of adopting this course. The writer is glad to be able to mention, on the authority of Dr. Agardh, that he (Dr. Agardh) found tetraspores on a plant of *Nemaleon multifidum* from Copenhagen, but he had met with them only once. It is hoped that this statement will finally settle the question.

The description of the second division of the marine algæ, Phæophyceæ, is begun at p. 282 with the Fucoideæ; these are followed by the Dictyoteæ, and after these follow the Phæozoosporeæ. Each order is preceded by a careful description of the structure and fructification of the plants included in it, and an enumeration of the genera; in the case of the Phæozoosporeæ, a short diagnosis of each family is inserted. We are glad to see, from the long list of synonyms appended to the description of many plants, that M. Hauck has greatly diminished the number of species, especially of those from the Adriatic.

British algologists will find in the later numbers of this work, as well as in those which preceded them, much that is interesting and instructive. The succeeding numbers will be welcome. It is hoped that they will be followed by a good index, which will add very much to the value of the work. MARY P. MERRIFIELD

## *METEOROLOGICAL OBSERVATIONS FROM BEN NEVIS*

A WEATHER REPORT from the Ben Nevis Observatory is now published daily, which gives the observations made at 9 a.m. and 9 p.m., these being the hours adopted by the Meteorological Societies of the British Islands, to which are added the highest and lowest temperatures, the amount of rain and snow in all cases where it is possible to measure it, the height of the snow on the plateau, measured by the snow gauge, the hours of sunshine, taken directly from the sunshine recorder, and the quantity of ozone, droughts, changes of wind, auroras, glories, halos, electrical and other phenomena, recorded as they occur. The record is strictly one of observations, and as these are made at the usual observing-hours, British meteorologists and all persons interested in the weather are thus afforded the means of comparing their own observations with those made at Ben Nevis Observatory, which is by far the most valuable high-level station we possess, as furnishing data of the first importance in the study of the weather changes of Europe. In the winter climate of the Ben, the problem of hygrometric observation is beset with formidable difficulties. With a view to the practical solution of these it is part of the winter's programme that Mr. Omond conduct a series of investigations with a hygrometer of a novel description specially designed by Prof. Chrystal for the purpose. In the meantime, and until the problem be solved, the word "Sat," meaning saturation, is entered in the wet bulb column in all cases when the wet does not read lower than the dry bulb, it being evident that in such cases the air is all but, if not altogether, saturated. Indeed, a saturated atmosphere at all temperatures may be almost regarded as a persistent feature in the climatology of the Ben. Occasionally, however, as recently happened about Christmas and the New Year, a sudden change sets in, the clouds clear away, the sun blazes out in a sky of marvellous clearness, and a dryness of air comes on such as is rarely if ever experienced at lower levels. In these circumstances the dry and wet bulb readings separate to a degree so extraordinary that Glaisher's tables are no longer of any use in calculating the humidities of the air. As the periods of sudden and intense dryness of the atmosphere are intimately connected with the anti-cyclonic systems prevailing at the time in north-western Europe, it is not improbable that a careful record and study of them will lead to a more exact forecasting of some of our most important weather changes.

By and by the observations, combined with those made by Mr. Livingstone at the low-level station at Fort William, will furnish the data for ascertaining what is the normal distribution of pressure, temperature, and humidity in the stratum of the atmosphere between the top of Ben Nevis and the level of the sea at its base. These being once determined, all deviations therefrom, whenever occurring, will be readily seen. When the departures from the normals to subsequent changes of weather have been further investigated and their relations more accurately determined, the high expectations formed regarding the part to be played by the high-level station on Ben Nevis in contributing important data towards the forecasting of the weather of the British Islands will doubtless be realised. It must not, however, be forgotten that

this intensely practical problem is an excessively difficult one, requiring for its successful prosecution no small expenditure of time, labour, thought, and money.

## NOTES

THE Royal Society at their last meeting elected the following five *savants* foreign members:—Anton de Bary (Strasburg), Carl Gegenbaur (Heidelberg), Leopold Kronecker (Berlin), Rudolph Virchow (Berlin), Gustav Wiedemann (Leipzig).

WE are informed that it has been arranged that Sir William Thomson will give, at Johns Hopkins University during the first twenty days of October next, eighteen lectures on "Molecular Dynamics."

CAPTAIN W. J. L. WHARTON, R.N., at present in command of H.M. surveying vessel *Sylvia*, has been selected to succeed Capt. Sir F. Evans, K.C.B., as Hydrographer to the Navy.

ON Tuesday afternoon, at Oxford, Convocation witnessed in the Sheldonian Theatre the most exciting scene that has been enacted in the University since the opposition to Dean Stanley as Select Preacher. Last summer Convocation passed by a small majority a vote of 10,000*l.* for a new physiological laboratory. The vote was opposed by the anti-vivisectionists and by some on the ground of economy. A memorial got up by Mr. Nicholson against vivisection having produced no effect on the Council, the opponents of Prof. Burdon Sanderson determined to oppose the decree brought before Convocation on Tuesday for empowering the sale of stocks for the 10,000*l.* voted last June. The decree was supported by the Dean of Christchurch, Dr. Acland, and the Warden of Keble, and was opposed by Prof. Freeman and Mr. Nicholson. After a stormy debate the vote was carried by 188 votes against 147. The result was received with enthusiasm, and Oxford is to be congratulated on it. To what shifts Dr. Sanderson's opponents were put may be seen from what the *Times* calls "the most astonishing speech" of Mr. Freeman the historian, "who afforded a curious example of the confusion of thought into which even intelligent men may be led by an over-indulgence in sentiment. It would be as reasonable, said Mr. Freeman, for the historian to illustrate the festivities of Kenilworth by an actual bull-baiting as for the physiologist to experiment upon living animals. Mr. Freeman, in his zeal to establish the scientific character of the historian, forgets the difference between description and discovery, and ignores the fact that the physiologist, at least under the existing law, makes his experiments not for the instruction of pupils, but with a view to discover what is as yet unknown. A more curious article in the indictment against vivisection we have not met with since the celebrated letter in which Sir George Duckett told the Royal Commission that he had no evidence to give, but that he considered vivisection 'an abomination introduced from the Continent going hand in hand with Atheism.'" The *Times* in its leader on the subject treats it sensibly and moderately. "All those who are open to argument have been long ago convinced that science cannot proceed on her beneficent way without the aid of experiments, some of which must be painful; and those who are not open to argument, and those who believe, like some of the wiseacres whose opinion is on record, that 'medical science has arrived probably at its extreme limits,' are not likely to be convinced by anything that can be said or by any facts that can be brought against them. Parliament, on the recommendation of one of the strongest Royal Commissions ever appointed, has legislated in the matter, and physiological experiment is now under limitations as severe as it is possible for it to be consistently with any kind of progress in discovery. Abuses are of the rarest occurrence. Men like Dr. Sanderson are not only humane, but they are conscious that public opinion is awake on the matter, and their discretion as to what should be done and what should not is absolutely to be trusted. It is to be hoped that the sensible action of Convocation will not only encourage the Waynflete Professor to proceed as his scientific conscience may guide him, but will convince the well-meaning but irrational opponents of scientific freedom that further action on their part would be not only vexatious but unsuccessful."

BY the election of Dr. J. H. Gilbert to the separate chair of Rural Economy, Oxford has gained a man of European reputation, whose advent to the professoriate all parties will welcome.

DR. P. P. C. HOEK, of Leyden, writes to inform us of the death of Prof. Dr. H. Schlegel, Director of the Royal Museum of Natural History at Leyden, on January 17 last. Schlegel was born in 1804 in Altenburg (Saxony). It was intended to make him a brazier, but on his paying a visit to Vienna about 1824, his love for natural history was awakened. He came to Leyden in 1825, and tried to obtain an appointment as traveller for the Museum of Natural History, of which Dr. Temminck was then superintendent. He did not receive that appointment, but stayed in the Museum as preparator. He remained in this position until he was nominated conservator in 1839. He was appointed to the post of Director of the Museum in 1858 after the death of Temminck. Schlegel was doctor *honoris causâ* of the Leyden University, member of the Royal Academies of Sciences of Amsterdam and Berlin, &c. The Leyden Museum of Natural History, well known to every zoologist, has become under Schlegel's superintendence one of the richest in existence. For descriptive zoology, and especially that of the vertebrata, (reptiles, birds, and mammals), Schlegel was a first authority; the number of papers and monographs published by him in these groups is very considerable, and their scientific importance great.

THE death is announced of M. Richard Cortambert, *fils*, at the age of forty-eight years. He was attached to the geographical department of the National Library, and, in company with his father, had published many geographical works.

ADMIRAL MOUCHEZ read a paper before the Paris Academy of Sciences at the sitting of February 4, in which he stated that it was impossible to make any observations with large instruments in the old establishment at present the headquarters of French astronomy. He proposes to erect a new observatory on a site in the vicinity of Paris. Admiral Mouchez states, moreover, that to find the money required it would be advisable to sell the new grounds which were annexed to the Observatory in the time of Leverrier. The extent of this land is about 28,000 square metres, and the Admiral states that the sale might realise 4*l.* per metre. This ground was given to the Government by the City of Paris, which sold it for the nominal price of 4*l.*; it is supposed that the Municipal Council will oppose the scheme, which has come to light quite unexpectedly.

BY the last mail from Iceland we have received a communication from Dr. Sophus Tromholt, dated Reykjavik, middle of December, in which he informs us that the weather had till then been mild and very unfavourable for his researches, in consequence of which he defers to the next mail giving to NATURE an account of his studies in the island. By the same mail apparently the reports which have lately been circulating in the Scandinavian press of terrific eruptions in the island have also arrived. It is stated in private letters that in November two enormous columns of smoke were seen in the direction of the great Vatnajökull, and that ashes had fallen in the Seidisfjord. According to the direction it seemed as if this eruption was far more easterly than that occurring in the spring. In connection herewith it may be of interest to call attention to the note published in NATURE (vol. xxix. p. 135), in which it is reported that on the night of

November 17 the snow in the valley of Storelo, in Central Norway, between 61° and 62° N., became covered with a layer of gray and black dust. It is, however, remarkable that Dr. Tromholt's communication contains no reference whatever to any volcanic eruption.

WITH reference to the Krakatoa eruption, Prof. Alph. Milne-Edwards read at the Paris Academy of Sciences, on January 28, a letter from a correspondent in Réunion, in which it is stated that the intensity of the sky-tints was always greatest where the showers of volcanic ashes had been observed. Thus the path of the volcanic cloud can be traced step by step, and its trajectory found to be that of an ordinary cyclone. M. Wolf showed how a study of the curves registered by the barometer establishes two atmospheric waves starting at the same time from Krakatoa, one towards the east and the other towards the west; the former to reach us had to traverse 11,500 kilometres, and the latter 13,500. M. Wolf showed that the rate of progress was that of sound, and on the basis of this and the distances, he found the eruption to have taken place on August 27, at 11h. 43m. a.m.

THE Birmingham Town Hall was crowded on Sunday night, January 27, to hear a lecture from the Rev. W. Tuckwell on "Natural History for Working Men." He dwelt upon the difference between the homes of the working man and his employer, the first being destitute of the beauty and the resource with which the latter overflowed. One resource at any rate he could recommend to them in the study of natural history. Illustrations were drawn from the modification of the sap in their window-plants, the rise of the fluid in their trees, the structure of the spiders' webs on their walls, the transformation of insects in their water-butts; from the heavenly bodies within their gaze, Mars with his polar ice-caps, Jupiter with his moons, the sun with his spots, the moon with her craters, the nebular clusters, and the falling meteorites, to show that enveloping and pressing on us everywhere were miracles of creative and developing energy, surpassing a thousandfold the wonders of human enterprise, and that we walked amongst them unheeding and uninquiring. Instances were given of working men who had been discoverers and happy workers in these subjects, some unknown to fame, others, like Charles Peach, Robert Dick, and Thomas Edwards, the heroes of widely read memoirs. Instructions were detailed for setting up aquariums, collecting fossils and insects, preserving plants, stuffing birds, buying microscopes or telescopes with one year's saving from the public-house. A good museum should be examined; and a visit to Oxford on the next bank holiday was proposed. Annual *soirées* were recommended, at which the collections and constructions of the past year might be exhibited. The lecture ended with a few words of religious feeling arising out of the subject, which were received with deep sympathy by the audience. Thanks were proposed by Mr. Jesse Collings, M.P., Mr. Lawson Tait, and Rev. E. F. MacCarthy. The lecture will shortly be published.

IN connection with the forthcoming International Health Exhibition, it is desired to illustrate as far as possible the relations of meteorology to health, and for this purpose a special sub-Committee has been formed. It is hoped that the Royal Meteorological Society will establish a typical climatological order station, provide the complete equipment, and supervise the same. This will be arranged on a level grass space about thirty feet square, which space will be railed in, and provided with a gate through which a limited number of the public can from time to time be admitted. The attendant will take daily observations from the instruments, which will be exhibited in diagrams, and a copy of them furnished to the editorial department of the Exhibition, for publication in the daily programmes and also as a *communiqué* to the press. It is hoped that a series of large diagrams illustrative of the climatal conditions prevailing in various parts of the world may be exhibited. Besides the collective exhibit above described, space will be provided for the exhibition of instruments by manufacturers, inventors, and others who may desire to show them. Attention is particularly directed to the fact that the Committee specially invite the exhibition of meteorological instruments bearing upon the relations of climatology to public health. The Committee also appeal to authors of papers upon the relations between health and disease, rainfall, percolation, evaporation, and flow from ground, and other subjects embraced by the Exhibition, and invite them to exhibit diagrams, models, and apparatus illustrative of their researches.

BULLETIN No. 3 of the Entomological Division of the U.S. Department of Agriculture (Washington, 1883), when stripped of the "red-tape" that appears to be even more necessary on official documents in the States than it is in this country, is of more than usual interest. The notorious "army-worm" appears in a new character, viz. as destructive to cranberries, which form an important feature in the productions of the States. Various additional enemies to forest-trees are treated on by Dr. Packard. A long chapter (by Drs. Anderson and Barnard) is devoted to the "cotton-worm," in which (in addition to interesting biological information) elaborate contrivances for distributing arsenical solutions are described. Dr. McMurtrie contributes an exhaustive report on the examination of raw-silk "grown" in the States. From a scientific point of view the most valuable article is a posthumous one, by the late Dr. J. S. Bailey, on the North American *Cossidæ* (or "goat-moths"), illustrated by two very excellent plates.

WE cannot speak too highly of the work and management of the Sheffield Free Libraries. One-quarter of their rate is mortgaged to meet the debt incurred at starting; yet more than one-seventh of its entire amount is spent in books. Practically this is more than one fifth of the available income; and since, besides the central library, there are three large active branches as well as a museum and observatory, it shows a careful economy in the expenses. The committee regret in their report that their income will not allow them to further increase their premises in both size and number. In many libraries the income is almost swallowed up in the expenses of a single costly establishment. The management of Sheffield, therefore, combined with the excellence of the collection of books which its catalogue displays, deserves support from any who feel an interest in intellectual progress or wholesome and harmless recreation.

THE Norwegian naturalist, Dr. S. A. Buch, has been commissioned by his Government to prosecute practical scientific researches as to the herring fisheries of Norway during the present year, according to the instructions of the Society for Promoting the Norwegian Fisheries in Bergen.

ON January 24, at 11.25 p.m., a splendid meteor was observed at Husqvarna in Sweden. The meteor passed rather slowly in a southerly direction, leaving a lustrous trail behind about a yard long. It was nearly the size of an ordinary cheese-plate. After a few seconds it burst with a loud report, emitting a light green lustre. The fragments seemed to turn red and soon vanished.

WITH the January number the Austrian *Monatschrift für den Orient* has increased its size, and introduced illustrations. It is also promised that scientific supplements will be occasionally issued.

MESSRS. HODDER AND STOUGHTON have issued a translation of the first volume (the only one yet published) of Dr. Rein's work on Japan—"Japan: Travels and Researches undertaken at the Cost of the Prussian Government"—of which we were able to speak in high terms in reviewing the original German edition. Altogether it is probably the most solid contribution

which has been made to a knowledge of Japan and its people; the translation seems to us to be well done.

THE next evening lecture of the Society for the Encouragement of the Fine Arts will be delivered by Mr. Lennox Browne, at the rooms of the Society in Conduit Street, on February 14. It will be entitled "Science and Singing," and will be elucidated by vocal and other illustrations.

FROM the *Adelaide Express and Telegraph* of December 31, 1883, we learn that Mr. Clement L. Wragge was about to start an astronomical and meteorological observatory on his own account on the banks of the Torrens. Observations of the usual meteorological elements were to be commenced on Jan. 1, 1884. The meteorological instruments comprise mercurial barometers, a barograph, numerous self-registering and other thermometers by the best makers and Kew verified; besides rain-gauges, ozone tests, rain-band spectroscope, and other appliances used by Mr. Wragge at the Ben Nevis Observatory. He hopes to train an assistant, who will carry on the work during any prolonged absence. The house is to be called the Torrens Observatory, and is admirably situated on Stephens Terrace, Gilberton, two miles from Adelaide.

ON the proposal of M. de Lesseps, the Paris Geographical Society has decided to publish the biographies of all the French travellers of the present century.

THE *Journal of the Society of Arts* for February 1 contains two papers of special interest. One by Mr. J. G. Colmer, the Secretary to the Canadian High Commissioner, tells what the British Association will find in Canada on its visit in August next; the other is a paper of much practical value, by Mr. Thomas Fletcher, on coal-gas as a labour-saving agent in mechanical trades.

WE learn from a communication from Orkney that on January 27 at 3 a.m. the barometer fell to 27·508, and that the tide was unusually high. At Dundee the lowest record was 27·382 at 10.30 p.m. on the 26th, while the velocity of the wind is given at from fifty to sixty-five miles per hour. In Orkney a velocity of eighty-eight miles was recorded by the anemograph.

IT appears from the researches of M. Sokoloff that the water of the Neva at St. Petersburg, at a depth of 9 feet, is very pure when compared with the water supplied to other large cities. The matter in suspension in 1 cubic metre of water (in September and October) does not exceed 5·5 grm., and sometimes it is so small as to be less than 0·02 grm. The mineral matter dissolved varies from 31·0 to 38·1 grm., and the organic matters reach but 18·7 to 22·5 grm. The average for August and September is 20·4 grm. of organic matter and 31·6 of inorganic; for October, 21·7 and 33·9 grm. respectively.

CAPTAIN STUB, Corresponding Member of the Society of Arts at Smyrna, writes to Mr. Hyde Clarke that "the cold wave which was passing over America reached here last Sunday, January 21, and for Smyrna the cold was intense. I am told in exposed positions the thermometer went down to 10° below zero. At the point near the railway station I saw ice one inch thick. On the 24th the weather became milder."

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Dr. Harrison Branthwaite; a Bonnet Monkey (*Macacus sinicus* ♂) from India, presented by Mr. E. F. Shortt; a Quebec Marmot (*Arctomys monax*) from Virginia, U.S.A., presented by Mr. G. S. White; a Long-eared Owl (*Asio otus*) from Germany, presented by Master Owen Dallmeyer; a Water Rail (*Rallus aquaticus*), British, presented by Mr. T. E. Gunn; a West African Python (*Python sebæ*) from West Africa, presented by Capt. J. Grant Elliott; five European Tree Frogs (*Hyla arborea*) from France, presented by Miss E. Brunton; a European Tree Frog (*Hyla arborea*), South European, presented by the Rev. J. Stapledon Webber; a Rhesus Monkey (*Macacus rhesus*) from India, a Common Wolf (*Canis lupus*), European, a Fallow Deer (*Dama vulgaris* ♀), British, two Chattering Lories (*Lorius garrulus*) from Moluccas, two Vieillot's Firebacks (*Euplocamus vieilloti* ♂ ♀) from Malacca, deposited; a Sykes's Monkey (*Cercopithecus albigularis*), a Gray-cheeked Mangabey (*Cercocebus albigena* ♀) from West Africa, two Spotted Hyænas (*Hyæna crocuta* ♂ ♀) from South Africa, a Red-vented Parrot (*Pionus menstruus*) from Brazil, a Golden Eagle (*Aquila chrysaëtos*), a Tawny Eagle (*Aquila nævioides*), a White-tailed Eagle (*Haliaëtus albicilla*), a Cinereous Vulture (*Vultur monachus*), seven Knots (*Tringa canutus*), European, a Temminck's Snapper (*Macroclemmys temminckii*) from North America, purchased.

## OUR ASTRONOMICAL COLUMN

THE COMET OF 1664.—"Cette comète de 1664," remarks Pingré, in introducing the description of it given in his "Cométographie," "a singulièrement exercé les presses des Imprimeurs," and that this statement was justified will be evident to any one who may consult Lalande's "Bibliographie," the catalogue of the library in the Observatory of Pulkowa, or the "Repertorium der Cometen-Astronomie," by Dr. Carl of Munich; in the latter will be found references to some eighty works, either treating specially upon this comet, or in which it is noticed in more or less detail. And further, as Mädler observes: "Lubienietsky hat über ihn allein einen ganzen Quartband geschrieben, der freilich für unsere Zwecke sich auf einige Seiten reducirt;" the volume here referred to is the first of the "Theatrum Cometicum."

This comet appears to have been discovered in Spain as early as November 17. Huyghens observed it at Leyden on December 2, while the observations of Hevelius at Dantzic, which have been used exclusively in the determination of the orbit, commenced on December 14, and it was generally observed in France and Italy about the same time. Observations properly so-called do not appear to have been made in this country, and on scanning the long list of publications enumerated by Carl we find, in addition to a notice by J. Ray in the *Philosophical Transactions* for 1707, only two works named as having been printed here: (1) "An Astronomical description of a comet as it appeared in new Ingland, in the year 1664;" and (2) "The blazing star, or a discourse of Comets. In a letter from J. B. to T. C. concerning the late comet." Flamsteed was then an ailing youth, and though given to astronomical exercises he has no reference to the comet in question. Indeed, in his account of his early life we read: "I had now completed eighteen years, when the winter (that of 1664-1665) came on and thrust me again into the chimney, whence the heat and the dryness of the preceding summer had happily once before withdrawn me;" and he thus attended rather to calculation from Street's "Caroline Tables," which he had just procured, than to observations.

The comet was not suffered to remain without notice by Samuel Pepys, and we find several references to it in his "Diary," which it may not be quite without interest to examine. Pepys records the old style dates, but we reduce them to the present reckoning. The first notice of the comet is on December 27, and runs thus: "Mighty talk there is of this comet that is seen a' nights; and the King and Queene did sit up last night to see it, and did it seems. And to-night I thought to have done so too; but it is cloudy, and so no stars appear. But I will endeavour it." On the night of December 26 the comet would rise in London just before eleven o'clock, and would be on the meridian at two o'clock at an altitude of less than nine degrees, in R.A. 126°·4, and declination 30°·0 south, distant from the earth 0·193. The apparent length of the tail (37°) mentioned by Carl, assigns a real length of 43,000,000 miles, if it were in the line of the radius-vector. On December 31 we read: "My Lord Sandwich this day writes me word that he hath seen (at Portsmouth) the comet, and says it is the most extraordinary thing he ever saw." On January 3 Pepys says: "I saw the comet, which is now, whether worn away or no I know not, but appears not with a tail, but only is larger and duller than any other star, and is come to rise betimes, and to make a great arch, and is gone to quite a new place in the heavens than it was before; but I hope in a clearer

night something more will be seen." At eight o'clock on the evening of January 3 the comet was in R.A. 47°·5, declination 1°·5 south, distant from the earth 0·276; the moon was at full two days previously, so that the tail might have been in great measure overpowered by her light in the indifferent state of the sky. Pepys has no further reference to the comet till March 11, when the "Diary" says: "To Gresham College, where Mr. Hooke read a second very curious lecture about the late comet; among other things proving very probably that this is the very same comet that appeared before in the year 1618, and that in such a time probably it will appear again, which is a very new opinion; but all will be in print." We do not remember to have met with other reference to this opinion of Hooke's, though probably such must exist; and it is not easy to explain upon what grounds he founded the idea. The comet referred to was the third of 1618, which, to use Pingré's phrase, almost exercised the printing-press as much as that of 1664. It was observed by Harriot at Sion House, Isleworth, or, as it was then called, Thistleworth.

## GEOGRAPHICAL NOTES

OUR readers may have noticed that Dr. Holub had met with unexpected difficulties at the Cape in the prosecution of his journey into the African interior, the Cape authorities insisting on payment of the full duty on the traveller's scientific equipment. It will be seen from the following communication, which has been sent us for publication, that the difficulty has been happily and promptly settled:—"Downing Street, February 2, 1884.—Sir,—I am directed by the Earl of Derby to acknowledge the receipt of your letter of the 29th ult., relative to the exploring expedition undertaken by Dr. Holub in South Africa; and I am to acquaint you, for the information of Sir Joseph Hooker, that a telegram has been sent to the officer administering the Government of the Cape of Good Hope, requesting that special concessions may be made in respect to the Customs duties, and that support may be afforded to Dr. Holub in the prosecution of his enterprise. A despatch to the same effect will follow by the outgoing mail.—I am, &c. (signed), ROBERT G. W. HERBERT.—The Assistant Director, Royal Gardens, Kew."

IN the *Bolletino* of the Italian Geographical Society for January an account is given of a curious manuscript recently presented to the Society by Count Pietro Antonelli. It forms a bulky codex of 125 sheets of parchment, consisting mostly of formulas and magic incantations written in the old Giz (Ethiopic) language with a large admixture of Amharic. Amongst the contents is also the *Aud Neges't*, or Royal Circular, comprising sixteen circles, each of which occupies a whole page of the codex. All are divided into sixteen segments, each containing some text on the various incidents of human existence, which are afterwards expounded in greater detail. Then come thirty chapters, each divided into fifteen lines, every one of which contains some sentence or aphorism. The donor has received the King Humbert gold medal for the scientific work accomplished by him in the Italian settlement of Assab and neighbouring district. The same number of the *Bolletino* contains a description of the interesting collection presented last year to the prehistoric ethnographic museum at Rome by M. van Oordt of Leyden. This collection comprises a beautiful series of amulets, musical instruments, costumes and all kinds of personal ornaments used by the Maronites of the Lebanon, the Druses of Hauran and other Syrian populations. Some have a considerable intrinsic value, while others are noteworthy for their rarity and the elegance of their forms and ornamentation. One of the most remarkable objects is the girdle worn by rich Bedouin and Druse brides, consisting of a broad many-coloured silken sash with a large silver clasp nearly oval at both extremities. It is opened by means of a needle, and embellished with conic filigree buttons and silver chains, from which are suspended little globules, crescents, and other charms.

THE *Sydney Morning Herald* of December 27, 1883, says:—An exploring party, under the leadership of Mr. Charles Winnicke, an experienced explorer and bushman, has just made a successful journey through a large portion of unknown country in the interior of Australia. The party was provided with camels and horses, but the latter were never required. Mr. Winnicke made a start from Cawarrie station, on the Warburton River, in latitude 28° S., and traversed the country to the north as far as latitude 27°, effecting a connection with previous explorations near Goyder's Pillars. A most remarkable natural feature in the Tailton Range was discovered by Mr. Winnicke during his Herbert River explorations. Several long stages without water were encountered a few days after the party left Cawarrie station, and a distance of 200 to 300 miles had to be traversed across the highest sand ridges in Australia before water could again be obtained. Many more long stages of between 100 and 200 miles without water were travelled. In many instances the sand ridges, which were from 300 to 400 feet high, and very steep, had to be crossed at right angles. Two large rivers and an extensive range were discovered near the Queensland boundary, and altogether Mr. Winnicke succeeded in mapping about 40,000 square miles of unknown country, which will help to fill in another large blank space on the map of Australia.

MR. O'NEILL, who arrived at Mozambique on February 4, after having traversed 1400 miles of unexplored country, situated between Mozambique and Lake Nyassa, has discovered Lake Amarambu, the existence of which was previously unknown, and which he declares to be the true source of the Pienda (?) River. Mr. O'Neill reports Lake Shirwa to be smaller than has been represented. On his return Mr. O'Neill followed the Likelungo Valley, which he found to be well populated.

DR. CHAVANNE will start in a few days on his expedition to the interior of Africa, undertaken for the Belgian "Institut National de Géographie." He will employ the first eight months of his time in drawing up an accurate chart of the Congo; and then penetrate from Leopoldville to the north to explore the hitherto unknown districts lying in that direction and the watercourses. It must depend on circumstances whether he will effect his return along the Nile, by Zanzibar, or by the Congo. The provisional chart of the Congo, which was published a short time since in America, is now sold here.

IN vol. xix. of the *Izvestia* of the Russian Geographical Society we find the results obtained by M. Grinevetsky during his journey across Novaya Zemlya in the spring of 1878. The country is a plateau, about 450 feet above the sea-level, with deep valleys in which several lakes are concealed. The rivers cut deeply into the plateau. The south-eastern winds blow freely on the plain, denuding it of its snow covering. Three different parts may be distinguished in the southern island of Novaya Zemlya: the northern part, which is covered by mountains quite unknown, is bounded on the south by the Pukhovaya River. The middle part is covered by five or six parallel chains of hills, the highest summits of which reach 800 feet; they run north-west, close to the western coast, having a wide plateau to the east. The southern part is a plateau not more than 450 feet high, and M. Grinevetsky doubts very much if there are mountains 2000 feet high, as has been stated. One observation of M. Grinevetsky is worthy of notice. It is most probable, he says, that there are two varieties of reindeer in Novaya Zemlya. One of them inhabits the southern island, and the other, which does not mix with the former, inhabits only the northern island; it is said by the hunters to be much like that of Spitzbergen. In fact the Russian hunters have found very often on Spitzbergen a kind of reindeer with cut ears, which, they are persuaded, comes from Novaya Zemlya. In the Report of the Polar Commission in the *Izvestia* of the Russian Geographical Society (1871) reasons were given for believing, along with Baron Shilling, in the existence of an archipelago to the north-west of Novaya Zemlya (the feebleness of the cold sea current in Barents Sea, and the large quantities of mud and gravel seen on the floating ice north-west of Novaya Zemlya). The remark of the hunters was also referred to, and the opinion expressed that, if such an archipelago existed, the Novaya Zemlya reindeer really might cross the sea during favourable years, reach this archipelago, and thence continue their migrations to Spitzbergen. The discovery of Franz Josef Land renders this supposition still more probable, especially if the Franz Josef archipelago extends farther to the east, which extension seems most probable, on account of the feebleness of the polar current that enters Barents Sea, which surely would be much stronger if the space between Novaya Zemlya and the North Pole were occupied entirely by an open sea. The observation of M. Grinevetsky again raises this question: Is it true that the Novaya Zemlya reindeer afford so many distinct affinities with the Spitzbergen reindeer as to be considered as belonging to the same subvariety? And if so, how explain these affinities without admitting (as the hunters do) that the reindeer in his migrations

goes from Novaya Zemlya over to Spitzbergen, availing himself of the archipelagos scattered between the two islands?

In Nos. 9 and 10 of vol. x. of the *Transactions of the Berlin Geographical Society*, is an address on the wild tribes of Madagascar, by Herr J. Audebert, who divides them collectively, both those of Malayan (the Hovas) and those of African descent, according to their mode of life, into three classes: the inhabitants (1) of the coast; (2) of the woods; (3) of the grassy lands and steppe-like wastes of the southern interior. Of all the races the Sakalavi are first in point of number, power, and civilisation. The aborigines, or Malagasy proper, are generally of a dark complexion, though those of direct Arabian descent are very clear-skinned, with hard features, broad, often also high forehead, eyes wide apart, nose flat, lips prominent, but not swollen, mouth broad, with splendid teeth. The long rather woolly hair is worn in innumerable plaits woven, in the case of the women, into crowns, vaccine ears, snail-shells, &c., smeared with tallow and ashes into the hardness of stone, and very malodorous. In the grassy interior cattle-rearing is the principal industry; on the coast fishing and the cultivation of rice. In the woods the people live on roots, tubercles, and honey.—Next follows an interesting though brief account of Dr. Stecker's chequered travels, of nearly three years' duration, through Abyssinia. About the middle of February, 1881, when Dr. Rohlfs left Debra Tabor, Dr. Stecker made his way to the Tana Lake, which he travelled round, sending a detailed map of it, executed on the spot, to the German African Society. At Zabul, the recently-acquired seat of King John, Dr. Stecker drew a plan of the grand and interesting chain of mountains traversing the eastern part of Abyssinia, but both report and map failed to reach the German African Society, whither they were directed. Dr. Stecker was bent on penetrating into Koffa, but on account of war tumults and King John's refusal to give him permission, was obliged to abandon his design. He, however, joined the three kings, King John, the King of Shoa, and the Negus Tekla Haimanot into the Eastern Gala lands of Komboltsha, Antsharo, Tshaffa, Rikke, and Argobba, and was thus enabled to make first acquaintance with a tract of country never before trodden by a European.—Some interesting particulars of travels in South America are taken from a letter of Dr. G. Steinman to Dr. W. Reiss, dated November 5, 1883.—The stones collected by Herr P. Güssfeldt on the north-west slopes of Aconcagua, at a height of from 5500 to 6100 metres have been analysed by Prof. J. Roth of the Academy of Sciences, and the result has established beyond all further doubt the fact that Aconcagua is a volcano.

## THE ORIGIN OF THE SCENERY OF THE BRITISH ISLANDS[1]

A TRUE mountain chain is the result of a local plication of the earth's crust, and its external form, in spite of sometimes enormous denudation, bears a close relation to the contours produced by the original uplift. Tried by this standard, hardly any of the heights of Britain deserve the name of mountains. With some notable exceptions in the south of Ireland, they are due not to local but to general upheavals, and their outlines have little or no connection with those due to underground movement, but have been carved out of upheaved areas of unknown form by the various forces of erosion. In the course of their denudation the nature of these component rocks has materially influenced the elaboration of their contours, each well-marked type of rock having its own characteristic variety of mountain forms. The relative antiquity of our mountains must be decided not necessarily by the geological age of their component materials, but by the date of their upheaval or of their exposure by denudation. In many cases they can be shown to be the result of more than one uplift. The Malvern Hills, for example, which from their dignity of outline better deserve the name of mountains than many higher eminences, bear internal evidence of having been upheaved during at least four widely separated geological periods, the earliest movement dating from before the time of the Upper Cambrian, the latest coming down to some epoch later probably than the Jurassic period. The oldest mountain fragments in Britain are those of the Archæan rocks, and of these the largest portions occur in the north-west of Scotland. Most of our mountains, however, belong to upheavals dating from Palæozoic time, though the actual exposure and shaping of them into their present forms must be referred to a far later period. Two leading epochs of movement in Palæozoic time can be recognized. Of these the older, dating from before the Lower Old Red Sandstone and part at least of the Upper Silurian period, was distinguished by the plication of the rocks in a dominant north-east and south-west direction, and the effects of these movements can be traced in the trend of the Lower Silurian ridges and hollows to the present day. In Wales two types of mountain-form exist—the Snowdon type, and that of the Breconshire Beacons. In the former the greater prominence of the high grounds arises primarily from the existence of masses of volcanic rocks, which from their superior durability have been better able to withstand the progress of degradation. In the latter the heights are merely the remaining fragments of a once continuous tableland. The Lake District presents a remarkable radiation of valleys from a central mass of high ground. It might be supposed that these valleys have been determined by some radiating system of fractures in the rocks; but an examination of the area shows them to be singularly independent of geological structure. So entirely do they disregard the strike, alternations, and dislocations of the rocks among which they lie that the conclusion is forced upon us that they have been determined by some cause wholly independent of structure, and before the present visible structure was exposed at or could affect the surface. This could only have happened by the spread of a deep cover of later rocks over the site of the Lake mountains. The former presence of such a cover, which is demanded for the explanation of the valleys, can be inferred from other evidence. The Carboniferous Limestone on the flanks of the Lake District is so thick that it must have spread nearly or entirely over the site of the mountains. But it was overlaid by the Millstone Grit and Coal-measures so that the whole area was probably buried under several thousand feet of Carboniferous strata which stretched continuously across what is now the north of England. At the time of the formation of the anticlinal fold of the Pennine Chain the site of the Lake District appears to have been upraised as a dome-shaped eminence, the summit of which lay over the tract now occupied by the heights from Scafell to Helvellyn. The earliest rain that fell upon this eminence would gather into divergent streams from the central watershed. In the course of ages, after possibly repeated uplifts, these streams have cut down into the underlying core of old Palæozoic rocks, retaining on the whole their original trend. Meanwhile the whole of the overlying mantle of later formations has been stripped from the dome, and is now found only along the borders of the mountains. The older rocks yielding to erosion, each in its own way, have gradually assumed that picturesqueness of detail for which the area is so deservedly famous. The Scottish Highlands likewise received their initial plications during older Palæozoic times their component rocks having been thrown into sharp fold, trending in a general north-east and south-west direction. But there is reason to believe that they were in large measure buried under Old Red Sandstone, and possibly under later accumulations. No positive evidence exists as to the condition of this region during the vast interval between the Old Red Sandstone and the older Secondary rocks. We can hardly believe it to have remained as land during all that time, otherwise, the denudation, vast as it is, would probably have been still greater. Not improbably the region had become stationary at a base-level of erosion beneath the sea; that is, it lay too low to be effectively abraded by breaker-action, and too high to become the site of any important geological formation. The present ridges and valleys of the Highlands are entirely the work of erosion. When they began to be traced the area must have presented the aspect of a wide undulating tableland. Since that early time the valleys have sunk deeper and deeper into the framework of the land, the ridges have grown narrower, and the mountains have arisen, not by upheaval from below, but by the carving away of the rest of the block of which they formed a part. In this evolution, geological structure has played an important part in guiding the erosive tools. The composition of the rock-masses has likewise been effective in determining the individuality of mountain-forms. The mountains of Ireland are distributed in scattered groups round the great central plain, and belong to at least three geological periods. The oldest groups probably took their rise at the time of the older Palæozoic upheaval, those of the north-west being a continuation of the Scottish Highlands, and those

[1] Abstract of second lecture given at the Royal Institution, February 5, by Archibald Geikie, F.R.S., Director-General of the Geological Survey. Continued from p. 325.

of the south-east being a prolongation of those of Wales. Later in date as regards the underground movements that determined their site, are the mountainous ridges of Kerry and Cork. These are local uplifts which, though on a small scale, are by far the best examples in Britain of true mountain structure. The Old Red Sandstone and Carboniferous rocks have there been thrown into broad folds and troughs which run in a general east and west direction. In some cases, as in the Knockmealdown Mountain, the arch is composed entirely of Old Red Sandstone flanked with Carboniferous strata. But in most instances an underlying wedge of Lower Silurian rocks has been driven through the arch. As not only the Carboniferous Limestone, but the rest of the Carboniferous system covered the south of Ireland and participated in this plication, the amount of denudation from these ridges has been enormous. On the Galty range, for example, it can hardly have been less but may have been more than 12,000 feet. The third and latest group of Irish mountains is that of Mourne and Carlingford, which may with some probability be referred to older Tertiary time when the similar granitic and porphyritic masses in Mull and Skye were erupted.

The tablelands of Britain strictly include the mountains, which are in general only prominences carved out of tablelands. But there are still large areas in which the plateau character is well shown. Of these the most extensive and in many respects the most interesting is the present tableland or plain of Central Ireland. As now exposed, this region lies upon an undulating eroded surface of Carboniferous Limestone. But it was formerly covered by at least 3000 or 4000 feet more of Carboniferous strata, as can be shown by the fragments that remain. The present system of drainage across the centre of Ireland took its origin long before the ancient tableland had been reduced to its present level, and before some of the ridges, now prominent, had been exposed to the light. The Moors and Wolds of Yorkshire present us with a fragment of a tableland composed of nearly horizontal Jurassic and Cretaceous rocks. The Lammermuir Hills and Southern Uplands of Scotland form a broad tableland which has been formed on a deeply eroded surface of Lower Silurian rocks.

## THE MONK FISH

*NATUREN* has recently supplied its readers with some interesting details concerning the so-called "monk-fish" of the Sound, which may be regarded as the genuine forerunner of the sea-serpent of modern times. Its capture and appearance were deemed worthy of record in Arild Hirtfeld's great "History of Denmark," published in 1595, while portraits of the sea-monk embellished the works of various Scandinavian and German natural history writers of the middle of the sixteenth century. Among these, Guillaume Rondelet, in his great folio work, "Libri de Piscibus Marinis," first claimed the special privilege of giving to the world a facsimile of the authentic likeness of the monk. This, we are assured, had been taken from life for, and in the presence of, a nobleman, who had caused one copy to be made for the Emperor Charles V., and another for Margaret, Queen of Navarre, by whom it was presented to the author. Hirtfeld does not profess to have been brought into such close connection with the original, but he and the historians, Krag and Stephanius, agree in reporting that a fish, bearing the semblance of a human head with a monk's shaven crown, and having torn or mutilated limbs indistinctly defined under a scaly covering, was, in the year 1550, captured in the Sound, in a herring-fisher's net, and brought to the King of Denmark, who immediately gave orders that it should be buried deep underground, "to hinder indiscreet talk among the ignorant, whose minds are always perturbed by what is new." The speedy burial of the monster did not allay the excitement caused by its apparition, and Rondelet found, to his extreme annoyance, that his Swiss friend, Gesner, and other philosophers then in Rome, were in possession of other reputed original likenesses of the monk, differing from his own. This circumstance, he admits, inclined him to suspect that the artist had added "this or that according to fancy to make the fish seem more wonderful than it was in reality." He even confesses that some of the portraits have no more resemblance to a human head than might be detected in a frog or a toad; that the extremities look like fins, and that the so-called monk's gown is more like a dark seal's skin than a scaly armour. From these and other corrections, coupled with Gesner's mention of a fish's tail having formed part of the monk's body, Prof. Steenstrup infers that the "monk-fish" was an unusually large specimen of the Loligo or Squid family, whose caudal extremity, bearing probably bruises or other marks on the skin, had acquired in the imagination of the spectators the semblance of a head and neck with torn-off arms, while the arms of the cephalopod had served to represent lacerated extremities. A comparison of the numerous conflicting contemporaneous descriptions of the Danish "sea-monk" and of the later "*Kraken*" of the old Norwegian Bishop Pontoppidan might possibly be not wholly useless in the present day in checking an over-hasty confidence in the truth of every fresh tale of encounters with sea-serpents, as recorded by credulous seafaring men. We may, in the meanwhile, refer all who are interested in sea-monsters to the July number of *Naturen*, in which they will find a faithful representation of Rondelet's monk-fish, while the September number of the same journal gives reproductions of two characteristic Japanese pictures, in one of which a solitary boatman is battling in a stormy sea with a formidable creature, evidently a highly magnified form of octopus, one of whose arms has been severed as it encircled man and boat, while the other arms are represented as striving to draw their prey nearer to the huge head with its protruding eyes. In the second picture, which, if less forcible, is more realistic, we see in the wondering and terrified expression of the assembled men and boys the surprise and alarm excited by the appearance at a fishmonger's stall of two octopus arms, not unlike suspended serpents. The terror of the spectacle has communicated itself to domestic animals—a dog hiding himself, while a cat is taking rapid flight up the roof of the house.

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The Examiners for the Radcliffe Travelling Fellowship give notice that the examination will commence on February 20 at 10 a.m. in the University Museum. The Examination for the Burdett-Coutts Geological Scholarship will commence on March 3 at 10 a.m.

Mr. Robert Stockdale, of Giggleswick School, has been elected to a Hastings Exhibition in Natural Science at Queen's College.

CAMBRIDGE.—The following are the words spoken by the Public Orator in presenting Dr. Hans Gadow (formerly of the British Museum), Curator of the Strickland Collection of Birds, for the complete degree of M.A. *honoris causâ*:—

"Dignissime Domine, Domine Procancellarie et tota Academia: Anni proximi sub finem (iuvat recordari) fabulam illam Aristophanis quæ Aves nominatur cum voluptate maxima prope omnes spectavimus. Hodie vero, ad studia nostra severiora redeuntes, nihil auspicatius esse arbitramur, quam annum novum honore in illum collato signare qui omnium avium genera et naturas quasi propriam provinciam sibi sumpsit explorandam. Illum igitur senatoribus nostris hodie merito adscribimus, qui Pomeraniæ maritimæ in parte orientali a gente antiquissima oriundus in celeberrimis Germaniæ Academiis zoologiæ, palæontologiæ, mineralogiæ, studiis operam suam feliciter impendit; qui quarto abhinc anno in Britanniam idcirco est vocatus, ut aves in Museo Britannico conservatas summa cura describeret; qui in nostra denique Academia nuper non modo de vertebratis quæ dicuntur animalibus prælectiones habuit doctissimas, sed etiam thesauris nostris ornithologicis custodiendis cum fructu nostro maximo est præpositus. Inter antiquos quidem avium a volatu cantuque rerum futurarum omina ducebantur; nos meliora edocti hodie in hoc viro Procancellarii novi auspiciis veram avium scientiam laude debita exornamus, ex initio tam felici omnia fausta in futurum augurati. '*Date candida cives Omina, et inceptis dextera cantet avis.*' Vobis præsento virum et de studiis ornithologicis et de Academia nostra optime meritum, HANS GADOW."

Mr. W. F. R. Weldon, B.A., St. John's College, has been appointed Demonstrator of Comparative Anatomy.

Mr. Francis Galton, F.R.S., has been appointed Rede Lecturer for the present year.

Prof. W. J. Sollas, M.A., late Fellow of St. John's College, First Class in the Natural Sciences Tripos, 1873, and Mr. P. H. Carpenter, M.A., Trinity College, First Class in the same Tripos, 1874, have been approved for the degree of Doctor of Science. The able original works in Geology and Zoology by both these gentlemen are familiar to all students.

LONDON.—At King's College, Prof. W. Grylls Adams, F.R.S., will continue the course of lectures on Light, and the Scientific Principles involved in Electric Lighting, during the remainder of the session. A course of practical work in Electrical Testing and Measurement with especial reference to Electrical Engineering will also be carried on under his direction in the Wheatstone Laboratory. The lectures will be given once a week—on Mondays, at 2 p.m.—and the Laboratory will be open on Wednesday and Friday from 1 to 4.

## SCIENTIFIC SERIALS

THE monthly parts of the *Journal of Botany* for 1883 contain many useful and interesting papers. Among the more important must be regarded Mr. J. G. Baker's synopsis of the genus *Selaginella*. This is not yet completed, but already extends to nearly 100 species, many of them now described for the first time. This is understood to be an instalment of a complete monograph by Mr. Baker of the Vascular Cryptogams, excluding ferns, a work eagerly demanded by botanists.—The additions to the phanerogamic flora of Great Britain are not yet completed; and the palm of recent discoveries must be awarded to Mr. Arthur Bennett. In this year's record he describes and figures two, one of them, *Potamogeton Griffithii*, new to science, from a lake in Carnarvonshire. The other, *Naias marina*, is a native of the "Broads" of Norfolk. This is rendered more interesting by the discovery, by other botanists, of another species of *Naias*, *N. alagnensis*, also during the present year, in Lancashire. It is not many years since the genus was first found in Britain; and the only species hitherto known, *N. flexilis*, has been gathered only in Scotland and Ireland.—The structure and distribution of the Characeæ are still engaging attention from Messrs. H. and J. Groves and others; and of this cryptogamic order, another species, *Chara Braunii*, has also been added to the flora of Great Britain.—Mr. H. Boswell also describes two new British mosses, *Bryum gemmiparum*, from Breconshire, and *Sphagnum torreyanum*, from Shropshire.—Messrs. R. M. Christy and H. Corder contribute an interesting paper on the cross-fertilisation of *Arum maculatum*.—Numerous other articles and short notices of more local and special interest fill up the number.

THE second part of vol. xiv. of *Pringsheim's Jahrbücher für wissenschaftliche Botanik* contains two important articles on cryptogamic botany:—Dr. A. Fischer, on the occurrence of crystals of gypsum in the Desmidieæ shows that they are of very wide distribution in the family, as well as in other freshwater algæ such as *Spirogyra*, though by no means universally present. He believes it to be simply a product of excretion in the process of metastasis, whether present in the form of crystals or dissolved in the cell-sap. Dr. O. Müller, on the law of cell division in *Melosira arenaria*, offers an important contribution to the life-history of the diatoms. By a most careful series of observations he establishes the law that "the larger daughter-cell of the $n$th generation divides in the following or $(n + 1)$st generation, while the smaller daughter-cell always divides only in the $(n + 2)$nd generation," by an argument which is too long to go into here. He deduces from this law the reason of the comparatively rare occurrence of the auxospores, by which the original size of the species is restored after the continued degradation which it necessarily undergoes in the process of division.—B. Fritsch contributes also a paper on coloured granular constituents of the cell-contents.

THE second part of vol. iv. of *Engler's Botanische Jahrbücher* for 1883 contains a continuation of its very valuable review of the more important works on systematic and geographical botany which appeared in 1882.—The other papers are:—By T. Wenzig, on the genus *fraxinus*.—By F. Moewes, on hybrids of *Mentha arvensis* and *M. aquatica*.—By E. Warming, on the order Podostemaceæ.

*Archives of the Physical and Natural Sciences, Geneva*, December 15, 1883.—Meteorological *résumé* of the year 1882 for Geneva and the Great Saint-Bernard, by M. A. Kammermann, Assistant-Astronomer.—On the ancient lake of the Soleure district (coloured map), by M. Alph. Favre. The existence of this lacustrine basin confirms the conclusion arrived at by other geological studies, that during the early post-Glacial epoch a far greater portion of Switzerland was under water than at present.—Descriptive notice of the meteorological observatory installed on September 1, 1882, at Sentlis, canton of Appenzell, 2467 metres above sea-level.—On the periodical oscillations of the ground, determined by the spirit-level (fifth year, 1882-83), by M. P. L. Plantamour.—On the theory of dynamo-electric machines, by M. R. Clausius. These machines having in their practical development outstripped the theory of their construction, an attempt is made in this elaborate paper to expound a theory more in harmony with the results already obtained than are any of the mathematical formulas hitherto employed to represent them.

*Rendiconto of the Sessions of the Accademia delle Scienze di Bologna* for the year 1882-83. Nov. 19, 1882.—Memoir on the "null envelopes" of the second class in a given system of points affected by given coefficients, showing how, from the general formula, others may be deduced, rendering more evident the property of the envelopes, and solving some questions connected with the momenta of the second order of said system, by Prof. Ferdinando P. Ruffiani.—On three sicephalous monsters, and more particularly on the seven-month Janus recently born in Bologna, by Prof. Luigi Calori.—Note on the extremities of the motor nerve fibres in the striated muscles of the torpedo (*Torpedo marmorata*) treated with bichloride of gold and cadmium, by Prof. G. V. Ciaccio.—Microscopic researches on the traces of electric sparks incised on glass, by Prof. Elmilio Villari.—On the electric figures of condensers, by the same author.

November 26.—A systematic classification of the genus Puccinia, by Prof. Cocconi and Dr. F. Morini.—On a case of hypertrophic hepatitis, by Prof. C. Taruffi.—Symptomatic and anthropometric studies on the cretinism prevalent in the Valle d'Aosta, Piedmont, by the same author.—Some new researches on the artificial reproduction of the spleen, by Prof. Guido Tizzoni.—On the results of the measures hitherto adopted to improve the soil and climate of malarious districts in Italy, by Dr. Paolo Predieri.—A new contribution to the study of Addison's disease, by Prof. Ferdinando Verardini.

January 14, 1883.—On a fossil cetacean (*Orca cetoniensis*) recently discovered at Cetona in Tuscany, by Prof. G. Capellini.—A study of some reactions of phosphuretted hydrogen gas, by Dr. Alfredo Cavazzi.

January 28.—On a rapid method for determining the lunar motions, by Prof. A. Saporetti.—New researches on the anatomy and pathology of the placenta in mammals, by Prof. G. Escolani.

February 11.—Notes on the history of geodesy in Italy from the earliest times down to the second half of the present century, by Prof. P. Riccardi.—Experimental researches on the hypertrophy and partial regeneration of the liver, by Dr. V. Colucci.—On the relative length of the neck in both sexes, and on the best method of making these anthropometric measurements, by Dr. G. Peli.—On the preventive inoculation of contagious pleuro-pneumonia for cattle by means of intravenous injection of the virus, by Prof. A. Gotti.—Anatomical researches on five bovine monstrosities, by Prof. G. P. Piana.

## SOCIETIES AND ACADEMIES

### LONDON

Royal Society, January 10.—"Experimental Researches on the Electric Discharge with the Chloride of Silver Battery." By Warren De La Rue, M.A., D.C.L., Ph.D., F.R.S., and Hugo Müller, Ph.D., F.R.S.

*Plasticity and Viscosity of Strata.*—During our experiments we have often been struck by the evident plasticity of strata whose form at times becomes modified when they meet with an obstacle or are influenced by other causes, as, for example, the crossing of other strata produced by a separate discharge.

One of our tubes, No. 9, with a residual hydrogen vacuum, has a diaphragm in the centre ¼ of an inch, 0·63 cm., thick, through the centre of which there is a hole ¼ of an inch, 0·63 cm., in diameter. To the end of the tube is attached a potash absorption chamber, the heating and cooling of which causes a change in the number of strata; when the number of strata increases they approach closer and closer to the diaphragm, and occasionally one threads itself through it, as if squeezed through, and its form is gradually changed thereby.

A tube, No. 368, Fig. 1, with a hydrogen residue gives evidence of the viscosity of a stratum.

At right angles is a tube of smaller diameter; in this tube is a stopper having a loop underneath from which is suspended by two silk fibres, *s*, a piece of decarbonised iron, *n n'*. The stopper when greased turns quite smoothly, and by rotating it the needle can be easily placed in any direction with regard to the tube.

In the first place the tube was placed in the magnetic meridian, and the needle of iron wire, *n n'*, in the same direction; tested by means of a very small magnet, both ends were equally attracted and not repelled, showing that the needle had been thoroughly decarbonised; this was done by heating it to redness for many hours in peroxide of iron, prepared by burning its oxalate.

The discharge was in the first instance passed from the ring to the point, so that the needle was in the dark space; no magnetism

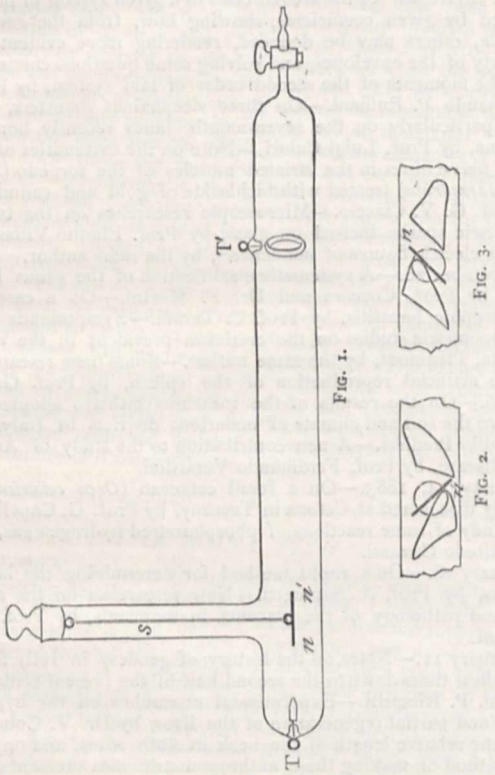

FIG. 1.



FIG. 3.



FIG. 2.

was developed in the needle, which would have been the case if the discharge had had a spiral motion as we have often observed and described to be sometimes the case. It was indeed with the object of ascertaining this fact that the apparatus had been made.

The needle was now placed at right angles to the tube, and the point made positive; after a few trials at different exhausts a beautiful tongue-shaped stratification was obtained, and it was then possible by altering the amount of the current to make the apex of a stratum impinge on one or the other end of the needle, Figs. 2 and 3; on whichever end the stratum touched, that end was pushed away by it, showing clearly that the balance of forces which hold together the molecules composing a stratum are sufficient to render it viscous, and unyielding to a small resistance.

**Geological Society**, January 23.—R. Etheridge, F.R.S., vice-president, in the chair.—George Henry Nelson and John Philip Spencer were elected Fellows of the Society.—The following communications were read:—On the Serpentine and associated rocks of Porthalla Cove, by J. H. Collins, F.G.S.—Outline of the geology of Arabia, by C. M. Doughty. Communicated by Prof. T. G. Bonney, F.R.S. The author described the general outline of the geology of a considerable district of the western part of Arabia, over which he had travelled. It was not in his power to enter into details, especially as regarded the sedimentary rocks, because the circumstances under which his journey was undertaken made it impossible to bring back specimens. There was, however, considerable simplicity in the geological structure of the country. The igneous rocks consisted of granites and basalts, the latter breaking through the former. The sedimentary rocks, which are newer than the granites and, in fact, rest upon them, consist of—(*a*) A yellowish sandstone, with stains of a reddish or greenish colour and veins of ironstone. In this, for example, the rock-tombs, &c., of Petra have been excavated. These substances, in the author's opinion, may be traced as far as Medina, and occur all about Kasîm. They often weather in a singular way; pebbles are scarce in them; fossils he had not seen. (*b*) The limestone contains bands of flint, and appears to be identical with that which occurs in Palestine, and is, he thinks, probably of Cretaceous age. (*c*) Of much later date is a coarse flat gravel which overspreads a considerable tract of country, as, for example, at Mount Seir in Edom, altogether about 250 square miles. The flints are doubtless derived from the limestone, and are often polished by drifting sand. It occurs on plateaux at very considerable elevations above the sea, sometimes forming the highest ground in the neighbourhood; and sections had shown this gravel to be more than 20 feet deep. In it the author had discovered two or three flint weapons of palæolithic type, rude, but very like those of Hoxne or St. Acheul. The granite by its aspect and mode of occurrence recalls that of Sinai. It is cut by dykes of basalt; and now and then the author had observed other intrusive igneous rocks, which he must be content to classify as traps. The dykes of basalt, however, were not the only modes of occurrence of this rock; there were considerable flows of basaltic lavas and occasional small craters. These volcanic districts bear the name of Harra; the principal are the Aneyrid, the Khaybar, and the Kesshub. The last lies between Nejd Arabia and the Mecca country. These masses of lava, &c., are comparatively modern; eruption, indeed, has in one or two localities occurred in historic times, and steam has been seen to issue from certain craters.

**Physical Society**, January 26.—Prof. Clifton in the chair.—New member, Yung Free, Secretary of the Chinese Legation.—Prof. Clifton announced that Lady Siemens had presented a portion of the late Sir William Siemens's library to the Society.—The meeting, which was at first a special meeting to consider the resolution that it is expedient for the past presidents of the Society to be permanent vice-presidents, having agreed to this resolution, was constituted an ordinary meeting, and Professors Ayrton and Perry described and exhibited their new ammeters and voltmeters, also a non-sparking key. The well-known ammeters and voltmeters of the authors used for electric light work are now constructed so as to dispense with a constant, and give the readings in amperes and volts without calculation. This is effected by constructing the instruments so that there is a falling off in the controlling magnetic field, and a considerable increase in the deflecting magnetic field. The deflections are thus made proportional to the current or E.M.F. measured. The ingenious device of a core or soft iron pole piece adjustable between the poles of the horseshoe magnet is used for this purpose. By means of an ammeter and voltmeter used conjointly, the resistance of part of a circuit, say a lamp or heated wire, can be got by Ohm's law. Professors Ayrton and Perry's non-sparking key is designed to prevent sparking with large currents. It acts by introducing a series of resistance-coils determined experimentally one after the other in circuit, thereby cutting off the spark.—Dr. C. R. Alder Wright, F.R.S., read a paper on the electromotive force set up during interdiffusion, being the result of experiments made by himself and Mr. C. Thompson to determine the effect of varying densities of solutions used in voltaic cells on their E.M.F.'s. The observations were made by constructing the cells of pure materials and opposing them so that the differential E.M.F.'s could be measured by galvanometer or quadrant electrometer, when solutions of different densities were employed. The following general conclusions were reached: (1) In any two fluid cells containing solutions of two metallic salts and plates of the respective metals contained therein, an increase of strength in the solution surrounding the plate acquiring the higher potential in virtue of the normal action of the cell causes an increment in the potential difference between the two plates; and the opposite effect is produced by an increment in the strength of the solution surrounding the other plate. (2) A law of summation holds, expressible thus: the effect of the sum of a series of changes in the strengths of the solutions in a two-fluid cell is equal to the algebraic sum of the effects of each change severally. The author considered this law very fully; and pointed out that "diffusion cells" act at least partly after the fashion of thermo-couples transforming into electric energy a certain amount of sensible heat.

**Anthropological Institute**, January 22.—Anniversary meeting.—Prof. Flower, F.R.S., president, in the chair.—The following gentlemen were elected officers and Council for the year 1884:—President: Prof. W. H. Flower, F.R.S.; vice-presidents: Hyde Clarke, John Evans, F.R.S., Francis Galton, F.R.S., Lieut.-Col. H. H. Godwin-Austen, F.R.S., Major-General Pitt-Rivers, F.R.S., E. B. Tylor, F.R.S.; director: F. W. Rudler, F.G.S.; treasurer: F. G. H. Price, F.S.A.; Council: J. Beddoe, F.R.S., S. E. B. Bouverie-Pusey, E. W. Brabrook, F.S.A., C. H. E. Carmichael, M.A., W. L. Distant, C. I. Elton, B.A., A. W. Franks, F.R.S., J. G. Garson, M.D., Prof. Huxley, F.R.S., Prof. A. H. Keane, B.A., A. L. Lewis, Sir J. Lubbock, Bart., M.P., R. Biddulph Martin, M.P., Henry Muirhead, M.D., J. E. Price, F.S.A., Lord Arthur Russell, M.P., Prof. G. D. Thane, A. Thomson, F.R.S., Alfred Tylor, F.G.S., M. J. Walhouse, F.R.A.S.—The President delivered an address on the aims and prospects of the study of anthropology, which we gave last week.

EDINBURGH

**Royal Society**, January 21.—Robert Grey, vice-president, in the chair.—Prof. Crum Brown communicated a paper on distant vision, by Dr. Maddox. Dr. Maddox finds that accommodation for a distant object in the case of most persons is naturally connected with a slight convergence of the optic axes, so that the intersection of the optic axes is nearer than the object looked at. At a certain distance, different in different persons, and probably varying in the same person from time to time, the optic axes naturally converge at the distance focused for. When a nearer object is looked at, the point of intersection of the optic axes is beyond the object. In ordinary vision these differences between the distance of convergence and of accommodation are not observed, because the effort for single vision easily overcomes them, and forces the optic axes into the portion corresponding to the accommodation.—Mr. John Aitken read a paper on the dark plane in dusty air, a full report of which was given in our last issue.—Mr. Aitken also read a note on the recent sunsets.

CAMBRIDGE

**Philosophical Society**, January 28.—On the microscopic structure of a boulder from the Cambridge Greensand found near Ashwell, Herts, by Prof. Bonney.—On critical or apparently neutral equilibrium, a note on Mr. Greenhill's paper, *Camb. Phil. Proc.*, 1883, by Mr. J. Larmor.—On the normal vibrations of a thin isotropic shell, bounded by confocal spheroids, by Mr. W. J. Ibbetson.—On the isochromatic curves of polarised light seen in a uniaxial crystal cut at right angles to the optic surface, by Mr. C. Spurge.—Tables of the number of numbers less than $n$ and prime to it, and of the sum of the divisors of $n$, and the corresponding inverse tables up to $n = 3000$, by Mr. J. W. L. Glaisher.

PARIS

**Academy of Sciences**, January 21.—M. Rolland in the chair.—Reflections on M. P. Bert's last communication regarding his new method of anæsthesis in surgical operations, by M. Gosselin. Although somewhat inconvenient in practice, the author still considers that the innovation presents certain advantages, while supplying a fresh argument to those who recommend moderate and progressive inhalation, rather than a large dose administered all at once. In his reply M. Bert submits that the objections raised to his method on the ground of the cumbrous nature of the apparatus are greatly exaggerated in the case of public hospitals. He further urges that it appears to be the only process in which surgeons are relieved of all personal responsibility in administering anæsthetics.—On the preparation in large quantities of artificial virus (bacilli of splenetic blood) attenuated by rapid heating (continued), by M. A. Chauveau. Here the author explains the conditions essential to the successful performance of this important and difficult operation. The subject is treated at length under the following heads:—(1) on the degree of heat required for the complete attenuation of the artificial virus; (2) on the heating process; (3) on the practical value of this system of prophylactic inoculation.—Extract from a letter by Baron Nordenskjöld on the remarkable optical effects observed during the last two months at sunset and sunrise in Sweden, presented by M. Daubrée. The author suggests that the phenomenon cannot be attributed exclusively to the dust discharged during the recent eruptions in Sunda Strait. Small particles of dust contained in the snow which fell near Stockholm at the end of last December were found on analysis to contain a considerable quantity of carboniferous matter, which burnt in the dry state with a flame, and left a reddish residuum containing oxidised iron, silica, phosphorus, and as much as 0·5 per cent. of cobalt and nickel.—Observations of the Pons-Brooks comet made at the Brunner 6-inch equatorial (0·160m.), Observatory of Lyons (continued, by M. F. Gonnessiat.—On the multipliers of linear differential equations, by M. Halphen.—On the approximate values assumed by an integral polynome when the variable quantity varies within definite limits, by M. Laguerre.—Note on the shading of a sphere, by M. J. Cotillon. The author here attempts a reproduction of the shaded sphere traditionally said to have been constructed at the Ecole Polytechnique on the theoretical indications supplied by Monge.—On the electric conductibility of greatly diluted saline solutions, by M. E. Bouty. M. Berthelot, who insists on the importance of the results obtained by M. Bouty, points out that, according to the new law established by his numerous experiments, the electric resistance of greatly diluted solutions is determined, not by the atomic weight, but by the chemical equivalent of the bodies.—On the repulsion of two consecutive portions of the same electric current, by M. Izarn.—On the development of the nacreous crystals of sulphur, by M. D. Gernez.—Determination of the equivalent of chromium by means of the sesquioxide of its sulphate, by M. H. Baubigny.—Telegraphic despatch regarding the liquefaction of hydrogen addressed to M. Debray by M. Wroblewski. On this communication, which was worded: "Hydrogen cooled by boiling oxygen has been liquefied by expansion," M. Debray offers some remarks, and shows how it entirely confirms the remarkable observations made by M. Cailletet on the expansion of hydrogen.—On the products of reduction of erythrite by formic acid, by M. A. Henninger.—On an aromatic diacetone, by M. E. Louise.—Quantitative analysis of the moisture of amylaceous substances (starch, fecula, &c.), by M. L. Bondonneau.—On the classification of the plumicole Sarcoptidæ (sub-family of the Analgesinæ), by MM. E. L. Trouessart and P. Mégnin.—On the Cipolino marble of Paclais, Loire-Inférieure, by M. Stan. Meunier. From a careful study of this remarkable calcareous formation the author considers that even more than the blue marble of Antrim it may be regarded as a type of metamorphic rock by contact.—On the nature of the deposits observed in the water of contaminated wells, by M. E. Gautrelet. To the organisms examined under the microscope the author gives the name of *Stercogona tetrastoma*, and for several reasons concludes that they are the true typhic microbe.—On the remarkable atmospheric disturbances produced by the Krakatoa eruption, by M. E. Renou.—On the twilight effects observed on December 27 on the summit of the Puy de Dôme, by M. Alluard.—The recent remarkable sunsets and sunrises compared with those observed in various parts of Europe during the summer of 1831, by M. A. Angot.

January 28.—M. Rolland in the chair.—Spectral study of the group of telluric bands in the brightest regions of the solar spectrum, which were discovered by Brewster and collectively called $\alpha$ by Angström, one illustration, by M. A. Cornu. A protracted study of the bandlets of lines in this mysterious $\alpha$ band has suggested a practical method for distinguishing by simple inspection the lines of telluric from those of solar origin. It has also enabled the author to establish the intimate relation between this group and the A and B Fraunhofer bands, while the origin of the group itself must be referred to absorption by the oxygen of the air.—Remarks on Faraday's electrochemical law in connection with the law discovered by M. Bouty regarding the conductibility of greatly diluted saline solutions, by M. Wurtz.—On the atmospheric disturbances attributed to the Krakatoa eruption, and on the storm of January 26, by M. C. Wolf. The storm was announced the day before by great oscillations of the magnetic curves, especially those of the declinometer. The most remarkable feature attending it was its sudden cessation about one o'clock a.m. when the velocity of the gale fell at once from 38m. to 12m. per second.—On the physical disturbances that have taken place during the last few months, by M. Faye.—On the period of most frequent occurrence of solar spots in recent times, according to the data supplied by M. R. Wolf of Zurich, by M. Faye. The maximum (424) seems to have been reached during the first six months of 1882.—Remarks on the official topographic chart of Algeria, scale 1 : 50,000, the first twelve sheets of which have been presented to the Academy, by M. F. Perrier.—On the employment of titrate mixtures of anæsthetic vapours and air in the

administration of chloroform, by M. Richet.—Note on the dissemination, assimilation, and determination of phosphoric acid in arable lands, by M. P. de Gasparin.—On the mean movement of the first satellite of Saturn (Mimas), based on ninety-one observations made at Toulouse since October 24, 1876, by M. B. Baillaud.—Observation of the Pons-Brooks comet made at the Observatory of Meudon (one illustration), by M. E. L. Trouvelot.—On the reduction of a continuous fraction of a fraction satisfying a linear equation of the first order with rational coefficients, by M. Laguerre.—Further reduction of the limits furnished by Descarte's rule of signs, by M. D. André.—On the distribution of the potential in liquid masses limited by two parallel planes, by M. Appell.—Relation between the power and resistance applied to the two points of attachment in a continuous spring break, regard being had to the elasticity of the spring, by M. H. Léauté.—On the reciprocal action of two electrified spheres, by M. Mascart.—On the Skrivanow electric pile (pocket model), by M. D. Monnier.—On the variations of electromotor force in accumulators, by M. E. Reynier.—On a method of determining the longitude of a place, the latitude and astronomic time being known, by the observation of the true altitude of the moon at a given moment beforehand, by M. Ch. Rouget.—Report on the fresh experiments made with the marine gyroscope on board the ironclad *Le Turenne* in the harbour of Brest on November 11 and 16, 1883, by M. Edm. Dubois.—On a new method of preparing the permanganate of barytum, by MM. G. Rousseau and B. Bruneau.—On a nitrous colloid derived from amidobenzoic acid, by M. E. Grimaux.—On some remarkable properties of the lutidine derived from coal tar, by M. Oechsner de Coninck.—On the operculum of the gasteropods, by M. Houssay.—On the proportion of incompletely oxidised phosphorus contained in the urine, especially under certain nervous conditions, by MM. R. Lépine, Eymonnet, and Aubert.—Researches on the intensity of the chemical phenomena of respiration in superoxygenised atmospheres, by M. L. de Saint Martin.—Researches on abnormal menstrual discharges, by M. J. Rouvier.—On the barometric disturbances produced by the Krakatoa eruption (second note), by M. E. Renou.—On the barometric disturbances observed on August 27, 1883, at Montsouris, by M. Marié-Davy.—On the causes (1) of the production of atmospheric electricity in general; (2) of electricity in thunderstorms; (3) of electricity of sheet-lightning, by M. G. le Goarant de Tromelin.—On an auroral and crepuscular display of light observed at the island of Réunion, in the Indian Ocean, on September 8, 1883, by M. Pélagaud.

BERLIN

**Physiological Society**, January 11.—Prof. Kossel discussed the methods which had hitherto been adopted in order to become acquainted with the transformations of nitrogenous substances in the animal body in the course of their passage from the well-known starting point, the albumen, to the likewise well-known final products, urea, uric acid, and creatine. The way which, in the opinion of the speaker, was most likely to lead to good results was to seek in the tissues the chemical combinations which, in accordance with their composition, stood midway between the albumen and its final products. In relation to this point, the analyses of nitrogenous substances occurring in the animal body had already yielded some definite data to work on. The proportion of carbon to nitrogen (C : N) had, namely, been found to be, in the albumen, 100 : 30; in urea, 100 : 233; in creatine, 100 : 66; in hypoxanthine and xanthine, 100 : 93; and in guanine, 100 : 116. It appeared evident, therefore, that the substances creatine, hypoxanthine, xanthine, and guanine were mediate products in the process of the transmutation of the albumen, with the discovery of which in the tissues Prof. Kossel had been busied. The bases hypoxanthine, xanthine, and guanine were not found in an isolated state in the tissues, but compounded with albumen and phosphoric acid into the complicate molecule, nuclein, a subject to which the speaker had devoted searching inquiry. There were different forms of nuclein which varied probably according to the share the bases had in their composition. All of them, however, agreed in having common reactions. Nuclein had already, by its discoverer, been brought into close relationship with the cell-nucleus, and it would be of great consequence if it could be conclusively proved that the cell-nucleus consisted exclusively of nuclein, as in that case the changes of the cell-nucleus occurring under different physiological conditions would be accompanied by chemically demonstrable quantitative changes in this nuclein substance. The quantitative analysis of the nuclein could, namely, be worked out by determining the xanthine or guanine bases. In this case, however, it was necessary to ascertain beforehand that the tissue examined contained no free xanthine or guanine besides the nuclein. A second method for determining the quantitative nuclein was through determining the amount of phosphoric acid in the composition. Phosphoric acid occurred in the body in three different combinations, namely, as inorganic phosphoric salt, in lecithin, and in nuclein. Inorganic phosphoric acid was to be extracted by diluted acids, lecithinic phosphoric acid by hot alcohol. The phosphoric acid then remaining would belong to the nuclein, and could serve for its quantitative determination. Prof. Kossel had now ascertained that the blood of mammalia contained no nuclein, while on the other hand the blood of birds did. The muscles contained little nuclein, the brain somewhat more; still more was found in the liver, and most of all in the spleen. In all these successive cases the nuclein substance kept about equal pace with the presence of cell-nucleus. Nuclein was also, however, to be met with in substances which contained no cell-nucleus; in the yolk, for example, and in the milk. Possibly in this case there might be chemical proof of granules without their having come morphologically to view. In pathological processes, by which cell-nucleus becomes excessively developed in tissues which otherwise contained no cell-nucleus, as was the case in leucæmia or sarcomatous tumours in the muscles, Prof. Kossel had invariably found an increase of nuclein in corresponding quantities.—Dr. W. Wolff explained some microscopical preparations which he had set up in the demonstrating hall. In one of these preparations was seen a stage in the development of the nerves in the tail of the larva of a frog. These nerves consisted of primitive fibres ramifying as far as the finest fibrelets. At a farther stage cells were seen attaching themselves to these at the thicker parts. Next appeared the nerve-sheath, and finally the marrow. Other preparations demonstrated the growth of the bones of frogs which took place only at the periosteum and at the ends of the diaphyses. By treatment with chromic acid and with two different aniline colours, Dr. Wolff had stained the cartilages a beautiful blue, and the osseous tissue red, and was therefore able readily to follow the development of the latter.

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