THURSDAY, DECEMBER 23, 1875

LORD DERBY ON THE ENDOWMENT OF SCIENTIFIC RESEARCH

WE do not think it possible to estimate too highly the value of Lord Derby's address last Friday at Edinburgh, and his statements as to the rapidly widening fields of science and the increasing value of the results of scientific research. We shall simply content ourselves with quoting the very remarkable views he put forth as to the duty of the State with regard to the encouragement of research, views which, when we consider the character of the speaker and his official position, must be regarded as of the greatest significance. After speaking of the all-absorbing nature of scientific research, of the necessity of complete devotion to a special department in order to achieve success, and of the "world-wide benefit" of scientific results, Lord Derby said :—

"Science, above all, needs leisure, and I hope it is not utopian to look forward to the possibility of a far ampler provision being made for its prosecution by competent persons than exists at present. I do not refer merely or principally to help from the State ; though, speaking for myself, I should not grudge it in such a cause. But the spirit of patriotism which animated founders of schools and colleges and public benefactors of former days is not extinct ; in some directions it is more flourishing than ever. An American banker lately gave half a million to help the poor of London ; a well-known Scotch gentleman has given the same sum within the last few years in aid of the Kirk of Scotland ; money is never wanting at either end of this island when men see their way to make a good use of it. When have schools, hospitals, public parks, museums, institutes been more abundant than at the present day? Science has no endowments, or next to none ; but only because the interest in that class of subjects is comparatively new, and rich men, who want to do some good with their capital, have not looked much in that direction as yet. Is it too sanguine a hope that we may see individual liberality take a form which hitherto it has rarely taken? Who knows how many discoveries might be worked out, how many conquests of man over nature secured, if for, I do not say a numerous body, but even for some 50 or 100 picked men, such modest provision were made that they might be set apart, free from other cares, for the double duty of advancing and of diffusing science? Who can measure what has already been lost to England and to the world, when intellects capable of the highest kind of original work have been wasted, not by choice, but by necessity, on the common drudgery of every-day life? I know very well that to some extent that must continue to be the case ; it is visionary to contemplate a state of society in which every man will find exactly the employment that suits him ; in human life, as in nature, there will always be a vast apparent waste of power. But we may at least reduce that waste where we see it going on ; original capacity is not so common that we can afford to throw it away, nor so difficult to discover that we may excuse ourselves by saying we did not see it. I am quite aware that endowments of all sorts are discountenanced by a certain class of thinkers, of whom I speak with respect, but who, I think, argue from the abuse of a thing against its use. The fact remains that the most enduring and valuable work done in the line of pure science will not bring a shilling to the man who does it ; and while that is so (and one does not see how it can be otherwise), there seems nothing unreasonable in saying that society shall, in one way or another, make provision for those who are doing so much for society. Nor do I see that the risk of jobbing in such matters is great. Men who work to make money, or men who care for reputation of the popular sort, do not choose such pursuits as those of which I am speaking. And, making all allowance for the little jealousies and rivalries from which no profession is free, I believe that there is seldom any difficulty in picking out the best qualified candidates for professorships and appointments of that kind where there is an honest wish to find them. I go into no detail ; I indicate no special plan. I had rather, for my own part, see action taken by the community than by the State, or, at least, I should wish to see the community largely helping the action of the State ; but whatever is done, or whoever does it, I think that more liberal assistance in the prosecution of original scientific research is one of the recognised wants of our time. How far that assistance can be obtained by the utilisation of ancient endowments is a question partly of principle, partly of detail. I do not agree with the extreme views which have been put forward on either side in regard to it. I cannot follow the reasoning of those who say that the State has no right to divert endowments from one purpose to another. There must be a regulating power somewhere, else changes which, by common consent, lapse of time has made necessary could not be effected ; and whether that power is vested in a Court of Justice or in a Commission, it is equally the power of the State. To my mind, so far as right is concerned, the Legislature may do what it chooses in regard to any endowment, without injustice, provided only that the rights of living individuals are respected. How far it is politic to use that power is another matter. Push its exercise too far, and you kill the bird that lays the golden eggs. Men give or leave funds, not for the promotion of useful public purposes in the abstract, but for some special form of public usefulness that has taken their fancy. You never hear of a fortune left to the Chancellor of the Exchequer to employ as he thinks best for the public service. One man cares for schools, another for hospitals, and so forth ; and unless intending benefactors have a reasonable security that the general purpose for which they leave their money will be respected, the stream will soon dry up. More than that, I consider, they ought not to ask. Respect the founder's object, but use your own discretion as to the means ; if you do not do the first, you will have no new endowments ; if you neglect the last, those which you have will be of no use."

We need not add one word of our own in support of these views ; the case on behalf of the endowment of research, which we have long advocated on the grounds stated by Lord Derby, could not be more forcibly put. It may, however, be useful to collect for reference the opinion of the country as expressed through the daily press.

The *Daily News* thus endorses Lord Derby's views :—

"The real advancement of science needs, as Lord Derby says, leisure, and the power and opportunity of purely disinterested study. In this sense all scientific men will agree with Lord Derby that science needs more help. We have, indeed, in England, some very illustrious living examples of men who not only teach, as a daily and laborious duty, the methods and results of scientific investigation, but who have themselves, in a precious and hard-earned leisure, carried that investigation far forward along paths hitherto untrodden. But it has occurred to every reader of their writings to ask what they might have added to the world's knowledge had they been able to devote their whole time and strength to their favourite pursuit. There is a growing conviction that investigation of this kind, as apart from teaching, ought to be encouraged by the State. Lord Derby would not grudge it help, even from national resources; but he throws out a suggestion which may be commended to the notice of men who, like the late member for Bridport, have money to leave, and are on the look-out for heirs. We have, as Lord Derby says, bequests of all kinds; and it would be a welcome sign that science had been made popular, even in a sense he would approve, if bequests of large sums to endow original research should come into fashion."

The *Daily Telegraph* says:—

"And here the speaker could not but touch on the question of the better endowment of scientific research, which he disposed of by heartily wishing that such benevolent people as give half a million to a charity, or to the Kirk of Scotland, would turn the stream of Pactolus upon the dry ground of natural science. There is no soil which would yield back more profitable harvests. A discovery in mechanics or physics benefits all mankind; and great investigations are undoubtedly kept in abeyance for want of the help which society does not, and the Government cannot, bestow. Lord Derby, indeed, expressed himself willing to advocate all that could be done in this direction by a Government; but his opinion is that the community must take up the question, if anything really large was to be hoped for, though something might, perhaps, be effected by the careful application of old endowments, upon which point the Lord Rector uttered some observations balanced so finely that a pinch of the dust of a 'dead founder' would turn his well-trimmed scales."

The *Globe* speaks as follows:—

"Valuable as were the hints suggested on what may be described as the conduct of intellectual life, still greater interest attaches to Lord Derby's observations on the subject of scientific research and University Reform. On the former topic scientific men have sometimes talked rather wildly of late, as if it were the duty of the State to provide an elaborate scheme for the endowment of science. Lord Derby did not accept this view; but he distinctly laid it down that the community has not yet realised the vastness of its obligations to science, and that, when it does so, much larger funds will be devoted to its encouragement than are now available. He also declared that, for his own part, he would not object to the State doing something to foster original research. These utterances will be eagerly fastened on by scientific men, but it may perhaps be questioned whether the difficulties in the way of definite action are not somewhat underrated. By what test would it be possible to select the men who should be supported for the purpose of extending the bounds of science? And if this difficulty were overcome, how could an assurance be given that the opportunities secured would be applied to the best advantage? Would it not be necessary to associate duties with the rights conferred on successful candidates? These and other obstacles may not be insuperable; but they will have to be thoroughly considered before a large additional expenditure is undertaken on behalf of science. Perhaps the best solution would be a generous endowment of scientific professorships—by private liberality, if possible—in connection with which there would be teaching to some slight extent, but not so much as would interfere with work of a high kind."

According to the *Hour*—

"Perhaps that which will seem to English readers the most important part of Lord Derby's address is that relative to the importance of scientific research."

The *Scotsman* has the following:—

"Lord Derby does not know much about science, but he knows enough to have a clear view of the truth that 'science, in the strict sense of the word, can never be popular.' He also sees plainly enough that, as a consequence of this, science as a pursuit can never pay. Nothing in his address is more important or more just than his plea for the endowment of science, coupled as it is with an expresson of his individual willingness that some aid should be given to science by the State. It is plain, too, that Lord Derby thinks that something might be got from our older endowments for this object, without doing injustice to anyone, living or dead."

The *Glasgow Herald* thus writes:—

"Scientific culture seems to command the largest share of Lord Derby's sympathies. Those who have the taste for the investigation of material objects 'have the satisfaction of knowing that while satisfying one of the deepest wants of their own nature, they are at the same time promoting, in the most effectual manner, the interests of mankind.' There is, in other words, the investigation of the unknown, and a service of utility rendered to mankind. Then, the charm of scientific studies to Lord Derby lies in their definiteness. The student is held down to the facts of nature; if he investigates them at all he must investigate them thoroughly. He knows nothing till he knows all that the facts reveal. Popular science is, to his mind, a misnomer. Science can never be popular, for its study involves leisure, careful industry, and patient waiting and watching. He is so convinced of the advantages of cultivating the study of nature that he would not be averse to a Government endowment."

It will thus be seen that public opinion, so far as we at present have been able to glean it, approves of the views expressed by Lord Derby; we cannot therefore doubt that Government will take an early opportunity of giving them practical effect.

AFRICAN HANDIWORK

Artes Africanae. By Dr. Georg Schweinfurth. With twenty-one lithographic plates. (London: Sampson Low and Co., 1875.)

THE title of this work may perhaps be thought too comprehensive, the author having, wisely as we think, confined himself to the arts of the negro tribes visited by him in the vicinity of the White Nile between the equator and about 12° north latitude.

Africa may be divided into three regions, corresponding to the movements of trade. In the northern half of the continent where Islamism and firearms have penetrated, home-made goods have been supplanted by European commodities and the last traces of native industry threaten shortly to disappear. An intermediate zone in which the cotton stuffs of Europe are made the chief articles of trade intervenes between this and the interior, where European goods are unknown and native arts are found in their most primitive condition. It is to a portion of this latter region that Dr. Schweinfurth's work relates.

The tribes of the White Nile were first visited by Consul Petherick in 1857-8, and many specimens of their arts which were brought home by him have since been

dispersed. A considerable number have, however, since found their way either into the Christy collection, or into Col. Lane Fox's Anthropological collection at Bethnal Green, and have been described in greater or less detail. But with the exception of a brief account of the war weapons of this people which was contributed by Mr. Petherick to the *Journal of the United Service Institution* in 1860, including numerous illustrations, no original account of their native arts has been published until the appearance of the present work.

The tribes referred to in this volume are named Dinka, Dyur, Bongo, Mittu, Niam Niam, Bellanda, Monbuttu, Sere, and Kred, and as a rule the same types of art with innumerable but closely-allied varieties pervade the whole of them. Imitation of natural forms, that invariable characteristic of primitive arts, is not less frequent here than amongst other savages; thus we find amongst the Bongo, bells and rattles in imitation of leguminous fruits, and iron thorns upon the heads of spears, both named and copied from the Makrigga, a thorny shrub of the district which no doubt was used and served as a model for these barbarous weapons before the introduction of iron. Notwithstanding the prevalence of iron, the Mittu and some other tribes still employ an arrow with a hard wood point or fire-shaft in preference to the iron ones, which carry only one-third the distance although with greater accuracy of flight.

The partiality for doubling certain objects without in most cases the least practicable utility being perceptible is noticed by the traveller as a characteristic of Central African art. Thus we find double points to roofs, double pipe-bowls, double lance-heads, double spoons, and double bells included amongst the objects illustrated. The art of the carpenter, as with most savages, appears to be confined to carving household utensils such as seats, tables, dishes, boxes, mortars, musical instruments, canoes, &c., out of a solid block; the joiner's art seems almost unknown, the only exception here recorded being a sleeping-bench of the Monbuttu tribe, in which the framework of Raphia stalks is fastened to the feet by pegs of hard wood. One of those curious transformations so common in savage art is seen in the case of the broad mushroom-headed club, "Bollong." This club has been described by Mr. Petherick, amongst the Dor tribe, as a weapon for cracking skulls. The broad head, which is obviously a monstrous development of the ordinary club head, appears to have suggested its employment as a seat by sticking the pointed handle into the ground and sitting on the head. Accordingly we find that amongst the Dinka, Dyoor, Madi, and Gani, the upper surface of the head has been made perfectly flat, in order to adapt it to this new use, whilst at the same time preserving its efficiency as a weapon. The wooden parrying-stick or shield, "Kwrr," constructed of one piece with a hollow for the hand carved out in the centre, has been noticed by Mr. Petherick amongst the Mundo, and is here figured as a Dinka weapon. Its close resemblance to the Australian parrying-shield, Tamarang, and to one from an Egyptian tomb, now in the Louvre at Paris, has been noticed by Col. Lane Fox in his catalogue of his collection at Bethnal Green. Dr. Schweinfurth compares it to a specimen from the Pacific Isles now in the Berlin Museum. Should this turn out to be correct, and not a mistaken locality, it will add another link to the area of distribution of this peculiar form of weapon. Parrying-sticks, without the hand hole, are undoubtedly employed in some of the Pacific Isles. The bow-shaped parrying-shield, "Dang," represented by Mr. Petherick, now in the Bethnal Green collection without a string, is here represented with a string attached, showing that although now used exclusively as a parrying weapon, it was without doubt derived from the bow, which it resembles, and that the curved ends have been retained for a totally different use from that which they served originally. The identity of this weapon with a Caffre implement figured in Wood's "Africa" is, however, doubtful, as it appears not unlikely the latter may be a musical instrument.

Several illustrations are given of the peculiar iron boomerang of the Niam Niam, here called "Pingah," but known as "Hunga Munga," or "Shanger Mangor," by the Musgu of Soudan, and Kulbeda in Upper Sennaar. The distribution of this class of weapon and its varieties has been traced by Col. Fox in his catalogue, where it is shown to be common to the greater part of the black races of mankind, including the Australians and the aborigines of Central India; but we have here some additional points of interest in connection with the African variety. We now learn from Dr. Schweinfurth that, like the Australian weapon, it is thrown by the Niam Niam, so as to rotate in a horizontal plane, which, though anticipated, has not been distinctly stated by former travellers. We learn also from this work that the wooden variety of this weapon, called "Trumbash," a name which is sometimes also applied to the iron variety, and which was first noticed by Sir Samuel Baker in Abyssinia, is in use amongst the Mohammedan negro tribes throughout the district between that country and Lake Tsad. This weapon, described as a flat two-edged projectile of wood, curved more or less sickle-like, and wider towards the point, is undoubtedly the original of the whole class, and from its resemblance to the Dravidian and Australian forms of it, affords one of several links which connect the arts of those black races of the southern hemisphere, which are supposed by Prof. Huxley, and by Prof. Haeckel after him, to have been derived from a now submerged paradise in the Indian Ocean.

To our knowledge of the iron-work of these tribes Dr. Schweinfurth also adds some important details, but it is remarkable that he should not have especially noticed the peculiar ogee-sectioned blade, sunk on alternate faces, which is such a characteristic feature of the iron implements of all Africa, from the Caffres on the south-east to the Fans on the west, and which, like the double bellows, connect them with the iron-workers of Sudia and Burmah. It is true that illustrations of this peculiar blade, so far as the shading enables us to judge, are given in the plate of Niam Niam spear-heads, but without comment. They are absent in the plate of Bongo spear-heads, and it would be interesting to know whether this is an accidental omission, or whether the Bongo form is in this respect an exception to the custom prevalent amongst other tribes of iron-workers.

The plates are well executed, and though not furnished with a scale, as is desirable in such works, the dimensions are given in most cases.

It might be suggested as an improvement to future travellers, that in the arrangement of the plates more attention should be paid to varieties, and that the several forms should be placed side by side according to their affinities. There is no point of so great interest to the scientific student of early culture as the allied varieties of form. As a rule with exceptions, it may be said that arts which are indigenous present greater varieties than those which are exotic, and hence the importance of studying minute differences, more especially in cases where, by means of gradual variation, transitions to other types or other uses may be traced. A few finished drawings are no doubt valuable in order to give a correct idea of the leading types; but for the varieties, outline drawings on a smaller scale in the style of the illustrations of "Demmin's History of Arms," are all that is needed, and enable these transitions to be given at a trifling cost. With these additions, and with due attention to such other matters relating to savage art as are suggested in the "Anthropological Notes and Queries," published by the British Association, we would earnestly commend the example of Dr. Schweinfurth to all travellers, for, as he truly says in his preface, "Hurry is needed: the destructive tendency of our industrial productions obtruding themselves upon all the nations of the earth menaces, sooner or later, to sweep away, even in Africa, the last remnants of indigenous arts." Of the utility of such a work as this no anthropologist or antiquary can doubt. There is, however, one remark of the author's to which we would draw special attention, and which he in this work reiterates with commendable emphasis:—"A people, as long as they are on the lowest step of their development, are far better characterised by their industrial products than they are either by their habits, which may be purely local, or by their own representations, which, rendered in their rude and unformed language, are often incorrectly interpreted by ourselves. If we possessed more of these tokens we should be in a position to comprehend better than we do the primitive condition of many a nation that has now reached a high degree of culture."

RECENT FRENCH EXPERIMENTAL PHYSIOLOGY

Physiologie Experimentale. Travaux du Laboratoire de M. Marey. (Paris: G. Masson, 1876.)

UNDER the auspices of the Minister of Public Instruction of France are published from time to time volumes of the "Bibliothèque des Hautes Études." The work before us is one of these, and its value will be fully appreciated by any physiologist or physicist who has once glanced at its well illustrated pages. It contains several papers by M. Marey, mostly on points connected with the employment of the "graphic" method of depicting the magnitude and duration of dynamical phenomena both physical and physiological, and two by Dr. François-

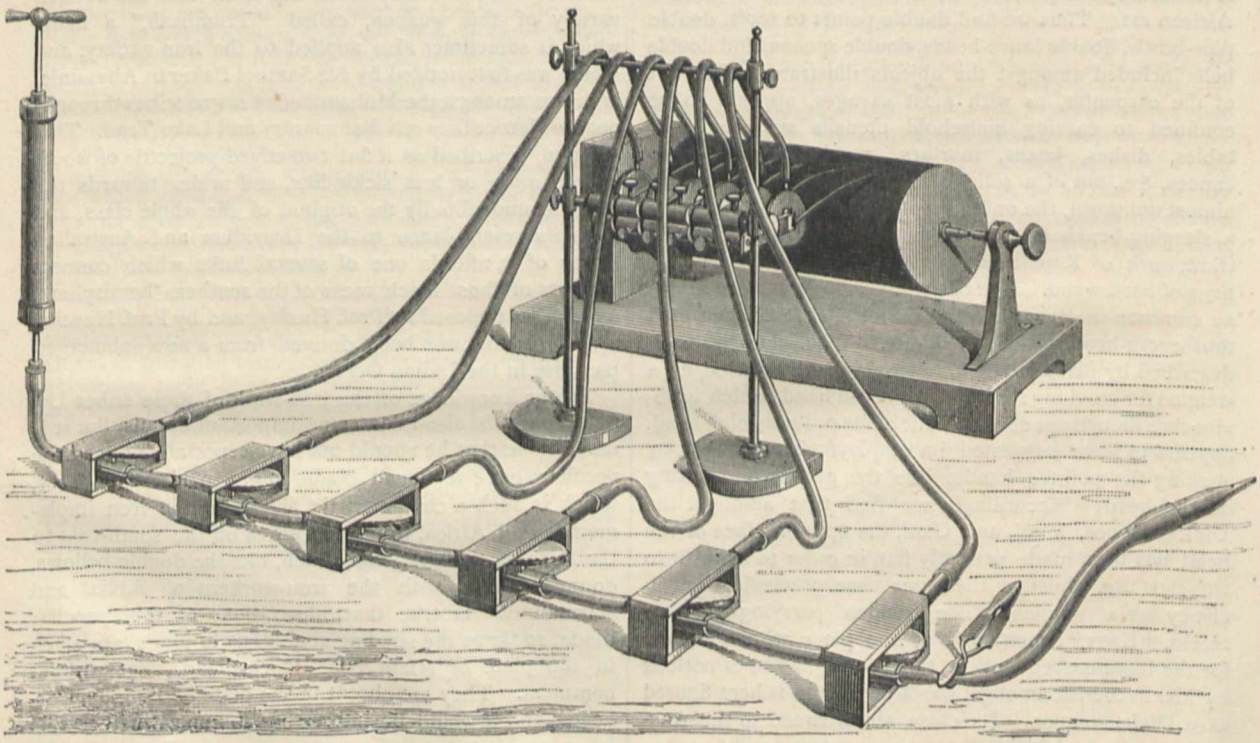


FIG. 1.

Franck on the anatomy and physiology of the vascular nerves of the head.

The most important of the memoirs by M. Marey is, in our estimation, that on "the movements of liquid waves, undertaken with a view of assisting in the theory of the pulse." Of this we will give a short account on the present occasion.

M. Marey's extraordinary mechanical skill has enabled him to devise and construct an apparatus by means of which he has been enabled to represent synchronously,

by the graphic method, the moment of origin and the conformation of the wave produced in every part of an india-rubber tube distended with fluid. A glance at the accompanying figure (Fig. 1.) will indicate the method employed. The wave is produced by the movement of the piston of the pump at the left side of the figure. It is transmitted along the continuous horizontal tube in the foreground, which is made to record the movements of six equidistant spots twenty centimetres apart, on the revolving drum, covered with smoked paper, in the background, by means of the delicate system of double "tambours," or elastic-covered drums and levers which have been introduced and so much employed by the author. The tubes connecting the tambours, being of the same material and of equal length, any error from irregularity in the rate of transmission along them is avoided. A pair of forceps, as in the figure, close the experimental tube just beyond the point of attachment of the last of the tambours.

When a positive wave, in other words, one of compression, is transmitted along this tube, thus arranged, it is seen that the levers rise one after the other, beginning at that nearest the piston; and that immediately the last one begins to rise, a second wave commences in the opposite direction. There is still more to be learnt from the curves recorded on the smoked cylinder, which are reproduced in Fig. 2, from an actual experiment. In this figure the six undulations are those of the six levers, the lowest being that of the portion of the tube nearest the piston, and the highest that of the furthest end. The trace of a chronograph vibrating fifty times a second is given below the lowest of the curves. Perpendiculars projected from the summits of each of the curves upon the chronograph trace would be separated by equal intervals if, during the different parts of its course, the rapidity of transmission of the wave were uniform. But it is seen from the figure under consideration that, although in traversing each 20 centimetres of the tube the wave takes about one-fiftieth of a second, and so travels at the rate of about 10 metres a second, nevertheless its rapidity is not absolutely uniform, being at its maximum at its orifice of entry, and after it has become slower again, slightly increasing in velocity in the neighbourhood of the closed end. There is therefore a double change in the velocity of the wave.

When it has reached the extremity of the tube the wave takes a reverse course, and returns through each of the recording drums to the place from which it started. This reflected wave is indicated by the down-turned arrows in Fig. 2; the direct one and its secondary companions having upturned arrows above them. By varying the distance of the occluding forceps from the last recording tambour the time of commencement of the reflected wave can be similarly varied.

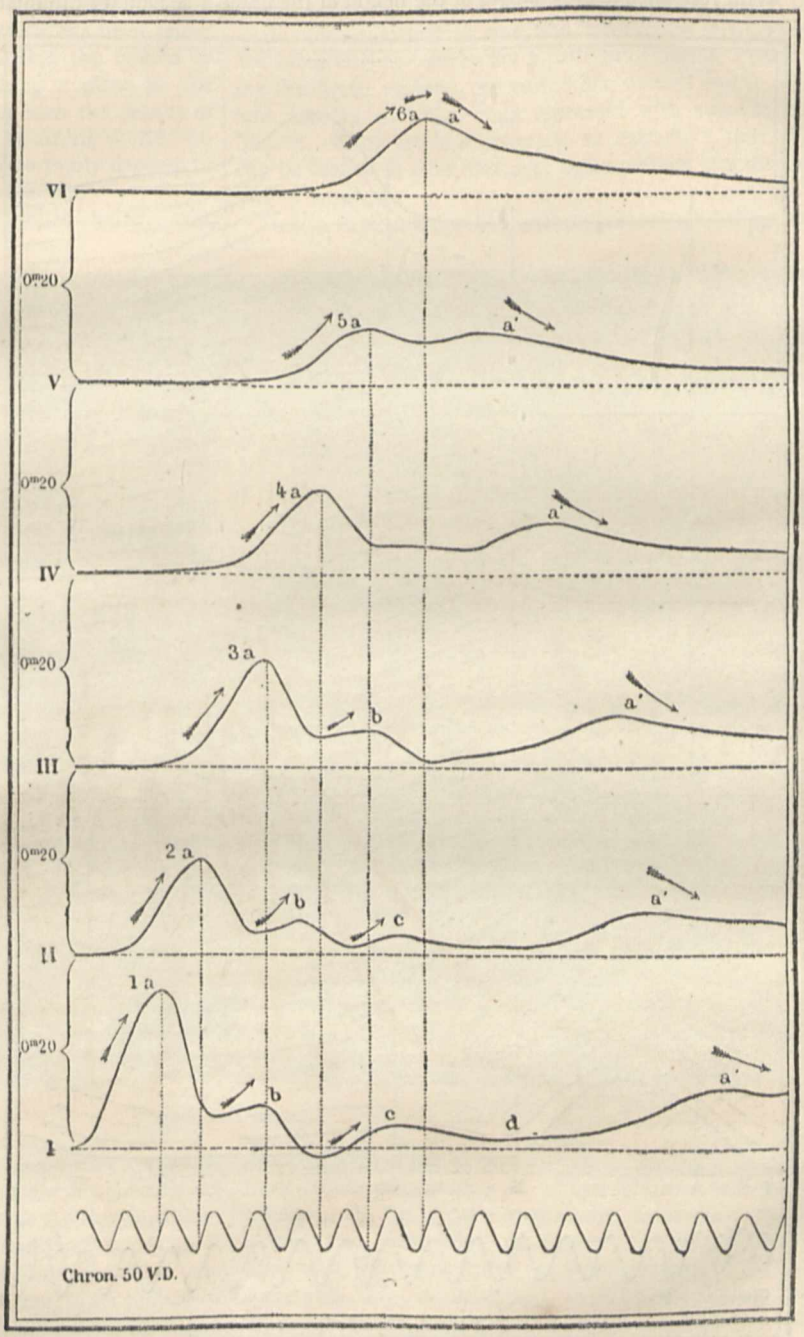


FIG. 2

It is interesting to observe that in a paper on the movement of the pulse-wave in the human arte-

ries,* Mr. Garrod has shown that the pulse-wave augments its rapidity as it gets further from the heart, a result which is specially interesting in connection with those of M. Marey on the undulations in closed tubes, the blood system being similar in all respects.

With reference to the changes of the height of the undulation in different parts of its course, it can be proved that the wave has its maxima of intensity at its two ends, its minima in the intermediate part of its course. The wave also changes in form during its progress, this change consisting essentially in a diminution in its amplitude and an augmentation in its rapidity. This depends on the elasticity of the tube, which tends to distribute the pressure in the different parts of the liquid column.

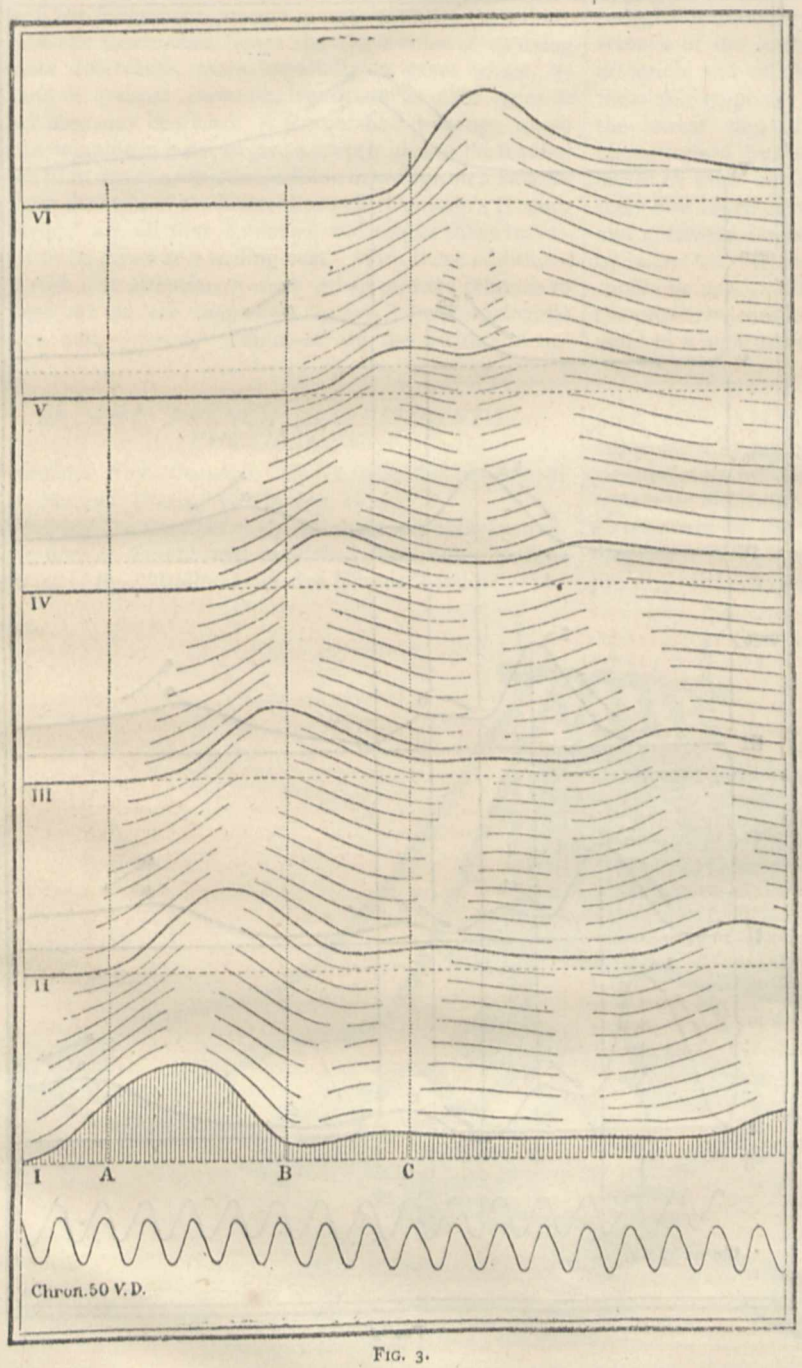


FIG. 3.

It will be seen from Fig. 2 that the primary direct wave is followed by a more or less numerous series of secondary diminishing minor waves. They are dependent on the rapidity with which the liquid is forced into the elastic tube. The reflected wave may also give rise to secondary undulations. The whole of the foregoing results are represented in a most vivid manner by the translation of their results stereoscopically or into a figure of three dimensions, represented in Fig. 3. We have never before seen results of a similar kind similarly depicted.

Among the other results arrived at by the employment of the same instrument, M. Marey has shown that *negative* waves, that is of absorption, obey exactly the same laws as do *positive* waves, or those of compression; also, in tubes opened at their distant end, if the aperture is large, no reflected wave is produced, at the same time that the intensity of the undulation diminishes from one to the other end, and its rapidity also gradually.

(*To be continued.*)

* "Proc. Royal Soc.," 1875, p. 150.

THE ARCTIC WORLD

The Arctic World: its Plants, Animals, and Natural Phenomena. (London and Edinburgh: Nelson and Sons, 1876.)

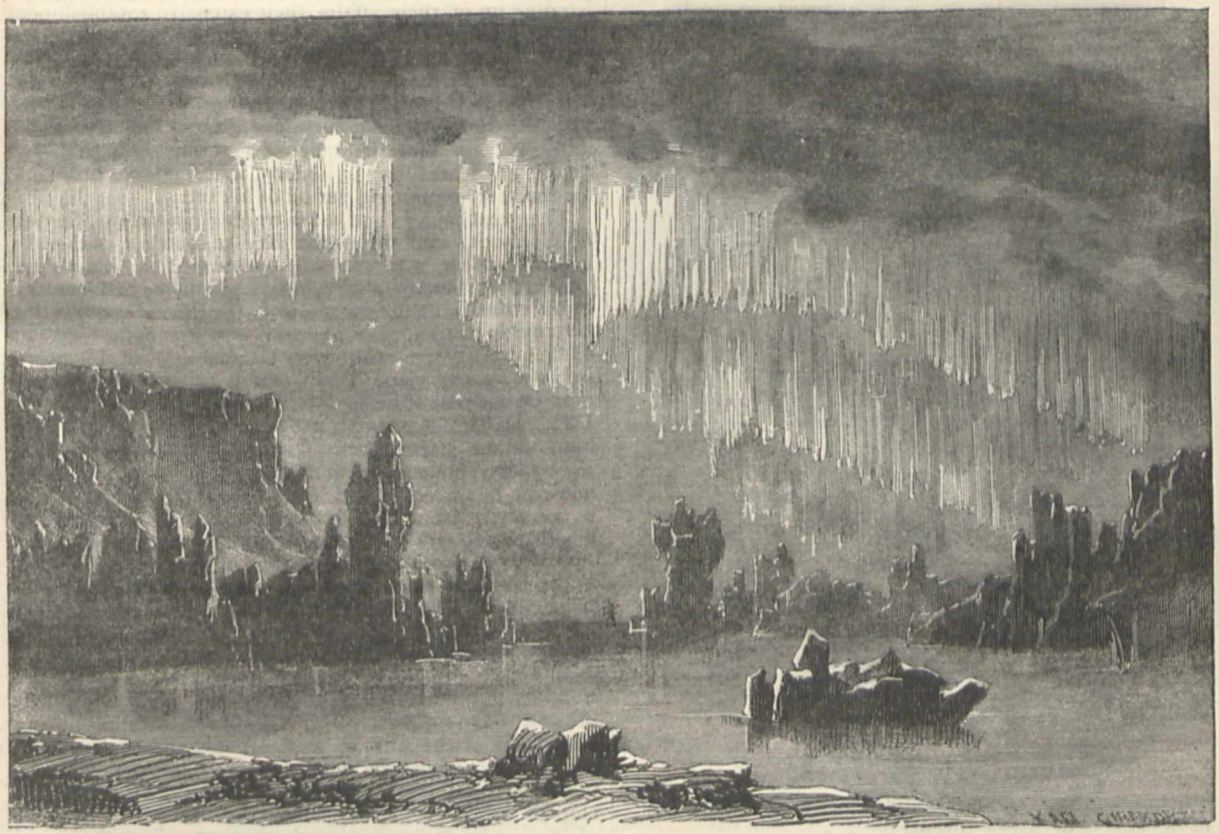
THE Messrs. Nelson have in the present work made a praiseworthy attempt at innovation on the usual style of drawing-room book; for that "The Arctic World" is meant mainly for the drawing-room table its whole appearance indicates. The work is something more than a mere picture-book, though its pictures are certainly a striking attraction. The compiler of the text has made an honest, and, we believe, remarkably successful, attempt to carry out the promise of the title-page, and present a satisfactory account of the physical phenomena, the plants, animals, people, and scenery of the entire round of the Arctic regions. There is really a great amount of solid and accurate and valuable information conveyed, information in itself calculated to interest in a high degree any healthy mind, and which the compiler has had skill enough to put into shape without detracting from its interest.

While we congratulate the publishers on their successful attempt to elevate the quality of drawing-room litera-

ture, we also rejoice, in the interests of science, that they think there is some chance of such a work becoming a commercial success; for thus, in the judgment of practical men, there exists a considerable public who are able to understand, appreciate, and enjoy a work which is largely scientific in its character. This is an additional sign of the general advance in intelligence which has been going on in recent years, and of the fact that the results of scientific research are gradually taking a place in the public estimation of equal importance with the results of literary effort. We sincerely wish "The Arctic World" an extensive circulation; the publishers certainly deserve to be rewarded for the venture they have made.

Although the text is of substantial value, still, the most striking feature in this beautifully got-up book is its pictures, which are most, if not all, of French workmanship, and are really beautiful in execution, with that touch of artistic exaggeration which the French manage to impart to the most commonplace woodcut. These pictures, upwards of 100 in number, render the work a most attractive one, and besides, of themselves, are calculated to convey not a little information concerning the Arctic regions, the varied life, animal and human, and scenery of which they represent with considerable fulness. They are in all respects so attractive, that they can be looked at over and over again without any diminution of interest.

In the first chapter the author points out briefly and



The Aurora Borealis.

forcibly the scientific and practical gains which may be expected from Arctic exploration, and which were fully set before the public in connection with the Arctic expedition, which no doubt is now upon or beyond the "threshold of the unknown region." He gives a short sketch of the geographical features of the Arctic region, of its surface in relation to snow and ice, and of the general character of life in the Polar World. In the second chapter an interesting account is given of some of the most striking phenomena tures of the region, the scenery, atmospheric phenomena, the aurora, and some of the most prominent astronomical features. The nature and formation of icebergs are pretty fully discussed in the next chapter, and the various forms of ice to be met with in the Arctic regions described; after which comes an interesting account of some of the forms of animal life to be met with in the Polar Seas, and the methods of capturing it. Then follows a well-written account of the most trustworthy researches on the nature and formation of snow and ice in connection with the constitution and movements of glaciers. Vegetable life is described in Chapter V., as also the connections, habits, and uses of the principal land-animals and birds. A slight divergence is made in Chapter VI., in order to give a brief account of Iceland its scenery, its physical phenomena, and the life and character of the people; this chapter is written in a tone that Capt. Burton would probably think too highly pitched. In the three succeeding chapters the characteristics and mode of life of the various people who inhabit the Arctic regions are set forth with considerable

fulness. The Eskimo, the Lapps, the Samojedes, the Ostraks, the Jakuts, the Tungusi, the Tchuktche, the principal groups of people in short that inhabit Arctic America, Europe, and Asia, all come in for detailed notice, and that in a manner calculated both to interest and instruct. It is the same with respect to all the other matters referred to in the work: we are too apt when thinking of the Arctic World to limit the term to Greenland or Arctic America at most, forgetting how much more the term includes. In the present work the whole region within the Arctic Circle, all round, is included, and its various features, phenomena, and life described with greater or

Kamtschatkans.

less minuteness. The last chapter contains a brief *résumé* of the course of Arctic discovery.

The work altogether is one of the most interesting and trustworthy of its kind we have had the pleasure to come across; we do not knowof any similar book which gives a more satisfactory account of the principal features of the Arctic World. Boys and girls we are sure would consider it a treasure; and to all old boys and full-grown girls who desire "something fresh" both to read and to look at, we can heartily commend it.

OUR BOOK SHELF

Notes of Travel in South Africa. By Charles John Andersson. Edited by L. Lloyd. (London: Hurst and Blackett, 1875.)

THOSE who are acquainted with the late Mr. C. J. Andersson's "Lake N'gami," "The Okovango River"—discovered by him—or any of his other writings, will gladly avail themselves of the opportunity afforded by the "Notes of Travel" of again learning, from his own pen, other incidents in the short and far from uneventful career of the enterprising semi-Swedish traveller and fluent writer.

The posthumous "Notes" edited by Mr. Lloyd—who performed the same service with reference to another of Mr. Andersson's works, "The Lion and the Elephant"—contain, besides the descriptions of the habits of some few of the birds and animals of the districts in question, the account of the doings of the author during the last four or five years of his life, a period in which the political differences between the neighbouring South African tribes of Damaraland and Namaqua Land compelled him to devote more time to trade and the disputes which arose therefrom, than to geographical and biological research.

Not long after his marriage, in 1861, Mr. Andersson purchased of the Walwich Bay Mining Company, on the winding up of their affairs, their extensive establishment—Otjimbingue—in Damaraland, with the object of making it a trading station for cattle and ivory. In a war which arose between the Damaras and Namaquas Andersson found himself constrained to become the leader of the former; during this he sustained, from a bullet, a wound in the leg smashing the upper end of the right tibia and fibula, which was long in healing, and rendered him lame for the short remaining period of his life.

The great injury done to his trading operations, the loss of his stock, and the probability of further outbreaks, led the author, who was still suffering from his wound, and further incapacitated by repeated attacks of dysentery, in his enfeebled state, to entertain the idea of establishing favourable trading relations with the Portuguese settlers of Benguela, north of the river Cunené. With this object in view he left Cape Town, where he had spent some time on account of his health, in May 1866, once more for Damaraland. Namaqua marauders continued to harass him, and he started from Ondonga for the Cunené in May 1867. He reached that river in the middle of June; however, he never crossed it because of the bad treatment he received from the ferrymen and from his state of health, which will be best understood from his own note on the day following that on which he reached it. He died in the Ovampo wilderness, where he was buried by no one but a youthful and faithful attendant, Alex Ericson.

During his illness he spent much of his time in collecting the materials for a work on the ornithology of South-west Africa, a book which was to have been published in a profusely illustrated and otherwise costly form by Messrs. Day and Son. This important addition to our knowledge of the African avifauna the author never saw in print; but since his death it has been produced in a more unassuming form, under the able and careful editorship of Mr. J. H. Gurney, under the title of "The Birds of Damaraland;" now a standard volume of ornithological literature.

The notes on the habits and powers of the vulture will interest naturalists, as will the attempt to distinguish a second species of ostrich, said to differ from *Struthio camelus* in that the male bird is slightly larger, whilst the female is jet black, like the male, instead of greyish; and the young is of a sooty brown. *Machaerhampus anderssoni*, or Andersson's Perm obtained from Otjimbingue, is fully described, as are the Kori Bustard (*Eupodotis kori*), the Rufous-crested Bustard (*E. ruficrista*), Rupell's Bustard (*E. rupelli*), and a few other birds. Mr. Lloyd tells us in his preface that, among numerous papers, Andersson left behind him "Notices of several of the quadrupeds indigenous to Damaraland and the neighbouring countries." These it was his original intention to incorporate in the present work, but to preserve the continuity of the narrative they were, with the exception of a single chapter on the Leopard and its congeners, omitted, though not without hope that at some future

time they may be submitted to the public, as we wish they may be.

In conclusion, we may remark that, with the exception of a few descriptions of personal symptoms, which would have been much better left out, Mr. Andersson's "Notes on Travel in South Africa" forms an interesting and instructive volume to the general reader, as well as the student of geographical and natural science.

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.*]

A New Cetacean from New Zealand

I HAVE just received from Dr. Julius Von Haast of Canterbury, New Zealand, for presentation to the Zoological Society, an account of what appears to be a new species of Ziphioid Whale.

As far as can be at present ascertained, for, unfortunately, the heads only of three individuals, and these not in a perfect state, were obtained, it is nearly allied to the genus *Mesoplodon*, Gervais, but differs from the known species in the possession of a row of small pointed, conical, recurved teeth, about twenty in number, in the hinder part of the upper jaw, in addition to the usual single large tooth, placed near the middle of the ramus of the mandible. This is a very interesting circumstance as connecting the peculiar dentition of the ziphioids with that of the ordinary dolphins.

Another fact, new in the history of the Cetacea of this group, is that they belonged to a shoal of twenty-eight, all stranded together on one of the Chatham Islands, whereas all previously recorded examples have been either solitary or in pairs. It is evident that the attention which the naturalists of New Zealand are paying to the Cetacea, will throw much light on the history of the order, and it is to be hoped that they will persevere in collecting and preserving every specimen which may come within their reach. Dr. Haast's paper will be read at the next meeting of the Zoological Society. W. H. FLOWER

Evidences of Ancient Glaciers in Central France

MY attention has been recently called to a communication on the above subject which appeared in NATURE, vol. xiii. p. 31, from Dr. Hooker. Not having myself observed any traces of glacial action in the Mont Dore, and finding that M. l'Abbé Lecoq, whose examination of every portion of the district was most painstaking and exhaustive, has declared his conviction that no such traces exist, may I be permitted to remark that the evidence produced by Dr. Hooker does not appear very conclusive on the question? It consists of the occurrence of some large fragments of trachyte in the floor of the valley in which the Dordogne takes its rise, "the head of which occupies a noble amphitheatre immediately under the highest summit of Mont Dore," which "seen from a height above, were presumably huts, haystacks, *or glacially transported blocks*." The next day the doctor descended into the valley for a fuller examination of these blocks, and found himself "amongst a group of magnificent boulders *that had evidently been deposited* (?) *by an ancient glacier* which had flowed from the rocky amphitheatre at the head of the valley;" "others were seen further down the valley, its stream meandering among the blocks."

Now this description together with all that follows, and which I need not quote, strongly reminded me of a large assemblage of *débris* of trachytic rocks which on my last visit to the Mont Dore in 1860, I observed exactly in the position indicated by Dr. Hooker in the valley of the Dordogne, and which had been the result of a prodigious landslip or fall of a huge slice of the cliffs above, nearly a thousand feet high, forming the left flank of the valley as we look up it extending for upwards of half a mile. This landslip had occurred, if I remember rightly, in the previous winter, and was by no means an unprecedented occurrence, as the ruins of several older "eboulements" along the same line of cliffs attested. The summit of the cliffs consisted of a solid bed of trachyte perhaps fifty feet in thickness, and the action of frost on the waters infiltrated into the vertical joints of this rock tended to detach occasionally blocks of it which in large numbers, and many of them of enormous size, had evidently fallen from above on the floor of the valley. Some of these bore exactly the appearance of those described and figured by Dr. Hooker, and with every deference to his high authority, I cannot but suspect that they are the identical rocks which he, somewhat hastily, perhaps, concluded could only have been transported by "an ancient glacier descending from the neighbouring head of the valley." Should this prove to be the case, as no other evidence of the action of glaciers in the Mont Dore has been produced, it is presumable that M. Lecoq's view is correct, that none such are to be found. G. POULETT SCROPE

Fairlawn, Cobham, Surrey

Science Classes and Penny Lectures in Birmingham

IN NATURE, vol. xiii., p. 82, is an article on "The Manchester Science Lectures," in which it is stated that the popular lectures at the Midland Institute Birmingham "are chiefly frequented by the middle classes," while "at the Manchester lectures the class of persons present was chiefly working men for whom the lectures were designed.

This statement, although not absolutely incorrect, conveys quite a false impression respecting the Birmingham lectures; the fact being that the Midland Institute has two Departments, the "General" and the "Industrial," the former being designed for the middle classes, and the latter for artisans, &c. As the history of the popular scientific teaching at this Institute includes some instructive practical experience, a few reminiscences of the leading facts may be interesting.

The Institute commenced its working existence in October 1854 with three classes, one for Physics meeting on two evenings per week, one for Chemistry also on two evenings per week, and one on Popular Physiology and the Laws of Health meeting on one evening per week. These were all conducted by myself—then the only teacher of the Institute—at the rooms of the old Philosophical Institution, 7, Cannon Street. They were attended by men and boys, for the most part artisans and *bonâ fide* students. The first course on Chemistry comprised about 90 lectures, that on Physics about 130, and that on Physiology about 30 lectures.

The number of students and the general success of these lectures exceeded the expectations of the promoters of the Institute, and refuted the predictions of the large proportion of influential Birmingham men who loudly expressed their anticipations of failure.

Such was the beginning, but ere long we were threatened with a repetition of the old experience of the old Mechanics' Institution, and other similar efforts that had failed in Birmingham, and upon which failures these gloomy predictions were founded. The Chemistry class, which was the largest at first, sustained its numbers and attendance during what I may call the combustive stage of its existence, that is, so long as the three oft-quoted essentials of successful chemical lectures "the flash, the bang, and the stink," were maintained; but when we came to the metals, to mere precipitates, equations, analysis, &c., the numbers seriously declined.

The Physics class, which began more modestly, kept up its numbers rather better; there, the progress was from the heavy business of statics and dynamics, to the more wonderful phenomena of heat, light, and electricity. The physiology class was the smallest from the first, but held on pretty steadily to the end of the course.

On completing the first course of each subject we encountered a check that threatened our very existence. The numbers diminished, and this diminution became alarming with the third course on Physiology (which commenced before that of the other subjects). The alarming element was not merely the diminishing number of students, but the obvious cause of this diminution. We were evidently exhausting our raw material. The total number of Birmingham artisans who desired the amount of scientific instruction we offered them was but limited, and the majority of these had attended the first courses, and in the ordinary progress of normal generation they were not reproducible with a rapidity at all corresponding to the repetition of our courses of instruction. What was to be done?

This difficulty of course presented itself more forcibly to me than to anybody else as the facts were more directly before my eyes, and naturally led to serious reflections. To have shortened the courses of instruction, to have made them lighter and more popular, would have sacrificed our main object, seeing that I had already gone as far in that direction as sound instruction permitted. What then?

My own early experience suggested a solution. Might I not deliver some well advertised public scientific lectures of a sufficiently light and sensational character to captivate the intellect by the natural bait of wonderment? If so, the systematic classes might be fed by their means.

My first idea was, considering the poverty of the Institute at that time, to charge twopence or threepence for admission to such lectures, but on communicating my scheme to Mr. Arthur Ryland, the Vice-President of the Institute, he improved it materially by suggesting that the charge for such lectures should be one penny, and that they should be called "Penny Lectures."

The Council assented to this, and on Jan. 22, 1856, I commenced the first course of Twelve Penny Lectures in the Lecture Theatre, Cannon Street.

The lecture theatre was crowded throughout the course, which served its intended purpose of supplying an outline of the grasp of Physical Science. This course was followed by others. I continued them every Tuesday evening during above nine months of each year until July 1863, when I left Birmingham. They were always well attended but with some degree of fluctuation. The smallest attendance was during a course on the Birmingham manufactures, and the best attendance when subjects connected with combustion, electricity, or my own travelling experiences were treated and well illustrated.

I do not at all presume to describe these lectures as nearly equal to the Manchester lectures that have been lately delivered. They were necessarily extemporised, as may be supposed from the fact that, with the exception of an occasional volunteer (four or five lectures per annum), I delivered them all myself, and at the same time conducted the Lectures on Chemistry, Experimental Physics, Junior and Ladies' Classes, and the Practical Analytical Class in the Laboratory, besides being compelled to supplement my very small salary by writing newspaper articles.

I mention this to show how much may be done by small means. The Institute was so poor at its beginning that I was obliged to fit the lectures to the small stock of apparatus we possessed, and lecture on whatever subjects I could best illustrate. The average outlay upon illustrating these early lectures did not exceed three or four shillings each.

Nevertheless their object was fulfilled. The Penny Lectures fed the Science Classes, which without such aliment would have been starved and extinguished in their infancy. Their success led to the establishment of the "Penny Readings" of the Midland Institute in 1857 or 1858, which were, I believe, the first of these entertainments that have since become so popular and so much degenerated. These again were followed by the Penny Arithmetic Classes and the other Penny Classes which have since formed one of the leading and most important features of good work done and doing in Birmingham.

The egotism of the above narrative will possibly be pardoned, seeing that the experiences of the early struggles of the Science Classes of the Midland Institute have been so often repeated where similar efforts have been made, and are likely to be continued so long as the prevailing inefficiency or total absence of scientific instruction in our primary schools remains. The success of these Penny Lectures, in spite of all their shortcomings, in creating a demand for more thorough instruction indicates an available means of rendering science classes successful in other places. My advice to all concerned in the promotion of such classes is that they should make no compromise in reference to the classes themselves, by attempting to bring *in them* the subjects down to the level of present requirements of the majority, but that instead of this, they should, by means of very popular, attractive, aye, even sensational public penny lectures, excite curiosity, and create an interest in science among those they desire ultimately to teach.

Being now in the confessional I may as well admit that I practised several small illegitimate devices to keep my audiences together, one especially copied from the young lady who occupied "the thousand and one nights," that of leading the subject up to some amusing experiment just at the end of the lecture, and then discovering that it was time to conclude, and therefore that the experiment must be shown next Tuesday. The small boys who occupied the front seats and applauded all the explosions soon found me out, but they came next week nevertheless, and some of these who at first were blue-fire pupils only, ultimately joined the classes and became satisfactory students. Therefore the Penny Lecturer should not be too rigidly regardful of his own scientific dignity, but Barnumise to some extent, when he can thereby advance towards the high object he seeks to attain.

"Should this meet the eye" of any disconsolate projector and manager of a failing Mechanics' Institution or similar effort, let him try Penny Lectures forthwith, not musical or dramatic lectures, but lectures on the most wonderful of natural phenomena, including as much scientific explanation as the audience can digest, and at the same time let him prepare to supply the solid class instruction for which such lectures should ultimately create a demand.

W. MATTIEU WILLIAMS

Belmont, Twickenham

Proposed Optical Barometer

I WAS led the other day to consider the possible effect of changes of barometric pressure on the ultimate destination of light passing through lighthouse refracting agents, and although I was satisfied that such changes cannot produce any effects of practical importance, the idea occurred to me that a glass prism might be used as a barometer. When a refracting prism is successively immersed in media of different refractive indices the ultimate angular deviation of the ray will, as is well known, depend in each case on the relative indices of the glass and the medium surrounding it at the time of the experiment. And as the refractive index of atmospheric air varies with its density, the amount of deviation of the refracted ray will be a measure of the density of the air, *i.e.* will give the means of ascertaining the reading of the barometer at the time.

If the ray of light were made to pass through a number of refracting and totally reflecting prisms the deviation would be increased. If with these prisms a microscope were combined the prisms might be used as a barometer. Or if the ray be received obliquely on a number of pieces of glass having parallel faces and slightly separated from each other, although there would be no angular deviation there would be horizontal displacement which would admit of being measured by a micrometer. How far such an application would be of practical value is certainly doubtful, as the effects of changes of temperature on the prism itself might interfere with the very limited range of the instrument. Or again, it is possible that easterly, westerly, or other currents—or perhaps differences in the hygrometric state of the atmosphere—may affect the index of refraction otherwise than by the mere changes of density which they produce. But if such be the case, the refracting prism will be useful in determining the existence and amount of such variations in the refrangibility of the atmosphere.

Edinburgh, Dec. 13

THOMAS STEVENSON

Seasonal Colour in Flowers

THE "blue of the wild hyacinth" (see vol. xiii. p. 129) is anticipated by the yellow of the primrose, the daffodil, the marsh marigold, the coltsfoot, the lesser celandine (*Ranunculus Ficaria*), and especially the winter aconite. We may add as contemporaries the buttercup, the yellow deadnettle, and the cowslip. The furze blooms in autumn and winter, and the golden broom in spring; the dandelion and the groundsel flower during the greater part of the year. The "deep scarlet of our summer flowers," represented in Britain by the poppies and the pimpernel only, is accompanied by the no less vivid blue of the cornflower, the wild chicory, the viper's bugloss (*Echium*), whose blossoms change from red to blue as they approach maturity, the flax, and the various campanulas. I say nothing of white flowers; but it is worth notice that the hepatica, bugle (*Ajuga*), and milkwort (*Polygala*), vary to almost precisely the same shades of blue, white, and pink, at quite different seasons.

R. A. PRYOR

Hatfield, Dec. 17

Glands of the Cherry Laurel

THE nectariferous glands on the back of the leaf of the cherry laurel (vol. xiii. p. 107) are present also, I believe, in all the Drupaceæ. The position is not in all cases the same; but when the glands are not found on the back of the leaf, they may be seen on the petiole. Ants may often be found drinking this leaf-honey; and I heard, two or three years ago, that the same attraction had brought many hive-bees to the laurels in a garden at Sidmouth.

E. H.

OUR ASTRONOMICAL COLUMN

VARIABLE STARS.—Nos. 2065-67 of the "Astronomische Nachrichten" contain another of Prof. Schönfeld's

important contributions to our knowledge of the variable stars, the eighth of a series commenced in No. 1628, ten years since. The observations discussed in the last communication were chiefly made in 1874, but there are also observations of several objects to the middle of the present year. In the comparisons of the observed epochs of maxima and minima with those calculated, the elements in Schönfeld's second Catalogue (Manheim, 1875), which should be in the hands of every observer of variable stars, have been employed, while in a few cases new elements are given.

Mira Ceti was at minimum 1874, Nov. 20 (mag. 8·6), and at maximum 1875, March 4 (mag. 2·5), the latter being about eight days later than is deduced from Argelander's formula of sines.—T Tauri, the star adjoining the variable nebula in Taurus (Hind, 1852), has exhibited irregular fluctuations between the years 1868 and 1875; previous to 1868 it had occasionally been as bright as 9·5, but according to Schönfeld's observations since that year, it has not been higher than 10·3, while at a maximum, 1871 Nov. 25, it was only 12·0, and at another very certain one, 1874 Feb. 10, it was 11·7. Schönfeld states that the nebula of 1852 was invisible in the Manheim refractor (6·5 inches aperture) during the whole period 1868-75, while the small nebula detected by Mr. Otto Struve immediately preceding this was only occasionally glimpsed. This spot requires to be closely watched with large instruments.—U Geminorum was satisfactorily observed at a maximum, 1874 Feb. 4·4 (mag. 9·6), 111 days after the preceding one; another maximum may be expected at the beginning of January next, or possibly in the last days of the present month; since the discovery of this star in 1855, it has shown variation of period between about 70 and 150 days.

R Crateris, the star following a, which Sir John Herschel describes (Cape Obs., p. 448) as of "a most intense and curious colour," and "scarlet, almost blood colour," has exhibited during the last ten years a slight variation estimated from 8·2 to 8·9 mag., but the observations have not afforded any epoch to assist in determination of elements.—S Virginis has been twice observed by Schönfeld at minimum viz., 1874, April 20 (mag. 12·5), and 1875, April 26 (mag. 12·4), which he believes are the first minima yet secured; at certain maxima this star becomes distinctly visible without the telescope (mag. 5·7).—χ Cygni attained a maximum 1874, Nov. 9, mag. 4·7, or about midway between ϕ and η Cygni; this epoch is upwards of two months later than the date assigned by Argelander's formula in the Bonn Observations, vol. vii., but the extreme difference between the formula and observation appears to have occurred in 1870, when it exceeded three months; the star must be near a maximum at the present time.—R Vulpeculæ: the further observations support the addition of the term depending on E^2 introduced in Schönfeld's last catalogue; he remarks that a uniform period would involve differences from the observed epochs amounting to twenty-two days, while these epochs are uncertain to three days at the most.—S Pegasi. This star, detected by Mr. Marth at Malta, 1864, Nov. 24, when its magnitude was 8·3, was at maximum 1874, July 8 (mag. 7.3): it must not be confounded with the star which first appeared upon our list of variables as S Pegasi, the insertion of which probably arose from an error of observation. The position of the variable for 1876·0 is in R.A., 23h. 13m. 46s; N.P.D., 81° 48′·8.

The following are Greenwich times of geocentric minima of Algol according to the third elements of Schönfeld (Der Lichtwandel des Sterns Algol in Perseus. Manheim, 1870).

		d.	h.	m.			d.	h.	m.
1875.	Dec.	24	15	7	1876.	Jan.	2	5	35
,,	,,	27	11	57	,,	,,	16	13	41
,,	,,	30	8	46	,,	,,	19	10	30
					,,	,,	22	7	20

The next maximum of Mira Ceti may be expected about January 17.

THE MINOR PLANETS.—M. Bossert has calculated elements of the small planet discovered by M. Paul Henry at Paris, Nov. 2, from which it appears the planet is not identical with No. 98, Dike, as surmised by Prof. Tietjen, and the actual number in this group, therefore, stands at 157. The best orbit of Dike is that of MM. Lœwy and Tisserand (*Comptes Rendus*, 1872, Feb. 19), and is subjoined with M. Bossert's for No. 152, for the sake of comparison.

	No. 98, Dike.	No. 152.
Longitude of perihelion	240° 35′ 34″	80° 0′ 3″
Ascending node	41 43 42	41 28 49
Inclination	13 53 18	12 10 13
Angle of excentricity	13 47 30	4 42 59
Log. semi-axis major	0·446639	0·49582
Long. from equinox of	1868·0	1875·0

Circular No. 37, issued by Prof. Tietjen, contains ephemerides of Sylvia, Austria, No. 148 with elements from two months' observations, No. 150, No. 151 from elements founded on three weeks' observations, No. 152, No. 153, and No. 156: a circular orbit of the latter places the ascending node in 253° 52′, with an inclination of 4° 42′.

COGGIA'S COMET, 1874.—Dr. Schmidt, Director of the Observatory at Athens, publishes the first portion of the results of his observations on the appearance of the great comet of 1874, between May 3 and July 23, when he believes to have glimpsed the tail for the last time. The observations refer to the brightness of the nucleus as viewed in the telescope, and of the head of the comet seen with the naked eye, the apparent length of the tail, and semi-diameter of the coma; the measures are not reduced to actual values, in the absence of a complete ephemeris from good elements. On June 9 and subsequently the nucleus was always remarked to be yellow, and the mean of its apparent diameters, given by Dr. Schmidt, would be, for the earth's mean distance, about 0″·65, or 290 miles, as we find by taking the distance of the comet from the earth, deduced from one of the best parabolic orbits.

HUMAN ANATOMY AS A PART OF THE BIOLOGICAL CURRICULUM

WE would draw the attention of our readers to the following "minute" from Cambridge, dated Dec. 2:—

"The Board of Natural Sciences Studies report that the study of human anatomy in the University is at a disadvantage in consequence of its not occupying a more prominent and definite position in the Natural Sciences Tripos. It is found from experience that medical students who are candidates for the Natural Sciences Tripos relinquish the study of human anatomy until after the examination for the Tripos, and many are therefore deterred from making the attempt to obtain a degree with honours. Further, the more distinct recognition of human anatomy in the examination for the Tripos cannot fail to elevate the character of the teaching and study of it in the University as a branch of science, especially as it is contemplated by the Board that the subject of human anatomy shall include the mechanism of the human body, the comparison of its parts with those of lower animals, its development, &c. In proposing this addition to the subjects of the Natural Sciences Tripos it is not intended to add to the number of subjects with which students are expected to be acquainted; but the subjects represented in the examination are now so numerous and extensive that they have become practically, to a large extent, alternative, and the additional subject would, it is thought, prove attractive to a large number of students. The addition would also help to maintain the connection between the schools of Natural Science and Medicine.

The two days allowed for the examination in practical work in the second part of the examination is scarcely sufficient, and as the number of candidates increases, more time will certainly be required. The Board recommends some alterations in and additions to the regulations for the Natural Sciences Tripos, which will accomplish the object it has in view."

The Biological Schools of the older Universities, on account of their recent origin, are still in a far from settled state. Men who have had a previous education in some other medical school enter as undergraduates, and on more than a single occasion these have had the opportunity of demonstrating to the less highly educated of their year how great is the value of a knowledge of human anatomy, and how excellent a scientific training it forms.

The Board of Natural Science Studies at Cambridge mention as the first claim in favour of the greater stress which it desires to lay on anatomy, that medical students suffer from its omission, and are tempted to delay their special work. We are not among those who believe that the Universities will ever form good medical schools. The advantage of the University curriculum is that it prolongs the *higher* education through the period during which the mind is acquiring its reasoning powers, and, as a result, tends to strengthen these by continually varying the material to be reasoned on. Except as far as the production of teachers of the subjects it inculcates are concerned, it has not, and ought not to have, any direct ulterior objects in view. If medicine is to be specially studied we see no limits to the extension of the subjects embraced within it. The practice of medicine by most is hardly more than a trade, and why, as such, it should be more highly favoured than any other special training it is difficult to understand.

The arguments in favour of making human anatomy a part of the biological education are of a very different nature, and are insuperable. The study of zoology may be commenced at either end, with the simplest protozoa, or with a foundation of human anatomy. Both of these have their advantages. A glance at the previous education of those who are, at the present day, devoting themselves to the subject, shows that almost all who commenced it after having mastered human anatomy, have devoted themselves to the vertebrate sub-kingdom; whilst those who have commenced without any or with but little knowledge of anthropotomy, have taken to the invertebrata. The intricacy of the higher forms, and the standard of comparison afforded by the structure of the human frame, naturally leads to a comparison of this with those of its closest allies, and consequently places the vertebrata in a more favourable position for investigation. It also helps to develop a greater interest in human anatomy from the light thrown on it by those of less elaborate organisation.

The student who commences with the lowest sub-kingdoms has to acquire his training as well as his facts from the simpler forms, amongst which there is so little correlation that he is led to lay little stress on that general uniformity of type which seems to him to detract from the interest of a group apparently presenting so little variety among its different members.

Under the existing system, therefore, the tendency of the University education is to develop invertebrate rather than vertebrate zoologists, and this condition is capable of being modified in the direction of improvement by the introduction of human anatomy into the biological curriculum; for then those who take up such subjects might have the opportunity of acquiring the knowledge of vertebrate anatomy to an extent which would place them in a position that would prevent them from laying themselves open to the correction, by any anthropotomist, of their otherwise shallow information on vertebrate structure.

As to the character of the human anatomy which is required by the student of biology, it is a mistake to suppose that it is exactly that needed by the surgeon or medical man. In almost all manuals of the subject great stress has to be laid on relational anatomy, because this is the aspect of the subject required by them. Nevertheless a very fair and biologically valuable knowledge of the structure of the human body can be acquired without any necessity for so much time being spent in the mastery of the exact relations, through the whole of their course, of vessels and nerves. A thorough training in osteology, the disposition of the various viscera and nerve centres, and the structure of the organs of sense, together with a comparatively slight acquaintance with the exact course followed by each nerve, artery, and vein, is all that is required by the majority of comparative anatomists. Upon such a basis any special regional relationships might be mastered in a short time with but little difficulty, and if the student afterwards commenced a medical training, he would do so on a footing of peculiar advantage.

The latter part of the report above quoted attracts attention in another direction also. From it we learn that "the subjects represented in the examination are now so numerous and extensive that they have become practically to a large extent alternative." This we very much regret, and we are convinced that this tendency in the direction of the system adopted at Oxford will be as little satisfactory as it has proved in that University. It has the effect of turning out a number of narrow specialists, instead of, as it ought to do, starting the student in some definite direction with a fund of general information, which he will find invaluable after he has taken his degree.

THE BIRDS OF THE PELEW ISLANDS *

THE eighth part of the "Journal des Muséum Godeffroy," which has been lately issued at Hamburg, contains an interesting article upon the Birds of the Pelew Islands, from the pen of the well-known ornithologist, Dr. Otto Finsch, of Bremen. This group of islands, until recently almost unknown to naturalists, has of late years been visited by several collectors in the employment of the House of Godeffroy, who have transmitted to Europe full series of specimens of its natural productions. Dr. Finsch, in conjunction with Dr. Hartlaub, has already published various notices of these collections, and given descriptions of several new and most interesting species which they contained. The present memoir gives a *résumé* of the previous articles, and adds a complete account of all that is yet known concerning the ornithology of this far-removed group of islands. The total number of species of birds as yet ascertained to occur within their limits is fifty-six, of which twelve are peculiar to the group, and are not known to be found elsewhere. Perhaps one of the most remarkable facts connected with the ornithology of the Pelew Islands is the occurrence of a Jungle Fowl (*Gallus bankiva*)—being the species generally recognised as the original of our domestic fowl—in a wild state. It is possible, however, that this may be an introduction. It is singular also to note that the Nicobar Pigeon (*Calœnas nicobarica*) has spread thus far to the west. Noteworthy again is the entire absence, so far as is hitherto known, of parrots and finches in these islands. Dr. Finsch's excellent text furnishes complete details upon these and other points of interest, and contains full authorities for the occurrence of all the species attributed to the avifauna of the Pelew Islands. Five well-executed coloured plates give illustrations of some of the rarer species and adorn the work. Of the physical features of these islands an account has already appeared in a former number of the same journal, together with an excellent map of the group.

* "Zur Ornithologie der Südsee-Inseln." I. Die Vögel der Palau-Gruppe. Von Dr. Otto Finsch in Bremen. "Journal des Muséum Godeffroy," Heft viii., 1875.

THE VOYAGE OF THE "CHEVERT" TO NEW GUINEA

MR. WILLIAM MACLEAY, of Sydney has, in a letter to the *Sydney Herald*, given an account of his expedition to New Guinea, an abstract of which, though so small in its results, will no doubt interest our readers.

The *Chevert* sailed from Port Jackson on the 18th of May last with a crew of twenty, together with a doctor, four zoological and three botanical collectors, Captain Onslow, and Mr. Macleay. The ship was fitted up chiefly with the object of making collections in all branches of Natural History in the islands of Torres Straits and in New Guinea.

The voyage from Sydney to Cape York occupied a month, five days being spent in the Palm Islands, and six at Cape Grenville. On the 4th of June a stoppage was made at Brookes Island, and on the next day on the north-west of the North Barnard Isles, in the latter case with the object of getting a species of *Ptiloris* peculiar to the island, and Mr. Masters was so fortunate as to procure a male and two female specimens in the course of the afternoon. The next stage was Fitzroy Island, where a few birds were obtained; but much progress was prevented by the dense brushwood, which was also found in Palm Island.

On the next day the *Chevert* anchored off a low wooded sandbank, marked on the chart "Low Wooded Isle." It was surrounded by an extensive coral reef, the first seen on the voyage. They afterwards reached Turtle Reef, opposite the Endeavour River, passing a belt of country on the mainland which looks very promising. A belt of low land near the coast was backed up by steep hills of about 2,000 feet elevation, the whole densely wooded, with numerous landslips, showing a dark red soil. On June 8th, Number 4 Howick Group was reached, after passing a mainland which consisted, for a long distance back, of bare sandhills with elevated patches, forming Capes Bedford, Flattery, and Lookout. The next stage was Flinders Island, near which the land is very rough and rocky. Two days took them to Cape Grenville, where they supplied themselves with water. The weather being stormy and wet, not many specimens were procured. The land in the neighbourhood is the most barren that can be imagined. The rock is a kind of metamorphic sandstone, with sometimes a sub-horizontal stratification, quite vertical on the hills, with sharp laminated edges. The vegetation is scanty, the lower hills being clothed with coarse grass, dwarf grevilleas, &c.; the higher ranges being thinly clothed with acacias, banksias, and pandanus; the declivities and gullies alone being densely wooded; whilst near the water's edge the mangrove predominates. The natives are tolerably numerous, and for Australians above the average, well grown and developed. They know a little English, can appreciate tobacco and biscuits, and are good workers. They adopt the practice of cutting the ear-lobe into thin strips, as do the natives of Cape York, the islands of the Torres Straits, and New Guinea.

On the 18th of June, after sailing through Albany Passage, the *Chevert* anchored in Mud Bay. The settlement of Somerset, of which some years ago the Government had hopes, has proved unsuccessful, except as a pearl fishery, on which occupation about 700 men are employed. The fishing-ground lies almost entirely to the west of Cape York, and extends from Endeavour Straits and the Gulf of Carpentaria northwards to the very shores of New Guinea. Diving dresses are much employed in the fishery.

The vessel was detained in Mud Bay till June 26th for the Sydney mail. Not much collecting-work was accomplished in the densely-wooded, but *pauvre* neighbourhood, which is entirely composed of a very hard ferruginous sandstone. She then took a course due north to Warrior Island, a distance of sixty miles, stopping off the Sue Islands, where the anchorage is perfectly covered with masses of the young pearl shells. Warrior Island is a mere sandbank of small extent, and without vegetation; but it is the birthplace and home of the strongest, most numerous, and most adventurous of the races inhabiting the Torres Straits, who closely resemble the inhabitants of New Guinea.

On June 28th the *Chevert* proceeded on its course to New Guinea, making for the entrance to the Katow River. They dropped anchor 1¼ miles from the mouth of that river, and the village of Mohatta. The following morning they were visited by two canoes with about twelve men in each. In one was Maino, the head-man of the village, in the other Owta, the head-man of a village three miles further west. They came on board with the utmost confidence, though they could never have seen so big a vessel before. It was explained to them, through interpreters, that the visit was a friendly one, with no other object than the collection of specimens; both Maino and Owta expressing a desire to assist, and inviting the crew ashore. Shortly afterwards twenty-two of the men landed in the fishing and surf boats, and were received at the village by the elder members of the tribe seated in a circle upon a large piece of new matting. They would not join in the company and participate in the smoking; those forming the circle consequently arose, perhaps not the best pleased.

The village consists of seven houses, exactly like those described by Jukes in the voyage of the *Fly*. Each house is ninety or 100 feet long, elevated about 6 feet from the ground, and covered with a thick thatch. The ends are open, and on each side are the sleeping places of the inmates. Each house holding about 50 people, so the population of the village must have been about 350. The houses are built near the sea, and are everywhere surrounded by mud, filth, and stench. The people are powerful and well made, jet black, with straight foreheads and Jewish noses, the projecting jaws of the Australian being absent. The hair is woolly, but grows in small tufts, which, when long, form close, compact ringlets; and it is not uncommon for the people, not here only, but at Warrior and Darnley Islands, to cut off their hair when thus grown into ringlets, and convert it into a wig for their own use. The men are quite naked; some being marked like the Australians with seams on the shoulders, all cutting the lobes of their ears into fantastic shapes and piercing the rim all round, and ornamenting it with coloured wool or fibre. They seem fond of ornaments of birds' feathers for the head, and necklets of pearl-shell. The women are kept from the view of strangers, but they are in no way beautiful. They are the hewers of wood and drawers of water. Their clothing is a scanty loin-covering, with ornaments of cassowary feathers round the knees and ankles.

Almost the only weapons of defence are bamboo bows and four-feet arrows. They use kava, said to be obtained some distance up the country. They are great navigators, their canoes, of great size, being formed of excavated trunks of large coral trees (*Erythrina*). Their supply of animal food is chiefly from pigs, which, both wild and tame, are numerous.

The appearance of the country is the same everywhere. In some places the mangrove seems to grow out into the sea; in others, as at Mohatta, there is a beach closely belted by cocoa-nut palms, and behind, everywhere the same absolutely level mud flat, without the slightest apparent rise as far as the eye can reach, and all densely covered with trees of all sizes and kinds, never reaching more than three or four feet above the sea and river level. The driest spots have been selected by the natives for their banana and taro plantations. They also cultivate yams, sago, and bread-fruit.

All efforts to penetrate the jungle proving ineffectual, an attempt was made to navigate the river in a steam launch and surf boat. At its mouth the Katow is about 200 yards wide, rapidly narrowing to 60 yards, and soon to 30 yards. For the first two miles Mr. Macleay and his party, accompanied by Maino and Owta, passed through a dense forest of mangrove, beyond which the river was edged by a palm nearly 50 feet in height. Behind these was the lofty and interminable forest. After ascending the river for between eight and nine miles they were abruptly stopped by a tree of great size which had fallen, or been felled, across the river. They had to return in order to obtain instruments for removing the obstruction. As they in this however never succeeded, they had to return to Warrior Island, whence they made for Darnley Island, at which place some successful dredging was accomplished. This they left on Aug. 13 for Hall Sound, on the east side of the Gulf of Papua, which they reached after much difficulty from adverse winds. The ship's captain declined to go further on this account. Yule Island forms the sea face of this Sound, and the opening on the north side between the island and the main is merely a shallow sandbank. The anchor was dropped close to the north-west point of the island, opposite the residence of Signor D'Albertis, the enthusiastic Italian naturalist, which can be seen perched on the side of a clear hill, about 100 feet above the water. Signor D'Albertis had established himself on Yule Island some months previously, in this his second expedition to New Guinea, and though, as Mr. Macleay tells us, he has encountered serious difficulties from the desertion of most of his men, the loss of his boat, and robbery by the natives, he still persists in holding his ground and prosecuting the object of his wanderings—the collection of objects of natural history. Assuredly if pluck, per-

severance, and determination can command success, Signor D'Albertis ought to be successful.

The island is about six miles long, picturesque, and healthy-looking. The soil is rich, and the plantations of the natives are numerous. The geological formation consists entirely of a calcareous sedimentary rock, containing numerous remains closely resembling recent forms. The appearance of the opposite shore of New Guinea is very different from that at Katow. Mangrove swamps are intersected by salt-water creeks, with low ranges of well-wooded open forests behind; beyond which the country seemed to become very rough and mountainous, with a stupendous mountain chain, on a clear day distinctly visible from the magnificent peak of Mount Yule on the west, to Mount Owen Stanley on the east. The natives of the country hereabouts are light-coloured, of medium size and active. Their hair is not woolly, and is generally worn long, being tied up in a chignon behind. They do not use tobacco, but chew the betel leaf. They wear a very tight belt, carrying a small piece of cloth. They seem to be timid and inoffensive, greedy and thievish. The women appear to be the rulers, and they are far from reticent in the presence of strangers. Some of the younger ones are tolerably good-looking; they wear showy loin dresses, and are tattooed about the breasts and belly. Their villages and houses are clean, and generally on sloping ground; they have a house in every village for the reception of guests; their mutual relations seem most friendly. They pay considerable attention to cookery, and manufacture pottery, cloths, and nets of excellent quality.

Mr. Macleay remained on Yule Island until Sept. 2, collecting and exploring. No Birds of Paradise were obtained, although many plumes were seen in the hands of natives. No Tree Kangaroo nor Cassowary was seen. He then, on account of adverse winds, returned to Cape York, and so terminated this unsuccessful attempt to explore New Guinea.

It may be mentioned that Dr. James, the surgeon, Mr. Knight, one of the botanists, and Mr. Pollard, one of the taxidermists from the *Chevert*, have undertaken an independent expedition to New Guinea on their own account, which though so much more unassuming than the one above described, may on that account have greater chance of success.

NOTES

Dr. George Bennett, of Sydney, has been in correspondence with Signor D'Albertis, the Italian naturalist now residing on Yule Island, off S.E. New Guinea. From him we learn that Sig. D'Albertis is on most friendly terms with the islanders; that he has made several excursions on to the main land, though in so doing he has been much delayed on account of his boat having been stolen by four of his own men. He afterwards, however, managed to purchase a canoe, and has visited five villages, the language of the natives of which he can now speak pretty well. On the coast he finds a fauna and flora much resembling North Australia, but inland, on the mountains, the Papuan vegetation predominates. He has succeeded in obtaining a perfect specimen of his new bird of paradise, *Paridisea raggiana*, and has shot a second specimen of the ground tree-kangaroo, *Dorcopis luctuosa*. His health is excellent; but an Italian companion has suffered from fever and slight sunstroke.

Lieut. Cameron has earned a high place as an explorer by the work which he has so successfully and so quietly accomplished. It will be remembered that Cameron was sent out in 1873 to find Livingstone, whose fate was then unknown. On his way to Tanganyika he learnt the fate of the great traveller, but continued westwards and determined to carry out an exploration on his own account. After surveying a great part of Lake Tanganyika and discovering what he thought was likely to prove an outlet to the westward, he proceeded to the Lualaba for the purpose of finding out whether that river is connected with the Congo or the Nile system. The latest news that Sir Henry Rawlinson had to announce in his address to the Geographical Society about a month ago was that at the end of May 1874, Cameron had finally left Ujiji for the West. The telegrams just received are very brief, and announce that he came out at Benguela and reached Loanda on Nov. 19, with fifty-seven followers, "all well." Cameron was forced by adverse circumstances to abandon the Congo route, and followed the watersheds between the Zambesi and Congo. He has thus accomplished the rare feat of marching right across the continent, and will no doubt bring home many additions to our knowledge of central tropical Africa.

The Professorship of Physiology in the University of Glasgow will be vacant at the end of the present session on account of the resignation of Dr. Andrew Buchanan.

We have received from Prof. Mohn, Christiania, a printed paper giving a brief *résumé* of the meteorology of Norway for 1874. Monthly results of temperature are stated for forty-one stations, and of rainfall for thirty stations, and these results are compared with averages of previous years for those stations at which observations have been continued for some time. These forty-one stations show an increase in the number of the stations of previous years, and we have much satisfaction in learning that, as the result of a recent special grant by the Norwegian Government, the stations have still further increased to fifty, and that each of them has been furnished with minimum thermometers and with new thermometer screws. Of the stations sixteen are supplied with Fortin's barometer, sixteen with the Kew barometer, thirty-one with wind-vanes and velocity-plates, thirty-seven with rain-gauges, thirty-two with dry and wet bulb hygrometers, nine of the coldest stations with hair hygrometers, and all of the fifty with aneroids. In Prof. Mohn's energetic and able hands highly valuable results may be looked for from these changes and additions in the further development of the meteorology of Norway, which plays so prominent a part in the meteorology of Europe.

The *American Naturalist*—the recognised organ of intercommunication between naturalists in America—will pass, at the commencement of the coming year, into the hands of Messrs. H. O. Houghton and Co., of Cambridge, Mass. It will still be under the able editorship of Dr. A. S. Packard, jun., who will be assisted by a number of eminent men of science, in all departments. Indeed, the list of expected contributors for 1876 is a very strong one. The amount of matter in each number will be increased, and articles will be introduced of a more popular character than heretofore. We are glad to take this opportunity of again calling the attention of English naturalists to this excellent periodical.

M. Dumas, the distinguished Perpetual Secretary of the French Academy of Sciences, has been elected a member of the Académie Française in room of the late M. Guizot. Science has now two representatives amongst the grandees of French literature —M. Claude Bernard and M. Dumas.

Sir Henry Rawlinson, President of the Geographical Society, has been elected a foreign member of the Geographical Society of Paris.

The *Pall Mall Gazette* is informed that Mr. Max Müller has been asked to accept a professorship at Florence, at the highest salary ever offered to a professor in Italy.

A telegram dated Adelaide, the 18th inst., states that Mr. Giles's exploring expedition (see vol. xii. pp. 135, 194), fitted out by the Hon. Thos. Elder, M.L.C., has arrived at Perth, Western Australia, direct from Adelaide. This is the third expedition that has crossed Central Australia within the last two years. The first was that under Col. Warburton, from the telegraph line westwards, generally between 20° and 21° S. lat.; then Mr. Forrest crossed from Perth to the telegraph line by a route about 5° farther south. Mr. Giles's route, we believe, has been much farther south than Mr. Forrest's; judging from previous news, probably about 100 miles from the south coast.

A TELEGRAM from Naples, Dec. 19, states that Prof. Palmieri reports from the observatory near Vesuvius that fire has appeared in the interior of the crater, and expresses his opinion that an eruption of long duration may be expected. A volume of black smoke rose from the volcano on the morning of the 19th. A telegram of the 20th states that the fire in the crater is gradually increasing in strength, and that the instruments of the observatory are in motion.

A REUTER'S telegram of Dec. 21 states that the New York papers publish advices from Porto Rico stating that the town of Arecivo in that island had been wholly destroyed by an earthquake. Only two churches and six houses are stated to be left standing.

DURING the recent heavy floods, the low-level districts of Somersetshire have been submerged beyond precedent, so that it has been possible to sail across country for twenty miles. Many farms and cottages had to be abandoned, and for the first time the railways beyond Bridgwater were covered with several feet of water. One of the results of the flood was the driving from their haunts of great numbers of rats, some of which might have been seen by railway passengers to have taken refuge in willows and other trees along the line. Deserted houses were also taken possession of. In one case a labourer, on proceeding to his cottage by boat to obtain some necessary articles, was about getting into the bedroom window, when he found the room swarming with starving rats, whose demonstrations were so threatening that had he not made a hasty retreat there was every probability he would have been eaten up alive.

THE third annual dinner of the students of the Royal School of Mines took place on Friday the 19th inst., at the St. James's Hall Restaurant. In spite of the unavoidable absence of many who had expressed their intention of being present, the students, associates, and professors mustered to the number of nearly sixty.

A COMMITTEE was appointed some time ago by the Geographical Society of Paris to arrange for the erection of a building for its special use. A large sum of money has been collected, partly by loans, partly by private subscription and grants from the Society. Further proceedings have, however, been stopped, the Prefet of the Seine having intimated his intention to erect an establishment in which several of the learned societies of Paris are to have meeting rooms and libraries, and in which collections will be located at the expense of the city.

A *Daily News* telegram announces that the Italian Geographical Society has resolved that its exploring expedition to equatorial Africa shall start at the end of next January, so as to reach Ankober, the capital of the Kingdom of Shoan, before the rainy season. From Ankober, the expedition will penetrate the Galla country, in a south-west direction, towards the Victoria Nyanza Basin. Subscriptions for defraying the expenses will be received by the Italian Geographical Society in Rome.

THE Admiralty have made arrangements with Mr. Allen Young, the experienced Arctic voyager, to communicate with the entrance of Smith's Sound in the summer of 1876, in hopes of obtaining some information of the proceedings of the Arctic expedition.

IN Nos. 2 and 3 (1875) of Guido Cora's *Cosmos*, just to hand, is the first instalment of a paper, by Giacome Bove, giving an account of a journey to Borneo; Sarawak and Labuan were visited, and an ascent of Kini Balu is described. In continuation of the papers on recent expeditions to New Guinea a useful *résumé* of our knowledge of the island at the end of 1875 is given; there are also letters from Beccari, D'Albertis, and L. Cambiaso of the *Vettor Pisano*. Two maps illustrate these New Guinea papers.

IN accordance with the will of Prof. Jüngken, of Berlin, the *London Medical Record* states, his collection of scientific works and all his surgical instruments have been presented by his widow to the Augusta Hospital, and a letter of thanks has been sent to her by the Empress Augusta. The Royal Saxon Academy of Sciences at Leipzig has also received a donation from the late Dr. Hermann Härtel of 30,000 marks, to be expended in helping German students to prosecute scientific inquiries.

AT the annual meeting of the Eastbourne Natural History Society on the 8th ult. the Secretary read a satisfactory report. The President, Mr. F. C. S. Roper, announced that ninety-one additions had been made to the fauna and flora of the district during the year.

IN the form of a supplement to the December number of the *Journal of Botany*, Mr. W. B. Hemsley publishes an "Outline of the Flora of Sussex," a list of all Phanerogams and Vascular Cryptogams known to occur within the county, with their authorities.

THE *Garden* announces an addition to its attractions in the form of a "coloured plate (full-page size) of a beautiful or rare flower or fruit, of proved value for our gardens, and executed in the best style of art." The aim is to illustrate, as nearly as may be in their natural colours, the finest of new flowers and fruits. The specimens which we have seen are really beautiful, and the enterprise deserves encouragement.

M. H. GIFFARD has reported on the Paris balloon accident to which we referred last week. He finds that during the process of inflation the net and the canvas got frozen together, the consequence being that during dilatation of the latter, the net could not yield freely, and therefore exerted pressure on the canvas, which broke suddenly near the valve. Precautions will be taken in future to prevent a similar occurrence.

AN examination will be held at Clare College, Cambridge, on March 28 and three following days, when a scholarship in Natural Science of the annual value of 60/ for two years will be offered for competition. Particulars by application to the tutor, the Rev. W. Raynes. A Natural Science Scholarship at Caius College, of the same value, will be offered for competition on April 4. Particulars from the Rev. N. M. Ferrers, tutor of Gonville and Caius College.

THE Cambridge University Natural Science Club commenced the October Term by the formation of a new code of rules. The officers for the term were—President, A. J. Jukes Browne, B.A.; Vice-president, J. F. M. H. Stone; Hon. Sec., A. F. Buxton. Six papers have been read during the Term, usually followed by interesting discussions—"On the evolution of fossil forms," by A. J. Jukes Browne, B.A. (St. John's); "The motion of glaciers," by T. W. Bridge (Trinity); "Darwin's Insectivorous Plants," by J. F. M. H. Stone (St. Peter's); "Huxley's classification of animals," by A. F. Buxton (Trinity); "'Typical' number of somites in arthropoda," by A. M. Marshall, B.A. (St. John's); "Molecular energy," by E. B. Sargant (Trinity). There were sixteen members in residence.

THE fourth number of volume ii. of the Cincinnati *Quarterly Journal of Science*, edited by S. A. Miller and L. M. Hosea, has lately been issued, and, we regret to learn, closes the series of this publication. During the short period of its existence it has been the medium of presenting a number of original scientific papers especially relating to the palæontology of the Mississippi Valley, which will render it a necessary work of geological and zoological reference.

A ROMAN Society has commenced excavations quite close to the monument of Minerva Medica. They have come upon some very interesting things, among which are the paintings that

adorned a columbary. The Roman archæologists and artists believe that these paintings are of the Augustan age, and are of great value both to science and art. In making preparations for constructing the central hall in the Conservatory Palace at the Capitol, a ground-plan has been discovered supposed to be that of the Temple of the Capitoline Jupiter, to which Dionysius gave a surface of 4,000 square feet. In the same place has been found a column of large size, which appears to belong to the Temple of Jupiter Optimus Maximus. Excavations in other places have brought to light additional fragments of antiquarian interest.

THE Secretary of the Interior, in his annual report to the President of the United States, commends in high terms the work of the Geological and Geographical Survey of the Territories, and presents the following brief summary of the results for the season of 1875 :—The survey under Dr. Hayden continued its labours of the two preceding years in the Territory of Colorado. The field of work during the past season was the southern and western portions of said Territory, and including a belt, fifteen miles in width, of the northern border of New Mexico and the eastern border of Utah. The survey was divided into seven parties, four of which were devoted to topographical and geological labours, one to primary triangulation, one to photographic work, and one to the transportation of supplies. The survey of the southern and south-western portions of Colorado has been completed, so as to make six sheets of physical atlas, designed by this Department, leaving unexplored only the north-western corner thereof, which can be surveyed by a single party during the coming year. The districts explored in the past season were not so mountainous as those of the previous years, but were quite remote from settlements, and in perhaps the most inaccessible regions of this continent. The total area surveyed is about 30,000 square miles, portions of which were very rugged. Much of this area is drained by the Colorado river, and is mainly a plateau country cut in every direction by deep gorges or canons, the sides of which show, for geological investigations, admirable sections of the strata forming the earth's crust. The topography of the district surveyed was elaborated in detail by the aid of the plane-table. The exploration of the remarkable prehistoric ruins of Southern Colorado, glimpses of which were obtained the preceding season, was continued with great success. They were traced down the canons to the Colorado river in New Mexico, Utah, and Arizona, and their connection established with the cliff cities of the Moquis of the latter Territory. Hundreds of cave-dwellings, of curious architecture and many miles from water, were found in the sides of the gorges, and the ruins of extensive towns discovered in the adjacent plains, indicating the former existence of a people far more numerous and advanced in the arts of civilization than their supposed descendants of the present day. Of these ruins many interesting sketches, plans, and photographs were made, and a valuable collecion of flint weapons, earthenware and other specimens, was gathered. The materials thus obtained will enable the survey to present an exhaustive report on this interesting subject. The photographer of the survey obtained a series of mountain views on plates twenty-four inches long by twenty wide, or larger by several inches than any landscape photographs ever before taken in this country.

A FRENCH clerical journal, quoted by the *Revue Scientifique*, maintains that the tolling of the church bell is of much greater efficacy than the use of lightning-rods in warding off the effects of a thunder-storm, and advises the faithful to resort to the former means in preference to the latter.

THE *Revue Scientifique* announces the death, at Zurich, of the chemist Prof. E. Kopp, "one of the creators of the atomic theory."

THE Institution of Naval Architects has issued a list of subjects on which communications are desired.

THE American Institute of Mining Engineers held a meeting at Cleveland, Ohio, October 26–28. Its proximity to several of the large iron and steel works and the interest taken by its President, Prof. A. L. Holley, in the details of the Bessemer process, caused the meeting to be more especially devoted to that class of subjects. Prof. Holley in his opening address referred to several improvements which ought to be made in the iron and steel manufactures. Among the papers of scientific interest relating to mining subjects was a mention by Mr. Charles A. Ashburner of the discovery of coal-beds in the Vespertine sandstone of Pennsylvania. Mr. Ashburner is one of the assistant geologists of the Second Geological Survey of Pennsylvania. There have been a few scattered instances of discoveries of coal in the Vespertine rocks, and such beds have been designated as false coal-measures. The present discovery may, however, serve to modify our notions as to that sub-carboniferous formation. In a tunnel passing through Sideling Hill, Huntingdon County, Penn., in cutting the Vespertine sandstones, there were found not less than nineteen beds of coal ; their thickness varies from one to thirteen inches ; collectively they would make a thickness of four feet. The coarseness and false bedding of the Vespertine strata indicate a period of frequent agitation and numerous local currents ; but the presence of coal-beds shows that considerable spaces of repose must have intervened, and that the changes were slowly effected.

AT the meeting of the Norfolk and Norwich Naturalists' Society, on Nov. 30, the Secretary read a short paper from Dr. Lowe on the occurrence of a rare microscopic fresh-water Alga (*Clathrocystis æruginosa*, Hen.) at Anmer, near Lynn. In June 1870 Dr. Lowe discovered a large quantity of it in the lake at Sandringham in the form of a green scum. In October of the present year he again discovered it growing in a pond at Anmer, two miles from Sandringham, his attention being attracted by the peculiar scum which he at once recognised as *Clathrocystis*. It seems probable that it has recently been introduced at Anmer by the agency of wild fowl.

THE additions to the Zoological Society's Gardens during the past week include a Haste's Apteryx (*Apteryx hastei*) from New Zealand, presented by Baron Ferdinand von Muller ; a Marginated Parrakeet (*Tanygnathus marginatus*) from the Philippine Isles, presented by Master Hugh Sutton ; two Bengal Leopard Cats (*Felis bengalensis*) from Cashmere, presented by Mr. W. A. Cuthell ; a Bay Antelope (*Cephalophus dorsalis*) from W. Africa, received in exchange ; an Ocelot (*Felis pardalis*) from S. America, a Hoffmann's Sloth *Cholopus hoffmanni*) from Panama, a Duck Falcon (*Falco anatum*) captured at sea, purchased ; a pair of Peacock Pheasants (*Polypectron chinquis*) from Burmah, deposited.

SCIENTIFIC SERIALS

Jahrbücher für wissenschaftliche Botanik. Herausgegeben von Dr. N. Pringsheim. Band x. Heft 11.—In the present number of Pringsheim's well-known and valuable year-books there are four papers, all of them of considerable interest. The first is by Dr. J. Reinke, of Göttingen—Contributions to the anatomy of the secreting organs, occurring especially on the serrations of certain foliage-leaves. It has been observed that in many plants the serrations of the leaves act as glands and secrete in many instances a mucilaginous substance, and in others resin, or a mixture of mucilage and resin, called blastocolla by Hanstein. Reinke has carefully examined the structure of these secreting organs in a large number of dicotyledonous plants, but has not made any exhaustive micro-chemical investigation of the secretions themselves. His observations show that the serrations of the leaves of Dicotyledons are in general the bearers of peculiar organs of secretion, whose activity may cease even while the leaf is in the bud, or at a later period. *Æsculus* and plants with

spiny leaves apparently have no such secreting organs. In respect to the secretion itself, it is in the bud either a fluid mucilage or resin, while in the full-grown leaf it is only a watery or somewhat mucilaginous fluid. The paper is illustrated by two plates, on which are figured the glands of *Prunus avium*, *Kerria japonica*, *Vicia faba*, *Betula alba*, *Corylus avellana*, *Evonymus japonicus*, *Ribes multiflorum*, *Epilobium Dodonæi*, *Catalpa syringæfolia*, *Clerodendron fragrans*, and *Viola odorata*.—The second paper, on the process of fertilisation in the Basidiomycetes, is by Dr. Max Reess. Every day renders it more and more probable that the receptacles, or fruit-bearers, of the Basidiomycetes are, like the sporocarps of the Ascomycetes, the result of the fertilisation of a carpogonium. The researches of Reess now under consideration, those of Van Tieghem, and lastly, those of Dr. Eduard Eidam, in the *Botanische Zeitung*, 1875, p. 649, all tend in the one direction, and lead us to look with very great caution on the results obtained recently by Mr. Worthington Smith, and published in the *Gardener's Chronicle* for October. Reess has examined the early stages of *Coprinus stercorarius*, Bulliard, which develops rapidly, and could be easily obtained. The ripe spores of *Coprinus stercorarius* are ellipsoidal in shape, pointed towards each pole, and average eleven mic. mill. long by six mic. mill. broad, having a brown episporum. Germination begins by the protrusion of the endosporium in the form of a colourless papilla at one, rarely at both, the poles of the cell. The process is a rapid one, and at the ordinary temperature of a room occurs in from four to five hours after sowing. The mycelia rapidly develops and branches frequently, so that in three or four days the mycelia from a single spore will form a patch from 1½ to 2 mill. in circumference. At first the mycelium is formed of a single much-branched cell filled with colourless homogeneous protoplasm, numerous vacuoles forming in the older parts as branching proceeds. At the end of the second day numerous transverse walls appear in the mycelium, and a little later the hyphæ are seen to anastomose. In from three to four days after the germination of the spores, special bearers of minute rod-like cells appear. They are more or less long cylindrical cells with protoplasm, and they bear at their ends, or sometimes at the side, the short, straight rod-like cells. These grow until they have attained a certain length, then they divide, and the upper one drops off, a process which may be repeated two or three times, so that at about the end of two days, when the entire protoplasm of the bearers has disappeared, the process stops, and then the bearers themselves may fall off. When this occurs a little pile of about fifty to sixty rod-like cells may be noticed. These rod-like cells might be confounded with conidia, but further observation has shown that they cannot germinate, and there is now no doubt whatever that they are *spermatia*, and therefore male cells. The youngest stage of the fruit-bearer is a thick, more or less irregularly-shaped hypha thread, densely filled with protoplasm, and resembling the earliest stage of the carpogonium of Ascobolus. The next stage is the fertilisation by means of the spermatia which attach themselves to the branching sacklike structure, and as the spermatia at once lose their contents, the empty wall contrasts strongly with the protoplasm of the carpogonium. After fertilisation the carpogonium becomes more and more tortuous and branched. The spermatia of Coprinus are therefore male cells; their bearer the antheridium, while their function is the fertilisation of the carpogonium. As a consequence of fertilisation the carpogonium develops into the fruit-bearer of the fungus. The process described by Reess will thus be seen to have a very close resemblance to the fertilisation of the Florideæ, such as Nemalion and Batrachospermum.—The third paper is on the "Germination of the spores of *Cyathus striatus*, Willd., one of the Gasteromycetes," by Dr. R. Hesse, with one plate. The spores germinate by the protrusion of the endosporium at one, rarely at both, poles, a single hypha thread three or four times the length of the spore being formed. Transverse walls then appear, and the free end of the thread separates into a number of small cells, but the further history of these minute cells has not been studied.—The fourth and last paper in this number is "On the development of certain flowers with especial reference to the theory of Interposition," by Dr. A. B. Frank, with three plates. The author gives the results of his researches on plants belonging to the natural orders Papilionaceæ, Geraniaceæ and Oxalidaceæ, Malvaceæ, and Primulaceæ. Many important observations are made in reference to the order of succession of the parts of the flowers, the development of diplostemonous flowers, and of flowers with superposed stamens. The paper is however not one that can be usefully abstracted. Altogether this number of Pringsheim's *Jahrbuch* maintains its well-known high standard of excellence, and is well illustrated.

THE first part of the twenty-fifth volume of Von Siebold and Kölliker's *Zeitschrift für Wissenshaftliche Zoologie* (Nov. 1874) contains an article of 100 pages by E. Ehlers, of Erlangen, on the vertical distribution of the marine chætophorous annelids, based on the specimens secured in the *Porcupine* Expedition. In the same article is included M. Claparède's report on the chætophorous annelids brought home by the *Lightning*. The forms are carefully described, new species are added, and the results are excellently tabulated. It is concluded that all the families of polychætous annelids which are known as littoral inhabitants on the Atlantic coasts of Europe, excepting the Telethusæ and Hermellidæ, are represented in the deep-sea fauna; that beyond the littoral region a greater or less depth does not influence the character of the annelid fauna; that temperature influences it just in the same manner as temperature influences the littoral annelids. Four very excellent plates, chiefly of annelid appendages, are given.—Karl Möbius gives a detailed account of the anatomy of the Rotifer *Brachionus plicatilis*.—Dr. F. C. Noll describes *Kochlorine hamata*, a new genus and species of boring Cirripede, boring into Haliotis and other shells, differing from Cryptophialus and Alcippe in lying free in the artificial cavity in the shell, and in other important particulars.—The second part (March 1875) opens with a contribution by W. Repiachoff to the embryology of *Tendra zostericola*.—Prof. Ranke describes minutely the supposed organs of hearing in *Acridium cærulescens* and the eyes of the leech.—Dr. Claus describes the shell-glands of Daphnia, identifying them with the segmental organs of annelids, and with the kidneys of vertebrates.—Dr. H. Dewitz writes on the structure and development of the sting and the ovipositor in several common Hymenoptera and the Grasshopper, which he calls *Locusta viridissima*, instead of using the generic name Gryllus.—O. Bütschli contributes some "preliminary observations" on the first steps of development in Nematodes and Snails.—Dr. von Willemoes-Suhm's third letter from the *Challenger* concludes the number.—The third part (May 1875) contains as its *pièce de résistance* a very valuable memoir, by Dr. C. Claus, on the development, organisation, and systematic position of the Argulidæ. *Argulus foliaceus* is the species chiefly described, both in its development and adult state. Dr. Claus concludes that it is useless to describe a distinct species of Argulus for every fish on which it is parasitic. It is established that *Argulus foliaceus* is parasitic on a great variety of fishes, also on toads and tadpoles, and even on the Axolotl. It appears that Argulus reproduces itself not only in early spring but also in summer and autumn with great freedom. For many reasons Dr. Claus places the Argulidæ among the Copepoda, and constitutes them a sub-order under the name Branchiura.—Dr. L. Stieda describes the structure of the central nervous system of Axolotl; the brain he asserts to be of a more completely embryonic type than any whose structure has been carefully examined.—E. Metschnikoff describes the early development of Geophilus. He finds that its larva differs from those of Chilognathous Myriopods in having its yelk-mass inside instead of outside the alimentary canal.—Oscar Grimm gives an account of the results of his dredgings in the Caspian Sea last year, resulting in the discovery of eighty new species.

Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie Nov. 1.—Dr. Hann contributes an article on the meteorology of the Punjab, founded on the reports made by Mr. Neil for 1871, and by Mr. Calthrop for 1872.—Prof. Buys Ballot gives a table showing the tension of aqueous vapour at eighteen places in Russia for each month. It appears that at all stations the tension is below the average from November to April, and above it from May to September, and at some places in October. The influence of height, latitude, longitude, and proximity of the sea is plainly indicated by the table.

Journal de Physique, October.—In this number M. Penaud describes some researches on aviation, and apparatus for mechanical flight, for which a prize was recently awarded him by the Paris Academy.—Some experiments by M. Moreau are given as showing that a fish with swimming bladder undergoes variations of interior pressure, and that it adapts itself to different heights not by a mechanical action exercised on the bladder by means of its muscles, but by changing the quantity of air contained in the organ.—The penetration of electricity into badly-conducting substances has been sufficiently demonstrated, but there is still a good deal of confusion as to the mode of its action. M. Neyreneuf here endeavours to give precision to ideas

on the subject. He finds, *inter alia*, that in the case of a compound insulating plate between two armatures, the electrification of the two extreme plates is the same as that of a single plate (*i.e.* positive on the side of the positive armature, negative on the side of the negative), and the *persistent* electrification of the intermediate plates is also the same; but at the moment of separation these plates may appear positive and negative on both their faces.—M. Righi contributes a mathematical note on the laws of electromotive forces, and there is the usual amount of matter abstracted from other serials.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Dec. 9.—On the Development and *Lepas fascicularis* and the "Archizoëa" of Cirripedia, by the late R. von Willemöes-Suhm, Ph.D. The author shows that the *Archizoëa gigas* of Dohrn is the nauplius of *Lepas australis*, a form closely allied to *L. fascicularis*. The life history of the latter is described.

Preliminary remarks on the Development of some Pelagic Decapoda, by the late R. von Willemöes-Suhm, Ph.D. The genera described are *Amphion*, *Sergestes*, and *Leucifer*. The first passes through a true Zoëa stage, *Amphion* itself being, as Dohrn has shown, adult. The larvæ of *Leucifer* and *Sergestes* pass through an *Amphion* stage. The form *Elaphocaris* of Dohrn is proved to be the larva of a *Sergestes*. The form *Erichthina* of Dana is proved to be the larva of a *Leucifer*.

Dec. 16.—On the Structure and Development of the Skull in the Batrachia, by W. K. Parker, F.R.S. The author makes some corrections in his memoir on the skull of the frog, specially showing that the hyoid arch does not coalesce with the mandibular. The skull of *Dactylethra* and *Pipa* are described. The indications of vertebral segmentation in the cephalic part of the notochord are demonstrated in a manner which has much theoretical interest in relation with the theory of Goethe and Oken.

On the development of the spinal nerves in Selachians, by F. M. Balfour, B.A. The author shows that both the roots of the spinal nerves arise as outgrowths from the involuted epiblast of the neural canal, the posterior first, and by the more complicated process.

Chemical Society, Dec. 16.—Prof. Abel, F.R.S., president, in the chair.—Dr. C. R. A. Wright read a paper by himself and Mr. G. H. Beckett, on narcotine, cotarnine, and hydrocotarnine (Part iii.), in which the authors brought forward experimental evidence of the constitutional formula for hemipinic acid, opianic acid, and meconin.—Dr. H. E. Armstrong then gave an account of researches by Mr. Harrow and himself, on the action of alkaline sulphites on the haloïd derivatives of phenol, and on the action of nitric acid on tribromophenol.—Mr. E. Nelson subsequently made a communication on the sebates of the alcohol series, after which papers were read by the Secretary, on the compounds of ether with anhydrous metallic chlorides, by Mr. P. P. Bedem, and observations on variations in the composition of river waters, by Mr. J. Andrews.

Royal Astronomical Society, Dec. 11, 1875.—Prof. Adams President in the Chair.—Mr. Burton read a paper on the Southern nebulæ 30 (Bode) Doradûs and the nebulæ about η Argus. Mr. Burton had while stationed at Rodriguez on the Transit of Venus Expedition made drawings of these nebulæ with a 12½ inch silver on glass reflector, and on his return had compared them with Sir John Herschel's drawings. After a careful comparison he was not disposed to think that there had been any great change in either of the nebulæ since the date of Sir John Herschel's observations.—Mr. Ellery, of the Melbourne Observatory, described the observations which they had made of the same nebulæ with their great Melbourne 4-feet reflector. He was inclined to think that rapid change could be traced not only in the details of the nebulæ but also in the relative positions and magnitudes of the stars which appeared to be involved in them.—Mr. Ellery also read a paper on the results of some experiments with Huygen's parabolic pendulum for obtaining uniform rotation. The instrument he had used consisted of a heavy weight or bob attached by a thin flexible band of watch-spring steel to the upper part of a piece of metal cut into the form of the evolute of a parabola. This was attached to the upper part of a revolving axis so that the contrivance formed a conical pendulum, in which when the rate of motion was increased the bob or pendulum flew away from the axis and wound the watch-spring band round the evolute of the parabola. He found that with this contrivance a very uniform rate of motion was obtained, and it seemed to be independent of the weight which was placed on the bob of the pendulum and of variations in the driving power used.—A paper by Mr. With on the structure of Coggia's Comet was read. On the night of the 8th July, 1874, an oscilatory motion of the fan-shaped jet in front of the nucleus was observed. The fan seemed to tilt over from the preceding towards the following side and then for an instant appeared sharply defined, then it became nebulous and all appearance of structure vanished. These pulsations and appearances of structure occurred several times at intervals of from three to eight seconds.—Mr. Ranyard read a paper on the duplicate structure of Coggia's Comet. He showed two drawings each made on July 14, 1874, the one by Mrs. Newall with the great refractor at Gateshead, and the other by Mr. With at Hereford. Both drawings showed that on that evening there were two faint parabolic arcs, which intersected one another in front of the nucleus. The axes of the arcs were parallel to one another, and were separated by a distance of about 1°. During the earlier evenings of July the parabolic arcs within the envelope of the comet had been drawn by several observers as double and overlapping, but the axes of the two sets of parabolic arcs were much less separated than those of the arcs visible on the evening of the 14th. Mr. Ranyard suggested that possibly a disruption was going on similar in character to the disruption which took place in Biela's comet as it approached perihelion in 1846.—Father Perry showed some photographs of the transit of Venus which had been sent to him from Manilla. They appeared to show the body of Venus projected on a bright back-ground outside the sun's limb. It was suggested, however, from other evidence, that the photographs must have been taken from drawings. Lord Lindsay and Mr. Brothers, after an examination of the photographs, both inclined to the latter view.

Meteorological Society, Dec. 15.—Dr. R. J. Mann, president, in the chair.—William Ellis, F.R.A.S., Kaufmann J. Marks, Thomas Read, and Philip Wright, F.C.S., were elected Fellows of the Society. The following papers were read:—On the registration of sunshine, by R. H. Scott, F.R.S. This paper is on the continuous record of sunshine and rainfall obtained at Kew for September 1875; the latter by Beckley's rain-gauge, the former by a method originally proposed by Mr. J. F. Campbell, of Islay, F.G.S. This consists in the use of a sphere of glass to concentrate the sun's rays, and a strip of cardboard is placed on a frame concentric with the sphere and distant from it by its own focal length. The sun when it shines burns a hole in the cardboard, the length of the trace being regulated by the duration of the sunshine. It remains to be proved whether such a record is of real practical value, as it affords no measure of the heat of the sun.—On the rainfall at Calcutta, by R. Strachan. These observations were made at the Office of the Surveyor-General, and extend over a period of twenty-eight years, viz., from 1847 to 1874. The most rain falls in July, but the heaviest downfalls are most frequent in June, and heavy downfalls are more frequent in August than in July. The greatest number of days of rain is in July, but the number is almost the same for August. December has the least frequency and amount of rain. The dry season includes November to April, during which on an average 6·04 inches of rain fall, on 12 days out of 181, or 1 out of 15 days. The wet season is from May to October inclusive, during which 61·60 inches of rain fall, on 84 days out of 184, or about 1 in 2 days. There is therefore ten times as much rain in the wet season as in the dry, and nearly seven times as many rainy days. The mean annual rainfall is 67·64 inches on 96 days.—On the use of the rotatory thermometer (*Thermomètre fronde*) on board ship, by R. H. Scott, F.R.S. This paper showed that the mean of 76 days' observations made by Capt. Heggum, of the *Rozelle*, on a voyage from Liverpool to Calcutta only differed by $-0°{\cdot}4$ from the mean of the observations made in the ordinary way.—On the moon's influence in connection with our extremes of temperature, by George D. Brumham.—Mr. Scott exhibited a complete set of instruments, with thermometer screen, &c., as used at the Russian meteorological stations.

Anthropological Institute, Dec. 14.—Col. A. Lane-Fox, president, in the chair.—Mr. M. J. Walhouse read a paper on the belief in Bhutas—devil and ghost—worship in Western India. Although the lower castes and classes in India acknowledge and reverence the Brahminical gods, their familiar household cultus is much more especially addressed to inferior super-

natural beings analogous to the evil spirits, devils, ghosts, and goblins of European superstition. According to Hindu doctrine there are ten classes of such beings, the first seven of which are demons created aboriginally with the world or by acts of the higher gods on whom they wait as attendants or servants receiving some share of their worship, and avenging any omission or neglect of ceremonies due. Though not invariably, they are for the most part evilly-disposed towards human kind. But the last three classes of whom the paper more particularly treated, are exclusively of human origin, being malignant discontented individuals, wandering in an intermediate state between a heaven and a hell, intent upon mischief and annoyance to mortals, chiefly by means of possession and wicked inspiration, every aspect of which ancient ideas as well as of the old doctrine of transmigration they exemplify and illustrate. They are known by the name of Bhûta. The author went on to show how most of the evils and misfortunes of life were attributable to the Bhûta influence; death from violence, evil possession, diseases in families and in cattle, stone throwing, &c. He then described the priestly use of those supposed powers, the cure of diseases, the conduct of festivals, and dances. It was also pointed out how close was the similarity between the occurrences under Bhûta influence and the prevalence of a belief among European nations in witchcraft, demoniacal possessions, "levitations," ghosts, invisible powers, dancing manias, and the like. The Bhûta emples and ceremonies were also described and compared with those of the Todas and other hill tribes. The paper contained accounts of several well authenticated trials consequent on Bhûta interference and punishment. A series of Bhûta (Turanian) gods was exhibited by the author as illustrative of the wide difference between Turanian and Aryan art.—Mr. Groom Napier read a paper on the localities whence the tin and gold of the ancients were derived; and a paper by Mr. Bertram F. Hartshorne on the Weddas of Ceylon, was also read.

Royal Microscopical Society, Nov. 24.—The president, Mr. H. C. Sorby, F.R.S., described and exhibited his new contrivance for measuring the position of the absorption bands in spectra. The new apparatus and its principle of action may thus be described:—When polarised light passes along the line of the principal axis of quartz, it does not suffer double refraction and depolarisation, but *circular* polarisation. The result is that when the quartz is 1½ inch thick, and placed between two Nicol's prisms, the spectrum of the light transmitted through it exhibits seven well defined black bands, which gradually move up or down the field of the spectrum on rotating one of the Nicols, returning to the same place at each half-revolution. In order to make use of this property in measuring the wave-lengths of different parts of any spectrum, the lower Nicol is permanently fixed in a mounting connected with an ivory circle, each half of which is divided into ten large divisions, and these again into five smaller, so that it is easy to read off to the $\frac{1}{100}$ part of a half revolution. This of course corresponds to $\frac{1}{700}$ of the intervals between any two of the seven bands. Placing the circle at the zero point, the other Nicol's prism can be rotated until the bright line of sodium is all but invisible in the centre of total interference of the second band, counting from the red end. The position of all the other bands is then also definite and constant. By using a diffraction spectroscope the wave-lengths of all the bands and of each $\frac{1}{700}$ interval can be calculated and arranged in a table and the smaller intervals can be filled up by interpolation. There is then no difficulty in determining the wave-length of the centre of any well-marked absorption band seen in the spectrum of any substance which is compared side by side with that of the quartz; for which purpose the binocular form of apparatus described by Mr. Sorby is the most convenient. The number of the band counting from the red end is easily seen, and the fractional interval is easily measured by rotating the ivory circle until the centres of the bands are made to exactly coincide. In the case of well-marked absorption-bands consecutive readings differ by only what is equivalent to one-millionth of a millimètre of wave-length, and the means of several observations differ considerably less than that. By proper attention to the illumination of both spectra there appears to be no serious difficulty in measuring the position of well-defined absorption-bands to within one-millionth of a millimètre of wave-length, which is quite as near as appears to be necessary in the case of the spectra for which the instrument is designed.

Geologists' Association, Dec. 3.—Mr. Wm. Carruthers, F.R.S., president, in the chair.—On quartz, chalcedony, agate, flint, chert, jasper, and other forms of silica geologically considered, by Prof. T. Rupert Jones, F.R.S. After noting a few of the salient mineralogical features of quartz, pointing out the difference in specific gravity between fused quartz (2·2) and ordinary quartz (2·6), the author passed on to chalcedony, which bears a similar relation to quartz that barley-sugar does to sugar-candy. No definite crystallised structure can be observed; but a fibrous appearance may generally be noted, at right angles to the planes of deposit, which latter often render the mass flaky. In some specimens this fibrous structure gradually becomes stronger, close-set, minute, crystalline prisms being visible in the fracture, and these pass into regular quartz crystals. The sub-crystalline structure of chalcedony is not yet thoroughly worked out. On account of the unequal resistance of some chalcedonies in agates to the action of hydrofluoric acid, by which certain layers are eaten away, cut agates have been prepared in slabs which take printer's ink and give impressions of their concentric structure, and of the channels of infiltration (See Transact. R. Acad. Vienna, &c.). Speaking of the formation of the angles in "fortification-agates," the author was inclined to accept the hypothesis of the chalcedonic silica having replaced calcite or a zeolite; a portion of an agate, comprising flat transverse layers of chalcedony, with quartz and calcite, being exhibited in illustration. The porous nature of agates, and the facilities thus afforded for the absorption of colouring matter, artificially introduced, were alluded to as connected with the minute prismatic structure. The properties of flint are somewhat different; it is less translucent, more conchoidal in fracture, and never fibrous in structure. Aggregations of silica were stated to be present in every limestone, either in the form of common flint or as hornstone, or some variety of chert, and were regarded by the author as being due to the replacement of carbonate of lime by silica. But as this mineral rarely succeeds calcite (crystallised calcic carbonate) as a pseudomorph, it is only the amorphous, or detrital, carbonate of limé of the organisms constituting the limestone that becomes changed into, or replaced by, silica (as flint), and not the crystallised material of Echinodermatal structures (whether spines, plates, stems, or ossicles), nor of *Inoceramus*, *Ostrea*, *Terebratula*, &c. These latter, however, in some cases are replaced by *orbicular silex*. When such unchanged organisms are abundantly present in flint, or when they have left cavities after removal by water, or when other partially altered organisms abound in the flint, it appears coarse-grained and is called "chert." The fine calcareous detritus which filled the internal canal of encrinital stems, the perforations of echinite tests, the parasitical borings of oyster-shells and belemmites, the tubules of sponges, the cavities of sea-urchins, shells, foraminifera, &c., has been changed, atom by atom, into exquisite silicious casts of such hollows and interiors, and are exposed to light by the natural or artificial removal of the calcareous enclosure. In some beds of chalk the pseudomorphosis of the limestone has taken place near and around Sponges; elsewhere, without Sponges, large masses of Polyzoan Chalk have been silicified (France, Maestricht, &c.); also Orbitoidal and Nummulitic limestones (West Indies, Alps, &c.) Freshwater limestones (Paris, Asia Minor, &c.) Encrirital limestone (Carboniferous, Britain, and Tasmania). The white surface of a fresh chalkflint, of whatever shape it may be, shows by its rough subreticular surface, dotted with unchanged microzoa and fragments of shells, the extent of the creeping pseudomorphic change between the nodule and the matrix, and the replacement by silica has been through just so much chalk or other limestone as the nodule or tabular mass represents in size. Even some vertical flint-veins in chalk the author believes to consist of the two altered walls of a fissure, which has been traversed by water with silex in solution; for chalk fossils remain sometimes *in situ* in such vein flint. The author believed that in the south of England, at least, it is rare for sponge-structure to be itself converted into flint. This substance represents the calcareous mud filling the cavities of the sponge, the tissue having generally been lost, or remaining only as a ferruginous stain. Hollows in flints due to the removal of involved sponge-tissue have been lined, by infiltration, with either quartz-crystals or mammillary chalcedony. The specks, blotches, lines, and some other markings apparent on weathered flint, the author thinks, in many cases, arise from differences in the texture of the flint, due to the various organic substances inhabiting or buried in the calcareous mud now represented by pseudomorphic silex. Among such organisms, he suggests that the recent thread-like Foraminifera (*Botellina*, &c.) of the Atlantic ooze may have had their analogies in the Cretaceous mud, giving rise to some straight and cross-lined markings on the weathered surfaces of broken flint, and somewhat similar,

but raised, figures on the outside of nodules. Siliceous sinter, both stalagmitic and granular, resulting from hot siliciferous springs, as in Iceland, New Zealand, Colorado, &c., was next noticed; and it was suggested that some of the flint in the Purbeck "cap" at Portland may have been siliceous sinter. Hyalite and opal and its varieties were alluded to. The orbicular silex of "beekite" was exhibited, and referred to the deposition of silica around angular fragments of limestone, which at the same time it has replaced to some thickness. The origin of the "potato-stones," or siliceous geodes, in the Triassic beds of Somersetshire is similarly pseudomorphic. In some honestones we have extremely fine compact sand cemented by silica; thus approaching one of the two very different kinds of "chert;" other kinds belong to siliceous schists and altered argillaceous rocks. Jaspers the author was disposed to view, for the most part as altered argillaceous rocks; though some are opaque chalcedonies. Beds of shell and clay may be traced into iron-flint (Eisenkiesel) and other jaspery rocks. In Griqualand-west, South Africa, there are miles of bedded jaspers, highly contorted, varying in colour and character according to the nature of the original clays and sand-rocks, which were crushed and folded by lateral pressure, and altered by the accompanying hydrothermal agency (See G. W. Stow's sections). Such jaspers, lydites, and jaspery schists have great geological importance in many parts of the world, inasmuch they hold up the surface of the country by resisting denudation.

CAMBRIDGE

Philosophical Society, Nov. 15.—Mr. Trotter said that since reading his paper "On some Waterholes in the Gorner Glacier," his attention had been called to a passage in Agassiz (Nouvelles Études sur les Glaciers, Paris, 1847, p. 101), in which a similar phenomenon was described as having been first observed by Dr. F. Keller. There could be no doubt that the description in Agassiz referred to the same phenomenon as had been described by Mr. Trotter, and that therefore these holes had been first noticed by Dr. Keller, and described in 1847. Mr. Trotter however thought Dr. Keller's explanation of the phenomenon unsatisfactory, and adhered to his own as contained in the paper in question.—The following communications were made:—(1) By Mr. F. M. Balfour on the behaviour of Nucleus during Segmentation. The following observations were made upon the eggs of Scyllium and Pristiurus. At a late stage of the segmentation of these eggs most of the segments contain nuclei, but in some of them there is to be seen in the place of the nucleus a peculiar body. This has the shape of two cones with their bases in apposition. In each cone a series of striæ radiate from the apex to the base; and between the two is an irregular row of granules. From the apex of the cone there further diverge into the protoplasm of the cell a series of lines. The author regards these peculiar bodies as metamorphosed nuclei in the act of dividing. He points out that the simple division of the nucleus, as well as its complete disappearance, accompanied by the formation of two fresh nuclei, are well authenticated modes of behaviour of the nucleus during cell division. These two processes can only be connected on the supposition that in the second case the two fresh nuclei are formed from the matter of the old nucleus. The author considers that there exist in Selachians modes of behaviour of the nucleus intermediate between the two extremes mentioned above, and points out that in the peculiar striation of the body he described there are indications of the streaming out of its matter into the surrounding protoplasm; while on the other hand it never completely vanishes. It therefore affords an instance where part of the matter of the nucleus divides and part streams out into the protoplasm of the cell to be again collected to assist in the formation of two fresh nuclei. The author further states that he has found other bodies intermediate between the cone-like bodies mentioned above and true nuclei; and regards these also as nuclei in the act of division, where a still larger bulk of the protoplasm of the nucleus becomes divided and a smaller part rises with the surrounding protoplasm.—(2) By Mr. Foster, On the effects of Upas Antiar on the Heart. A summary of this paper will be found in the Proceedings of the Society.

PARIS

Academy of Sciences, Dec. 13.—M. Frémy in the chair.—The following papers were read:—On the laws of magnetic induction, by M. Jamin.—On the theory of refining of glass, by M. Frémy.—On the heat of dissolution of precipitates, and other little soluble substances, by M. Berthelot.—Researches on sulphines, by M. Cahours.—Atmospheric perturbations of the hot season of 1875; inundations in the south of France, by M. Belgrand.—Note accompanying the presentation of micrometric plates, for measurement of solar images, by M. Janssen.—Report on reclamations with reference to the decree given on request of the Governor of Algeria, concerning importation into Algeria of fruit and forest trees from France, by MM. Dumas, Blanchard, and others. The Commission think a line should be drawn through the points Phylloxera has reached in a northward direction, and that the exportation should be authorised of all plants accompanied with an authentic certificate stating they are from territory at least 40 to 50 kilometres north of this line.—On the temperature of elevated layers of the atmosphere, by M. Mendeleeff.—Exposition of a new method for the resolution of numerical equations of all degrees (first part), by M. Lalanne.—On destruction of the vegetable matter mixed with wool, by MM. Barral and Salvetat. They give lists of substances which destroy and those which do not destroy the vegetable fibre. The first action of the former is to remove part of the water from the fibre and carbonise it.—Researches on the constitution of fibroin and of silk, by MM. Schutzenberger and Bourgeois.—Comparative study of instantaneous and continuous electric currents in the case of uni-polar excitation, by M. Chauveau.—On a fish of the Lake of Tiberias, the *Chromis paterfamilias*, which incubates its eggs in the buccal cavity, by M. Lortet. The male fish sucks in the eggs from a sandy hollow (where the female has deposited them) and passes them in among the folds of his branchiæ, where they go through the usual stages.—Researches on the respiratory apparatus and mode of respiration of certain Brachyouran Crustaceans (land crabs), by M. Jobert.—Lithological examination of green chalk sand, by M. Meunier.—On the discussion of a system of simultaneous linear equations, by M. Meray.—On the calorific intensity of solar radiation and its absorption by the terrestrial atmosphere, by M. Crova.—On the action of flames in presence of electrified bodies, by M. Douliot.—Note on the sulphocyanates of the radicals of acids, by M. Miquel.—On the saccharification of amylaceous matters, by M. Bondonneau.—Influence of stripping off the leaves, on the weight and saccharine richness of beet, by MM. Champion and Pellet.—On the embryogeny of Tunicata of the group of Luciæ, by M. Giard.—Meteorological observations in a balloon, by M. Tissandier. This voyage was made on Nov. 29. At 1,500 m. a remarkable bank of ice-crystals (in whirling motion) was passed through. The balloon rose to 1,776 m., and from about 1,100 m. upwards, a rise of temperature was observed.

BOOKS AND PAMPHLETS RECEIVED

BRITISH.—A Brief Account of Bushman Folk Lore: W. H. J. Bleek, Ph.D. (Trübner).—Euclid Simplified: J. R. Morell (H. S. King).—Map of India. To illustrate the Travels of H.R.H. the Prince of Wales (W. and A. K. Johnston).—Botany for Schools and Science Classes: W. J. Browne, M.A. (Belfast, Mullan).—Gorilla Land and the Cataracts of the Congo: Capt. R. F. Burton (Sampson Low).—Explorations in Australia: John Forrest (Sampson Low).—List of Works on the Geology, &c., of Cornwall: W. Whitaker (Truro, J. R. Netherton).—The Geological Story briefly told: J. D. Dana (Trübner).—The History of Creation: Ernst Haeckel (H. S. King).—A Physician's Notes on Ophthalmology. 2nd series: J. Hughlings Jackson, M.D.—The Natural History of Eugenia Viridis: E. Parfitt.—Tissandier's History and Handbook of Photography. Edited by J. Thompson, F.R.G.S. (Sampson Low).

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