THURSDAY, JULY 3, 1873

AN ORDER OF INTELLECTUAL MERIT

THE many obvious objections that may be urged against the well-meant proposal which Earl Stanhope brought forward in the House of Lords the other evening, for the creation of an Order of Merit to confer upon men who have deserved well of their country in Literature, Science, and Art, have already been pretty fully discussed both in the Upper House itself, and by the daily press. Happily "It is not now as it hath been of yore;" the classes for whose behalf it is sought to create a special Order of Merit, are getting to be regarded as less and less a peculiar people, both by themselves and by the public generally. To many it appears that the creation of any such order would be going in the face of the progressive tendencies of the age, and, we are confident, would not be in accordance with the desires of many of the men whom Lord Stanhope is sincerely anxious to honour. It is well-known, that over and over again have both academical and imperial honours been refused by men whom all acknowledge to have produced works that must be placed in the highest rank of intellectual products, and they spurn patronage.

The matter is not, however, all one way. The medals conferred by the Royal Society are really the decorations of an Order of Merit, election to which, however, lies in the hands of competent men; and much of the objection to the creation of an Order of Merit, such as that proposed by Lord Stanhope, would be done away with if Government were composed of men as competent to select the candidates for such an honour, as are the Fellows of the Royal Society. No doubt as civilisation based on Science advances, a Government competent to elect to such an order, as well as of performing efficiently all the other functions of a model Government, will be found at the head of this great country.

Speaking specially for men of Science, for men who devote to the advancement of scientific knowledge what leisure they have to spare from the necessary work of bread-winning, we must at once point out a tremendous difference between them and those who are generally classed with them.

The work of the artist and the author is always a marketable commodity—sometimes a very marketable one—while the investigation of new scientific truth is absolutely unremunerative; all the same, we may safely say that they seek no such recognition from the State as is indicated in Lord Stanhope's proposal.

From the tenor of all the speeches in the Upper House on Friday night, even those adverse to the creation of a special Order of Merit, we judge that the Government, as well as the House of Lords, believes that men who attain eminence in Science are as deserving of recognition by the State as men who have distinguished themselves in the army or navy, in diplomacy or politics. If this is so, then we are sure we speak the wishes of the great majority of scientific men when we say that they are willing to dispense with all hope of ever obtaining any honour from the State, if Government would do what is without doubt its duty,—enable those who have shown themselves competent to pursue original scientific research, to devote all their time to this object without care as to the means of living.

Most of those who, not being rich men, have done most to advance scientific knowledge have done so in moments snatched from the duties imposed upon them by the necessity of procuring the wherewithal to support life. Many who do the most valuable work in Science, which is generally *not* the work that is most volubly brought before fashionable audiences, are compelled, for bare life, to adopt some profession, and almost the only profession open to men who have qualified themselves for thorough scientific research, is the profession of teaching. This profession, it is well known, is one demanding, for the thorough performance of its duties, a very large expenditure of the highest energy as well as of time, so that men of Science of the class we are speaking of, who are compelled to adopt it, have but a small amount of energy and little time left to devote to that pursuit on which their heart is set, for which their whole training has qualified them, and in which they have shown themselves competent to attain the highest results;—results of the greatest and most wide-spread value both to our own country and to humanity generally. Is it not shameful then, nay does it not argue the greatest blindness on the part of Government to the best interests of the country, that these men should be compelled to expend the very best of their valuable and well-skilled energies in the drudgery of a profession for which they may by no means be peculiarly fitted, merely to keep the life in their bodies, while but a very moderate expenditure on the part of the State, would enable them to devote, without dread of coming to want, the whole of their power to the pursuit of that research, from which the country already has reaped the highest benefit? No man whose opinion is of any value, not even any member of Her Majesty's Government, we believe, doubts the eminently practical utility of scientific research, and the dependence of our country for its foremost place among the nations of the world, that it should have at its disposal the highest and latest results of such research. Instead then of devising new and empty honours wherewith to reward men who, amid a life passed in the worry and struggle for existence, have been able to push forward scientific knowledge a short stage, would it not be honouring the pioneers of Science far more, and at the same time making an investment which ere long would be repaid a hundredfold, if Government would only bestow upon these men the means wherewith to do thoroughly, and with all their might, the unspeakably valuable work which at present they can only do by snatches, or be compelled to give up when probably it is about to bring forth noble results? If Lord Stanhope and those in both houses of Parliament who have the wisdom to see wherein the true glory and highest good of their country consist, would only set themselves earnestly to devise some plan whereby scientific research could be pursued under the most favourable circumstances, they would delight the hearts of scientific men infinitely more than if they heaped upon their heads all the honours of all the Courts of Europe.

COOKERY AT SOUTH KENSINGTON

THE most successful department of the International Exhibition this year is undoubtedly that connected with Cookery. Twice a day is a lecture delivered on some practical department of cooking, and at the same time a demonstration is given by a well-trained group of female cooks, in a conveniently fitted-up kitchen open to the audience. These lectures are the great attraction of the Exhibition, and many persons anxious to gain admission are turned away for want of space to accommodate them. This shows, at any rate, on the part of the public, an appreciation of the subject and a desire to be instructed as far as possible.

At the same time it is to be lamented that the class of persons who most need instruction in cooking do not attend. The charges of sixpence and a shilling for entrance to hear these lectures and see the cooking demonstrations must exclude the class of people for whom such instruction is most needed. Although there is a widespread notion that people in England do not know how to cook at all, yet we question very much if the civilised world produces better dinners than are to be found daily on the tables of the wealthy classes of England. They need not to consult economy either in the cost of materials of food or its preparation. For them lectures on cooking are not needed, and even their cooks, who get from fifty to a hundred pounds a year, could hardly be instructed by Mr. Buckmaster and his bevy of cleanly cooks. If anything is wanted by the wealthier classes, it is a more scientific knowledge of the nature of food and the processes by which it is prepared for digestion. This they will not get at South Kensington. Mr. Buckmaster's lectures are not intended as a scientific exposition of the chemical or physical properties of substances used as diet, or of the way in which they affect the palate or act on the body. They consist simply of directions how to prepare dishes, and the cooks in the kitchen follow his directions. There is no doubt that to thousands of people this is of great service. No housekeeper, however low in the scale of society, but must be benefited by seeing prepared poor man's soup, omelettes, macaroni, and Australian meat, in Mr. Buckmaster's kitchen. At the same time they will learn only how to imitate the methods of cooking they have seen: they will learn no principles. They will hear nothing about the nature of the materials they see cooked, unless it is that hot water and heat act upon them to produce the results they see. They will see eggs made into an omelette in a frying-pan, but hear nothing with regard to the nature of eggs, their value as an article of diet, and other means of cooking them besides frying.

Another defect we observed in these lectures was the truly British defect of ignoring weights and measures. Mr. Buckmaster's lecture sounded very like the magnification of a receipt out of an ordinary cookery book. Take a piece of this, a pinch of that, and a handful, a sprig, a few teaspoonfuls, and so on for every ingredient used. We know this is the rule of the kitchen, and any attempt to introduce scales and weights would be flouted with contempt. It is the same with temperature; water is called "cold," "warm," and "hot," without the slightest allusion to temperature. Surely in lectures like these accuracy ought to be studied: and when things can be measured and weighed, so good an opportunity of teaching the importance of this should not be lost. It is because of the neglect of these matters in the kitchens of our wealthier classes that they seldom have put on their tables dishes two days alike. Nay, we know more: we tasted some macaroni made by a cook who had been to Mr. Buckmaster's lecture, which was no more like the macaroni made in his kitchen than his was like plum pudding. This arose entirely from the cook not measuring rightly the time of cooking the macaroni and the quantity of the flavouring ingredients.

Now we do not say it is possible to teach all the science of cookery in one lecture, but we do say that it is possible to speak accurately about the *weights* of the materials used, the degrees of *heat* to be employed in cooking, and the *time* that things require to cook.

We throw out these suggestions in the hope of seeing them acted upon. There is no doubt that it would be attended with some difficulty. There is the Italian cook, Mr. Buckmaster's *chef*, and the four young female cooks, all not only to be educated, but to be got into the frame of mind to submit. We see also that there is a Cookery Committee, who would, we suppose, have to be consulted; but these gentlemen would, we are sure, assist in introducing so desirable a system of instruction. Mr. De Rivaz is on the Committee, and he is well known for his book on cookery called "Round the Table," as also for his receipts in the *Queen* newspaper.

Whether there is any intention on the part of this Committee to extend the lectures, and give a course on cookery comprising the teaching of the elements of the sciences involved in the facts acted upon in the kitchen, we do not know, but this would be a worthy object and probably would succeed, as the public is evidently disposed to listen to the subject. It must, however, be done at once, and done in the International Exhibition. It cannot be done at South Kensington; the experiment has been tried there and failed. The country gentlemen in the House of Commons do not see their way to voting public money for the instruction of people in London. Whether done in London or the country, such courses of instruction would be a capital way of getting a little scientific knowledge into the heads of people edgeways, as it were.

But now we come to the question of opening the present lectures to the poor. These lectures were intended for their instruction and got up in their interest, but they are conspicuous by their absence at these lectures. The whole Exhibition is open to them for a shilling, and when they have screwed this sum out of their hard-earned wages, and paid for a crust of bread and cheese and half-a-pint of beer, they have nothing to spare for learning cookery. Yet we are quite sure the money would be well spent. The persons in the community who suffer most for want of economy in cookery are the very poor. They buy their food in the most expensive way, by buying it in small quantities, and when they have got it they know less than any class how to cook. They know nothing of the way of making, or of the economy of using soup. They hardly know the difference between warm, hot, and boiling water in cooking food. The fact is, we believe, that half the food of this class is really lost for the want of a knowledge of the proper means of cooking it. To such people these lectures

should be open at the cost of a penny or twopence each lecture; and that each person of this class who attends the Exhibition should have the benefit of the lectures and demonstrations, these should be more frequent, and the theatre larger.

Something may be done before the Exhibition closes; but the cookery question is a permanent one. Cannot something be done to establish a School of Cookery, in which teaching such as is now going on at the International show can be carried on continuously? We can conceive such an institution possible, and even self-supporting. The whole of the middle and upper classes are interested in getting good cooks, and the school boards should be urged to allow their elder female pupils to attend the instructions given in such an institution. This would be an immense economy to all, for it would save a large portion of that waste which now goes on in every household, in teaching girls to become the sort of cooks they are.

If girls and women could be sent to such a school with a previous elementary knowledge of chemistry, physiology, and natural philosophy, they would derive more advantage than they would otherwise get from the necessarily short courses in such a school. In short it comes to this, that nearly all the details of practical life are dependent on facts which are comprehended in the various branches of scientific knowledge; and it is only as men and women are taught the nature of these facts that society can progress and man attain the highest possibilities of civilisation.

E. LANKESTER

COX'S POPULAR PSYCHOLOGY

What am I? A Popular Introduction to Mental Philosophy and Psychology. Vol. I. The Mechanism of Man. By Edward William Cox, Serjeant-at-law. (Longmans and Co.)

NO doubt many of the Serjeant's friends will read his popular introduction to the study of psychology, and think it very profound, and many of them, especially his lady friends, charmed with the vague denunciation of "Scientists" and materialists, the religious element, the quackery of science, and the scraps of poetry, will be able to tell him in all sincerity that they think it "a very nice book." But from those whose opinion is worth the paper it is written on, Mr. Cox has nothing to hope. The first sentence of the preface declares that "The study of psychology has not kept pace with the progress of the physical sciences." The truth of this statement must be painfully brought home to every real student of psychology, by the fact that a man possessing the intelligence and general culture of Mr. Cox could write such a book, and that educated people will be found to read it. We can agree with the author that there is at the present time room for a work presenting the leading truths of mental science in, if possible, a popular shape. But surely one qualification of the writer who would make such a book for the benefit of the "many persons who desire to obtain some knowledge of psychology, but who are deterred from its study by the ponderous volumes of abstruse argument . . . intelligible only to the far advanced philosopher," must be, that he is himself up with the best science of the day, that he has made himself acquainted with "the ponderous volumes of abstruse argument." Unfortunately Mr. Cox does not appear to have taken this view of the matter. In setting himself to produce an "outline of the science of psychology written in plain language," he has, in plain language, attempted work for which he is no more qualified than an ordinary farm labourer is qualified to translate Homer into the vernacular of his native village.

Like books of its class the volume before us is rich in curious absurdities of presumption. For instance, scientific men are very severely taken to task for their lamentable want of scientific method; and there is no end to the tirade against materialists, metaphysicians, and mental philosophers. Who these greatest of sinners are, we cannot tell; for Mr. Cox prudently refrains from mentioning names. Nor are we told very precisely what are the particularly damnable heresies with which they have poisoned the public mind; indeed, it would appear that mindful of the good old proverb that one cannot touch tar without being defiled, Mr. Cox has been careful to keep his own mind at an angry distance from all their evil thinking. It may however amuse some of our readers to know what, according to Mr. Cox, is not materialism, while it will enable all to estimate the claim of the writer to rank as a psychologist. This is spiritualism: "Rightly, then to conceive of spirit, the first step is clearly to comprehend that it is not, and cannot be, *immaterial*—but only that it is composed of very refined matter—so refined that it is imperceptible to our bodily senses, which are adapted only to perceive certain forms of matter that affect ourselves." "The soul, therefore, being composed of molecules infinitely finer than the molecules of the body—as fine possibly as those of the comet, could, with the utmost ease, permeate the body, infusing itself among all the atoms of which the body is built, and thus occupy the whole frame;" and as a consequence "the shape of the soul must be the shape of the body." The soul here spoken of is not "the mind" nor the "life," but the proprietor of the body, the mind, and the life. As Mr. Cox's "inquiry is designed to be purely *scientific*," and is "addressed mainly to those who reject the authority of the theologian," we must give one specimen of the scientific arguments, in support of the existence of this entity, which scientists in their stupidity have hitherto failed to appreciate. Here is the best one:—"Does any sane man ever talk or write of his mind or his life as 'Me?' Does he not always say '*my* mind,' '*your* mind, '*my* life,' '*your* life,'—that is to say 'the mind, the life,—that belongs to *me*,' 'the life—the mind—that belongs to *you*.'" We hope the learned serjeant does better than this when he has a concrete mortal for a client. Without going farther a-field for an answer it must be sufficient to remind him that we not only say "*my* mind," and "*your* mind," but also "*my* soul," and "*your* soul," "*my*self," and "*your*self." Who, or what is the "*Me*," which according to the profound word-argument must exist as the proprietor of the *soul* and the *self*? This very refined existence has not yet got a name; but perhaps Mr. Cox, now his attention has been called to it, will be able to tell us in his second volume (which already promises to be much more interesting than the one before us) what sort of matter it is made of, its shape, and its dwelling place.

One word more, if men will write nonsense, they might at least endeavour to write original nonsense. It is sad to think that even young ladies should have to admire the old empty sentences in every new book. S.

OUR BOOK SHELF

The Darwinian Theory and the Law of the Migration of Organisms. By Moritz Wagner; translated by J. L. Laird. (Sandford.)

AFTER the perusal of the preface to this pamphlet, the reader will expect to find that a serious objection to the Darwinian hypothesis has been detected, and that what is to follow will, by the introduction of a new law, clear up the assumed difficulty, and immortalise its discoverer.

"The Law of the Migration of Organisms" of Prof. Wagner is that it is only by the isolated migration of single individuals from the station of their species, that natural selection could and can be effected, and that only by this means new varieties of plants and animals could arise in the past as well as in the present. This law is based on the considerations that the greater the change to which individuals are subjected on migration from their homes to some fresh locality, the greater will be their tendency to vary, and the less they have the opportunity of crossing with the parent stock, the more permanent will variations become. Most of the observations on which these arguments are founded have been arrived at from the author's researches on the distribution of insects and plants; and he has been led to propose it, because, as he says, "Darwin's work neither satisfactorily explains the external cause which gives the first impulse to increased individual variability, and consequently to natural selection; nor that condition which, in connection with a certain advantage in the struggle for life, renders the new characteristic indispensable."

To us it is not easy to see what direct bearing this law has on the theory of natural selection, for it seems to be nothing but one of the many deductions of Lamarck's theory of the origin of species. It is evident that on that very ingenious but equally inefficient hypothesis, the removal of individuals from their homes to some other locality in which the temperature and food are different, would cause them to vary; and that if the so modified forms are allowed again to mix with those which have not altered their position, the induced peculiarities will disappear. But, though by artificial selection an apparently similar result may be attained, yet in a wild state this is hardly the sequence of events which the evolution hypothesis supposes. According to it, the forces which come into play affect large numbers, and being generally comparable in degree and gradual in their action, those individuals which escape change in one direction are almost certain to undergo some equally considerable modification in another; consequently there will at no time be left any of the original unmodified stock for the varieties to intermix with, as required in the theory under consideration, at the same time that the effect of simple change of locality in producing new and well-marked varieties has not been conclusively proved.

From the study of the breeds of horses and cattle, Prof. M. Wagner is convinced that the invariable result of intercrossing is uniformity, and that only in connection with isolation is natural selection able to come into play. This, as do many other remarks throughout this pamphlet, shows clearly that its author does not really recognise the point of Mr. Darwin's great theory, and that whilst under the idea that he is attempting to modify it, he is really discussing another, but distantly related, and much less important problem. Such being the case, it is not surprising that the author of the theory of Natural Selection should differ from the German professor; with whom we also cannot agree in thinking that "perhaps that generous British naturalist, who is always open to conviction, after calmly weighing his reasons and data, may yet be induced to modify his opinions."

A Practical Manual of Chemical Analysis and Assaying, as applied to the Manufacture of Iron from its Ores, and to Cast Iron, Wrought Iron, and Steel as found in Commerce. By L. L. de Koninck, Dr. Sc., and E. Dietz. Edited, with notes, by Robert Mallet, F.R.S., F.G.S., M.I.C.E., &c. (London: Chapman and Hall, 1872.)

THE above little work appeared at Liège in 1871, and as it was well arranged, succinct, and clear in its descriptions, Mr. Mallet considered it worthy of translation. The plan is similar to that of Fresenius's well-known quantitative analysis, the reagents being described first, then the apparatus and operations, and then the practical application to the special class of work to which the book is devoted. On the whole we cannot help thinking that too much space is given to matter with which every person ought to be thoroughly familiar before he attempts to make a practical application of his chemical knowledge. The supercession of the skilled chemist by the "tolerably intelligent man" mentioned by the editor in his preface is not, we think, a desirable reform. The editor's notes consist of some four and twenty pages of small print at the end of the book, and they are full of valuable suggestions. His remarks on the construction and arrangement of the laboratory of an iron-work are particularly worthy of attention. The book concludes with a table of atomic weights, one for the conversion of English weights and measures, with their metrical equivalents, and one of constants for calculating percentages of substances found. The book will no doubt prove very useful in its special field.

Verhandlungen der k.-k. Zoologisch-botanischen Gesellschaft in Wien. Jahrgang, 1872, 22er Band. (Leipzig Brockhaus.)

THE annual volume of "Transactions of the Zoological and Botanical Society of Vienna" contains, as usual, a number of interesting and valuable articles. The papers are almost entirely systematic and descriptive:—On the flora of Poland (the longest paper in the volume); on birds from the shores of China and Japan; on the lichens of the Tyrol; on a collection of birds from Australia; on the bees of Germany; on North American Micro-Lepidoptera; on the oak-galls of Central Europe; and others of a similar character. Physiological or anatomical contributions occupy but a small portion of the volume, which is illustrated by seven plates.

The Art of Grafting and Budding. By Charles Baltet. (London: W. Robinson, 1873.)

THE various modes of the reproduction of plants comprised under the designations grafting, budding, layering, &c., have been more scientifically studied and carried to greater perfection by gardeners in France than in England. Baltet's "L'Art de Greffer" is the text-book on this branch of horticulture, and of this little volume we have here a translation, although the omission to note this fact on the title-page might give unwary purchasers who have not dipped into the preface the impression that it is an original work. M. Baltet is so successful a fruit-grower, and his manual is so well and favourably known, that no apology was necessary in furnishing the English reader with a translation of it, which will be an indispensable companion to all engaged in horticulture. At the end of the volume is a useful list of the more commonly grown trees and shrubs, with instructions as to the best kind of stock on which to graft them, and the method to be pursued; though it is a pity that the translator did not

take the trouble to re-arrange them in some order more intelligible to the English reader than that of the alphabetical sequence of the common French names.

LETTERS TO THE EDITOR

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

Dr. Bastian's Turnip-Cheese Experiments

FROM Dr. Bastian's letter in last week's NATURE I learn that my last communication has afforded him satisfaction. The gratification which I feel at this expression of his approval is mixed with some surprise; for however confirmatory my experiments may be of his, so far as relates to the bare fact that boiling is insufficient to destroy the germinating power of the turnip-cheese liquid, they certainly do not tell in favour of the inference which he is understood to draw from that fact.

The experiments which Dr. Bastian was kind enough to show me last December were regarded by him as unequivocal instances of spontaneous generation. He will remember that at that time I stated to him, both orally and in writing, that the significance of the results in their relation to the doctrine of heterogenesis, appeared to me to be doubtful, and that I thought it probable that they would be interpreted by different persons in opposite senses, according to their preconceived opinions. I expressed myself in a similar manner at a discussion which took place on the subject last winter at the Royal Society. It was for the purpose of clearing up this doubt that I made the experiments recorded in my last communication. I did not expect to prove that the production of Bacteria in Dr. Bastian's experiments was *not* spontaneous, but merely to determine whether the fact afforded any support to the opposite conclusion.

Having first shown that living organisms increase and multiply in the liquid in question, when boiled at the ordinary temperature, under circumstances which absolutely preclude the introduction of living matter from without, I prove that under otherwise similar conditions this result is not obtained when the liquid is subjected to ebullition at a slightly higher temperature. I show further that the liquid even when heated to 102°·5 C. suffers no impairment of its power of supporting the life of Bacteria, for by inoculating it with a drop of ordinary distilled water it at once becomes pregnant. Hence I conclude, not that spontaneous generation is impossible, but that the particular experiment in question is not an instance of it, and that no argument founded on it in favour of the doctrine is of the slightest value.

It is unnecessary for me to occupy your space by at any length adverting to the side questions raised by Dr. Bastian in the other paragraphs of his letter.

In examining the liquids within a few days after heating rather than later, I followed his own method.

I made no attempt to determine the temperature of ebullition in flasks with capillary orifices, because I know of no method by which it could be done accurately. Besides, it was not required for my purpose.

I employed the word "chance" in its ordinary sense. In the sentence to which Dr. Bastian refers I explained that, although there may be a limit of temperature at which a liquid, before possessing the power of breeding Bacteria, is deprived of that power, experiments such as mine are insufficient to define that limit. As regards the turnip-cheese liquid it has been shown that between the temperatures of 100° and 102° C., the probability of pregnancy diminishes rapidly as the temperature increases. It is not as yet possible to say at what point the probability vanishes.

University College, June 30 J. BURDON SANDERSON

The Zodiacal Light

CONTRARY to Mr. Hall's experience of astronomical books (see NATURE, vol. viii. p. 7), in neither Herschel's "Outlines of Astronomy," Humboldt's "Cosmos," nor Guillemin's "Heavens," can I find any hint of a permanent difference between the brightness of the zodiacal light east of the sun and west of it, though Arago's "Popular Astronomy" says that according to Cassini, "it is generally less lively and less extended in the morning than in the evening." But even if Cassini was correct, this is no positive proof of any difference between the two "branches" of the zodiacal light at the same time, seeing that he lived in the temperate zone, and probably did not observe it in both morning and evening at the same time of year. Mr. Hall's situation in Jamaica is favourable for investigating this point, and I should not wonder if he finds the fact different from what he supposes. But even the books that consider the zodiacal light to surround the sun in the shape of a lens, acknowledge that it may extend further one way than another, and further at one time than another.

T. W. BACKHOUSE

Sunderland, June 7

AT about half-past one in the morning of June 5, the sky was clear, but the stars were not very brilliant, on account of the diffused light, and consequently the Eastern branch of the Zodiacal Light was very faint; as I was endeavouring to trace its course, a strong beam of light appeared so suddenly as to have quite a startling effect; it was not shot out like the rays of the Aurora Borealis, but gathered strength throughout its whole course, which lay through Aquarius, over the stars α and β Capricorni, through Sagittarius, across the Milky Way, and through Scorpio, passing to the N. of Antares; its visible length was therefore upwards of 100°, and as I was about to make accurate observations, it suddenly disappeared, having lasted somewhat less than one minute.

Its course was therefore nearly parallel to the Ecliptic, and about 6° to the N. of it; its breadth was from 3° to 4°; its brilliancy was equal to that of the brightest part of the Milky Way, through which it passed, and therefore allowed me to judge very accurately; and it had no colour.

Now Humboldt says in his "Cosmos," * "I have occasionally been astonished, in the tropical climates of South America, to observe the variable intensity of the Zodiacal Light," and he considered the variation to be due to atmospheric changes, as I myself have hitherto done; but in the case above no ordinary atmospheric changes could have produced the effect observed.

It occurred June 4d. 18h. 40m. Greenwich mean time, and it would be very interesting to know whether the magnetic instruments were affected at any part of the earth.

Jamaica, June 1873 MAXWELL HALL

Meteorological Influence of Trap Rocks

THE thermometer in a mine, or coal-pit, rises, according to Herschel, 1° for every 90 feet of descent, or 58° per mile; and, according to Clerk Maxwell, the rate of increase in this country is 1° for every 50 feet of descent. These results are obtained in passing through a very small portion of the superficial crust of the earth; such, for example, as a part of the coal formation, which possesses a very low degree of conductivity. We can hardly, indeed, conceive a worse conductor than a crust consisting of alternating strata of freestone, shale, till, coal, limestone, &c. But these strata are very frequently perforated by comparatively homogeneous intrusions in the form of trap dykes, which not only possess greater conductivity, but which, from the analogy presented by volcanoes, very probably extend down to the molten matter subjacent to the external crust of the earth. Such trap dykes may be compared to an iron poker thrust through the superficial strata having its lower end in a state of fusion, and its upper end kept cool by radiation into the atmosphere. Through any continuous dyke, if this view be correct, there will therefore be a more rapid escape of heat; and when such igneous rocks occupy spaces of many square miles of the earth's surface, one would, at first sight, expect them to play a very important part in affecting the meteorological conditions of the district in which they are found. They might be expected, by the large amount of heat which they conducted freely to the earth's surface, to stimulate the growth of plants; and by the radiation of the liberated heat into the atmosphere, they ought to become—especially during night—the generators of storms, by causing a constant ascent of rarefied air. It is quite true, however, that the meteorological effects of such an agent must, as in the case of volcanoes, be observed by the far grander cycle of disturbances initiated by the solar heat; and that its agricultural efficiency may be, to a large extent, negatived by differences of chemical constitution, acidity, and exposure. Still, however, the influence is there, and ought, in one way or other, to make itself sensible.

Do any of your readers possess information bearing upon this question? Such, for example, as experiments on the conductivity of the different kinds of trap as compared with the stratified rocks, or observations of the temperature of the air, especially during night, above trap-rocks as compared with that

* Otté's transl., vol. i. p. 131.

of the air above surrounding districts of the coal measures, or statistics of the fertility and periods of fructification of crops under similar differences of conditions. Of course the great difficulty affecting the last point is the difference in the chemical constitution of the soils produced by the decomposition of trap and stratified rocks. THOMAS STEVENSON

Edinburgh, June 21

Winters and Summers

A FRIEND writes to me:—"From my observations of climate here (Belfast) I should say that I never saw a severe winter followed by a really fine summer. The severest winters I remember were those of 1854-5, and 1859-60. The summer of 1855 was very wet, and that of 1860 deplorable. The finest summers I remember were those of 1842, 1857, and 1868; in every case the preceding winter was very mild."

I would add to this, that the severe winters of 1865 and 1870 were not followed by remarkably fine summers. The harvest weather of 1866 was unusually bad.

Can any of your readers throw light on this subject from carefully kept registers? JOSEPH JOHN MURPHY

Old Forge, Dunmurry, June 6

Cyclones

MR. MAURY'S theory of Cyclones, as stated in NATURE of the 19th, is, in my opinion, true and valuable. I hope you will permit me to call the attention of your readers to my letter in NATURE, Vol. iv. p. 305, where it will appear that I had independently arrived at the conclusion stated by him, "that the origin of cyclones is found in the tendency of the south-east trade-winds to invade the north-east trades by sweeping over the equator into our hemispheres." Only the words "south-east" and "north-east" must exchange places, and "the opposite hemisphere," must be read, instead of "our hemisphere," if we are to apply the theory to the cyclones of the Southern Indian Ocean and of the Southern Pacific. On this latter subject, see Mr. Whitmee's letter in NATURE, vol. vi. p. 121.

I wish, however, to call your attention to what I think an error in the diagram of the winds, which Mr. Maury reprints from Prof. Ferrel. It represents the winds at the surface of the earth in the Polar regions as blowing in nearly the same direction as the trade winds. This appears mechanically impossible, and I cannot think that Prof. Coffin's data are extensive enough as regards the Polar regions. As the late Capt. Maury remarks, the west winds of the higher and middle latitudes constitute "an everlasting cyclone on a great scale;" that is to say, a vast vortex whereof the pole is the centre. But it appears impossible that the direction of the motion of a vortex should be reversed at its centre. JOSEPH JOHN MURPHY

Old Forge, Dunmurry, June 24

A Mirage in the Fens

As the phenomenon called Mirage is not very common in this country, though more frequent in the Fens, perhaps, than elsewhere, I presume that a description of one which was seen on Thursday, May 29, last, will be interesting to the readers of NATURE.

Driving from Wisbech towards Thorney on the morning named, I stopped at Guyhirne, and my friend, Mr. S. B. J. Skertchley, of H. M. Geological Survey, who accompanied me, mounted the parapet of the bridge of the March and Spalding Railway, to view the Fens from that elevation, and then called my attention to what appeared a beautiful lake spread out a few miles distant. The illusory waters were of a bluish grey colour, and being apparently raised from the level, presented the perspective of a Mere of considerable breadth. But this was not a dull expanse; there were variously formed indentations—islands dotted here and there, pollard willows inverted, and the reflection of tall poplars and elms on the glassy surface. The use of my field-glass only brought these features more distinctly to the eye. As we stood on the bridge, we were looking from W. by S. to W. Whittlesea Church was eight miles distant, and Thorney Abbey seven miles. The mirage was stretched out from Eastern Fen over Prior's Fen to the west of Thorney, *i.e.* three or four miles. It was 11 o'clock. There was a fresh breeze from N.E.; the sky was not half obscured by cloud; the barometer stood high, being four degrees difference between the dry and wet bulb thermometers at 9 A.M. All these conditions were favourable to evaporation; there had been more than half an inch of rain the Monday previous. Mr. S. had witnessed a similar phenomenon from another point of view (see NATURE, vol. ii. p. 337) in 1870, when he saw it both E. and W. of his position, but on Thursday last there was not even a mist in any other part of the horizon. On both occasions the wind was N.E. It may be interesting to know whether these phenomena appear with a mild and moist S.W. or W. breeze.

Wisbech, June 5 SAML. H. MILLER

The Westerly Progress of Cities

REFERRING to Mr. W. F. Barrett's letter I would remark that there is a similar phrase, viz. the westerly or north-westerly progress of nations, which is intimately connected with "the westerly progress of cities," and the former helps to explain the latter. As a rule the more westerly of two peoples inhabiting a country is there by compulsion, having been driven thither by the invader who, as a rule, makes the attack from the east. The remnants of the ancient Celtic race, inhabiting portions of the western shores and highlands of Spain, France, and the British Isles, are an evidence of this. We see the same process going on now in America: the aborigines being driven before the invader, to the west. There are insignificant exceptions, both in ancient and modern times, but they only prove the rule.

So much then for the westerly among the peoples of a land: they are in the west by violent compulsion. Among the inhabitants of a city the westerly are there also by compulsion—not a compulsion by violence, but by uncomfortable pressure; in which case it is the powerful or wealthy who retire before the weaker or poorer.

The very fact of the westerly progress of nations establishes the further fact that what becomes afterwards more or less the eastern part of the city is the older and that where the first habitations were erected. An exception would be such a case as a city built on a western coast without any adjacent country to the west. Here the wealthy in retiring before their less fortunate fellow-citizens must necessarily go more or less to the east. B. G. JENKINS

London, June 9

To the instances of "westing" adduced by Mr. W. F. Barrett as occurring in the large towns of the Old World it is desirable to add that a similar tendency prevails in the large towns of the New, excepting, of course, the cases in which physical barriers impede or prevent it.

It should be observed, also, that this westward current of progress in cities appears to be but the special manifestation of a principle much more general—the direction of great emigrations and of the advance of civilisation, apparently in pre-historic and certainly throughout historical times, having been uniformly towards the west. G. J. R.

How does the Cuckoo deposit her Eggs?

A FEW days ago while examining a reed bed in the fens of Lincolnshire, near Wainfleet, I found a Reed Warbler's nest, in which was deposited a Cuckoo's egg. From the *shape* of the nest, which was very narrow and deep, and from the *position* of the nest, which was built on slender reeds, on the outer edge of the bed, it was utterly impossible that the egg could have been laid, as, in the first place, the nest was far too small for so large a bird as the cuckoo to sit in; and in the second, the weight of the bird would have inevitably swamped the nest. Does not this fact go far, at any rate, to confirm the theory held by many ornithologists to be the correct one, that the female cuckoo drops her eggs into nests by means of her bill, as it is well known she is provided by Nature with an enlargement in the throat, in which the egg could be carried in safety during her flight in search of a suitable place in which to deposit it. I give here a quotation from Bewick on the subject:—

"Naturalists are not agreed as to whether the female cuckoo lays her egg at once in the nest of another bird, or whether she lays it first on the ground, and then, seizing it with her bill, conveys it in her throat (supposed to be enlarged for this purpose) to the nest which is to be its depository."

I should be glad if any of your correspondents will inform me if the male bird has a like enlargement in the throat, or is it only to be found in the hen? T. AUDAS

Regent's Terrace, Hull

THE LATE MR. ARCHIBALD SMITH

MR. ARCHIBALD SMITH was born at Glasgow in 1813; his father, Mr. James Smith, of Jordanhill, Lanarkshire, was well known as a geologist, and as the author of a learned and critical work on the Voyage and Shipwreck of St. Paul.

At the University of Glasgow Mr. Smith was a contemporary of the late Norman McLeod and of the present Archbishop of Canterbury, with both of whom he retained a friendship through life.

From Glasgow he went to Trinity College, Cambridge, where, while still an undergraduate, he commenced to contribute papers to the Mathematical journals; his first, a most important paper "On the Equation to Fresnel's Wave Surface," is an excellent example of the extreme neatness and elegance of his style; it was published under the signature A. S. in the Cambridge Phil. Trans. and in the Phil. Magazine.

He, however, as the result well showed, did not allow his amateur mathematics to interfere with the regular course of Tripos reading, and he also found time for a good share of athletic exercise. He pulled in the Trinity boat of which the late Lord Justice Selwyn was stroke; all the oars in that boat were reading men, and were familiarly known as "Peacock's examples" (Peacock being a well-known tutor of the day). It was no doubt owing to Mr. Smith's strong physical constitution which was thus well trained in early life, that he was able so long to sustain the great strain of mental effort and the want of rest to which he never scrupled to subject himself in after years when occasion required.

In 1836 he finished his undergraduate's career by taking the first place in the mathematical tripos as well as the first Smith's prize, and he was soon after elected a Fellow of his College. The second wrangler of his year was Bishop Colenso.

Having chosen the profession of the Chancery Bar, Mr. Smith became a pupil and a friend of Mr. James Parker, afterwards Vice-Chancellor, and is said to have acquired the sound legal learning and careful method which distinguished that judge. It was during the intervals of his laborious Chancery practice that he found time for the long series of magnetic investigations which has made him famous throughout Europe.

His connection with Magnetic Science arose from intimacy with Sir Edward Sabine, the late distinguished president of the Royal Society, and who was interested in the question of the Deviation of the Compass, first as member of a committee appointed by the Admiralty to consider the question, and afterwards as having undertaken the reduction and publication of the magnetic observations made by Sir James Ross in his Antarctic voyage.

In the years 1842 to 1847 Mr. Smith, at General (then Colonel) Sabine's request, deduced from Poisson's general equations, formulæ for the correction of the observations made on board ship. These were published in successive numbers of Sabine's "Contributions to Terrestrial Magnetism," in the Transactions of the Royal Society.

In 1851, at the request of Captain Johnson, the superintendent of the Compass Department of the Royal Navy, he deduced from the formulæ the convenient tabular forms, and computed the auxiliary tables for determining the co-efficients A, B, C, D, E, which have ever since been in use. These were published by the Admiralty in successive editions, but without the demonstrations or formulæ.

In 1859 Mr. Archibald Smith edited and published the voyage of Scoresby to Australia, which was undertaken chiefly for magnetic research; and in his introduction gave, for the first time, the *exact* formulæ for the effect of the iron of a ship on the compass, the former approximate formulæ being found insufficient.

In 1862 he, conjointly with Captain Evans, the present chief of the Compass department, prepared the Admiralty Compass Manual, a book which has since been translated into French, German, Russian, and Portuguese, and gone through three editions. The work is divided into four parts, the first of which contains practical rules to enable a seaman by the process of swinging his ship to obtain a table of the deviations of the compass on each point, and then to apply the tabular corrections to the courses steered. The second part is a description of "Napier's graphic method," the practical advantages of which are that it enables the navigator from observations of deviations made on any number of courses, whether equi-distant or not, to construct a curve in which the errors of observation are as far as possible mutually compensated, and which gives him the deviation as well on the compass courses as on the correct magnetic courses. Part III. contains the practical application to this subject of mathematical formulæ derived from the fundamental equations deduced by Poisson from Coulomb's theory of magnetism. Prior to this time it was considered sufficient to use approximate formulæ, going as far only as terms involving the first powers of the co-efficients of deviation; but the very large deviations found in iron-plated ships of war rendered it desirable to use in certain cases the exact instead of the approximate formulæ, and this part was therefore re-written. The fourth part of the "Manual" contains charts of the lines of equal variation, equal dip, and equal horizontal force over the globe; the first for the purpose of enabling the navigator at sea to determine the deviation by astronomical observations, the two latter to throw light on the changes which the deviations undergo in a lengthened voyage, and to enable the navigator to anticipate the changes which will take place on a change of geographical position.

All Mr. Smith's investigations were undertaken as labours of love; but we must not leave unnoticed some of the recognitions which he received.

In the year 1865 one of the Royal medals of the Royal Society was awarded to him, and he was elected a corresponding member of the Naval Scientific Committee of Russia; in the following year the Emperor of Russia, with a most complimentary letter, presented him with a gold compass emblazoned with the Imperial arms, and set with brilliants.

Recently, too, our own Government offered him a present of 2,000*l*., and intimated the fact to him in a handsome letter from the First Lord of the Admiralty, begging his acceptance, not by way of recompense, but as a mark of the high appreciation which the Government had for the services he had rendered.

The history of Mr. Archibald Smith's legal life is soon told. He attained the reputation of being an eminently concise and perspicuous draughtsman, and made a practice at the bar which was above the average both in extent and importance.

When Sir James Parker was made Vice-Chancellor he appointed Mr. Smith his Secretary; but the early death of Sir James brought these duties to a close. Later, a Judgeship in Queensland was offered to him, which he declined. It is said that the important change which has substituted figures for words as to dates and sums occurring in bills in Chancery was made at the suggestion of Mr. Archibald Smith.

In 1868, when the Universities of Glasgow and Aberdeen were formed into a parliamentary constituency the liberal electors chose Mr. Smith as their candidate, and they did their best, though without avail, to bring him in for the new seat.

About two years ago he was compelled by ill-health to give up work; but he had greatly rallied; and the attack which ended fatally was totally unexpected, and of but a few hours' duration. In private life those who knew Mr. Smith best admired him most; he leaves unnumbered

friends to testify to the noble simplicity of his disposition, and to the true warmth of his heart, which was always open amongst his multifarious and engrossing work.

NEW EXPERIMENTS FOR THE DETERMINATION OF THE VELOCITY OF LIGHT BY M. ALFRED CORNU

AN exact value of the velocity of light is equally interesting to astronomers and physicists. It is interesting to astronomers, for it enables us to calculate an important and not exactly known number, namely, the distance from the sun to the earth, for which cause the learned world is looking forward with so much impatience to the passage of Venus on the disc of the sun, as the observation of this phenomenon, it is hoped, will fill up this chasm. It is interesting to physicists likewise, it is evident, but especially since the remarkable researches* of Prof. Clerk-Maxwell, who has found an unexpected relation between the theories of light and electricity.

M. Alfred Cornu's experiments, to which we now call attention, have for these reasons a great interest.

The first who busied himself with this difficult question was Rœmer, a Dane, at the Observatory of Paris, where Picart had called him ; but the observation of the eclipses of Jupiter's satellites, although giving a pretty good value of the velocity of light, offers, notwithstanding, some causes of error, especially the difference of brightness of Jupiter's satellites at their maximum or minimum distance from the earth ; and it requires moreover an exact value of the diameter of the terrestrial orbit.

M. Fizeau (1849) showed that it was not necessary to employ astronomical phenomena, and that it was possible on the surface of the earth to make use of relatively short distances, such as four or five English miles. This rather bold experiment was much spoken of. He operated between Montmartre and Suresnes, near Paris, at a distance of about five English miles and a half.

Léon Foucault, some time after, putting into execution a project of Arago, proposed another method founded on the revolving mirror of Sir Ch. Wheatstone. The value obtained by him, 189,000 miles (298,000 kilometres) was made use of by astronomers, who deduced for the parallax of the sun a number (8″. 86), that is in concordance with the best observations of the transit of Venus.

The number obtained at first by M. Fizeau was higher, but it was given by him, who dwelt upon all the difficulties of such a measurement, with hesitation.

M. Alfred Cornu left aside Foucault's method (viz., that of the revolving mirror) which is liable to serious objections, and employed that of M. Fizeau, although he had tried the two methods of experiment at the Polytechnic School, where many physicists were able to see them.

M. Fizeau's method is free from all objection. A ray of light is sent between the teeth of a cog-wheel, and it is reflected at a great distance, so as to bring it back to the point of departure. If the revolving motion given to the wheel is sufficiently rapid, the ray on its way back meets a tooth, instead of a free passage, and does not pass through ; when the speed is double, the ray meets the following interval, and passes through again, and so forth alternately for increasing rates of revolution.

Thus the returning ray alternately presents a minimum (or an extinction) and a maximum ; but the speed of rotation (in order to be measured) must be kept constant during several seconds in those moments : it is one of the greatest difficulties of the experiment, for that speed is enormous. Let us add the want of precision in the evolution of a maximum or a minimum.

M. Alfred Cornu has obviated all those difficulties :—

1. By giving a speed of rotation not constant but increasing or decreasing according to a regular law, which he registers by means of electricity ; so that he easily knows the speed at every moment.

2. By registering in the same manner the exact time in which the ray of light disappears and appears again : and thus he does not observe the instant of maximum or minimum, but two instants which are equally distant from the moment that is to be determined.

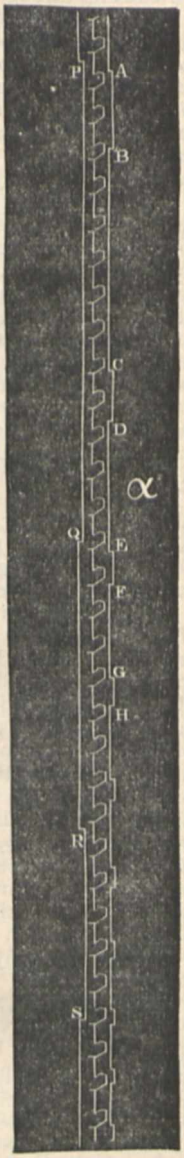
The various results are traced by fine needles that run on a sheet of paper covered with lamp-black, and rolled round a revolving cylinder. If the needles remain motionless, they describe a helix on the black paper, which becomes a straight line when the cylinder is unrolled. But these points are extremities of armatures of electro-magnets, and are moved when the electricity passes through ; and during all the time the current passes, the traced line is above the level of the normal line.

The annexed sketch shows a part of an experiment made in the month of July 1872.

The line *a* on the right hand side represents the increasing speed of the wheel ; each time a cog of the apparatus, in its movement of rotation, touched a certain wire, the electric current had passed through, and deviated the needle for the time the cog was passing (from A to B, from C to D). During the time, from the beginning of one deviation to the other (from A to C, from C to E, from E to G), 50,000 teeth had passed. We clearly see that these intervals are decreasing, because the speed increases.

The median line indicates seconds which are sent by an electric clock.

The third line has been obtained by the observer himself by means of a Morse-key ; he made the electric current pass during the time the light was invisible ; P Q and R S. The sketch thus shows two extinctions and two reappearances of light. It is the beginning of the experiment.



Copy of the Automatic Registrations.

This method, moreover, obviates one of the greatest difficulties in physical experiments, namely the noting down of various numbers, that diverts the observer and complicates operations. Furthermore, there remains not only the remembrance of the experiment made, but an exact, real, and living drawing.

M. A. Cornu has, moreover, changed the rather large and expensive apparatus of M. Froment for another,

* Everyone knows that in one of the last meetings of the British Association Sir William Thomson has estimated them at their real value.

strong and small, for it is not bigger than the fists. He uses the works of a common clock, which do not cost more than a sovereign. He has only replaced the largest wheel of the scapement by another one, lighter and more finely toothed. Special experiments, not mentioned in his present memoir enabled him to choose the most proper diameter for that cog wheel. A strong spring drives the wheel 700 or 800 revolutions in a second.

A drag has been added, in order to check the speed. By a special arrangement, the rotation of the wheel can be reversed, in order to eliminate certain errors that might result from the apparatus itself.

In order to try the improvements of the apparatus, a first series of experiments was made between the Polytechnic School and a tower of the telegraph office, at a distance of about one mile and a half (2 kilometres and a half). The observer could perceive a window of this tower amid a forest of chimneys. The distance was too short: he prudently did not publish the result.

A second series was attempted by him between the Polytechnic School and the Valérien Hill, at a distance of about six miles and a half (10 kilometres 310 metres).

But a transparent atmosphere is seldom now to be obtained in misty Paris If we go up to the garret where the observer stands, we perceive a sea of roofs below; on the right Montmartre Hill, on the left the heights of Meudon, and in the front the Valérien fortress; in one of the rooms in the barracks the mirror and the collimator were established.

The apparatus that sends forth the ray of light (an instrument with a large aperture) was laid on a solid timberwork; in front of the eyepiece is the little machine; on the left side the source of light is established, a ray of which, reflected by a glass, is sent between two teeth of the wheel.

But the Mont Valérien is concealed by mist; the window of the barrack is hardly distinguishable, although the sky is cloudless. Paris is covered with a damp and dusty veil. The sun sets behind the fortress, and suddenly the mist disappears and the air becomes transparent. The ray of light between the teeth of the wheel is to be seen in the telescope as a faint star in the midst of the inverted image of the window; it is a star of the sixth magnitude, the intensity of which increases and becomes of the first magnitude with the transparency of the air. But it is necessary to make the experiments hastily, for that transparency will not last more than one hour.*

An obstacle nearly checked the observer; the image often scintillated, and was agitated in such a manner that it was impossible to pursue the experiment. It was the warm air of a chimney unluckily standing in the way of the ray of light, the kitchen chimney of the Lycée Louis le Grand. M. Cornu waited for the holidays, and the operations were at last worked out.

He thus made more than a thousand experiments, and calculated 690 of them.

In order to determine the distance between the two stations, he compared the measures previously determined, and made himself a triangulation; the average of those numbers gave him the number above cited, about six miles and a half (10 kilometres, 310 metres).

He did not at once take the average of the numbers of his experiments, but he gave a greater value to the numbers obtained under the best circumstances. It appears evident that the results deduced from the fifth disappearance of the light are superior to those deduced from the first one, because of the more exact value of the velocity of the wheel, and that the favourable atmospheric condition rendered the disappearance and reappearances of light more plain.

The average thus obtained gives for the velocity of light 189,300 miles in a second; by dividing the number by the refractive indices of the air (1·0003) we obtain the number 189,200 miles in a second in a vacuum; the possible error in this value is about $\frac{1}{300}$.

M. Fizeau had found about 194,000 miles (312,000 kil.); Foucault 189,000 miles (298,000 kil.). The physicists will wonder at the concordance between M. Cornu's number and that of Foucault, obtained by an entirely different method; and so will the astronomers; for this number of 189,000 miles gives by calculating the value of the parallax of the sun the number 8″.86; and it is exactly the one recently obtained by M. Leverrier as a consequence of three series of observations made on the movement of planets, particularly of Mars and Venus.

If experiments on the velocity of light were made again under good topographic and atmospheric conditions, and between two stations, the distance of which would be known by a geodetic calculation, a value of this velocity would be obtained with an error less than $\frac{1}{1000}$. Astronomical methods do not easily perhaps give such an approach.

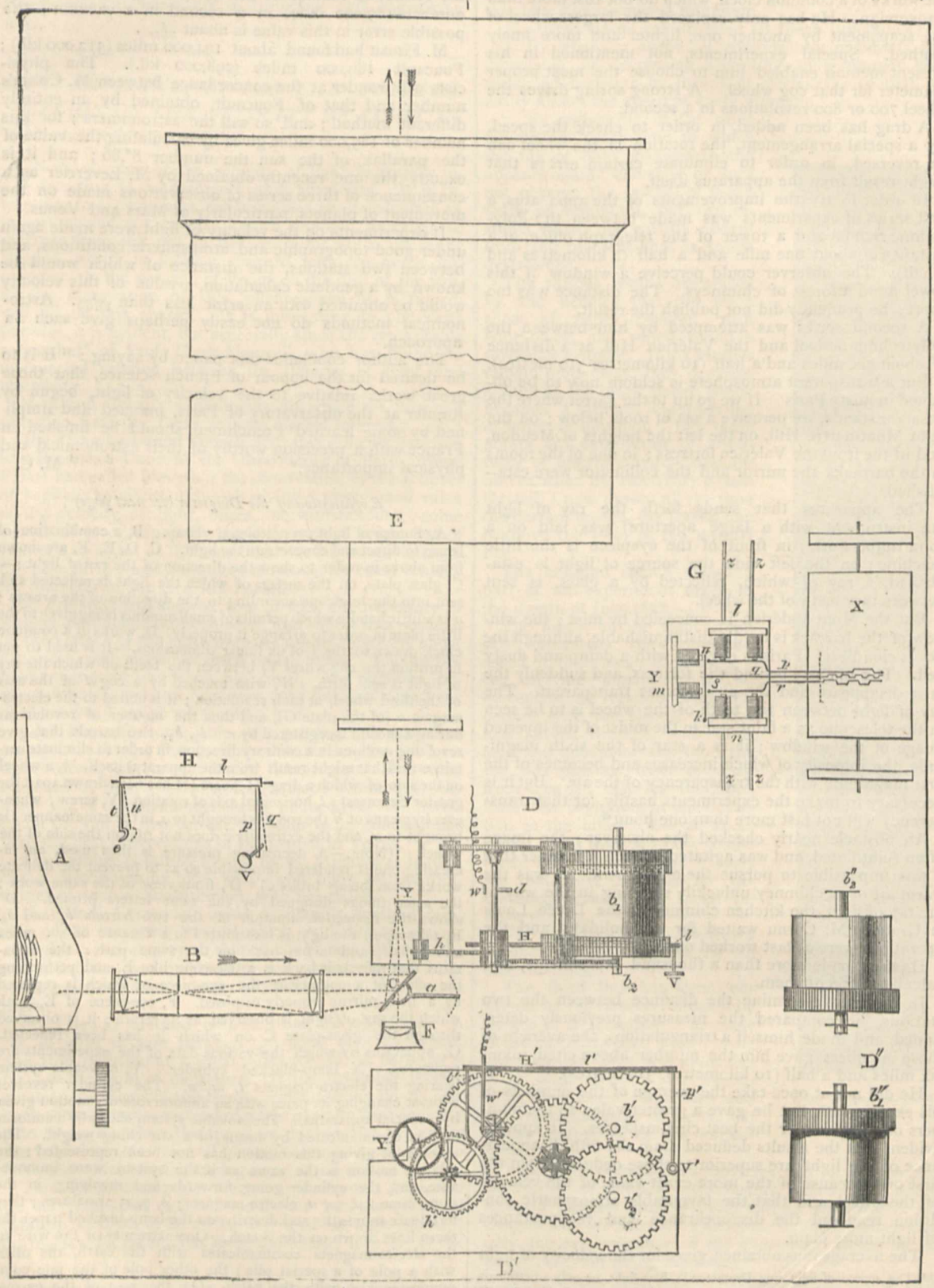
The author concludes his paper by saying: "It is to be desired for the honour of French science, that those great works relative to the velocity of light, begun by Rœmer at the observatory of Paris, pursued and simplified by some learned Frenchmen, should be finished in France with a precision worthy of their astronomical and physical importance." M. C.

Explanation of the Diagram (*see next page*):

A, Source of light; a petroleum lamp. B, a combination of lenses to direct and concentrate the light. C, D, E, F, are shown from above in order to show the direction of the ray of light:—C, glass plate, on the surface of which the light is reflected and sent into the telescope according to the direction of the arrows; *a* is a little handle which permits of small motions being given to the little plate in order to arrange it properly. D, works of a common clock drawn to the $\frac{1}{8}$ of its linear dimensions.—It is used to put in motion the cog wheel Y, between the teeth of which the ray of light is sent forth. *W*, wire touched by a cog *d* of the axis of the third wheel, at each revolution; it is united to the electro-magnet *n* (of the plate G), and thus the number of revolutions during a second is registered by *r*. b_1, b_2, two barrels that give revolving motions in a contrary direction, in order to eliminate certain errors that might result from the apparatus itself. *h*, a wheel on the side of which a drag H bears (H has been drawn apart for greater clearness); *l*, horizontal axis of rotation; V, screw; whenever by means of V the rod *p* is brought to *q*, in the same manner *t* is brought to *u*, and the extremity *e* does not rub on the side of the wheel. (Note.—A decreasing pressure is thus used, an increasing one is rendered impossible so as to prevent the delicate works from being broken.) D′, front view of the same work; the same things designed by the same letters primed. D″ shows the respective situation of the two barrels b_1 and b_2. E, telescope; the light is transmitted to a distance of six miles and a half, and comes back on the same path: the apparatus that reflects it back is a telescope like E, and performing the office of a collimator the eye-piece of which is replaced by a little mirror properly disposed. F, eye-piece of E, with which the ray of light is observed at its return; it is observed through the glass-plate C on which it has been reflected. G, apparatus by which the various data of the experiments are registered. X, lamp-blacked cylinder. Y, moveable system bearing the electro-magnets *l*, *m*, *n*. The cylinder revolves without changing its place with an uniform rotatory motion given by a special apparatus. The movable system slides by a uniform motion communicated by means of a stretching weight. The manner of giving this motion has not been represented; the relative motion is the same as if the system were immoveable, and the cylinder going forwards and revolving in the same time. *l*, *m*, *n*, electro-magnets; *p*, *q*, *r*, armatures; they terminate in needles and describe on the lamp-blacked paper the three lines drawn on the sketch. One extremity of the wire of the electro-magnets communicates with the earth, the other with a pole of a special pile; the other pole of the pile communicates also with the earth. On the way of the current that passes through from each particular pile to the three

* The source of light was Drummond's lime-light, or only a petroleum lamp. It was necessary sometimes, in the finest weathers, to moderate it, in order to have a disappearance of light more favourable to observations than a minimum of intensity.

electro-magnets *i m n*, is placed an interruptor different in each case. It registers: for *n* the law of rotation of the wheel *h* (it gives the speed of the wheel Y for each moment); for *m*, the seconds of time; they are sent by an electrical clock; for *l*, it



Cornu's Apparatus for ascertaining the Velocity of Light.

registers the time of appearances and disappearances of the light, by means of a Morse-key, on which the observer keeps his hand during the experiment. Each experiment with six, and even seven disappearances, lasts about two minutes.

ON THE FERTILISATION OF FLOWERS BY INSECTS AND ON THE RECIPROCAL ADAPTATIONS OF BOTH

DURING the last ten years, since, by his wonderful work on Orchids,* Darwin anew turned the attention of naturalists to the remarkable connection

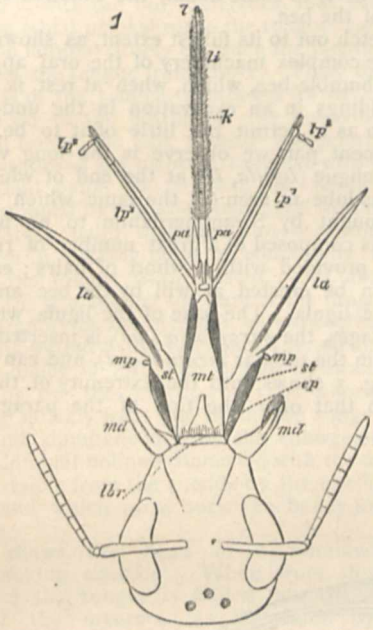


FIG. 1.—Head of a humble-bee (*Bombus muscorum* L. ♀) seen from above, with the oral apparatus stretched out to its fullest extent (5 : 1).

between the structure of flowers and the insects visiting

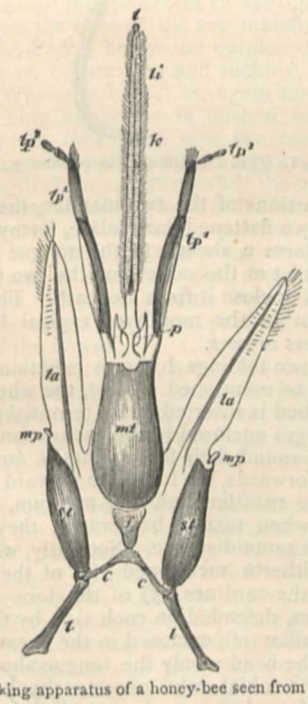


FIG. 2.—Sucking apparatus of a honey-bee seen from beneath (12 : 1)

and fertilising them, many essays on the contrivances of

* "On the various Contrivances by which British and Foreign Orchids are fertilised by Insects, and on the good Effects of Intercrossing." London, 1862.

flowers as apparently affording facilities for intercrossing distinct individuals have been published; but there is no doubt that by far the greatest part of the work on this subject is still to be done. The most conspicuous flowers attracted, of course, in the first place, the attention of inquirers, and much greater pains was taken to show the possibility of their cross-fertilisation by insects than to observe whether self-fertilisation may possibly take place if not visited by insects. Another very obvious deficiency of observations indispensable to be made on the subject in question resulted,—the fertilisation of flowers by insects being studied by botanists but little acquainted with insects. From this cause, for the most part, when flowers were examined as to their intercrossing by insects, no complete observations were made as to the insects themselves which were supposed to visit and fertilise the flowers, and in many cases the agency of insects was over-estimated in consequence of not observing them directly.

Therefore, being myself acquainted with our flowers as well as with a great number of our insects, I thought it would be as agreeable as useful if I observed, as far as it was possible for me, the insects which really visit and fertilise our flowers, their adaptations to gain the honey

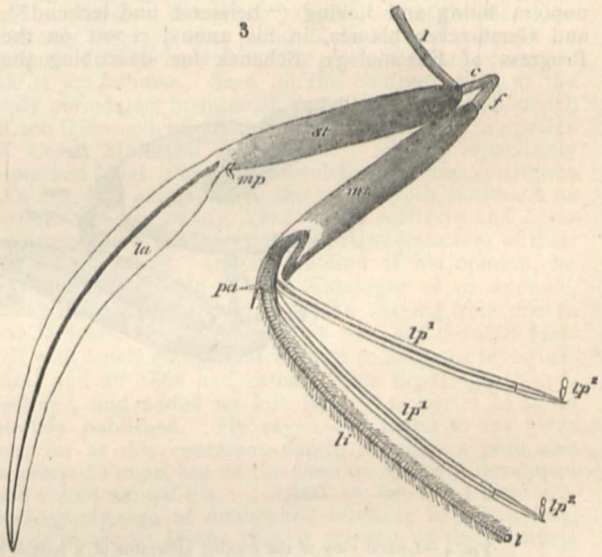


FIG. 3.—Lateral view of the sucking apparatus of a humble-bee (*Bombus silvarum* L.), representing all the four foldings partly commenced, partly imperfectly executed. A piece of the tubular mentum is broken away to show the folding of the base of the tongue (7 : 1).

and the pollen, and on the other hand, the adaptations of our flowers to the insects that visit them; and having during a series of years bestowed all my leisure upon observations of this kind, I put them together in a work which was published some months ago ("Die Befruchtung der Blumen durch Insecten und die gegenseitigen Anpassungen beider." Leipzig, 1873.) Supposing that this book is in the hands of only very few Englishmen, I think it may be of some interest for the readers of NATURE if I make them acquainted with the principal new facts contained in my work, adding some observations made since its publication.

I.—*In what manner the hive- and humble-bees obtain the honey of the flowers*

The first accurate description and drawing of the parts of the mouth of the hive-bee were given by Swammerdamm about two centuries ago, but he did not succeed in finding out the true function of the tongue; he described and drew it as perforated at the end,* and believed that it was a simple sucking pipe. His successors saw that the tongue

* "Joh. Swammerdamm, Bibel der Natur. Aus dem Hollandischen übersetzt." Leipzig, 1752. Taf. xvii.

of the bee is by no means perforated at the end, and that fluids, for that reason, cannot enter through its interior, but must be transported to the opening of the œsophagus by the outside of the tongue. Thus with Swammerdamm's error, that the tongue was perforated at the end, the view that it was a sucking organ was also rejected, and since then, even down to our own day, zoologists seem almost unanimously to have denied in general the sucking power of bees. Milne-Edwards calls the Hymenoptera licking insects ("Insectes lécheurs"), and says that the honey-bees nourish themselves not by sucking, but, as it were, by lapping, nearly in the same manner as a cat does ("Ainsi il n'est pas en pompant que l'Abeille se nourrit, mais pour ainsi dire en lapant à peu près comme le fait un chat"). In like manner Carl Vogt expresses his opinion on the same subject, with only the difference that he chooses for the comparison the dog instead of the cat. The bees make use of their tongue to lap, says Carl Vogt, in a somewhat similar manner as dogs apply their tongue to drink ("Sie gebrauchen ihre Zunge etwa in ähnlicher Weise zum Schlappen, wie die Hunde sich der ihrigen zum Saufen bedienen.") * Also Claus † calls the parts of the mouth of the Hymenoptera biting and licking ("beissend und leckend"), and Gerstaecker blames, in his annual report on the Progress of Entomology, Schenck for describing the tongue of the bees as serving to suck honey, whereas, according to Gerstaecker's opinion, it is only able to lick it. Hence, a good number of our best zoologists absolutely denying the sucking of bees, and our entomological works affording, indeed, very detailed descriptions of the single parts of the mouth of the bees, but not sufficiently accurate ones of the use of them, it may not be fruitless if I explain here, in some detail, the function of the oral apparatus of the bee.

If we stretch out to its fullest extent, as shown in Figs. 1 and 2, the complex machinery of the oral apparatus of a hive- or humble-bee, which, when at rest, is placed by different foldings in an excavation in the under-side of the head, so as to permit but little of it to be seen, the most prominent part we observe is the long vermicular annulated tongue (*ligula*, *li*), at the end of which a little membranous lobe is seen (*l*), the same which was erroneously thought by Swammerdamm to be perforated. The ligula is composed of a great number of rings, each of which is provided with a whorl of hairs; each whorl of hairs can be erected at will by the bee and pressed close to the ligula. The base of the ligula, which bears two appendages, the *paraglossæ* (*pa*), is inserted, together with them, in the tubular *mentum* (*mt*), and can be drawn back, as Fig. 3 shows, into the extremity of the tubular mentum, so that only the tips of the paraglossæ are

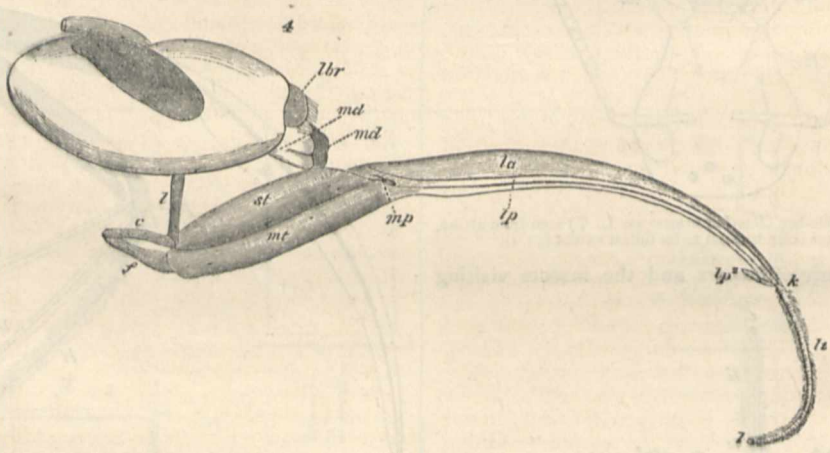


FIG. 4.—Lateral view of the sucking apparatus of a humble-bee (*Bombus hortorum* L. ♀) in a middle sucking position (7 : 1).

visible. On both sides of the ligula we observe, also inserted in the mentum, the two four-jointed *labial palpi* (*lp*), the two first joints of which (*lp*¹), being flattened and very slender, with a central rib, form a sheath to the tongue, enclosing it from beneath, whilst the two minute joints at the tip of the labial palpi (*lp*²) serve as feelers.

When drawn back into the extremity of the tubular mentum, as is shown in Fig. 3, the tongue by no means overtops the labial palpi, but is wholly enclosed by them from beneath, whilst when pulled out as far as possible (as shown in Figs. 1, 2, and 4) it considerably overtops the labial palpi. The base of the mentum is inserted in a horny ridge, called by Kirby (in his "Monographia Apum Angliæ") the *fulcrum* (*f*). The fulcrum is placed at the conjunction of two diverging horny ridges, called by Kirby *cardines* (*c*), which connect the base of the fulcrum with the basal portion or *stipes* (*st*) of the maxillæ. The cardines can be turned round their food-points; when turned forwards, they also push forwards the fulcrum and the mentum, so as to overtop considerably the basal portion of the maxillæ (as shown Figs. 1, 2); when turned backwards, they also draw backwards the parts inserted in them, and the mentum is now enclosed by the basal portion of the maxillæ (as shown in Fig. 4). In this position the terminal portions of the two maxillæ, the *laminæ* (*la*) appearing as two flattened, lanceolate, horny pieces with a central rib, form a sheath to the tongue enclosing it from above, whilst at the same time the two first joints of the labial palpi enclose it from beneath. The *maxillary palpi* (*mp*) exist in the mouth of typical bees only as atrophied useless organs.

Besides the two foldings hitherto explained, two other foldings are to be mentioned. First, the whole apparatus hitherto described is inserted in the terminal points of two long, horny ridges enclosed in the excavation of the head and moveable round their food-points (*l*, *lora*, of Kirby). When turned forwards, the lora push forward to twice their own length the maxillæ and the mentum, with all their appendages; when turned backwards, they draw them backwards the same distance. Secondly, when all three withdrawals hitherto mentioned—(1) of the base of the tongue, (2) of the cardines, (3) of the lora—are effected, the mentum lies, defended on each side by the basal portion of the maxillæ (*st*), enclosed in the excavation of the under-side of the head; only the tongue sheathed by the laminæ and the labial palpi overtop the head, and prevent the jaws from being used; but all these overtopping parts are bent downwards and backward very easily; and now the jaws or *mandibulæ* (*md*) are not prevented from being employed.

* C. Vogt, Zool. Briefe i. p. 678.
† Grundzüge der Zoologie, 1866, p. 323.

The separate parts of the mouth of the bee and their power of moving having been considered, it remains to examine what use the bee makes of them in its different actions.

1. In order to empty the deepest honey tubes accessible to it, the bee stretches out all the moveable parts of its sucking apparatus (lora, cardines, laminæ, maxillar palpi, and tongue) in the same manner as is shown in Figs. 1 and 2, with the only difference that the two first joints of the labial palpi sheathe the tongue from beneath, and that the laminæ closely embrace the mentum and the basal part of the tongue from above. Then the terminal hairy whorls of the tongue, protruded as far as possible and advanced to the bottom of the honey-tube, being wetted with honey, the bee, turning backwards the cardines (*c*), withdraws the mentum, together with the tongue and the labial palpi, so far that the laminæ are no longer overtopped by the labial palpi, and that the laminæ and the labial palpi together, closely embracing the tongue, form a sucking-pipe, of which only the part *k-l* (Fig. 4) of the tongue is prominent. But almost at the same time the bee, folding the base of the tongue into the tubular extremity of the mentum, withdraws the terminal hairy whorls wetted with honey into the sucking-pipe, in which the honey is forthwith driven downwards to the oral opening by the erection of the whorls of hairs progressing quickly from the tip of the tongue towards its base, and simultaneously by the enlargement of the interior abdominal hollows connected with the œsophagus, which are visible from the outside by the swelling of the abdomen, and which must suck the honey towards the œsophagus.

Fig. 4 shows the head of a humble-bee in a medium sucking position. When from this position the base of the tongue is folded into the hollow extremity of the mentum (as illustrated by Fig. 3), the part *k-l* of the tongue wetted with honey is withdrawn into the sucking-pipe. Now when the lora (*l* in Fig. 4, directed downwards) are turned backwards round their food-points, the base of the sucking pipe (near *mp* Fig. 4) is withdrawn to the opening of the mouth (between the base of the two mandibulæ, *md* and the labrum, *lbr*, Fig. 4, below the epipharynx *ep*, Fig. 1), and the honey is, by pressing and sucking, driven to the œsophagus. When the lora (*l*) are again turned forwards, the whole sucking apparatus is pushed forward double the length of the lora; and now the cardines turning forward, the mentum with its appendages again advances double the length of the cardines, while the maxillæ remain at the same place, and the laminæ from this cause embrace only the mentum and the basal portion of the tongue; when at last the base of the tongue infolded in the tubular mentum is stretched out, the tongue is again protruded to its fullest extent, and the terminal whorls of hairs are again wetted with honey at the bottom of the honey-tube of the flower.

In a flower rich in honey, a humble bee may be observed executing four, five, and sometimes more, even eight or ten separate acts of suction, probably accompanied by as many protrusions of the tip of the tongue into the honey, and withdrawals of it and of the whole sucking-pipe.

I am fully convinced that the movements of the oral apparatus of the bees are as described; for by intoxicating honey- and humble-bees by chloroform, and immersing the tip of their tongue into a solution of sugar, I sometimes succeeded in seeing the movements described performed sufficiently slowly to discern each separate act very well. What occurred within the sheath of the tongue formed by the laminæ and the maxillary palpi, was of course not visible, but bending them aside after wetting the tip of the tongue with the solution of sugar, I sometimes saw the erection of the whorls of hairs progressing from the tip towards the base of the tongue.

Hence undoubtedly the statement of zoologists, who, absolutely denying the sucking power of bees, assert that they lick or lap the honey in a manner similar to a dog or a cat when drinking, must be essentially modified. The terminal whorls of hairs are filled with honey by adhesion; this honey withdrawn into the sheath of the tongue is driven towards the œsophagus by a double cause, first by the pressure of the erect whorls of hairs, and secondly by suction. HERMANN MÜLLER

(*To be continued*)

*ON SOME REMARKABLE FORMS OF ANIMAL LIFE FROM GREAT DEEPS OFF THE NORWEGIAN COAST**

THE name of George Ossian Sars is honourably connected with a very interesting chapter in the history of deep-sea research. As early as 1850, his illustrious father, Dr. Michael Sars, had challenged Edward Forbes's conclusions respecting the bathymetrical terminus of animal life. He remarked,† that at least in the Norwegian Seas, it appeared to extend much beyond the limit which the English naturalist had fixed for it. Forbes had not dredged below 230 fathoms, and at this depth he had only obtained two living Mollusca and a couple of Serpulæ; hence he was led to place the zero of animal life at 300 fathoms. Sars, on the contrary, even at the early period just mentioned, had obtained from a depth of 300 fathoms a number of animals, including a species of Coral, Molluscs, Polyzoa, &c.; and he sagaciously remarked that there was evidence of the existence of a *vigorous* animal life at this great depth, inasmuch as some of the species (*e.g. Terabratula septigera* and *Lima excavata*) were the largest known representatives of their respective genera. In confirmation of his opinion, he was able to offer, in 1864, a Catalogue of 92 animals, which had been obtained in depths varying from 200 to 300 fathoms. More recently his son has devoted himself with much energy and success to deep-sea investigation, and in 1868 had extended his dredgings to 450 fathoms, and added no less than 335 species to those already published. He says:—"I found to my great surprise at this enormous depth, not . . . a poor and oppressed Fauna, but on the contrary a richly developed and varied animal life. . . . And so far was I from observing any sign of diminished intensity in this animal life at increased depths that it seemed, on the contrary, as if there was just beginning to appear a rich and in many respects peculiar deep-sea fauna, of which only a very incomplete notion had previously existed." Amongst the new forms thus obtained was the famous *Rhizocrinus Lofotensis*, descended from Oolitic ancestry, which furnished, according to Dr. Carpenter, "a principal 'motive'" of the *Lightning* expedition. It is interesting to learn that these productive dredgings at the great depth of 200-450 fathoms were accomplished in an ordinary fishing-boat with a crew of three men.

In the important paper which forms the subject of the present notice, Mr. G. O. Sars has given us an account of some of the results of his dredgings in the "great deeps" off the Coast of Norway, founded partly on the posthumous manuscripts of the late Prof. Sars, and partly on his own investigations. Various new species of Mollusca, Annelids, Corals, and Sponges, all of them dwellers in depths varying from 100 to about 500 fathoms, are described, and illustrated by excellent figures. But that which gives a peculiar and distinctive interest to the work is the elaborate memoir on a remarkable Polyzoon, taken in the year 1866, from a depth of 120 fathoms, at Skraaven, in Lofoten. This unique animal is not only

* Partly from posthumous manuscripts of the late Prof. Dr. Michael Sars. By George Ossian Sars.

† "Beretningom en i Sommerenn, 1849, foretagen Zoologisk Reise i Lofoten og Finmarken," p. 13.

generically distinct from all the forms that had been recognised at the time of its discovery, but must be referred to a new Order or Sub-class: it is chiefly interesting, however, to the biologist from the light which it throws on the history and affinities of the tribe to which it belongs. Its occurrence was first recorded in 1868 by the elder Sars, who gave it the name of *Halilophus mirabilis*, but did not at that time enter upon the details of its structure. In 1869 Allman described a new Polyzoon, under the name of *Rhabdopleura Normanni*, which had been dredged up from deep water in Shetland, and which presented some remarkable peculiarities. Its polypides (according to Allman) were of the Hippocrepian type, having the tentacles disposed in the form of a horse-shoe, instead of circularly, an arrangement which had only been noticed so far amongst the fresh-water division of the Polyzoa. Another anomalous character was the presence of a rigid, chitinous rod, extending throughout the creeping portions of the polyzoarium, to which the polypides were attached at intervals by means of a long flexible cord. It now appears that the Shetland Polyzoon belongs to the same genus as the Lofoten form just mentioned. Allman, however, having only access to specimens preserved in spirit, was unable to master all the details of the structure or to apprehend fully the significance of the organism as a whole. For a complete knowledge of *Rhabdopleura* we are indebted to the careful observations of the younger Sars, who studied the living animal; while to his father we owe a most interesting interpretation of the facts which the son had established.

Without entering into minutiæ, I shall endeavour to describe briefly the characteristics which mark out the *Rhabdopleura* as unique, and invest it with so high an interest, not only for the student of the Polyzoa, but also for the philosophical biologist. In the first place, it may be stated broadly that we find in this form the Polyzoan type in a rudimentary and half-developed condition. It clearly represents a very early stage in its evolution, if evolution be the method of Nature. The points which separate it most strikingly from its congeners are not the equivalent of the ordinary differences that occur amongst the members of the same class; they might rather be regarded as surviving features of another and very different type, from which it has diverged, and are strictly transitional in character. *Rhabdopleura* is a Polyzoon, and yet not *all* Polyzoon. A large portion of its structure, while clearly taking the Polyzoan direction, differs widely from that of all known Polyzoa. Some of the features which we should regard as most characteristic of this class are altogether wanting. And organs in which the Polyzoan type is most distinctly traceable, appear in a simpler and more rudimentary condition than in any other known form. In a word, two types of structure seem to blend in this remarkable animal, one, as it were, fading away, and the other dawning.

The polyzoarium in *Rhabdopleura* bears a striking reremblance to that of a Hydroid, and might belong to a *Coryne* or *Eudendrium*. It consists of a number of erect, chitinous tubes, distinctly annulated, which are united by a creeping, tubular stem. Each of the erect tubes (zoœcia) contains a polypide, and every polypide is attached by a contractile cord to a dark-coloured, cylindrical rod, which pervades the creeping portion of the polyzoary. The polypide differs from those of the normal Polyzoa in the following important particulars:—

1. It is without any sort of attachment to its cell, in which it lies quite free. In all other known Polyzoa a membrane (the endocyst) lines the cavity of the cell, and envelopes the polypide, to which it is attached above, at the base of the tentacular crown. When the animal retreats into its cell, it draws in with it the anterior portion of this membrane, which securely closes the aperture. Between the endocyst and the body of the polypide is a space (the perigastric cavity), in which the nutritive fluid is confined. But in *Rhabdopleura* the endocyst is altogether absent, or appears in a perfectly elementary condition, as a "thin, glassy skin," immediately surrounding the digestive apparatus. There is nothing to close the orifice of the cell, and the surrounding water passes freely into its interior. There is no perigastric cavity or fluid. The polypide is as free and unattached as a Hydroid in its calycle; and its only connection with the colony is through the contractile cord already referred to.

2. The digestive system is of the Polyzoan type, but of much lower grade than is found elsewhere. There is little specialisation of parts; the stomach and intestine consist of a simple tube, wider towards its upper extremity and narrowing off rapidly towards the posterior end, which is bent abruptly upon itself. The intestine is not separated from the true stomach by any valve, but is an immediate continuation of it, and passes off from its lower extremity in a straight line to the anal orifice.

In the normal Polyzoa, on the contrary, the stomach is divided into two well-defined regions; and the intestine, which is marked off by a distinct valve, takes the origin between the upper portion and the large, sub-globular sac, in which it terminates below. We have in *Rhabdopleura* the bent tube and the two orifices (oral and anal), but beyond this, perfect simplicity of structure.

3. The tentacular apparatus exhibits some remarkable features. It differs essentially from that of the marine, and also from that of the fresh-water Polyzoa, though it most nearly approaches the latter. It consists of two symmetrical lobes or arms, which extend out dorsally from the anterior part of the body, diverging to each side; and each of which bears a double row of ciliated tentacles. These lobes are very flexible, and exhibit great mobility, bending slowly in various directions; and in this respect they contrast strikingly with the unchanging lophophore of the fresh-water Polyzoa. The single tentacular crown, which belongs to all the other known members of the class has here disappeared; and instead of the circular verticil of the marine, and the crescentic but continuous series of the fresh-water species, we have here two series, borne on distinct flexible and movable appendages.

4. In *Rhabdopleura*, the complicated muscular system concerned in the protrusion and retraction of the polypide, which is so characteristic of the Polyzoa, and on which their lively and rapid movements depend, is suppressed along with the endocyst. *Retraction* is effected solely by means of the cord that passes from the body to the rod pervading the creeping stem. It is a very slow and sluggish process, the polypide exhibiting none of the sensitiveness and vivacity of its kindred. Under extreme provocation it retires very deliberately; an ordinary Polyzoon disappears with the speed of light, on the slightest alarm. This sluggishness, as our author remarks, is accounted for "by the want of special retractor-muscles, and by the slightly developed contractile elements, not distinguishable as evident muscular fibres, in the contractile cord."

Still more remarkable is the mode in which the protrusion of the polypide is effected. In the absence of the usual muscular appliances, it is difficult, at first sight, to imagine how the creature can raise itself from the lower extremity to the aperture of its tubular dwelling. It appears, however, that a special and most singular organ exists for the purpose, and that here also the *Rhabdopleura* departs altogether from the customs of its race. This organ consists of a large and prominent shield or disc, which projects from the anterior end of the body between the oral and anal orifices, and is thickly covered with cilia. It evidently corresponds with an anomalous structure (known as the *epistome*), which occurs only amongst the freshwater Polyzoa, and the function of

which has not hitherto been determined. Sars has observed that this ciliated disc is closely appressed to the wall of the cell, during the process of protrusion, and is in fact a kind of foot or creeping-organ, by means of which the polypide laboriously draws itself up towards the aperture of its tube. The Polyzoön, which, in its normal condition, is equipped with a powerful muscular apparatus, and remarkable for its vivacious habits, here literally crawls out of its cell.

5. It only remains to notice the dark-coloured cord, which runs throughout the creeping stem, and is a very marked feature of this curious form. It is described as a cylindrical tube, with firm, horny walls, inclosing a soft, transparent, cellular substance, from which branches are given off at intervals, and enter into the contractile cord of each polypide. This "axial cord" may no doubt be compared with the so-called nerve-trunk pervading the stem of other marine Polyzoa—the principal element of the supposed colonial nervous-system. Our author rightly regards the soft substance extending through the cord, as a sort of incompletely defined nervous trunk connecting all the individuals of the colony.

Of the development of *Rhabdopleura* little can be said at present. Both Sars and Allman, indeed, have recorded observations made on the formation of buds; but they disagree in their interpretation of several important points; and we must wait for further information before we can master this portion of the history.

From the foregoing account it is evident, as stated at first, that in *Rhabdopleura* we have the polyzoan structure in a very rudimentary condition, and half disguised by features that are alien to it as it now exists; some of its principal elements are fully established, though in a simpler form than we find them elsewhere; some are altogether wanting; while one important class of functions (the various movements of the polypide) is provided for by means which have no parallel whatever amongst other members of the tribe, and in part by an organ, which survives, reduced in size and with a different office, in one section only, as the so-called *epistome* of the fresh-water species.

Allman's examination of the Shetland *Rhabdopleura*, as preserved in spirits, led him to regard the Polyzoa as connected with the Mollusca, through the Lamellibranchiata, rather than the Brachiopods. Prof. Sars, relying on his son's investigations, takes a very different view of their affinities. He regards the *Rhabdopleura* as an organism "which stands as it were in the middle between the Hydrozoa and the Polyzoa," and forms a transition from one to the other. It is undoubtedly, he says, "like many other animals which at present inhabit the greater depths of the sea, . . . *a very old form*, which in its organisation has still retained several features from the time when the animal type that we call Polyzoa first developed itself from a lower type." He considers it to prove that the Polyzoa "are most closely related to the type of the *Cœlenterates*, and especially to the class *Hydrozoa*," from which they are probably derived.

It is my present object merely to report results, and not to offer any criticism upon them; but it may safely be said that the paper, a portion of which I have summarised, is one of the most interesting and important contributions to biological literature, that have lately appeared.

It is right to add that the author, considering "one of the great universal languages" preferable to his mother-tongue, as the vehicle of scientific research; and as a graceful acknowledgment of the services rendered by our countrymen in recent times to zoological science, has courageously, and to the relief of many of his readers, written his memoir in English.

THOMAS HINCKS

NOTES

AT the Midsummer Commencements, held last week in Trinity College, Dublin, the honorary degree of LL.D. was conferred by the University of Dublin on Dr. Andrews, of Belfast, and Professor Wright, of Cambridge.

DR. JAMES MURIE, Professor of Anatomy in the Edinburgh Veterinary College, has been elected to the newly-founded lectureship of Animal Physiology in the Edinburgh School of Arts.

ARCHÆOLOGISTS will be interested, and no doubt pleased, to hear, that Sir John Lubbock has just bought Silbury Hill, the grandest tumulus in Great Britain, if not in Europe.

WE have a number of earthquakes to chronicle this week; that in India, it will be noticed, preceded only by a day those of Italy. The earthquakes in Chili, on the 15th May, were of a very serious character. They affected Valparaiso, Santiago, Quillota, La Ligua, Canquenes, and Salvados. At Chillan, Concepcion, and Talchuano, in the south, so far as we can understand, it was slight. At Valparaiso, it commenced at 12.32 P.M., and lasted forty-two seconds, with a vertical motion, so that the ground danced under foot. Two churches and many buildings were damaged. Gas branches were wrenched from the ceilings, and books thrown from the shelves. In Salvados, in Central America, the earthquakes had ceased in May. At 2 P.M. on the 28th June, Asseerghur Fort was visited by an earthquake which lasted for about three or four seconds, direction from north-west to south-east. On the morning of June 29, about five o'clock, an earthquake visited several parts of Italy. At Verona, Treviso, and Venice, though the shocks were severe, little damage was done; but at Feletto, north of Piane, and near Conegliano, the church fell in and thirty-eight people are reported to have been killed. At Belluno four persons were killed and several wounded. At Pieve del Alpago several persons were injured. Two persons were killed at Torres, four at Curago, eleven at Puos, two at Visione, and one at Cavessago.

WE regret to hear that difficulties have arisen in the management of the Brighton Aquarium, which are likely to lead to the resignation of Mr. Saville Kent, who lately vacated a post in the British Museum for that of Curator and Resident Naturalist to the Aquarium. Of the nature of the dispute we are not informed, but it seems unfortunate if some means may not still be found by which an amicable arrangement may be arrived at between Mr. Kent and his colleagues by which his services may be retained to the institution.

THE female Octopus at the Brighton Aquarium still continues to guard her clusters of ova with the greatest vigilance, refreshing them at short intervals by turning upon them a powerful stream by means of her tubular funnel; no increase to the number deposited having taken place since last week, the usual complement produced may be presumed to have been excluded. The truncate "*Hectocotylus*" arm of the male, in this instance the third on the left side, is fast recovering its normal condition, a new slender filamentous process has sprung from the ruptured extremity, resembling, in detail, the reproduced arm of an *Ophiocoma* or Brittle Starfish. Mr. Saville Kent is of the opinion that the *Octopus tuberculatus* of D'Orbigny will prove on closer investigation to be the mate of *O. vulgaris*; the difference in appearance between individuals of the same species but the opposite sex being most marked when once recognised; the general surface of the integument in the female is comparatively smooth, while numerous rugosities and elevated papillæ adorn that of the male, more particularly in the neighbourhood of the head.

IT has been announced by cable from America that a new planet (No. 132) was discovered by Prof. Henry on June 13.

THE just published lecture, delivered in April last by Prof. Flower at the Royal Institution, on "Palæontological Evidence of Gradual Modification of Animal Forms," is accompanied by an excellent and very ingeniously-constructed diagram of the affinities of the different members of the class Ungulata, including all the fossil as well as the recent forms. Each genus is represented by a circle, the comparative size of which indicates the number of species included in it. The existing genera are left white, and those which have fossil representatives are surrounded by rings, which are so shaded as to make it easy by referring to an accompanying table, to find in which stratum the form first appears; the extinct genera appear as shaded circles. Consequently the Peccary and Babirussa are represented by unsurrounded white circles, while *Coryphodon* and *Lophiodon* are all shaded; *Antilope* is a large white circle surrounded by a late Miocene ring; *Aceraterium* has a central late Miocene circle and an early Miocene ring, indicating its range in time. Such a method applied to all the classes of animals, if equally thorough and accurate, would be an invaluable acquisition to Zoological Science.

THE following telegram dated Alexandria, June 30, 1873, 1 P.M., has been received at the Foreign Office, from the Hon. H. C. Vivian, Her Majesty's Acting Agent and Consul-General in Egypt:—"Telegram just received from Sir Samuel Baker, dated Khartoum, yesterday, reports his safe arrival there in good health, with all the other Europeans. The country as far as Equator annexed to Egyptian dominion. All rebellions, intrigues, and slave trade completely put down. Country orderly. Government perfectly organised, and road open as far as Zanzibar. El Zaraf navigable. Victory on June 8 with only 105 men, over army of Onioso. This mission completely successful."

M. DE LESSEPS is a candidate for the place in the French Academy vacant by the death of the late M. de Verneuil.

THE name *Drepanephorus* having been recently used by Sir Philip Egerton for a species of fossil fishes, Mr. Sclater proposes to change the generic name which he gave to the Paradise Bird discovered by the Italian naturalist D'Albertis, to *Drepanornis*. We shall shortly have the opportunity of offering to our readers a description of this bird from the hand of Mr. Sclater, together with a drawing illustrating its peculiarities.

SOME years ago, in connection with the Berlin Geographical Society, an Association, joined in by all the chief European powers except France and England, was formed for the purpose of determining a standard European metre, to be based on the exact determination of the meridian between Christiana and Palermo. The work has developed itself into the ascertainment of the dimensions of the globe, and the Association has been now joined by France, England thus being the only power which holds itself aloof from taking part in the highly valuable work. The result will be the union of the triangulation of the whole of Europe.

AT the recent D.Sc. examination of the University of London Mr. Richard Wormell, M.A., passed in Electricity, and Mr. Augustus C. Maybury in Geology.

ATTENTION has been lately given by the American Ethnologists to the fossil skeleton of Guadeloupe, and they support the suggestion that it belongs to the Carib race. This admission still allows of considerable antiquity.

DOCTOR Don Ricardo de la Parra, died at Envijado, in Antiouquia, U.S. of Colombia, on May 9. He was about to publish a work on Elephantiasis, which had been a special study.

THE volcano of Puraca, in the western state of Cauca, in the U.S. of Colombia, has been in convulsion for three years, and is now causing great alarm. It gives rise to frequent storms.

THE forthcoming number of Petermann's *Mittheilungen* will contain a very interesting article by Carl Dambeck on the Geographical Distribution of Sea-fish, in which the author divides the ocean into eleven regions, and gives lists of the principal fishes to be found in each region.

MR. LAMONT'S fine yacht *Diana*, which was chartered by Mr. Leigh Smith, and which recently left Dundee on a Polar Expedition, is reported by the whaler *Eclipse*, which arrived at Peterhead on Sunday. The letters which have been received announce that the party were on June 1 last in latitude 77°40, being among the floating ice, which reached northward to Spitzbergen. At that time all connected with the expedition were well, and notwithstanding that very severe weather had prevailed since leaving Scotland, no accident had happened. The arrangements had been slightly interfered with in consequence of the tempestuous weather, and the island of Jan Mayen had not been reached. The *Diana* was to proceed along the outside of the ice towards the north-west corner of Spitzbergen, where she will meet a storeship which preceded her.

MUCH gratification is felt in Peru at the discovery of a new coal deposit near Pisco, which is said to be one of the best and richest on the Pacific coast, and the locomotives on the Ica and and Pisco Railway are using it with great success. The mine is situated close to the sea, and near a perfectly safe harbour, and the coal is said to be finer in quality than any in Chili, and of great extent, and, if so, must prove to be of very great economical value.

A GENERAL meeting of the members of the Aëronautical Society of Great Britain was held on Monday evening in the theatre of the Society of Arts, under the presidency of Mr. Glaisher. A number of models prepared for the occasion were exhibited by persons actively interested in the advancement of the great scheme of aërial navigation. The chairman, in his opening remarks, expressed his satisfaction at having to record several marks of progress made during the past year in the science in which they were all so interested. These marks were certainly slight, but they were nevertheless decided steps in the right direction. Very many experiments of the highest importance to the furtherance of aërial navigation had been carried out in many cases with what might be considered tolerably satisfactory results. The Society had, he added, expended a sum of 1,200*l.* in the construction of a balloon the motive power of which was to be brought about by a small steam engine, now in preparation, of a merely nominal weight, and giving, for its size, an exceedingly high pressure of steam. A model of this was exhibited in operation by Messrs. Thomas Moy and R. E. Shill. Papers were read during the evening by several gentlemen, including Mr. Bennett and Mr. D. S. Brown.

THE French "Society of the Friends of Science," an association for succouring the widows and orphans of men of science, has distributed during the last three years, in spite of the misfortunes of the country, 88,439 fr.

THE scarcity of rags has, it is well known, recently induced paper manufacturers to look out for new textures as substitutes for those formerly used. In France hop-stalks have been successfully utilised for this purpose, and in this country an attempt has been made to utilise jute for newspapers. A copy of the *Warrington Guardian*, printed on jute paper, has been sent us, and it appears to us quite satisfactory.

A SOCIETY for the Promotion of Scientific Industry has recently been established in Manchester. Its object is the increase of the

technical knowledge and skill of those engaged in the various industries, the improvement and advancement of manufactures and the industrial arts and sciences, and the general progress, extension, and well-being of industry and trade. The society is sending out artisans to Vienna to profit by the Exhibition now being held there, as was done by the Society of Arts on the occasion of the Paris Exhibition, and it proposes to hold in the autumn an exhibition of designs in textile fabrics and of fuel economisers.

A PAPER entitled "Contributions to a Knowledge of North American Moths," by Aug. R. Grote, was read on June 6 before the Buffalo (U.S.) Society of Natural Sciences, in which it was stated that three new genera (Litognatha, Meghypena, Phæcasiophora), and nineteen hitherto undescribed species (Acronycta, 4; Agrotis, 1; Cloantha, 2; Litognatha, 2; Meghypena, 2; Botis, 1; Phæcasiophora, 1; Eurycreon, 1; Peuthina, 3; Grapholitha, 1; Oeta, 1) occur in the North American insect fauna. At the same time a paper entitled "Descriptions of New Species of Fungi," by Chas. H. Peck, was read, in which it was stated that 142 hitherto undescribed species of fungi (Hymenomycetis, 96; Gasteromycetes, 11; Coniomycetes, 18; Hyphomycetes, 6; Ascomycetes, 11) occur in the flora of the United States.

IN connection with the Social Science Congress, to be held at Norwich, from the 1st to the 8th of October next, there will be an Exhibition of Educational, Sanitary, and Domestic Appliances, based on the experiment which proved so successful at Leeds in 1871. The object of the exhibition is to bring under the notice of the public generally, and particularly those who are interested in social, sanitary, and educational questions, the latest scientific appliances for improving the public health and promoting education. The exhibition will be open to exhibitors from all parts, and the management will be under the superintendence of a committee.

A VALUABLE paper in the May number of the *Canadian Journal* is a contribution to a Fauna Canadensis, by Prof. H. Alleyne Nicholson, being an account of the animals dredged in Lake Ontario in 1872. The dredgings were all carried on within a radius of ten miles from Toronto, and Prof. Nicholson describes the nature of the bottom, and forty-three species of animals taken up in the dredge, belonging to Annelida, Crustacea, Arachnida, Insecta, Mollusca, and Vertebrata. The paper possesses several points of interest.

WE have received Nos. 3 and 4 of the *School Laboratory of Physical Science*, a small quarterly journal edited by Prof. Hinrichs, Director of the Laboratory of the Iowa State University. The longest paper is entitled "Science in Schools," and gives a comparative view of the place occupied by Physical Science in the Classical Courses of the American Colleges, the palm in this respect being given to Harvard. Prof. Hinrichs thinks, notwithstanding the comparatively great importance attached to physical science in America, the place allotted to it in her universities is still far from satisfactory. Under the head of "Laboratory Notes," Prof. Hinrichs gives a method of determining the Velocity of Sound in the Atmosphere.

MR. T. LOGIN, C.E., Superintending Engineer, 2nd Circle, Punjab, has sent us a small pamphlet, entitled "Practical Notes on the Egyptian Mode of Cotton Cultivation," containing a series of well-arranged directions on this subject, founded on Mr. Login's own experiments, which appear to have been unusually successful.

WE have received from Messrs. Asher and Co., Nos. 378, 379, 380, of Kirchoff and Wigand's (of Leipzig) "Antiquarisches Bücherlager," containing long lists of very valuable works in Mathematical, Physical, and Mechanical Sciences.

ACCORDING to the *American Artisan*, the new educational system in Japan embraces the organisation of 8 colleges, 256 high schools, and over 50,000 public schools, at which the attendance is to be compulsory for all children above six years of age.

A SUPPLEMENT to the Fifth Annual Report of the United States Geological Survey of 1871, contains an enumeration with descriptions by Mr. Leo Lesquereux, of some tertiary fossil plants, from specimens procured in the explorations of Dr. F. V. Hayden, in 1870. Another small pamphlet connected with the same survey contains carefully compiled and very valuable lists of elevations and distances in that portion of the United States west of the Mississippi, collated and arranged by Prof. C. Thomas.

THE "Report of the Entomological Society of Ontario," for 1872, contains papers on Insects injurious to the Grape, the Strawberry, the Hop, the Maple, the Peach, the Potato, on some innoxious insects, and on beneficial insects.

WE have received the "Report of Progress" of the Geological Survey of Canada for 1871-72, containing detailed and well-compiled accounts from the various parties who are carrying on the work.

WE learn that there has been erected a small observatory on the Columbia (U.S.) College campus for educational and, we hope, also for scientific purposes. The observatory is furnished with an equatorial, accompanied by a seven-prism spectroscope, by Clark, and a position micrometer, besides an altazimuth and a zenith telescope.

WE take the following from a paragraph entitled "Prof. Agassiz on Natural History in Schools," in the *University Monthly* (New York):—"I am satisfied that there are branches of knowledge which are better taught without books than with them; and there are some cases so obvious, that I wonder why it is that teachers always resort to books when they would teach some new branch in their schools. When we would study natural history, instead of books let us take specimens—stones, minerals, crystals. When we would study plants, let us go to the plants themselves, and not to books describing them. When we would study animals, let us observe animals."

ADDITIONS to the Brighton Aquarium during the past week; 2 Bass (*Labrax lupus*); 14 Black Bream (*Cantharus lineatus*); 1 Ballan Wrasse (*Labrus maculatus*); 1 three-bearded Rockling (*Motella vulgaris*); 6 Sea Crayfish (*Palinurus vulgaris*); 1 Toad Crab (*Dromia vulgaris*), 1 Octopus (*Octopus vulgaris*), presented by Mr. C. J. Small, of Hastings; 1 Sea-hare (*Aplysia punctata*); Oysters (*Ostrea edulis*); Mussels (*Mytilus edulis*); Zoophytes (*Tealia crassicornis*, *Alcyonium digitatum*).

THE additions to the Zoological Society's Gardens, during the last week, include an Erxleben's Monkey (*Cercopithecus erxlebeni*); a Moustache Monkey (*C. cephus*); a banded Ichneumon (*Herpestes fasciatus*) and two bronze Spotted Doves (*Chalcopelia chalcospilos*), from West Africa, presented by Mr. J. J. Monteiro; a greater Sulphur Crested Cockatoo (*Cacatua galerita*), from Australia, presented by Mrs. Thomas; a Hyacinth Porphyrio (*Porphyrio hyacinthinus*), from West Africa, presented by Lady Cust; a grey Ichneumon (*Herpestes griseus*), from India, presented by Mr. W. Walker; an Argus Pheasant (*Argus giganteus*), from Malacca; two Rufous-tailed Pheasants (*Ceriornis erythrophthalmus*), from India; a white-handed Gibbon (*Hylobates lar*), from the Malay Peninsula; a Puma (*Felis concolor*), from Bogota; two Lanner Falcons (*Falco lanarius*), from E. Europe, deposited.

SCIENTIFIC SERIALS

Der Naturforscher, May.—This serial, containing little that is original, furnishes a weekly supply of well-selected and adapted matter from various sources. In the present number attention may be called to an academical address delivered by Herr Streng at Giessen, on the "circle-course" of substances in nature, treating chiefly of geological phenomena; to an account of Herr Janettaz's recent careful researches on the conduction of heat in crystals (some 44 mineral species having been examined); to a theoretical investigation by Herr Handl (Vienna Academy) of the conditions of saturated and supersaturated solutions, and to several papers of meteorological experiment: on moisture in forests and in the open, on the temperature of rain, and on the velocity of winds as measured on various heights on Antwerp Cathedral.—Some observations of M. Du Breuil on the partial decortication of horse-chestnuts, are worthy of notice. He found about twenty of these trees in the park at Compiègne, the bark of which had been eaten off twenty-four years previously, by rabbits, to a height of 30 or 40 centimetres. From several experiments he concluded that the chestnuts could live thus long without communication with the soil, and that the elements necessary to their growth were obtained partly from the atmosphere, partly through endosmose from the woody tissue formed before decortication.—Among several French Academy papers are those by M. Jamin on the laws of the normal magnet, and M. Faye on circulation of hydrogen in the sun.—English and American science is also represented.—A curious fact is stated in the "Kleinere Mittheilungen": Herr Eimer has recently found, on a precipitous rock near the island of Capri, a new species of lizard. It is blue all over, with dark spots on the back; while the lizards in Capri are of a bright green, with only a little blue at the extremities. Now the rock (which is frequented by birds of prey) has little or no vegetation, and its natural colour is a bluish grey, or dark blue in the shaded parts. The lizard, when at rest, can hardly be detected by sight, its colour is so like that of the rock. Herr Eimer finds indications that the rock was once connected with the land, and supposes green lizards to have gone over and been gradually transformed to blue, through natural selection.

THE *American Journal of Science and Arts* for June commences with a biographical notice of Dr. John Torrey, the botanist, who died in March last, in the 77th year of his age.—Mr. G. J. Brush contributes a paper on the analysis of an Anglesite from Arizona, worked out in the Sheffield Laboratory of Yale College.—Prof. Dana discusses some results of the earth's contraction from cooling, including the origin of mountains and the nature of the earth's interior.—Prof. J. H. Eaton has a paper on the relations of the sandstone, conglomerates, and limestone of Sauk County, Wisconsin, to each other and to the Azoic.—Prof. Le Conte replies to Mr. T. S. Hunt's criticisms on his paper on the formation of the great features of the earth's surface.—Mr. Verrill remarks on Mr. Jeffrey's article on "The Mollusca of Europe compared with those of Eastern North America," in which, while differing from that author, who thinks that most of the New World forms are derived from the old, he considers the reverse is the case.—Prof. Young proposes the use of diffraction "gratings" as a substitute for the trains of prisms in a solar spectroscope; and he considers that they might well supersede prisms on account of their lightness and ease in management. Prof. Marsh gives further notices of Tertiary mammals, describing two new genera, *Tillotherium* and *Brontotherium*, allied respectively to *Anchippodus* and *Titanotherium*.

Bulletin Mensuel de la Société d'Acclimatation de Paris.—The April number of this serial has only just come to hand. It gives details of all the prizes in the gift of the Society for papers or works on matters in which it is specially interested, or for success in carrying out its objects in the acclimatisation or improvement of various animals or plants. No less than 88 prizes, of the money value of more than 75,000 fr. (3,000*l.*), remain to be competed for, besides 31 medals. By this means the Society does much to popularise the work it has in hand, and to make known the experience gained by those who have interested themselves in it. The system of lending specimens, on condition of receiving, for further distribution, a certain part of the produce, is explained in a paper by M. Passy, the vice-president. It appears that Algeria and Madeira, Guadeloupe and Martinique, besides Switzerland, Russia, Italy, Austria, and some other European countries, are brought within the field of the Society by means of branches, or affiliated societies of a similar nature.—A paper entitled "Le Jardin de mon Grandpère," by Edmond About, the George Augustus Sala of French literature, gives some idea of the benefits conferred by careful cultivation. "To increase the resources given by Nature to man is a task at once too noble and too useful not to induce the sympathy and earnest assistance of people in all parts of the world." Such is the aim of the Society. The last year has had good results. Foreign countries have all been made to give their quota towards increasing the material wealth of France and the knowledge of those interested in the Society. "China, hitherto so unknown, will soon have no secrets from us. A work on the ichthyology of the Celestial Land has given details as to the modes of pisciculture in that country." The financial position of the Society is satisfactory, the balance-sheet for 1872 showing receipts 54,944 fr. (2,200*l.*), and expenditure 45,704 fr. (1,828*l.*).

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 15.—On a Periodicity of Rainfall in connection with the Sun-spot Periodicity, by C. Meldrum, Director of the Meteorological Observatory, Mauritius. Communicated by Sir Edward Sabine.

Assuming that there is a sun-spot periodicity, in the course of which the sun undergoes a variation with respect to heat, or some other form of energy, we should expect to find a corresponding variation in the state of our atmosphere.

With this idea, it was some time ago determined to discuss the cyclones that had occurred during the last twenty-five years in the Southern Indian Ocean, and it was found, what had been often surmised, that they were more frequent and more violent in the maxima than in the minima sun-spot years.

It is well known that the cyclones of the Indian Ocean are attended with much rain, which is not confined to the body of the storm, but extends over wide areas. Years remarkable for cyclones, therefore, should be also years remarkable for rain; but to test this inference, with regard to the Indian Ocean, we had no rainfall statistics, except eighteen years' observations at Mauritius; and these were in every respect favourable, the rainiest years having been those in which cyclones were most abundant. In the absence of other data, the Brisbane and Adelaide rainfalls were consulted, and it was found that, like Mauritius rainfall, they indicated a periodicity. It was then surmised that there might be a rainfall periodicity generally; and that, if such was the case, both it and the cyclone-periodicity were concomitant effects of one and the same cause. This supposition having been strengthened by the results of an examination of the rainfall of England, it was resolved to examine all the rainfall tables (containing one or more sun-spot periods) that could be obtained. By comparison of an extensive series of weather statistics kept at a large number of places all over the world, the decided conclusion is that, with scarcely an exception, all the years of maxima and minima rainfall are within a fraction of the corresponding maximum and minimum sun-spot year.

Chemical Society, June 19.—Dr. Odling, F.R.S., president, in the chair.—Nine communications were read, of which the following are the titles:—1. "Researches on the Action of the Copper Zinc Couple on Organic Bodies III. on Normal and iso-propyl iodide," by J. H. Gladstone, F.R.S., and A. Tribe, being a continuation, in the propyl series, of the author's previous researches. 2. "On the Influence of Pressure on Fermentation, Part 4. The influence of reduced atmospheric pressure on the alcoholic fermentation," by Horace T. Brown, in which he finds that, under diminished pressure, the progress of the alcoholic fermentation is retarded in a remarkable way. 3. "On Cymene from different Sources, optically considered," by J. H. Gladstone, F.R.S. 4. "Note on the Action of Bromine on Alizarine," by W. H. Perkin, F.R.S. This reaction gives rise to *Bromalizarine*, an orange-coloured crystalline substance, possessing feebler dyeing properties than pure alizarine, the colouring principle of madder. 5. "On some Oxidation and Decomposition Products of Morphine Derivatives," by G. L. Mayer and C. R. A. Wright, D. Sc. 6. "On the Decomposition of Tricalcic Phosphate by Water," by R. Warrington. 7. "Communications from the Laboratory of the London Institution, No. XII.": "On the Nature and on some Derivatives of Coal-tar Cresol," by Dr. H. E. Armstrong and C. L. Field.

8. "On a new Tellurium Mineral, with Notes on a Systematic Mineralogical Nomenclature," by J. B. Hannay. 9. "Note on the Relation among the atomic Weights," by J. A. R. Newlands. The president, in adjourning the meeting until after the recess, congratulated the members on the number and importance of the papers that had been read during the session.

Zoological Society, June 17.—The Viscount Walden, F.R.S., president, in the chair.—Mr. Sclater laid before the meeting the first sheets of a catalogue of the birds of the Neotropical Region, prepared by himself and Mr. Osbert Salvin, and shortly to be published under the title "Nomenclator Avium Neotropicalium." The number of species included in it, as known to the authors, was 3,565.—Mr. Sclater exhibited and made remarks on a collection of birds recently made in New Guinea by Signor D'Albertis. The most remarkable of them was a new Paradise bird belonging to the Epimachine Section, but peculiar for its long incurved bill, which was proposed to be called *Drepanephorus albertisi*, after its discoverer.—Mr. J. W. Clark exhibited the skull of a Seal from the Northern Pacific, which appeared to be *Halicyon richardsi*, of Gray, and explained his reasons for regarding it as indistinguishable from *Phoca vitulina* of the North Atlantic.—A communication was read from Lord Walsingham, giving particulars as to the distribution of the different species of Deer and other Ruminants of Oregon and Northern California.—Dr. A. Leith Adams read a memoir on the osteology of the Maltese Fossil Elephants, in which was given the description of a large collection of remains discovered by him in Malta in the years 1860–1866. Dr. Adams referred these remains to two distinct species—a larger *Elephas mnaidriensis*, and a smaller—the *E. melitensis* of Falconer, and assigned *E. falconeri* of Busk to a smaller form of the latter species.—Mr. H. J. Elwes read a paper on the geographical distribution of Asiatic birds, in which he entered into the question of the best subdivision of the Indo-Malayan Region.—A communication was read from Mr. W. S. Atkinson, of Darjeeling, containing the description of a new genus and species of *Papilionidæ* from the South Eastern Himalayas, proposed to be called *Bhutanitis lidderdalii*.—Mr. R. B. Sharpe contributed the fourth of a series of papers on African birds. The present memoir dealt with the African Cuckoos, which were fully described and their geographical distribution pointed out.—Mr. R. B. Sharpe read a second communication, describing three new species of birds, proposed to be called *Macrodipteryx sperlingi* from the Bay of Malimba, West Africa, *Chamætylas princei* from the Gold Coast, and *Baza erythrothorax* from Celebes.—Mr. Sclater read a paper on the Curassows, based mainly upon specimens now or lately living in the Society's Gardens, and gave details on their geographical distribution and on the variations of sex of the known species.—A communication was read from Mr. R. Swinhoe on Chinese Deer, with notices of two new species proposed to be called *Cervus kopschi* and *C. euopis*.—Mr. Sclater read a note on the genus *Ornithion* of Hautlaub, and the synonymy of the four known species.—Mr. A. H. Garrod read a memoir on certain muscles of the thigh of birds and their value in classification, founded principally upon the examination of a large number of specimens that had lived in the Society's collection. This meeting closes the Scientific Session 1872–73.

Anthropological Institute, June 17.—Prof. Busk, F.R.S., president, in the chair.—Mr. J. G. Waller exhibited a series of bronze implements discovered on the site of an ancient camp near Hythe, Kent; and Mr. J. E. Price exhibited pottery and bones of *Bos* found at New Southgate.—Lieut. C. S. Holland read a paper on "The Ainos." The following papers were also read:—Account of an interview with a tribe of Bushmans in South Africa, by G. W. Stow, F.G.S.—Specimens of native Australian languages, by A. Mackenzie.—A brief account of three microcephales, by Dr. John Shortt.—On a patoo-patoo from New Zealand, by Sir Duncan Gibb, Bart.—The healing art in the North of Scotland in the olden time, by Rev. Walter Gregor, M.A.—On a hypogeum at Valaquil, Isle of Uist, by A. Carmichael.—Heathen ceremonies still practised in Livonia, by the Baron de Bogouschefsky.—The westerly drifting of nomads from the 15th to the 19th century, Part XI.—The Bulgarians, by H. H. Howorth.

Entomological Society, June 2.—Sir Sidney S. Saunders, V.P., in the chair.—Mr. Müller exhibited a remarkable *Psyche* case, sent by Mr. Rothney from Calcutta. It was composed of thorns, all of equal length (about 1½ inches), arranged with the points all in one direction, so as effectually to guard the entrance against an enemy.—Sir Sidney Saunders exhibited a series of living Hymenopterous larvæ and pupæ in briar stems lately received from Albania. These stems having been split, showed the occupants in their natural cells. Specimens of the perfect insects reared from the larvæ were also exhibited.—Mr. Müller communicated some notes on the discovery by Dr. Joly, of Toulouse, of a nymph belonging to the genus *Oligoneuria*, the immature state of which had been hitherto quite unknown. Drawings of the upper and under sides of the nymph accompanied the notes.—Mr. Wollaston communicated a valuable paper "On the genera of the Cossonidæ." It comprised (1) a catalogue of the several groups, arranged systematically and tabulated; (2) full generic diagnoses, taken seriatim; (3) Observations (diagnostic and geographical) on each separate genus; (4) brief characters of 139 species not hitherto recorded; (5) a complete list of the particular members of the family (amounting in all to 253).—The Secretary read a letter he had received from Mr. Roland Trimen, of Cape Town, containing some remarks on the Rev. R. P. Murray's "Notes on Variations of Neuration observed in certain Papilionidæ," published in the Proceedings of the Society in November last, and referring certain cases of variation to reversion to ancestral characters, pointing to a remote community of origin between the Papilionidæ and the higher Heterocera.

BERLIN

Geographical Society, June 7.—Baron Richthofen, president, in the chair.—Dr. Neumayer spoke on methods of measuring the temperature of the water of the sea at great depth, and a new instrument for that purpose, invented by himself. The discovery of the fact that the bulb of an ordinary mercurial thermometer does not indicate correctly the temperature when subjected to the pressure of many atmospheres such as prevails at great depth, and that the errors of any single reading may react as much as 12 degrees of Fahrenheit, first led to the improved method of surrounding the bulb with a larger one filled with alcohol. The thermometrical errors, so far as they relate to the working of the instrument itself, are thereby nearly abolished. The difficulty, however, remains of ascertaining the point in the scale which the column of mercury reaches at any required depth of water. The various methods devised for overcoming it are chiefly directed towards the introduction of means for indicating the maximum and minimum points. No one of them fully answers this purpose. Any further improvement must therefore have for its object the reading of the thermometer while under water. A step in this direction was made by Mr. N. Siemens, but it was argued that the results arrived at by this method are not satisfactory, although it may eventually be improved. Dr. Neumayer's new principle is based upon the plan of devising a self-registering thermometer which may be lowered into the sea, and his first object was to find out a kind of light which should be able to do photographic work and yet not create errors by producing heat. The Geissler tubes answer these conditions, chiefly those filled with nitrogen, which emit a bright light and do not affect the temperature in any measurable degree. The new apparatus, which was exhibited and experimented with, consists of a large vessel of brass containing (1) two vertical thermometers, which perforate the bottom and protrude into an open compartment underneath, free to the access of water; (2) a galvanic battery, with two Geissler tubes inserted, running in front of, and close to, the thermometers; (3) two rolls of Talbot paper standing upright and immediately back of the thermometers, and revolving by means of a clockwork. As soon as the batteries are closed and the clockwork wound up, the luminous columns of the nitrogen cause the picture of the column of mercury to be reproduced on the photographic paper behind, together with all the lines marking the partition of the scale. The vessel is shut hermetically and lowered into the sea to any required depth. When raised again, the record of the temperature which the surrounding water had at any minute, and therefore at the particular depth to which the apparatus was then lowered, is read distinctly on the paper. An additional improvement was made by attaching on the top of the instrument a compass-card turning freely around its axis, and on the outside of the vessel a sort of wing, which will be directed by the current when the ship is in a slight motion. By an ingenious contrivance the deviation of the direction of the wing from the north and south line of the card is indicated by the same photographic means. It is believed that the direction of the current at various depths will thus be determined.—Mr. Siemens

proposed to use chased copper in the place of brass in constructing the vessel, on account of its offering greater resistance to pressure, and believed to have already found satisfactory means for improving the instrument invented by himself and his brother.—Dr. Marthe gave an account of Khiwa based on the study of Russian literature on the subject, winding up with the suggestion, that the withdrawing of a large body of the water from the Amu for the irrigation of the oasis, deprived the lake Aral of so large a supply, that to this circumstance might be due the diminution its surface has suffered, and the fact of its present isolation. The water which before took its way through lake Aral to the Caspian, now evaporates from the rice-fields of Khiwa.

Geological Society, June 4.—Dr. J. Ewald in the chair.—Baron Richthofen drew attention to the activity recently displayed, according to newspaper reports, by several volcanoes of Japan, some of which have not been active for a long time, and gave an account of the distribution of volcanoes in Japan. The west and east portion of the aggregate body of the Japanese islands (leaving out of consideration the small inland passages), is in every way the direct continuation of the mountain system which occupies the south-eastern portion of China, the axial chain of which extends from the frontier of Annam to the island of Chusan, in the direction of W. 30° S. ; E. 30° N. It is accompanied on either side by a number of parallel chains. The prolongation of the main portion of this group of linear chains passes through the island of Kiushiu to the great bend of Japan ; and in that entire region of country, the structure of the hills, the rocks of which they are made up (chiefly Silurian and Devonian strata accompanied by granite), and the lines of strike are the same which were observed in south-eastern China. This first system is intersected, at either end, by another which runs SS.W., NN.E. On the west, it commences in Kiushiu, and extends southward in the direction of the Liu-Kiu islands, while on the east it constitutes the northern branch of the main island, and, with a slight deviation in its course, continues through the islands of Yesso and Saghalin. A third system, which does not properly belong to Japan, is indicated by the S.W. and N.E. line of the Kuril islands. The first system, where it occupies the breadth of the country for itself alone, is as free from volcanoes or any accumulation of volcanic rocks as it is in south-eastern China. The second is accompanied by volcanoes. But the greatest accumulation of volcanic rocks, as well as of extinct volcanoes, is found in the places of interference, or those regions where the lines of the two systems cross each other; and besides, in that region where the third system branches off from the second. To the same three regions of interference those volcanoes are confined which have been active in historical times. Some details were then given regarding the structure of Kiushiu. This island, although having its longer axis directed from north to south, is intersected, as it were, by several solid bars made up of very ancient rocks, and following the strike of W. 30° S., E. 30° N. They form high mountain barriers, the most central of which (south of the provinces of Higo and Bungo) rises to over 7,000 feet, and is extremely wild and rugged. Among the details regarding the volcanoes of Satsuma, particular attention was drawn to the fact that the various families of volcanic rocks have arrived there at the surface in exactly the same order of succession as is the case in Hungary, Mexico, the Great Basin, and many other volcanic regions, namely, 1st, Propylite, or trachytic greenstone ; 2nd, Andesite ; 3rd, Trachyte and Rhyolite ; and 4th, the basaltic rocks. There is the greatest accumulation of mountain masses in Japan, one of the several chains rising to upwards of 11,000 feet in its summits. Among them are situated several gigantic volcanoes, such as Fusi-yama, the highest of all, Yatsunga-Jake, a series of elevated cones with extinct craters, and several others partly active and partly extinct. Those of the third group were not visited by Richthofen.—Prof. E. Weiss exhibited some curious octahedral crystals of Hausmannite, remarkable on account of certain re-entering angles and the striated aspect of the faces, and proved that the lines which caused this appearance were due to a kind of twin formation not hitherto observed.

PARIS

Academy of Sciences, June 23.—M. de Quatrefages, president, in the chair.—The following papers were read :—Second note on guano, by M. Chevreul.—New researches on the silent electric discharge, by MM. P. and A. Thenard.—Researches on chlorine and its compounds, by M. Berthelot. The author dealt with the compounds of chlorine with water and the protosalts.—A new series of observations on the solar protuberances ; new remarks on the relations between protuberances and spots, by Father Secchi. The Rev. Father presented his observations for the last quarter, and then, in his letter, criticised Respighi's late remarks on the absence of the chromosphere over spots, which he maintains is not the case. He then gave an account of some experiments on sodium vapour, which, however, contained nothing new, and then proceeded to state that the line D_3 appears to him to coincide with one of the components of the D group which appears when the sun is near the horizon. He has also found a bright iron line between b_2 and b_3, and having examined the spectrum of iron with a battery of 50 cells, has seen 480 lines, but could not find 1474 Kirchhoff ; he hopes to repeat this experiment, and if the results are same, he considers that the absence of Fe from the corona will be proved. With magnesium in the lamp, he finds the same nebulosity as is exhibited by the sodium lines, but it is accompanied by a banded spectrum of MgO ; he thinks that if the nebulosity is also due to the oxide, that the occurrence of oxidation in the sun will be proved.—On the influence of atmospheric refraction as it affects the time of contact in a transit of Venus, by M. E. Dubois.—On the coloration and greening of *Neottia Nidus-avis*, by M. E. Prillieux.—On semi-diurnal barometric variations, by M. Broun.—On hot-air warming apparatus, by M. Ducrot.—A letter was received from M. de Lesseps praying the Academy to include his name among those of the candidates for the vacant seat of Académicien libre, vacant by M. de Verneuil's death.—On the constitution of the sun and the theory of the spots, by M. E. Vicaire.—On the production of methylic alcohol by the distillation of calcic formate, by MM. C. Friedel and R. D. Silva. The authors believe that formic aldehyde is first formed by the reaction $(CHO_2)_2Ca = CO_3Ca ? + H_2O + CH_2O$, and that the aldehyde is converted into alcohol by the action of nascent hydrogen.—On terebene, by M. J. Ribau.—On the production of the rotatory power in the neutral derivatives of mannite, by M. G. Bouchardat.—An answer to a late note, by M. du Moncel, on the resistance maxima of induction coils, by M. Raynaud.

DIARY

FRIDAY, JULY 4.

GEOLOGISTS' ASSOCIATION, at 8.
ARCHÆOLOGICAL INSTITUTE, at 4.
HORTICULTURAL SOCIETY, at 3.—Lecture.

SATURDAY, JULY 5.

GEOLOGISTS' ASSOCIATION.—Excursion to Plumstead and Crossness.

MONDAY, JULY 7.

GEOGRAPHICAL SOCIETY, at 8.30.—Boat Journey up the River Wami : C. C. Hill.—Remarks on Zanzibar and the East Coast of Africa : Sir Bartle Frere, K.C.B., president.
ENTOMOLOGICAL SOCIETY, at 7.

BOOKS RECEIVED

AMERICAN.—Families of Fishes: Theo. Gill (Smithsonian Institution).—Memoir of Sir Benjamin Thompson, Count Rumford, 2 vols : George Ellis (Claxton & Co., U.S.A.).—U.S. Sanitary Commission in Valley of Mississippi, 1861–6 : Dr. Newberry (Cleveland, U.S.A.).—Geological Survey of Indiana : E. T. Cox (Indianapolis, U.S.A.).

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