THURSDAY, JUNE 5, 1873

CONDENSED MILK

THE importance of milk as an article of diet is so great that anything offered as a substitute for it, or that renders it more available as food, demands attention. The composition of cow's milk is so nearly like woman's milk that the addition of a little water and sugar may be said to convert the one into the other; hence the practice of giving cow's milk to young children, and making it a substantial article of their diet long after they have cut their teeth and are able to masticate bread and meat. No inconsiderable quantity of milk is also consumed by adults, and its nutritive effect is not exceeded by any article of diet, as it contains all the constituents that are necessary to the perfect nutrition of the human body.

There are, however, several drawbacks in the use of cow's milk which diminish its utility, limit its use, and sometimes render it dangerous. One of the great drawbacks in milk is its liability to decomposition. The sugar it contains becomes acid, the caseine separates in the form of curd, and a fermentation ensues which renders it unpleasant and sometimes even dangerous as an article of diet. The latter effect is seen more particularly in young children. During the summer months they suffer extensively from diarrhœa, and there is little doubt that this is largely due to the acidity of the milk which is given to them. Milk bought in the morning in London is frequently unfit to be used in the evening for the diet of infants. These changes in milk are hastened by the present system of bringing milk to London from a distance in cans, by which means it is shaken, and its tendency to change hastened.

Another drawback in the use of milk is its liability to adulteration. Unfortunately the agent by which milk is adulterated, is easily accessible and can be detected with great difficulty. We cannot instruct cooks and poor people in the use of lactometers and hydrometers by which the learned test milk: moreover, the natural liability of milk to vary is very great. Thus the quantity of cream in milk received by the Aylesbury Condensed Milk Company varies from 9 to 17 per cent. Dr. Hassell states that the cream given by the milk of a cow, the milk of which he personally inspected, was but 4½ per cent. Although then all milk containing less than 9 per cent. of cream may be suspected of adulteration, yet it may happen that a milk containing but 4½ per cent. may be really not adulterated with water at all.

This varying quantity of cream also shows that even when milk is not adulterated it is liable to great variations in the quantity of cream which may be taken as the measure of its usefulness as an article of food.

Many attempts have been made to overcome these objections to the use of milk, and from time to time preparations of it have been sold by which freedom from acidity and adulteration are secured. The most available of these preparations have been those that submitted the milk to a process of evaporation by which more or less of the water naturally contained in milk is got rid of. By these processes the nutritive constituents of the milk are retained; the preparation keeps for some time, is easily conveyed from place to place, and by the addition of water milk, so to speak, is readily manufactured. None of these preparations, however, seemed to succeed till a process for making what is called "Condensed Milk" was introduced. Whether America or Europe has the honour of the invention we need not dispute here. It is now made in this country by thousands of gallons daily, and its manufacture may be witnessed on a large scale at Aylesbury.

Although the process of evaporating milk may be regarded as an exceedingly simple one, the attempt to carry it out at Aylesbury on a large scale has developed a complicated machinery in which steam power is extensively used; 200 persons are employed, and the milk of 1,200 cows, each yielding 14 quarts, is daily evaporated. The milk used is brought from farms in the neighbourhood in ordinary tin cans. Each can before it is sent to the factory is carefully tested by the taste and smell and the lactometer. Any doubtful specimens are set aside for re-examination or rejection. The milk is then passed into a vacuum pan, and the vapour thus produced is carried off and condensed and thrown away. When the milk has acquired a proper consistence it is mixed with sugar. This addition of sugar is the distinguishing feature of the condensed milk process. After this the milk is still further condensed till it reaches the required consistence, and is run off into the little tin cans which are so well known. The whole of these operations are carried out with a regard for cleanliness, which would look almost fastidious if it were not known that a single particle of decomposing milk allowed to get into the receiving pans might destroy the whole mass. Every can is returned thoroughly cleansed to the farmer who sends it, having been first submitted to hot water, then to a jet of steam, and then rinsed out by a jet of cold water.

The condensed milk thus prepared is of a semi-liquid consistence, and can be taken out of a jar with a spoon. Several analyses of this milk have been made. The late Baron Liebig found that it contained—

Water	22·44
Solids	77·56
	100·00

The *Lancet* has more recently published the following analysis:—

Moisture	25·10
Butter	11·73
Caseine	15·17
Milk sugar	16·24
Cane Sugar	29·46
Ash	2·30
	100·00

From these analyses it will at once be seen that the only perceptible difference between condensed milk and ordinary milk is that the former contains more sugar and less water than the latter. Both these things are necessary for attaining the objects for which condensed milk is manufactured. The diminution of the bulk of the water from 87 per cent. in ordinary milk to 25 per cent. in the condensed secures diminution of the bulk of the milk, and thus renders transportation comparatively easy. The condensed milk is easily converted to the condition of ordi-

nary milk by the addition of either cold or hot water. The addition of the sugar is found to be necessary, in order to enable the other constituents to resist decomposition. Milk will keep any length of time when entirely desiccated, but by the process of drying entirely the milk loses its flavour and many of its properties. The semi-liquid condition of condensed milk prevents these changes, but in this state it is liable to decompose; hence the necessity of additional sugar.

The question arises as to whether this added sugar in any way interferes with the quality of the milk in its relation to the diet of infants or invalids. In comparing human milk with cows' milk, we find that the latter contains more caseine and less sugar than the former. Hence, when given to children it is customary to add a little water and a little sugar to make it like mother's milk. This object is really effected by the addition of cane sugar to the condensed milk, and it may therefore be unhesitatingly employed in the nursery as a substitute for ordinary cows' milk.

After a personal inspection of the Aylesbury manufactory, and a full consideration of the whole subject, we are quite prepared to say that where good fresh cows' milk is unattainable, as it is almost practically so in our large towns, there is no substitute for it equal to condensed milk. Nor is this a matter of theory; hundreds of gallons are being used every day in London, and most of it under the direction of experienced medical men. One medical man assures us that he has a healthy, fine-grown child of ten months that has never taken anything but condensed milk.

As the diet of invalids, it may in some cases require watching when the action of sugar is injurious to the system: but in these cases milk should be altogether interdicted.

It is to be hoped that no disadvantage in the use of this agent has been overlooked, as the advantages of its use are so many and so obvious. It presents a pure form of milk in a condition in which it may be kept for any length of time, and is not injured by removal. It is always at hand night and day, and by the addition of cold or hot water can be converted into nutritious and wholesome food. E. LANKESTER

THE PHYSIOLOGY OF MAN

The Physiology of Man. By Austin Flint, Jun., M.D. Pp. 470. (New York: D. Appleton and Co., 1872.)

WE have already had to speak in terms of high commendation of Dr. Flint's comprehensive treatise on human physiology, as being written in a clear, methodical, and judicial style, the statements made being carefully weighed, and in most instances supported, by the best, if not the most numerous, authorities; whilst the author has in many parts enriched it with the results of his own important researches. The present, which constitutes the fourth volume of the work, is no exception to our remarks. It is occupied with the consideration of the nervous system, excluding the special senses, and gives a very complete account of that difficult and extensive section of physiology, the study of which has engaged the attention of so many of the best workers in all civilised countries during the past twenty years. Dr. Flint commences by a short *résumé* of the principal facts that have recently been made out in regard to the structure of the nerve-centres and cords, and the mode of termination of the nerves in muscle, gland, and skin; entering into the subject perhaps as far as is necessary in a strictly physiological work, the author taking Schultze's article in the recently published "Handbook of Histology" of Stricker, Kölliker, and Robin as his guides. The first chapter concludes with an account of the recent observations of Voit on the regeneration of the cerebral hemispheres after their ablation, which show that a large portion of these bodies may be reproduced, and that the organ may recover its functions to no very inconsiderable extent.

The second chapter deals with the general functions of the motor and sensory nerves, and gives a very fair account of the history of the discovery of the difference in the function of the anterior and the posterior roots, due prominence being given to the claims of Walker, Mayo, and especially of Majendie. In speaking of the recurrent sensibility of the anterior roots, Dr. Flint is not satisfied with Brown-Séquard's explanation that it results from the compression of sensory nerves distributed to the muscles during the spasm caused by the irritation of the anterior roots; but inclines to Majendie's and Bernard's opinion that there are actually recurrent sensory nerves in the anterior roots, on the ground that the pain is sometimes apparently severe when the cramps are slight. The relations of the nervous system to electricity, and the rapidity of nerve conduction, with the means of estimating it, are well and correctly given.

The cranial nerves are next considered. In this section we think the author fails in his account of the deep origin of each nerve. He does not appear to have heard of or seen the papers of Lockhart Clarke contained in the Philosophical Transactions (1858-67). Yet these contain by very far the most minute and the most accurate descriptions hitherto published on these points, and the importance of their relations to pathology would have fully justified more elaborate details. Thus, to take one point only, whilst speaking of the deep origin of the sensory root of the fifth pair of nerves, he makes no allusion to the very interesting facts described by Clarke of the internal connection of this root with the vagus and glossopharyngeal nerves in the grey tubercle, or caput cornu posterioris; of the connection of its motor root with the glossopharyngeal nucleus and the fibres of that nerve, and with the fasciculus teres; or, finally, of the connection of the sensory root with the nucleus of the third through the intermediation of the grey tubercle, into which the sensory root penetrates. On the other hand, his account of the functions of the various nerves and their branches is given extremely well; the account of the chorda tympani, for example, being excellent; and the conclusion at which Dr. Flint has arrived, namely, that it is a nerve of gustation, as well as a motor or stimulant nerve for the submaxillary gland, being fully borne out by Lussana's observations recently published in Brown-Séquard's journal, and which, at the time Dr. Flint wrote, had not appeared. A very long section commensurate with its importance is devoted to the pneumogastric nerves, the action of which on the heart, larynx,

lungs, and stomach is given, with full reference to their remarkable inhibitory and depressing powers.

In the description of the anatomy of the spinal cord, Dr. Flint takes Gerlach's article in Stricker's Handbook as his guide, and gives the following as the results of his own experiments, and those of others which he regards as most reliable. "The gray substance is probably inexcitable and insensible under direct stimulus. The antero-lateral columns are insensible, but are excitable both on the surface and in their substance, *i.e.* direct stimulation will produce convulsive movements in certain muscles, which movements are not reflex and are not attended with pain. The lateral columns are less excitable than the anterior columns. The surface at least of the posterior columns is very sensitive, especially near the posterior roots of the nerves. The deep portions of the posterior columns are probably insensible, except very near the origin of the nerves." Dr. Flint then proceeds to describe the functions of the grey matter, and of the several columns of the white, explaining and adopting the views generally accepted. The posterior white columns he regards, with Todd, as containing fibres acting as commissures between the several segments of the cord.

The functions of the cerebrum are very briefly given, indeed, except in regard to *language* they are not given at all, and for a reason that scarcely appears satisfactory, viz. that though their consideration is properly a part of physiology, the range of the subject is so extensive, that it is only treated of exhaustively in special treatises on mental physiology. This is much to be regretted, as we feel sure that if Dr. Flint had attempted it, he would have succeeded in giving a very interesting section upon it. The cerebellum he regards as the co-ordinator of the muscular movements, and he has collected many pathological cases in support of his view. The last chapters are devoted to the sympathetic nerve and to sleep. The account of the sympathetic system enters freely into the consideration of the vaso-motor and trophic nerves. Upon the whole, this volume of Dr. Flint's work may be regarded as a valuable accession to physiological literature, and as giving the results of modern research with such fulness, combined with accuracy, that the ordinary student will not require to look beyond its pages for any information on this important subject of medical knowledge. We look forward with much interest to the next volume on the "Special Senses," which the author assures us is nearly ready.

CLODD'S "CHILDHOOD OF THE WORLD"

The Childhood of the World: a Simple Account of Man in Early Times. By Edward Clodd, F.R.A.S. (London: Macmillan and Co.)

THIS genial little volume is a child's book as to shortness, cheapness, and simplicity of style, though the author reasonably hopes that older people will use it as a source of information not popularly accessible elsewhere as to the life of Primitive Man and its relation to our own. In brief chapters he states the principal points of the modern science of civilisation, discussing the condition of Præhistoric savages, the early use of stone implements and the introduction of metals, the discovery of other useful arts, the evolution of language, the invention of writing, &c. Having laid down this as a foundation, he then proceeds to his main purpose, that of explaining the successive phases of man's belief, the working of inventive fancy in mythic legend, the rudimentary ideas of the lower races as to souls and their existence in a future state, the nature of deities, and the meaning of the worship offered to them by prayer and sacrifice. Examining the religions of the less cultivated races of the world, he passes through them to arrive at doctrines which, regarding them as highest and surest, he turns all his gift of earnest eloquence to teach. This book, if the time has come for the public to take to it, will have a certain effect in the world. It is not a mere compilation from the authors mentioned in the preface, but takes its own ground and stands by and for itself. Mr. Clodd has thought out his philosophy of life, and used his best skill to bring it into the range of a child's view. Why, indeed, should not children be taught their elementary philosophy of nature at the modern level? Why should they not begin to shape their lives by the best theory of the world, and their own place and duty in it, which their parents can accept? Thoughtful children will take in most of the facts Mr. Clodd works on, and his ideas will open many doors in their minds, leading into regions to be more fully explored years later. Much of the book, it is true, is beyond a child's unhelped understanding; not that the words are too hard, but that the ideas are. Its story is anything but "a tale of little meaning tho' the words be strong;" its simple language has often to convey thoughts too abstract for easy assimilation. Yet there is no harm in this, for the best children's books are those which in part engrave knowledge on their minds with finished accuracy, and in part only stamp roughly impressions which will take their sharper lines another time.

The world is growing daily more alive to the fact that the history of man and man's ideas, with all the problems of belief and duty which can be rightly treated on a historical basis, have been shifted into new places and altered into new forms by the modern sciences of the World and Man. At this present time there are numbers of parents and teachers to whose views such a modern "Religio Medici" as Mr. Clodd offers is congenial, and who distinctly want a book like his to teach out of. The need is all the more felt, because so many of the topics treated are among those where both theology and science put forward claims to speak with authority, while the adjustment of these claims has been mostly attempted by the class of writers who may be called "reconcilers." But educated people now distrust the method of these writers as vitiated by foregone conclusion, and it is more and more felt that the great problems of humanity must be dealt with by men who do not shape their evidence, but let their evidence shape them. Mr. Clodd, at any rate, is no "reconciler." It is evident that his religious feeling has come into real union with his positive knowledge, and that this act of mental chemistry has generated doctrines which are at once his theology and his philosophy. These doctrines it is not the office of this journal to discuss: nor, considering how far Mr. Clodd adopts (of course with due acknowledgment) evidence and theories from the heavier volumes of technical ethno-

logists, my own included, would it be convenient for me to enter into detailed argument on his ethnology. I need only mention as points to which exception is likely to be taken, Mr. Clodd's easy passing over of the really serious difficulty, what became of the bones of the Drift-men and Cave-men, and his too confident expressions as to the first habitat of man, and the Origin of Languages. This said, what is left for me is simply to announce his work, helping to make it known to the class of readers who are waiting for it.

E. B. TYLOR

OUR BOOK SHELF

Notes on Natural Philosophy. By G. F. Rodwell, F.R.A.S., F.C.S., Lecturer on Natural Philosophy in Guy's Hospital and Science Master in Marlborough College. (London: J. and A. Churchill, 1873.)

THIS useful little work is an enlargement of Notes which the author had prepared for the students attending his lectures at Guy's Hospital. The title is perhaps a little too wide, as the book contains no reference to Sound and but a scanty treatment of Light, polarisation, for example, being not even mentioned. These omissions are explained in the preface as caused by the adaptation of the notes to the "Preliminary Scientific" Examination at the London University. We are quite sure, however, the author will agree with us that students for this examination will have to supplement their reading by some rather stiffer work than we find here. As an *introductory* text-book for this examination it is quite the best we have seen, the author having carefully avoided that atrocious system of giving candidates only just such knowledge as may help them to scrape through an examination. The evidence of conscientious labour which is conspicuous throughout the book makes us the more regret the incompleteness of these Notes. Even of the subjects treated it is obvious that in 160 pages, only the barest outlines of natural philosophy can be given. The "Notes" therefore chiefly consist of lucid and concise definitions, and everywhere bristle with the derivations of scientific terms. To this latter point the author has devoted much labour and thereby done good service to science; though on the other hand we cannot help thinking Mr. Rodwell runs a fair chance of being accused of pedantry by his frequent use of Latin quotations. One or two little points needing correction catch our eye. Fig. 18 is printed upside down; amidst all the derivations we do not see the meaning of the terms given to different thermometric scales; here as in some other books cobalt is erroneously stated to be attracted to a magnet even at the highest temperature. As this seems to be a frequent error we will give Faraday's own words on this matter: they are to be found on the very last page of his "Experimental Researches in Electricity." "By greater elevation (of temperature) nickel first loses its distinctive power at about 635° F., then iron at a moderate red heat, and cobalt at a far higher temperature than either, near the melting-point of copper." There cannot be a doubt that this little book will be of use to science teachers and science students.

Transactions of the Norfolk and Norwich Naturalists' Society, for 1872-73. (Norwich: 1873.)

THIS little volume contains some excellent papers. The president, Dr. Beverley, in his address, suggests, rightly, we think, that members of such societies ought, in their researches and papers, never to lose sight of the views and opinions usually associated with the name of Darwin, and very justly says that "the origin of species, the theory of evolution, and other Darwinian doctrines, cannot be proved or disproved by newspaper controversy or theological discussion." The first paper is by Mr. Howard Saunders, F.Z.S., on the Ornithology of Spain, which is followed by a short paper on *Vanessa Antiopa*, by Mr. C. G. Barrett. This is followed by a long, carefully compiled, and well illustrated list of the Fungi of Norfolk, by Mr. C. B. Plowright, M.R.C.S. The president, Dr. Beverley, also contributes a paper on the edible fungi of Norfolk, in which he draws attention to the great value of this much neglected source of nutritive food. There is an interesting paper on the Otter, by Mr. T. Southwell, F.Z.S. The two last papers are, one on the "Wild Birds' Protection Act," by Mr. H. Stevenson, F.Z.S., in which he points out the many obvious holes in the Act and adds a list of "wild birds," containing the most common provincial names by which they are known in England and Scotland; and Notes on the Mammalia of Norfolk, by Mr. T. Southwell. This society deserves the greatest credit for the important work its members are doing. They are making a praiseworthy, and so far a successful effort, to publish a fauna and flora of Norfolk. Already there have been prepared a list of the Mammalia and Reptilia, the Land, Freshwater, and Marine Shells, and, as we have above said, a list of the fungi. These will be followed by the Fishes, by Dr. Lowe; the Birds, by Mr. Stevenson (author of "The Birds of Norfolk);" the Flowering Plants and Ferns, by Mr. H. D. Geldart; Lepidoptera, by Mr. C. G. Barrett; all of which, we believe, are in hand, and will be published as the society finds funds to print them. Such a society deserves the greatest encouragement, and it is a pity that it should be hindered in its good work for want of funds. This ought not to be in a county like Norfolk, and we are sure that the intelligent inhabitants of that county only need to be made aware of the value of the work the society is doing, to come forward and lend it a helping hand. This they will best do by becoming members and taking as active an interest in the work as their circumstances permit. The society ought to take effectual means of making its aims and the value of its work be known throughout the county.

Birds of the Humber District. By John Cordeaux. (Van Voorst.)

MR. CORDEAUX is so well known as a careful and trustworthy observer of nature, that any work on his favourite subject, from his hand, must be read with interest. A residence of ten years in the district of which he writes, comprising North and Mid-Lincolnshire, and Holderness, has enabled him to gain a thorough familiarity with the times of appearance and departure of the birds which visit it. These points he has noted with great pains and precision, as is proved by the fact that he has been able clearly to trace the points of the district at which each of the migratory birds enter and depart, most doing so from the sea-coast, the grey wagtail, cuckoo, and common dotteril, being the only exceptions. The sections, of considerable length, devoted to the dates on which to expect the various wading birds, and the conditions of weather which cause these to vary, will be of great interest to sportsmen in the locality; the woodcock, snipe, and plover receive the fullest attention. Among the rare birds that are recorded as having been met with formerly, or of which one or more specimens have been shot lately, we find the cream-coloured courser, Macqueen's bustard (the only British example), Tengmalin's owl, and the tawny pipit. Most extraordinary of all is a jacamar in the collection of Canon Tristram, which was shot in 1849 by S. Fox, a gamekeeper, near Gainsborough; as the author remarks, "it must ever remain an ornithological puzzle how it could have reached this country." We recommend this excellent little work to all ornithologists and sportsmen.

LETTERS TO THE EDITOR

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

Permanent Variation of Colour in Fish

A QUESTION of some interest is raised by a letter published by Mr. Saville Kent, in NATURE, vol. viii. p. 25. It is stated that a Plaice, now in the Brighton Aquarium, has "the posterior half of its under surface, usually white, coloured and spotted as brilliantly as the upper one; the line of demarcation between these two colours again, though sinuous, is most abrupt," and the writer proceeds to say that, on the Darwinian theory, this may be considered as a remarkable instance of reversion—"the Pleuronectidæ being derived from ancestors originally possessing bilateral symmetry, and an equal degree of coloration on each side."

First, as to the fact:—Examples of such colouring among the *Pleuronectidæ* are not very uncommon, and they occur most frequently in the Flounder (*Pleuronectes flesus*) and Plaice (*P. platessa*). Sometimes it is the upper surface which is thus affected—more or less of it being purely white. In a specimen now before me the colouring of the upper surface occurs upon the under one in numerous blotches of various sizes, and this mode of distribution is not uncommon. In every instance that I have heard of, the line or lines of demarcation, when they exist, are such as your correspondent describes, but, in extreme cases, no such line is present—the whole of one surface having uniformly assumed the colouring of the other. Such abnormal colouring may occur either upon the upper or lower surfaces; the fish in the former case being entirely white, and in the latter entirely brown.

The *rationale* offered by your correspondent, although engaging, is not unopen to criticism. For nothing can be more evident to Darwinists than that the colouring of the *Pleuronectidæ* has been acquired because of its protective adaptation to their peculiar form and habits. But it is difficult to see how such colouring could have conferred protection upon their free-swimming ancestors, so that, unless we make the highly anti-Darwinian supposition that the common progenitor was coloured in anticipation of the habits to be contracted by its offspring, there is only one hypothesis open to us, viz., that the unmodified progenitor adopted, through natural selection, the habit of lying on its side *because* of its original sandy colour. As this view, however, will be rejected by all who know how much easier colour is to modify than habit or structure, we are compelled to adopt the supposition, as being the most probable, that the coloration of the *Pleuronectidæ* is the result and not the cause of their form, and has, therefore, been acquired during the process of their flattening.

Although, however, we cannot, without gratuitous supposition, imagine that the unmodified ancestor of the group in question was coloured exactly like his progeny, there is still one other hypothesis by which atavism might be called in to explain such instances as that adduced by your correspondent. Whatever may have been the original cause of the flattening taking place, it is not likely that the initial variations (whether these were sudden and considerable, or gradual and slight), presented nearly so great a modification as that which we now observe. During these initial stages the partially modified individuals may have lain indifferently on either side, and so have acquired protective colouring on both. As the flattening, however, proceeded (from whatever cause), and the bones of the skull, etc., became more and more contorted, the new exigencies of the case might have caused the left side to be more and more used as a ventral surface, until its colouring, being of no further use, was allowed gradually to disappear. Upon this view the deviations from the normal colouring which now occur would be reversions, not to the bilaterally-symmetrical ancestors of the flat-fishes, but to their partially modified offspring. And, if this view were tenable, it might throw some light upon the otherwise inexplicable fact that some species of *Pleuronectidæ* are normally reversed—*i.e.* the left side instead of the right, constituting the upper surface—while in both kind of species individuals often occur which are reversed with reference to their specific type.

As however, this explanation is rather far-fetched, and, moreover, fails to account for the appearance of the partly white and the wholly white specimens above mentioned, it is best, I think, altogether to abandon the reversion theory.

Another, and, to my mind, a more probable one is open to us. Accepting the occurrence of abnormally reversed fish as an unexplained fact, we might, *à priori*, expect that a cross between a normal and a reversed individual of the same species might present the appearance described in your correspondent's letter—the abrupt, though sinuous line of demarcation between the two colours, which always attends the occurrence of this variation, being precisely analogous to that which obtains in higher animals when piebald. Moreover, the abnormal coloration being of most frequent occurrence in the Flounder and Plaice—fish which are also the most frequently reversed—and the occasional appearance of the entirely white and entirely brown varieties, are just the facts we should anticipate were this explanation the correct one. Of course it may be objected that abnormal colouring is not of nearly so frequent occurrence as abnormal reversal, but when we remember how utterly ignorant we are regarding the causes which determine reversal in the *Pleuronectidæ*, and the blending or non-blending of colours in all animals when crossed, we should not lay too much stress upon this objection.

The truth or falsehood of this explanation would admit of easy experimental test on the part of the Brighton Aquarium authorities. Should they, however, undertake such, they must not rest satisfied with mere simple crosses, however numerous, but also try various complex and reciprocal ones. The piebald fish they possess should also be crossed with several normal and reversed Plaice. Should all their experiments prove unsuccessful, they would still be interesting as tending to throw us back upon the only remaining explanation, viz. that all these instances of abnormal coloration are independent sports, and so affording us by far the most striking of the many examples in the animal kingdom of the tendency towards bilateral symmetry which abnormal colouring frequently presents.

Dunskaith, Ross-shire, May 15 GEORGE J. ROMANES

Venomous Caterpillars

THE concluding words of Mr. H. S. Wilson's letter in your last number only reiterate the truth of a fact. Nearly all British entomologists who have collected *Lepidoptera* must have had painful experience of the irritation caused by the hairs of some one or other of our Bombyces that have very hairy larvæ. *Porthesia chrysorrhœa* is the greatest delinquent in this respect; and some years since I suffered intense agony after collecting the pupæ of this species. The hairs of the caterpillar are woven into the cocoon and the web surrounding it, and I recommend anyone in search of a counter-irritant to rub his face and neck with his hands after collecting these pupæ. The result, although painful, will be edifying and admonitory. The hairs have no effect upon the harder skin of the palm of the hand and fingers; and I believe (with most entomologists) that their action is purely mechanical, *i.e.* they pierce the tender skin in multitudes. A precisely similar, though less severe, effect is caused by the hairs of some Boraginaceous plants, *e.g. Echium vulgare*. On the Continent the extreme irritation caused by the hairs of *Cnethocampa processionea* is well known; and the introduction of a brood of these larvæ into a drawing-room would probably be followed by effects similar to those caused by the king's "great flea" in Faust.

At present I consider that the existence of caterpillars actually venomous (*i.e.* with a poison-gland at the base of each hair) requires confirmation. There are some pachydermatous individuals upon whom the hairs of Bombyces have little or no effect. I am unhappily not one of those, but my mental hide repels the insidious attacks of romancers in Natural History.

Lewisham, May 16 ROBERT MCLACHLAN

BETWEEN the years 1857 and 1862 when stationed at Belozi, the capital of British Honduras, I made the acquaintance of a so-called venomous caterpillar, which was held in very great dread by the natives, who averred that "its *bite* always produced fever."

Knowing their superstitious habits, and that, as far as my knowledge of natural history went, there did not exist a caterpillar capable of producing a wound of any kind by *biting*, I resolved to test the truth of the assertion. Accordingly, and to the intense horror of the bystanders, I took one in my hand from a tree that was literally covered with them. It was about 1½ in. long, by ⅝ in. thick, of a blue-grey tint, and in addition to the fine long hairs which clothed it, was armed with clusters of short spines. These clusters were formed nto rows

and contained about a dozen spines each. After a careful examination, I came to the conclusion that they were most likely to be the seat of the venomous propensities attributed to the insect, so I struck the back of my right hand against them two or three times to see what would be the effect. They were very brittle, and broke off as they entered the skin. I thought no more about it till about an hour had elapsed, when I experienced in the wrist a dead pain which gradually extended to the arm-pit, followed by a swelling of the glands.

For the whole day the pain was sufficient to render my arm useless; hence I thought that there must be some poisonous secretion in the spines, for the irritation caused by fine points, even if barbed, would scarcely produce such an effect. The pain died away in the evening, unattended by any feverish symptoms whatever, for I was in excellent health at the time. Next day I examined several of the spines under the microscope; they were not barbed, but hollow, and under pressure emitted a colourless transparent fluid, to which I attributed the poisonous qualities which caused me so much pain. A. M. FESTING

The Demagnetisation of Needles.

IT may not be generally known that magnetised needles, like those used in galvanometers and telegraphs, are easily and rapidly demagnetised in the neighbourhood of other magnets, when the fields of the two magnets are not coincident—that is, when their respective lines of force are not in the same direction.

A striking instance of this has just been brought to my notice. A tangent galvanometer used for taking daily readings of the escape of the current to earth upon wires, when they are disconnected at their terminal points, was found constantly and gradually to be losing its delicacy. This was traced to be due to the demagnetisation of the needle. The needle was re-hardened and even changed but with the same effect. The galvanometer was fixed near some Wheatstone's A B C instruments, which, being worked by magneto-electric currents, have powerful permanent magnets within them. The galvanometer was shifted to the other side of the office, when the effect entirely ceased.

Hence those who have delicate galvanometers should be careful to see that they are not kept in the field of permanent magnets, unless, as in the case of the mariner's compass, they are free to move in the direction of the lines of forces of the magnetic field in which they lie.

Southampton, May 20 W. H. PREECE

Microscopes—Information Wanted

I AM following up some investigations and experiments in which I require certain data, which, however, I cannot at present arrive at, not being in possession of sufficiently delicate and exact instrumental appliances. The information which I now desire to elicit from some more experienced observers than myself is of such importance as to be both useful and interesting to many of your readers, and I therefore crave your insertion of this communication. The information I require is all the more important as having a bearing upon many questions which are now attracting public attention, such as spontaneous generation, the initial stage and transitional forms of living organisms, also various researches in experimental physics, chemistry, &c. I desire to arrive at the following data:—

1. What is the estimated dimensions of most minute particles of matter which can be visible, under any circumstances or conditions, under the highest powers of the microscope? I leave out of consideration (under this head) the question whether such matter is living or dead, organic or inorganic, or in fact regardless of any of its properties whatever except its mere visibility as a minute portion of matter. Some observers speak of visible particles $\frac{1}{200000}$th and $\frac{1}{300000}$th of an inch diameter; this is surely near the limit.

2. What is the best or most accurate method of arriving at an estimate of the dimensions of such minute objects as are too small to admit of actual measurement by any of the appliances now in use? Every microscopist knows from experience that objects may be distinctly visible, not as a mere point, but having an appreciable diameter, and yet be too minute for actual measurement to any degree of accuracy.

3. Have the most recently constructed microscopic objectives, such as the $\frac{1}{50}$th or $\frac{1}{25}$th, any advantages over the $\frac{1}{12}$th or $\frac{1}{25}$th inch objectives in the determination of the data above referred to? and have immersion lenses any advantage in this respect? I find some difference of opinion on this point. Some microscopists consider that a really first-class $\frac{1}{12}$th with the use of deep eyepieces will enable us to see anything whatever which can be seen by any other objective of shorter focus. On the other hand, it is evident that a great number of the most experienced microscopists think otherwise; and from the very fact of their purchase of such expensive high powers, argue that such lenses are found to supply what other powers cannot accomplish.

It appears to me that there is too much of vague and indefinite assertion in regard to the comparative powers and qualities of microscopic objectives, and it is very desirable that some more definite results should be arrived at. With what precision and accuracy the results of astronomical observations are made! and taking into consideration that many of these results are obtained by different methods of observation, using different instruments, and by different observers, it is astonishing that the discrepancies and errors of observation are so small. It is generally admitted that the microscope is, to say the least, equally perfect, if not more so, than the telescope; and we should therefore expect a corresponding degree of accuracy in the results of microscopical observations. There are no doubt many who, like myself, have hitherto worked with only the medium and low powers, but wish to be possessed of the improved objectives of high power, but from want of sufficient information it is difficult to make a suitable choice. H. H.

Melbourne, Victoria, March 27

Arctic Exploration

THE story of the American Arctic Expedition under Mr. Hall is a wonderfully curious one; but are we justified, from what we have been told, in coming to the conclusion that the part of the crew of the *Polaris*, that has been rescued in so remarkable a manner, are "deserters?"

As far as I have understood the reports which have appeared in the papers, none of the rescued men have said they were deserters; and until we hear what those who remained on board the *Polaris* have to say, it appears to be unjust and reprehensible to bring so grave an accusation against men, possibly innocent.

Should it so happen that Mr. Tyson and his companions are deserters, can we put faith in the correctness of any part of their story?

There is certainly some mistake about the disposal of the six boats of the ship. As far as I can make out, only four, or at most five, are accounted for, namely, two abandoned in Smith Sound, and the two on the ice with Mr. Tyson, one of which was burnt for fuel, and the other, that in which they were when rescued, and which was taken on board the *Tigris*.

May 31 JOHN RAE

The Westerly Progress of Cities

IN his work on the Atmosphere, M. Flammarion draws attention to a peculiarity in the habits of our large towns which everyone must have noticed. "The wealthy classes have a pronounced tendency to emigrate westward, leaving the eastern districts for the labouring populations. This remark applies not only to Paris, but to most great cities—London, Vienna, Berlin, St. Petersburg, Turin, Liége, Toulouse, Montpellier, Caen, and even Pompeii."

Having frequently remarked this "westing" in many English towns, I have lately written to several friends, asking for definite information on this point, concerning the town in which they are resident. With scarcely an exception the reply of each showed, to alter Bishop Berkeley's line a little, that:—"Westward the course of fashion takes its way." This is true, I believe, of Edinburgh, Dublin in former years at any rate, Glasgow, Birmingham, Leeds, Southampton, Bristol, and Liverpool and Manchester to some extent. No doubt many of your readers can very largely extend this list; it would be interesting to collect wide information on this question. For supposing it established as a general fact, what an excellent speculation to buy up land in the west of a rapidly growing town like Leicester or Bradford! Perhaps it is common to do so already.

Whence arises this tendency? It can hardly be an accident, nor can it be due to the direction of the river beside which the town may happen to be built, for in the towns named, many of

the streams, where they exist, run in different directions. M. Flammarion thinks the westward movement is caused by the direction of sunset, towards which people feel disposed to form their gardens, build their houses, and in that direction most inclined to walk; the evening and not the morning being their usual time of recreation. Is not a more probable explanation to be found in the general dislike of an easterly wind? And, moreover, it has been pointed out that a westerly wind usually causes the greatest fall in the barometer, and thus the eastern portion of a town becomes inundated with the effluvia which arises on such occasions. Another and perhaps more potent cause may be the prevalence in Europe of south-westerly winds during the greater part of the year, whereby the smoke and vitiated air of a town are carried to the north-east more frequently than elsewhere; so that it is notorious the west end of a city is freer from smoke than the east end. Possibly all these causes may combine to produce this curious occidental march of the fashionable quarter.

W. F. BARRETT

Etymology of Aphis

WITH regard to the etymology of Aphis, I find the following in Lennis' "Synopsis der Natur-geschichte des Thier-reichs," p. 578:—

"Aphis, Blattlaus, nach Fabricius von ἀφίστημι trennen, abstehen; richtiger vielleicht ἄφυσσα von ἀφύω schöpfen; musste dann aber Aphys heissen."

The second explanation is ingenious; but neither seems to my mind satisfactory.

W. W. SPICER

Itchen Abbas Rectory, Alresford, May 14

Phosphorescence in Wood

ONE wet evening last autumn some pieces of phosphorescent wood were brought to me, which had formed part of a dead beech-tree that had been cut down during the day. They shone brightly that evening. The next night they were dark until dipped in water, when the light revived but was much fainter than before. On the third night they seemed to have lost the phosphorescence entirely, for water produced no visible effect on them.

Your correspondent, Mr. W. G. Smith, states that the luminosity of decaying wood is due to the presence of various kinds of fungus, but does not say what is the cause of it either in fungi or glow-worms. There is something so striking in the light unaccompanied by sensible heat, that an unlearned person's curiosity is roused to know whether phosphorescence is akin to burning or not. Where can one learn what is known about it?

C. A. M.

Tears and Care of Monkeys for their Dead

WE have heard much of late about the emotions of animals, and might have heard it sooner had Charles Bell's profound work on the "Anatomy and Expression," received due attention. The moral or psychical emotions of the brutes most resembling man in structure are peculiarly interesting, and sufficient observations as to this point on the monkeys seem to be yet wanting. Before I saw a picture of a weeping monkey, by Edwin Landseer, I always thought that this animal could be moved neither to tears nor laughter; and I still think that more observations, by persons most familiar with monkeys, are required on this subject, and hope to elicit them by this note in NATURE. But an affectionate care of brutes for their dead has been considered either very rare or inexistent, though it would seem to have been shown by monkeys. At least, we have evidence to this effect in the "Oriental Memoirs," 4 vols. 4to, London, 1813, by James Forbes, F.R.S., and indeed, very likely, there may be still better observations, with which I am unacquainted, on the subject. Here is an extract thereon from Mr. Forbes's book:—

"One of a shooting party, under a banian tree, killed a female monkey and carried it to his tent, which was soon surrounded by forty or fifty of the tribe, who made a great noise and seemed disposed to attack their aggressor. They retreated when he presented his fowling-piece, the dreadful effect of which they had witnessed and appeared perfectly to understand. The head of the troop, however, stood his ground, chattering furiously; the sportsman, who perhaps felt some little degree of compunction for having killed one of the family, did not like to fire at the creature, and nothing short of firing would suffice to drive him off. At length he came to the door of the tent, and finding threats of no avail, began a lamentable moaning, and by the most expressive gesture seemed to beg for the dead body. It was given him; he took it sorrowfully in his arms, and bore it away to his expecting companions: they who were witnesses of this extraordinary scene, resolved never again to fire at one of the monkey race."

GEORGE GULLIVER

Canterbury, May 24

RECENT WORKS ON ECHINODERMS

AMONG the most important of recent works on Echinoderms may be mentioned "The Revision of the Echini," by Alex. Agassiz. Of this work, which will be completed in four parts, Parts 1 and 2 were published early in this year, Part 3 is going through the press and may possibly be published in August next; it will contain the description of species not included in Part 2. Part 4 may be published this year; it will contain a review of the anatomy and classification of the order. This part will not be so well illustrated as the author had intended, for six plates of anatomy, the results of many years' labour, with all Mr. Agassiz's drawings, were lost in the great conflagration of November 9, and it will be impossible to supply their places. The present parts are accompanied by an atlas of forty-nine plates. Part 1 contains, in addition to an introductory chapter, the bibliography of the subject, a chapter on Nomenclature, a Chronological List of Names used from 1554, a Synonymic Index, and a chapter on Geographical Distribution. Part 2 contains Description of the Echini of the Eastern Coast of the United States, together with a report on the deep sea Echini collected in the Straits of Florida, by Count Pourtalès, Assistant United States' Coast Survey in the years 1867—1869.

The synonymic index will be simply invaluable to the investigator of the Echini. He who investigates the life-history of a species must surely know the name of the species he is investigating. It is therefore, even from this point of view, by no means an unimportant task to unravel the complicated and tangled network of synonyms; themselves an evidence of lack of knowledge on the part of many. Agassiz regards—and very correctly so—synonomy as the *History of the Species*, not its natural history. His opportunities for examining the types of those authors who have written on the subject were immense, and he has thoroughly availed himself of them. The great Museums of London, Paris, Copenhagen, Vienna, Stockholm, and elsewhere, were all visited by Agassiz; while the original specimens described by Klein, Gray, Desor, Michelin, and others were most carefully examined, and it must not be forgotten that in addition the Harvard College Museum contains one of the most perfect collections of Echini in the world.

It would serve no useful purpose if in this place we examined in any detail the catalogue of species of Echini given on pp. 88, 203 of this memoir; for convenience of reference the genera and the species in their respective genera are arranged alphabetically, but there is added a list of all known species arranged in their natural order, with the name adopted by Agassiz, the original name and the principal localities.

In treating of the geographical distribution of the Echini, Agassiz remarks that it was a matter of great surprise to him to find how few species, hitherto not noticed, were to be found in the European collections. Everywhere, although from different localities, were found repetitions of species already well known—so that in making a map of the littoral regions, but short stretches of shore were left out as unexplored. Though therefore new species may and will undoubtedly turn up, even in

well explored localities, we probably have even now a very fair representation of the littoral Echini of the world. It would of course be rash to make any predictions as to the number of new forms that will doubtless be brought to light by the researches of Wyville Thomson—but these will probably be deep-sea forms. Did space allow we would gladly have dwelt longer on this most interesting portion of Agassiz's memoir.

The total number of genera adopted is 90, with 207 species. The atlas accompanying these parts contains 49 plates—the first seven are devoted to charts, representing the distribution of the Echini throughout the old and new worlds, and the remaining portion to figures of some of the new or little known species. Some of the plates are photographs—and very excellent ones - others are photo-printed by the albert type process, and while these have scarcely the brilliancy or evenness of detail as such engravings as those of Echini in the expedition to Egypt, yet when the enormous difference in cost is taken into account, these photo-printed plates must be a subject of congratulation to the working and not over-rich naturalist. Some others of the plates are lithographed from Agassiz's drawings, and these we would select as being the most useful in this atlas.

Next we would mention a very important paper by Prof. Lovén, published in "Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar," 1871, No. 8. This paper was read on June 14, 1871, but was not, we think, published until the summer of 1872, and as a translation of it in full by Mr. Dallas has been published in the "Annals and Magazine of Natural History," vol. x., 4th series, October to December 1872, we will but very briefly allude to it here. Prof. Lovén describes some very small spheroidal button-like bodies furnished with a short stalk, which is normally attached to a small, slightly projecting tubercle, which he calls *Spheridia*; these occur apparently in all Echinoidea except *Cidaris*; they are fully described as they occur in the different families. Lovén next describes the order which prevails in the disposition of the ambulacral plates throughout the whole class, for which he even gives a formula.

Passing from the sea urchins to the Brittle stars, we have also, from the Proceedings of the Royal Academy of Stockholm, a paper by Ljungman describing the collection of Ophiuroids made by Dr. Goës in the West Indies, in the Josephine Expedition. Fifty-seven species are enumerated, of which fifteen are described as new. Many of these latter were dredged from very considerable depths. The author adds to his paper a conspectus of the genera of Ophiodermatidæ and a conspectus of the Atlantic species of the genera *Amphiura* and *Amphipholis*.

Lütken, in an important memoir published in the Proceedings of the Royal Academy of Copenhagen, Part 2, 1872, entitled "Ophiuridarum novarum vel minus cognitarum descriptiones nonnullæ," describes a number of new species from different parts of the world, as well as gives some details of little known species. To this memoir there is appended a chapter "On Spontaneous Division in the Star Fishes," at the conclusion of which the author sums up with the following general propositions:—(1), The most energetic manifestations of the faculty of regeneration in animals is the power of divisibility; (2), In certain forms of Radiates, in which the faculty of regeneration is very highly developed, spontaneous division takes place alone, as in Ophiuroids and Asteroids, or together with gemmation, as in Actinia; (3), Actual spontaneous division or "Schizogony," in the Actinia, Medusa, Asteroids, and Ophiuroids (which must not be confounded with the disguised forms of gemmation met with in Infusoria and certain Chetopods) may be regarded as a peculiar form of Agamic reproduction such as Blastogony, Sporogony, and Parthenogony.

Lastly we have to mention the appearance of a modest catalogue of Echinodermata of New Zealand, with diagnosis of the species, by Capt. F. W. Hutton, F.G.S., Assistant Geologist, Colonial Department. In it thirty-four species are described, eighteen of them being described as probably new to science.

E. Perceval Wright

ON THE SPECTROSCOPE AND ITS APPLICATIONS

X.

I HAVE not yet done with the spot-spectrum referred to in last article. Not only is there general absorption, but there are indications of increased selective absorption in the case of the line D, as I could also show if I were dealing with the iron lines, the magnesium lines, or the other well-known lines of the solar spectrum. Not only, then, have we a general absorption, increasing as the middle of the sunspot is approached, but this sodium line D is also thickened, so that we have, as a result of a single examination of a single sunspot, the fact that a sunspot is due to general absorption, *plus* special absorption in some particular lines.

Now, in what I said some time since on the radiation of hydrogen, I pointed out to you that the F line of hydrogen was different from the C line—in fact, I showed that it widened out towards the sun—and I also told you that Dr. Frankland and myself have asserted that that widening out is due to pressure, and we have been able artificially to widen out this F line of hydrogen by increasing the pressure. Now it struck us that possibly we might find some connection between that widening out of the F line of hydrogen and the widening out of the sodium line in the spot which I have just shown you. There is an experiment by which it is perfectly easy for us to reproduce this artificially, so that you see we can begin at the very outside of the sun by means of hydrogen, and see the widening of the hydrogen lines as the sun is approached; and then we can take the very sun itself to pieces, and, by examining the pieces, see that the sodium lines vary in thickness in different parts of the spot, as the hydrogen does outside the spot region altogether: in fact, the pressure is continually increasing down in the spot exactly in the same way as it increases in the hydrogen envelope towards the sun.

If we take a tube containing some metallic sodium sealed up in hydrogen, and pass a beam of light from the electric lamp through it, by decomposing this beam with our prisms we shall obtain an ordinary continuous spectrum without either bright or dark lines, but by heating the metallic sodium in the tube which is placed in front of the slit, we really fill that tube with the vapour of sodium; and as the heating will be slow, the sodium vapour will rise very gently from the metal at the bottom, so that we shall get layers of different densities of sodium vapour filling the tube. Immediately the sodium begins to rise in vapour, a black absorption line shows itself in our spectrum in precisely the same position as the yellow line of sodium, and you will find that the thickness of the sodium absorption line will vary with the density of the stratum of vapour through which the light passes. Thus from the upper part of the tube we obtain a fine delicate line, which gradually thickens as we approach the bottom; and thus we reproduce the appearance in the spectrum of the spot where the layers of sodium vapour are very dense, and the very fine delicate line of the sodium vapour when thrown up into the sun's chromosphere.

We must next speak of what happens in the case of the magnesium lines. A very obvious magnesium line is lettered *b* in the solar spectrum. It is a triple line, separated by different intervals. There is a very impor-

tant fact connected with these lines, which appear when magnesium vapour is thrown up into the envelope which I have called the Chromosphere. By means of the new method of research, it is quite possible to see, as I explained to you on a former occasion, what passes, which the eye could not possibly see. For instance, it is quite possible, by means of the spectroscope, to detect the existence of magnesium vapour outside the sun, although you know that, except during eclipses, we are never able to see these vapours. What I wish to call your attention to in the present case is this. We have there the three magnesium lines, and two of them are much thicker than the remaining one: and these two lines travel very much higher into the outside region than does the third one. Now, you will see in a moment that that indicates to us a fact something like this,—that the spectrum of magnesium, such as is generally at work, which cuts out these very black absorption lines in the solar spectrum, while the sodium gives us the yellow line D, is really a thing which is competent to give us three lines. This vapour, I say, is a thing, generally speaking, competent to give us three lines in this position; but if it so happens that when the magnesium is thrown up to a particular height we simply get two lines, the third stopping short, I think you will see that there is some force in one's reasoning, when one suggests that possibly in those regions where we find the hydrogen F line thin instead of thick, as I have shown it to you, and where the magnesium lines become reduced to two instead of three, the spectrum of magnesium vapour, like the spectrum of hydrogen, becomes very much more simple by *the reduction of pressure*, and therefore, that we should be able artificially, as in the case of hydrogen, and as in the case of sodium, to reproduce this result. In fact, it is perfectly easy to reproduce it, for we find by reducing the pressure of magnesium vapour we really can reduce that triple line of magnesium to a double one; so that, you see, we have three distinct lines of research, all leading us to the fact that where Kirchhoff placed an immensely dense atmosphere around a liquid sun, we really have vapour of considerable tenuity, by no means so dense as he supposed.

There is another point of very great interest which I should bring before you.

Mr. Huggins, who has done so much in his researches on stars, told us some few years ago that the spectrum of that wonderful variable star τ Coronæ, which had been just discovered, indicated that, over and above the light which we got from the star generally, we get evidence of incandescent hydrogen in the spectrum, so that the spectrum was a thing such as had never been seen before; for we got, in addition to the ordinary evidence of absorption visible in the spectrum of a star, as in the spectrum of the sun, indications also of selective radiation. There are indications of bright lines superposed above the others. Now, let me tell you—and this is a very important part of the question—that by observing the various changes that take place in our central luminary, it is quite possible to see on the sun almost any day evidence of its being violently agitated; that there are certain regions of the sun which appear exactly as that variable star did—that is to say, in addition to the ordinary absorption lines visible in the solar spectrum, the spectrum of these regions indicates to us that the hydrogen, instead of being black, instead of reversing the spectrum, as you have seen it in these spectra that I have shown you, really is bright, or else the hydrogen lines cease to be visible altogether, as in α Orionis.

I have to give you, as the last application of spectrum analysis, the power which the prism gives us of investigating, so to speak, the meteorology of the sun, the velocity with which the different stars are moving through space, and the velocity with which the storms are travelling over the face of our central luminary. Many of you know, no doubt, that Mr. Huggins, in his observations of the spectrum of the star Sirius, saw that the hydrogen lines were much developed; and in a further examination, carried on by the method in which the spectrum of hydrogen and other vapours which he wished to examine were absolutely visible in the field of view at the same time as was the spectrum of the star, Mr. Huggins was astonished to find that the hydrogen lines no longer occupied their usual positions, but that they were all jerked, so to speak, a little to the side of the place which they occupied in the spectrum of the hydrogen which he rendered incandescent in his tubes. The F line of hydrogen which he observed in the spectrum of Sirius he found did not exactly occupy the same position in the spectrum as did the actual F line of hydrogen, the incandescent hydrogen with which he compared it (Fig. 53). Owing to a physical law, which I have not time to explain to you now, it is perfectly easy, by means of the prism, to determine the velocity with which the light-source is moving to or from us; and therefore, if this holds good for absorption, we could determine the velocity with which any absorbing medium is rushing to or receding from us. In the case of Sirius, for instance, Mr. Huggins determined that the velocity of the star in a direction from the eye, the measure of recession, was something like twenty miles a second. I am sorry I have not time to fully explain this very beautiful adaptation of the spectroscope, but I may say that the position of a line, bright or dark, in the spectrum depends upon its wave-length—that is to say, the length of the wave of light which produces that colour. Thus, the length of a wave of red light is about $\frac{1}{39000}$ of an inch, and that of a wave of violet light is about $\frac{1}{57500}$ of an inch. I think when I mention that, you will see at once the possibility of determining any alteration of velocity—for an alteration of wave velocity we have, or appear to have, whether we move towards an object, or whether an object moves towards us, just in the same way as in the case of sound, and in the case of a wave reaching the shore. Suppose yourself a swimmer carried on a wave; if you are going with the wave it seems long, but if you attempt to swim against it it seems short. So with all these waves, beating from all these orbs peopling the depths of space on to the earth. If by the motion of those bodies or by our own motion, the waves are crushed together, we get an alteration in the light, which the prism alone is able to determine. If the luminous object is approaching the eye rapidly, the vibrations causing light will, of course, fall on the eye more frequently in the same time than if the bodies were at rest—or, in other words, the waves will be shortened; then the position of the dark or bright lines, as the case may be, will be shifted in the direction of the most refrangible rays—that is to say, towards the violet; whilst if the bodies are separating, the shifting will take place in the direction of the red or least refrangible rays. In the case of Sirius, the star was receding from us, and we got longer waves, and the lines are nearer the red end of the spectrum to such an extent as to leave unaccounted for a motion of recession from our sun amounting to something between 18 and 22 miles per second. Other stars, such as Betelgeux, Rigel, Castor, Regulus, and many of the stars in Ursa Major, are found to be moving away from the sun. Some, however, move rapidly towards us. Arcturus approaches us with a velocity of 55 miles per second; Vega and α Cygni, Pollux and α Ursa Majoris, also approach the sun with a velocity varying from 40 to 60 miles per second. If now we take a spot-spectrum (Fig. 54), in which, instead of the sodium line D, we have the F line of hydrogen, this strange crookedness which you notice is really a crookedness due to the fact that in one place we have incandescent hydrogen rising up with tremendous velocity, and in another we have it rushing down cool with tremendous velocity; again, we

have hydrogen in a different condition altogether. We know that in this case we have a variation of velocity, because we get distinct changes in one direction or the other, and we get changes in both directions. We can determine by the amount of crookedness of the hydrogen, whether bright or dark, how far it is driven from its normal condition, and then how fast per second the hydrogen is travelling. In one case the velocity was something like 38 miles a second; in other words, we had heated hydrogen coming up at the rate of something

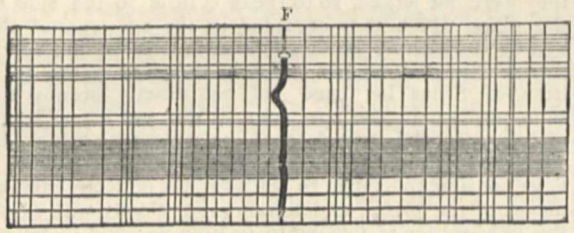

FIG. 54.—Deviation of the F line in a spot-spectrum.

like 38 miles a second, and cool hydrogen rushing down at something like an equivalent rate. Now, we are not only enabled, by a practical application of the prism, to determine these up and down rushes on the sun, by which we are enabled to learn much of its physical constitution, but also the rate at which storms travel over the sun—what we should call winds. The way that has been done will be perfectly clear on an inspection of the engraving (Fig. 55). It may appear strange to you that we should be able to observe a cyclone on the sun, but I hope to be able to prove to you that this is really a cyclone. Here is a spectrum of the region of the sun near the limb, and here is the hydrogen line. It is clear, if what I have said is true, that the incandescent hydrogen is there receding from us because the line inclines to the red. It is evident also, that in this case, when we get the line widened out towards the violet, it is coming towards us; therefore we have the thing travelling in both directions. It is obvious to you, I think, that if the slit enabled us to take in the whole cyclone, we should get an indication of motion in two directions; we should have the line diverted both towards the violet part of the spectrum, in the case of the hydrogen rushing towards us,

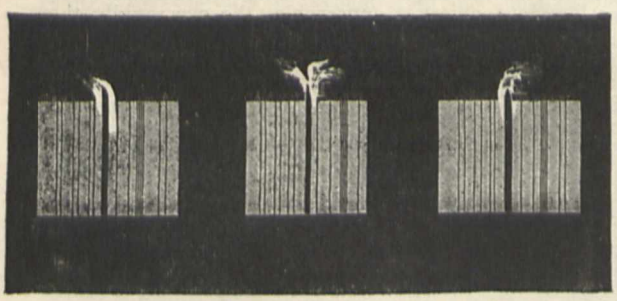

FIG. 55.—Shifting of the F line in a solar cyclone.

and towards the red in the case of the hydrogen rushing away from us in this circular storm, and the extreme velocity will be determined by the extreme limit to which the hydrogen line extends. In this case, the storm was moving with a velocity of something like 100 miles a second, which, I dare say, strikes you as something terrible; but if you compare the size of the sun with that of the earth, I think you will see it was nothing very wonderful after all.

In further evidence of the truth of this, the last application of the spectroscope, I will show you two pictures of solar prominences 27,000 miles high, drawn at an interval of ten minutes. Here you see, first, the prominence as it appeared at a particular time on a particular day in March 1869 (Fig. 56). I wish to call your attention to the left-hand portion of the prominence, which you see is pretty straight. In ten minutes afterwards the whole thing

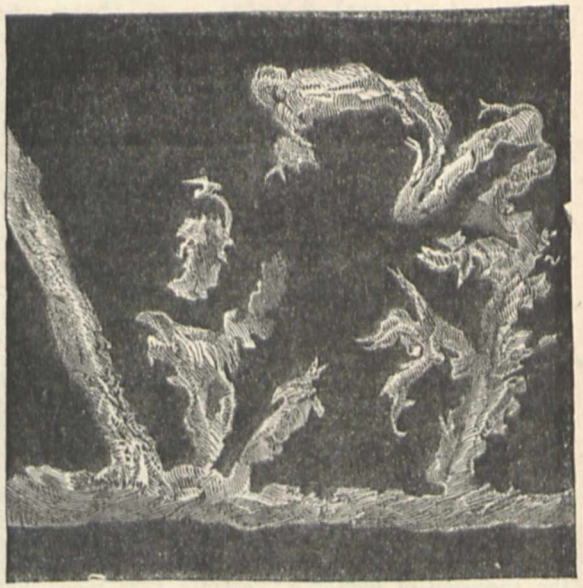

FIG. 56.—Prominence observed March 14, 1869, 11h 5m.

changed, and, as you see by the next picture (Fig. 57), the nearly straight portion is quite gone. That will give you some idea of the indications which the spectroscope reveals to us of the enormous forces at work in the sun, merely as representing the stars, for everything we have to say about the sun, the prism tells us—and it was the first to tell us—we must assume to be said about the stars. I have little doubt that, as time rolls on, the spectroscope

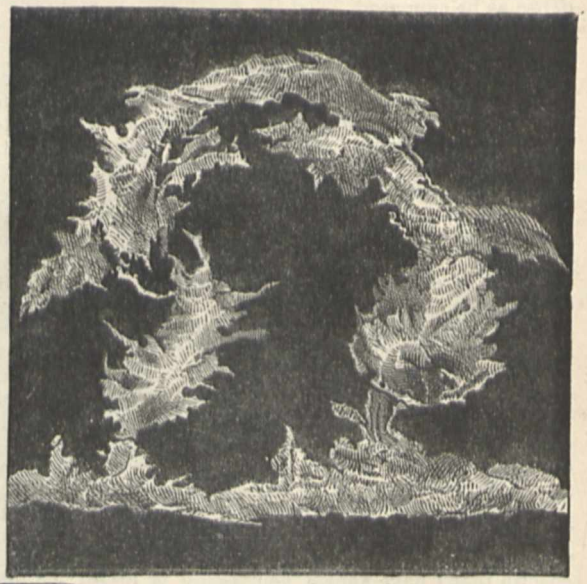

FIG. 57.—The same prominence, 11h. 15m.

will become, in fact, almost the pocket companion of every one amongst us; and it is utterly impossible to foresee what depths of space will not in time be gauged and completely investigated by this new method of research.

J. NORMAN LOCKYER

ON THE ORIGIN AND METAMORPHOSES OF INSECTS*

V.

THE development of the beautiful *Comatula rosacea* (Fig. 41) has been described in the "Philosophical Transactions," by Prof. Wyville Thomson.† The larva quits

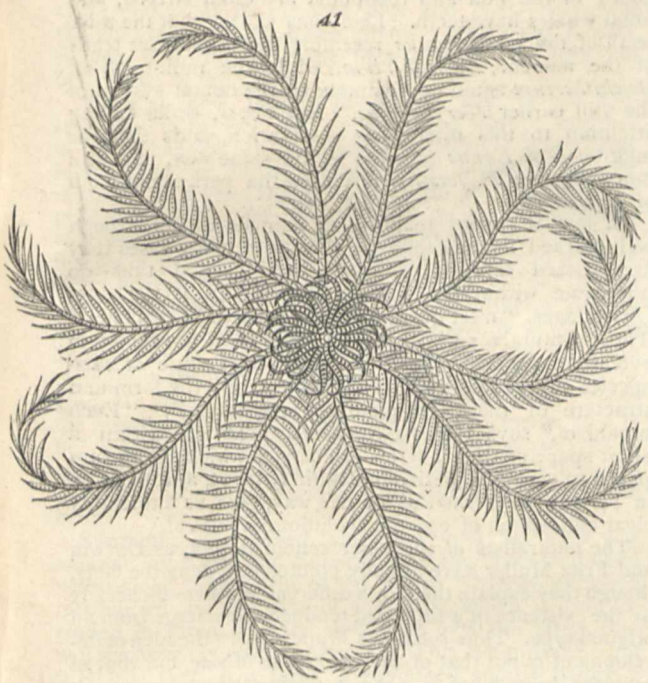

FIG. 41.—Comatula rosacea (after Forbes).

the egg, as shown in Fig. 42, in the form of an oval body about $\frac{1}{30}$ inch in length, something like a small barrel, surrounded by four bands or hoops of long vibratile hairs or ciliæ. There is also a still longer tuft of hairs at the narrower posterior end of the body. Gradually a number of minute calcareous spines and plates make their appearance (Fig. 43) in the body of this larva, and at length

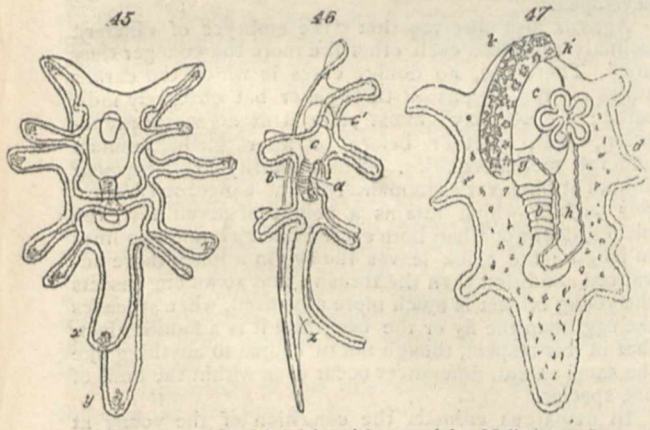

FIG. 45.—Larva of Starfish (Bipinnaria), × 100 (after Muller). 46, Larva of Starfish (Bipinnaria), × 100, seen from the side. *a*, mouth; *b*, œsophagus; *c*, stomach; c^1, intestine. 47, Larva of another Bipinnaria, showing the commencement of the starfish. *g*, canal of the ciliated sac; *i*, rudiments of tentacles; *d*, ciliated band.

arrange themselves in a definite order, so as to form a bent calcareous club or rod with an enlarged head.

* Continued from p. 70.

† Philosophical Transactions, 1865, vol. clv. . 513.

As this process continues the little creature gradually loses its power of swimming and sinks to the bottom, loses the bands and cilia and attaches itself to some stone or other solid substance, by its base, the knob of the club being free. The calcareous framework increases in size, and the expanded head forms itself into a cup, round which from five to fifteen delicate tentacles, as shown in Fig. 44, make their appearance.

In this stage the young animal resembles the Crinoids, a family of Echinoderms which were very abundant in earlier geological periods, but which have now almost disappeared, being, as we see, represented by the young states of our existing, more advanced, species. This attached, plant-like condition of Comatula, was indeed at

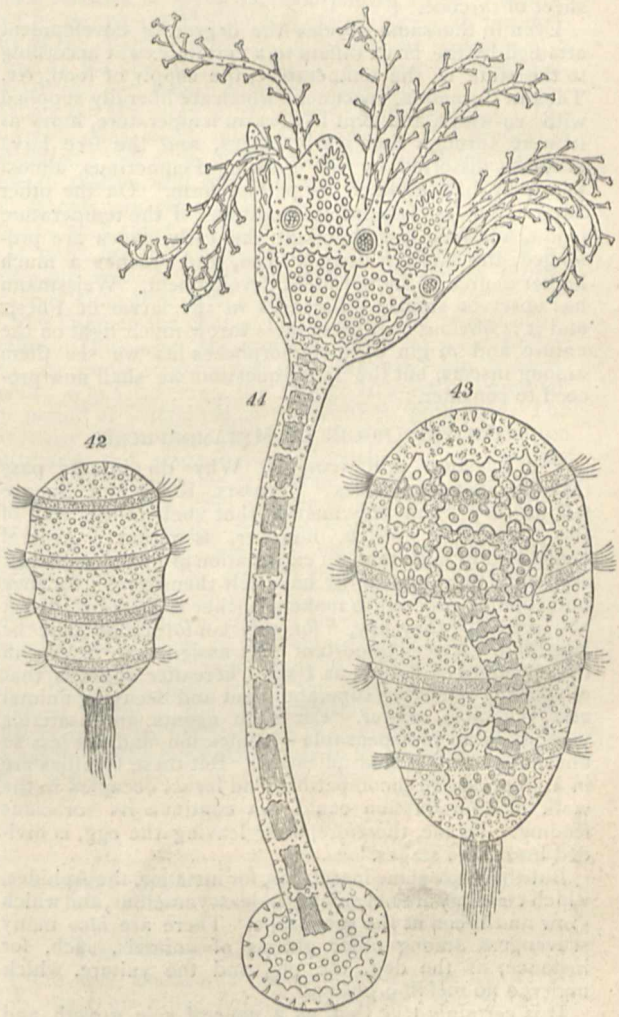

FIG. 42.—Larva of Comatula rosacea (after Thomson). 43, Larva of Comatula rosacea, more advanced. 44, Larva of Comatula rosacea, in the Pentacrinus state.

first supposed to be a Crinoid, and was named Pentacrinus, though we now know that it is only a stage in the development of Comatula. The so-called Pentacrinus increases considerably in size, and after various gradual changes, which time does not now permit me to describe, quits the stalk, and becomes a free Comatula.

The metamorphoses of the true star-fishes are also very remarkable. Sars discovered in the year 1835 a curious little creature about an inch in length, which he named *Bipinnaria asterigera*, and which he then supposed to be allied to the ciliograde Medusæ; subsequent observations however, made in 1844, suggested to him that it was the

larva of a star-fish, and in 1847 MM. Koren and Danielson satisfied themselves that this was the case.

Figs. 45 and 46 represent the front and side view of a Bipinnaria found by Muller* near Marseilles. *a* is the mouth, *b* the œsophagus, *c* the stomach, *c'* the intestine. Fig. 47 represents a somewhat older specimen in which the Starfish (*k*) is already beginning to make its appearance.

But while certain Starfishes thus go through metamorphoses, similar in character to, and not less remarkable than, those of sea-eggs; there are others, as, for instance, the genus Asteracanthium, in which the organs and appendages special to the Pseudembryo, are in abeyance, while in Pteraster "the zooid is reduced to an investing sheet of sarcode." †

Even in the same species the degree of development attained by the larva differs to a certain extent according to the state of the temperature, the supply of food, &c. Thus in Comatula, specimens which are liberally supplied with sea-water, and kept in a warm temperature, hurry as it were through their early stages, and the free larva becomes distorted by the growing Pentacrinus, almost before it has attained its perfect form. On the other hand under less favourable conditions, if the temperature is low, and food less abundant, the early stages are prolonged, the larva is longer lived, and reaches a much higher degree of independent development. Weissmann has observed similar differences in the larvæ of Flies,‡ and it is obvious that these facts throw much light on the nature and origin of metamorphoses as we see them among insects, but the latter question we shall now proceed to consider.

On the Origin of Metamorphoses

The question still remains, Why do insects pass through metamorphoses? Messrs. Kirby and Spence tell us they "can only answer that such is the will of the Creator;"§ which, however, is rather a general confession of faith than an explanation of metamorphoses. And this they appear to have felt themselves; for they immediately proceed to make a further suggestion. "Yet one reason," they say, "for this conformation may be hazarded. A very important part assigned to insects in the economy of nature, as I shall hereafter show, is that of speedily removing superabundant and decaying animal and vegetable matter. For such agents an insatiable voracity is an indispensable qualification, and not less so unusual powers of multiplication. But these faculties are in a great degree incompatible; an insect occupied in the work of reproduction could not continue its voracious feeding. Its life, therefore, after leaving the egg, is divided into three stages."

But there are some insects, as, for instance, the Aphides, which certainly are not among the least voracious, and which grow and breed at the same time. There are also many scavengers among other groups of animals, such, for instance, as the dog, the pig, and the vulture, which undergo no metamorphosis.

It is certainly true that, as a general rule, growth and reproduction do not occur together; and it follows, almost as a necessary consequence, that in such cases the first must precede the second. But this has no immediate connection with the occurrence of metamorphoses. The question is, not why an insect does not generally begin to breed until it has ceased to grow, but why, in attaining to its perfect form, it passes through such remarkable changes. And in addition to this, we must consider, first, the sudden and apparently violent nature of these transitions, and, secondly, the immobility of the animal in its pupa state; for undoubtedly the quiescent and deathlike condition of the pupa is one of the most remarkable characteristics of insect-metamorphosis.

In the first place, it must be observed that many species which differ considerably in their mature state, agree more nearly when young. Thus birds of the same genus, or of closely allied genera, which, when mature, differ much in colour, are often very similar when young. The young of the lion and the puma are often striped, and fœtal whales have teeth. Leidy has shown that the milk teeth of the genus *Equus* resemble the permanent teeth of the ancient *Anchitherium*, while the milk-teeth of *Anchitherium* again approximate to the dental system of the still earlier *Merychippus*. Rutimeyer, while calling attention to this interesting observation, adds that the milk-teeth of *Equus caballus* in the same way, and still more those of *E. fossilis*, resemble the permanent teeth of *Hipparion*.

In fact, the great majority of animals do go through well-marked metamorphoses, though in many cases they are passed through within the egg, and thus do not come within the popular ken. "La larve," says Quatrefages, "n'est qu'un embryon à vie independante."* Those naturalists who accept in any form the theory of evolution, consider that "the embryonal state of each species reproduces more or less completely the form and structure of their less modified progenitors."† "Each organism," says Herbert Spencer,‡ "exhibits within a short space of time a series of changes which, when supposed to occupy a period indefinitely great, and to go on in various ways instead of one way, give us a tolerably clear conception of organic evolution in general.

The naturalists of the older school do not, as Darwin and Fritz Muller have already pointed out, deny the facts, though they explain them in a different manner—generally by the existence of a supposed tendency to diverge from an original type. Thus Johannes Muller says "the idea of development is not that of mere increase of size, but that of progress from what is not yet distinguished, but which potentially contains the distinction in itself, to the actually distinct,—it is clear that the less an organ is developed, so much the more does it approach the type, and that, during its development, it more and more acquires peculiarities. The types discovered by comparative anatomy and developmental history must therefore agree."

And again, "What is true in this idea is, that every embryo at first bears only the type of its section, from which the type of the class, order, &c., is only afterwards developed."

Agassiz also observes that "the embryos of different animals resemble each other the more the younger they are." There are, no doubt, cases in which the earlier states are rapidly passed through, or but obscurely indicated; yet we may almost state it as a general proposition, that, whether before or after birth, animals undergo metamorphoses. The maturity of the young animal at birth varies immensely. The kangaroo (*Macropus major*), which attains a height of seven feet, ten inches, does not when born exceed one inch and two lines in length; the chick leaves the egg in a much more advanced condition than the thrush; and so among insects the young cricket is much more advanced, when it leaves the egg, than the fly or the bee; and it is a familiar fact, that in this respect, though not of course to anything like the same extent, differences occur even within the limit of one species.

In oviparous animals the condition of the young at birth depends much on the size of the egg; where the egg is large, the abundant supply of nourishment enables the embryo to attain a higher stage of development; where the egg is small, and the yolk consequently scanty, it is soon exhausted, and the embryo requires an addi-

* Ic Zweit. Abb. Pl. 1, Figs 8 and 9.
† Thomson, on the Embryology of the Echinodermata, *Natural History Review*, 1863, p. 415.
‡ Zeits. fur Wiss. Zool. 1864, p. 228.
§ Introduction to Etymology, 6th Ed. i. p. 61.

* Metamorphoses de l'Homme et des Animaux, p. 133.
† Darwin, Origin of Species, 4th Ed. p. 532.
‡ Principles of Biology, vi. p. 349.

tional supply of food. In the former case the embryo is more likely to survive; but, on the other hand, when the eggs are large, they cannot be numerous, and a multiplicity of germs is, in some circumstances, a great advantage. Even in the same species the development of the egg offers certain differences.*

The metamorphoses of insects depend then primarily on the fact that they quit the egg in a very early condition; many—as, for instance, flies and bees—before the thoracic segments are differentiated; others—as locusts, dragon flies, &c., after the formation of the legs, but before that of the wings.

We may now pass to the second part of the subject, that is to say, the sudden and abrupt instance of the changes which insects undergo. The development of an Orthopterous insect, indeed—say, for instance, of a grasshopper—from birth to maturity is so gradual, that but for the influence on our nomenclature exercised by the most striking changes which occur in insects of the Heteromorphous series, they would perhaps never have been classed as metamorphoses. But though the changes from the caterpillar to the chrysalis, as from the chrysalis to the butterfly, are apparently sudden and abrupt, this is in reality more apparent than real; the changes in the internal organs, though rapid, are in reality gradual; and even as regards the external form, though the metamorphosis may take only a few moments, this is but the change of outer skin—the drawing away, as it were, of the curtain; and the new form which then appears has been in preparation for days or, perhaps, weeks before.

Swammerdam, indeed, supposed (and his view was adopted by Kirby and Spence) that the larva contained within itself "the germ of the future butterfly, enclosed in what will be the case of the pupa, which is itself included in three or more skins, one over the other, that will successively cover the larva." This is a mistake; but it is true that, if a larva is examined shortly before it is full grown, the future pupa may be traced within it. In the same manner, if we examine a pupa which is about to disclose the butterfly, we find the future insect, soft indeed and imperfect, but still easily recognisable, lying more or less loosely within the pupa-skin.

One important difference between an insect and a vertebrate animal is, that whereas in the latter, as for instance in ourselves, the muscles are attached to an internal bony skeleton, in insects no such skeleton exists. They have no bones, and their muscles are attached to the skin. Hence the necessity for the hard and horny dermal investment of insects, so different from the softness and suppleness of our own skin. Moreover the result is, that without a change of skin a change of form is impossible. The chitine, or horny substance, forming the outside of an insect, is formed by a layer of cells lying beneath it, and, once secreted, cannot be altered. From this it follows that every change of form is necessarily accompanied by a change of skin. In some cases, as for instance in *Chloëon*, each change of skin is accompanied by a change of form, and thus the perfect insect is more or less gradually evolved. In others, as for instance in caterpillars, several changes of skin take place without any material alteration of form, and the change, instead of being spread over many, is confined to the last two moults.

The explanation of this difference is, I believe, to be found in the structure of the mouth. That of the caterpillar is provided with a pair of strong jaws, fitted to eat leaves; and the digestive organs are adapted for this kind of food. On the contrary, the mouth of the butterfly is suctorial; it has a long proboscis, beautifully adapted to suck the nectar from flowers, but which would be quite useless, and indeed only an embarrassment to the larva.

* For differences in larvæ consequent on variation in the external conditions, see *ante*, p. 31.

The digestive organs also are adapted for the assimilation, not of leaves, but of honey. Now it is evident that if the mouth-parts of the larva were slowly metamorphosed into those of the perfect insect, through a number of small changes, the insect would in the meantime be unable to feed, and liable to perish of starvation in the midst of plenty. On the contrary, in the Orthoptera, and as a general rule, among those insects in which the changes are gradual, the mouth of the so-called larva resembles that of the perfect insect, and the principal difference is in the presence of wings.

Similar considerations throw much light on the nature of the chrysalis or pupa state—that remarkable period of death-like quiescence which is one of the most striking characteristics of insect metamorphosis. The comparative quiescence of the pupa is mainly owing to the rapidity of the changes going on in it. In the chrysalis of a butterfly, for instance, not only (as has been already mentioned) are the mouth and digestive organs undergoing change, but the same is the case with the muscles. The powerful ones which move the wings are in process of formation; and even if they were in a condition favourable to motion, still the nervous system, by which the movements are set on foot and regulated, is also in a state of such rapid change that it could scarcely act.

It must not be forgotten that all insects, indeed all articulate animals, are inactive for a longer or shorter space of time after each moult.

The slighter the change the shorter the period of inaction. Thus, after the ordinary moult of a caterpillar, the insect only requires rest until the new skin is hardened. When, however, the change is great and gradual, the period of inaction is correspondingly prolonged. The inactivity of the pupa is therefore not a new condition peculiar to this stage, but a prolongation of the inaction which accompanies every change of skin. Most pupæ indeed have some slight powers of motion; those which assume the chrysalis state in wood or under ground usually come to the surface when about to assume the perfect state, and the aquatic pupæ of certain Diptera, swim about with much activity. Among the Neuroptera certain families have pupæ as quiescent as those of the Lepidoptera; others, as, for instance, Raphidia, are quiescent at first, but at length acquire sufficient strength to walk, though enclosed within the pupa skin, a power dependent partly on the fact that this skin is very thin. Others again, as, for instance, dragon-flies, are quiescent on assuming the pupa state, only in the same manner and for a similar time as at other changes of skin.

JOHN LUBBOCK

(To be continued.)

NOTES FROM THE "CHALLENGER"

III.

THE MILLER-CASELLA THERMOMETER

AT 8 A.M., on March 26, we sounded, lat. 19° 41′ N. long. 65° 7′ W., in 3,875 fathoms. The sounding was perfectly satisfactory, and left no doubt that the depth was estimated within a very small error. The "Hydra" sounding instrument was used weighted to 3 cwt. A slip water-bottle, and two Miller-Casella thermometers (Nos. 39 and 42) were sent down along with it as usual. The tube of the "Hydra" came up filled with a reddish clay containing a considerable quantity of carbonate of lime. The two thermometers were broken, and as the mode in which the fracture occurred is in itself curious, and has an important bearing upon the use of these instruments at extreme depths, I will briefly describe the condition of the thermometers when they came to the surface.

No. 39, a valuable instrument, with a small and constant error, which we had used for some time wherever

for any reason we required extreme accuracy, was shattered to pieces (Fig. 1).

In No. 42 this instrument was externally complete, with the exception of a crack in the small unprotected bulb on the right limb of the U-tube. The inner shell of the protected bulb was broken to pieces (Fig. 2).

In both of these cases there seems little doubt that the damage occurred through the giving way of the unprotected bulb. In No. 39 the upper part of that bulb was ground into coarse powder, and the fragments packed into the lower part of the bulb and the top of the tube. The large bulb and its covering shell were also broken, but into larger pieces, disposed as if the injury had been produced by some force acting from within. The thermometer tube was broken through in three places ; at one of these, close to the bend, it was shattered into very small fragments. The creosote, the mercury, and bubbles of air were irregularly scattered through the tube, and it is singular that each of the steel indices had one of the discs broken off. The whole took place no doubt instantaneously by the implosion of the small bulb, which at the same time burst the large bulb and shattered the tube.

In No. 42 a crack only occurred in the small bulb, either through some pre-existing imperfection in the glass or from the pressure. When the pressure became extreme the crack yielded a little, and the sea-water was gradually forced in, driving the contents of the thermometer before it, and taking it at a disadvantage from within, breaking the shell of the large bulb, which was unsupported on account of the belt of rarified vapour between it and its outer-shell. The pressure was now equalised within and without the instrument, and the injury went no farther. Alcohol, creosote, mercury, and sea-water were mixed up in the outer case of the large bulb, with the debris of the inner bulb, and one of the steel indices lay uninjured across the centre of it.

It now becomes an important question why the thermometer should give way at that particular point, and one still more important, how the defect is to be remedied. At first sight it is difficult to imagine why the small bulb should give way rather than the outer shell of the large one. The surface exposed to pressure is smaller, the glass is thicker, and it is somewhat better supported from within, as the tube is nearly filled with fluid under the pressure of an atmosphere. I believe the cause must be that the end of the small bulb is the last point of the instrument heated and sealed after the tube is filled with liquid, and that, consequently, the annealing is imperfect at that point. It is evidently of no use to protect the small bulb in the same way in which the large bulb is protected. The outer shell is merely a precaution to prevent the indications being vitiated by the action of pressure on the elastic bulb. Against crushing, it is

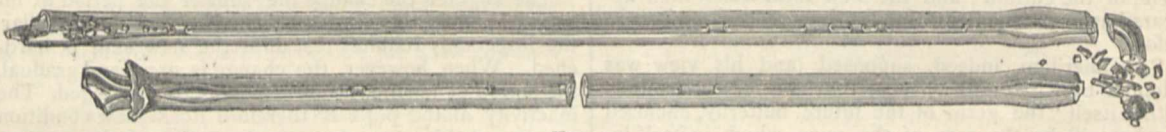

FIG. 1

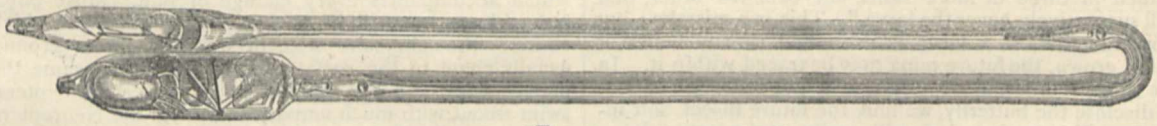

FIG. 2

no protection ; rather a source of weakness, from its greatly increasing the surface. The only plan which seems to be feasible is to thicken the small bulb itself, and, if possible, to improve its temper. It is only fair to say that these thermometers were tested and guaranteed to only three tons on the square inch, and that the pressure to which they were subjected was equal to four tons.

WYVILLE THOMSON

NOTES

THE Albert Gold Medal of the Society of Arts has this year been awarded to M. Chevreul, Member of the Institute of France, and Director of the Gobelins and of the Jardin des Plantes at Paris, for his valuable researches in connection with Saponification, Dyeing, Agriculture, and Natural History, which, for more than half a century, have exercised a wide influence on the industrial arts of the world.

PROF. HUMPHRY announces that the Cambridge class for Practical Histology will meet during the months of July and August at the Anatomical Museum on Tuesdays, Thursdays, and Saturdays, at 9 A.M., commencing July 1. The Class for Human Osteology will meet on Mondays, Wednesdays, and Fridays at the Anatomical Museum at 9 A.M. during July and August, commencing July 2. The Professor of Zoology and Comparative Anatomy (Mr. Newton) announces that a class for practical work will be carried on in July and August by the Demonstrator in Comparative Anatomy, commencing July 2. The fee for the course will be one guinea.

THE following gentlemen have been recommended by the French Academy of Sciences to the Minister of Public Instruction for the four vacant posts in the Bureau des Longitudes :—M. Serret, M. Mouchez, M. Perrier, and M. Janssen.

THE Council of the Society of Arts having been informed that Her Majesty's Commissioners do not intend to publish reports on the different departments of the exhibition of the present year, have decided to undertake that duty, and for this purpose have engaged the services of gentlemen specially skilled in the subjects of the several sections, to prepare such reports for publication in the Society's *Journal*. A report on Ancient Objects, by Mr. C. Drury Fortnum, F.S.A., and another on Surgical Instruments and Appliances, by Mr. R. Brudenell Carter, F.R.C.S., appear in the *Journal* for May 30.

AT a meeting of the Council of the Leeds Naturalists' Field Club and Scientific Association, three of its members—Mr. Wm. Todd (vice-president), Mr. W. D. Roebuck (secretary), and Mr. John W. Taylor—were appointed a sub-committee to consider the best manner of collecting information for a series of catalogues of the natural productions of the district. The sub-committee having taken into consideration all the facts bearing upon the subject in hand, are of opinion that the following procedure should be adopted :—1. That in view of the approaching meeting in Bradford, in August next, of the British Association for the Advancement of Science, it is advisable that there should be produced by this society, and under its auspices, a brief account of the present state of our knowledge of the fauna, flora, and geological and topographical features of the district. 2. That for present use the most convenient district to illustrate would

be the one produced by striking a circle of ten miles' radius, having the Leeds Town Hall for its centre. 3. That, as far as practicable, the lists should be complete, and as full as possible in detail as to the distribution of the species; and that they should be prefaced by a good outline sketch of the physical conformation and geological structure of the district. In conformity with these recommendations, the sub-committee would be glad to receive lists, as complete as possible, from all persons willing to co-operate in the work. These lists, to be available for immediate use, must be sent in before the 1st of July, 1873. Should the amount of information received up to that date warrant the Council in so doing, the lists will be placed in the hands of small committees of revision, whose province it will be to construct general catalogues combining all the information in the possession of the Society; and it is then hoped that during the first week in August, a small work may be published. The sub-committee will be very glad to receive all suggestions that may be made; and would be glad also to learn the names of all persons likely to be able to supply information. All communications to be addressed to the Secretaries, 9, Sunny Bank Terrace, Leeds.

We have received the Report, for 1872, of Mr. B. A. Gould, superintendent of the Argentine National Observatory at Cordoba, and a very creditable report it is, both to Mr. Gould and his assistants, as well as to the liberality of the Argentine Government, which seems to have done all in its power to provide the necessary buildings and instruments. The buildings are not yet quite complete, though a number of excellent instruments have been acquired, and others are being provided. The principal work of the observatory has been the preparation of a Uranometry, which will contain a larger number of stars than the recently published one of Heis for the northern heavens; Heis's contains 5,421 stars. In the Uranometria Argentina, the brilliancy of the stars will be determined to single tenths of a limit of magnitude. There now remains nothing of importance to be done in the way of observation, since each star has been observed upon the average at least four times, and the degree of its brilliancy determined with the greatest precision possible. To prepare these results for publication, the position of every star will be computed for the commencement of 1875, a part of which labour has already been accomplished, and then to prepare the maps for reproduction by the engravers. The observation of the zones for the formation of an extended catalogue of stars between the 23rd and 80th degree of south declination, was commenced in September last, and is being carried on satisfactorily; as also is the photographic work of the observatory, a very considerable number of photographic impressions of clusters of stars having been made, which only need a knowledge of their zero of position to render them serviceable. Means are also taken to spread a knowledge of the exact time at regular intervals throughout the Confederation. Altogether the Argentine Observatory appears to be exceedingly efficient.

We have received from Prof. A. Kerner, of Innsbrück, several interesting contributions to systematic and physiological botany —"Ueber die Schafgarben-Bastarte der Alpen," an account of the hybrid yarrows found in the Tyrolese Alps; "Novæ Plantarum Species, Decas iii.," containing descriptions of new Rubi of Austria and the Tyrol; and "Chronik der Pflanzen-wanderungen," in which he narrates the curious circumstances connected with the spread of a North-American plant, *Rudbeckia laciniata*. This plant first became known in Europe early in the seventeenth century, when it was introduced into the gardens of Paris; during two centuries and a half it has gradually spread over the gardens of nearly the whole of Europe, but appears only within the last twenty or thirty years to have escaped, and within that short space of time has become completely naturalised in a great number of places. In a communication to the Scientific and Medical Society of Innsbrück, Dr. Kerner states, as the result of his observations on Alpine plants, that the growth of the stem and even of the flowers of many species proceeds at the temperature of zero C.; the flowers may in some cases open, and even mature their pollen, beneath a thick covering of ice, the surface of the glacier being penetrated in innumerable places by their stems.

Dr. A. Kerner reprints from the Proceedings of the Scientific Society of Innsbrück an interesting paper on the means of protection of the pollen of plants against premature displacement or damp. As the vitality of pollen is immediately destroyed by exposure to the action of either rain or dew, he finds in nature a variety of contrivances to protect it against these injurious influences during the interval between its escape from the anther and its being carried away by insects, these contrivances being generally absent in those plants where fertilisation is effected by the pollen being conveyed at once to the stigma by the wind. In plants with coherent pollen, fertilised by insect agency, where some of the anthers are so placed as to be necessarily exposed to the weather, these are generally found to be barren, or destitute of pollen, and where they would interfere with the entrance of insects into the flower, they are altogether abortive or rudimentary. Plants with coherent pollen, which require insect agency for their fertilisation, Dr. Kerner believes to be of more recent geological occurrence than those with powdery pollen, which require only the wind to convey it to the stigma.

The proceedings of the Asiatic Society of Bengal contain remarks on winds, typhoons, &c., on the south coast of Japan, by Commander H. C. St. John, H.M.S. *Sylvia*. The most prevalent winds in the southern parts of Japan are from the north-east. Throughout an entire year the proportion was as follows, taking 1,000 hours as an index:—Between N. and E., 500; between N. and W., 200; between S. and E., 100; between S. and W., 0·99. During April, May, June, July, August, and September, N.E. winds prevail, hauling more easterly in June, July, and August. In August and September S.E. winds are more frequent than during any other months. In October variable winds prevail, and the N.W. wind begins. During November, December, January, and February the N.W. winds prevail and blow hard. In March the N.W. and N.E. winds are equally distributed. The S.W. winds most frequently occur during the early parts of September. It appears the winds on the southern coasts of Japan are easterly during April (spring), and hauling to the S. as the summer approaches, pass through S. and W. to N.W. during winter, coming again through N. to N.E. and E. in spring and summer. Typhoons occur between June and October, inclusive. From the middle of August to the middle of October they may be expected to occur most frequently. The usual tracks of these storms on the Japan coasts appear very regular; approaching from the S.E. travelling about N.W. On reaching the hot stream in about the latitude of the Bonin Islands, or between here and the Foochoo Islands, they begin to curve to the north, and following the course of the Kuro Siwo, strike the south coasts of Nipon. Owing chiefly to the high land along the coast, the northern disc of the storm becomes much flattened in, causing more easterly wind than would occur if the storm were in mid ocean. Retaining the course of the stream, they pass along in a north-easterly course, and, if not broken up previously, pass out into the Pacific Ocean on reaching Inaboya saki.

Mr. James Wood-Mason has sent us a description of a Macrurous Crustacean, which he has made the type of a new genus, *Nephropsis Stewarti*. The specimen (a female) he

describes was dredged in from 250 to 300 fathoms, about twenty-five miles off Ross Island on the Eastern coast of the Andamans. It is clearly allied to *Nephrops Norvegicus* of Northern European seas, its main difference being the absence of the squamiform appendage of the Antennæ. One of the most interesting points about the new crustacean is the loss of its organs of vision by disuse, a characteristic of several recently discovered crustaceans; this is compensated for by the great length and delicacy of the antennæ, and the great development of the auditory organs, the animal's habits being to burrow in the mud at the depth of about 300 fathoms.

It may be recollected that M. Alphonse Pinart, the French philologist, visited the Aleutian Islands and Alaska in the summer of 1871, for the purpose of collecting the vocabularies and the photographs of the different tribes. This material he carried back with him to Paris, where he has been engaged in working it up. We learn that he expects to revisit the United States this month, with ample funds in his hands from the French government, in order to effect an exhaustive collection of the antiquities of Alaska, his excursions to the different islands being made in a vessel especially fitted up for his use. Alaska is one of the finest fields in the world for ethnological and prehistoric research.

Professor Wyman has concluded, as the result of explorations among the shell mounds of Florida, U.S., during the past winter, that the aborigines by whom they were constructed must have been decided cannibals, as in eight different instances he has found considerable quantities of human bones in the shell heaps, the bones themselves being broken up and split, just as in the case of the bones of other animals. This, he is satisfied, was not the result of burial, but was done for the purpose of obtaining the marrow, probably after the flesh had been devoured.

Under the auspices of the Society of Biblical Archæology it is intended shortly to publish a series of translations of all the important Assyrian and Egyptian texts which exist in the various collections of England and the Continent, and thus place before the English student the remains of undoubtedly the oldest and most authentic literature in the world. Nearly all the principal translators have offered their services for this purpose, and while each author will be alone responsible for his portion of the work, the general arrangement of the materials will rest with the president of the society. The selection of the records will embrace the entire range of Egyptian and Assyrian history and literature. Each translation will quote the authorities upon which it is based, or the monument from which it is taken, and all other notes will be as few and brief as possible, to avoid controversy and expense. The first volume will be issued by Messrs. Bagster and Sons, at a price to bring it within the reach of all interested in such subjects.

The *conversazione* of the Society of Arts will be held at the South Kensington Museum on Friday evening, June 28.

The late distinguished chief of the U.S. Coast Survey, by his will, established a fund to be placed in the hands of executors, by whom the income is to be expended, under the direction of a committee of the National Academy of Science, for the advancement of some branch of physical research. The first report of results achieved through this bequest was recently made to the Academy by its President, Professor Joseph Henry. The committee had decided that in view of the great interest that Professor Bache had throughout his life manifested in terrestrial magnetism, it would be highly proper to further this science by gradually extending over the country the magnetic survey which, during his own lifetime, he had carried out in the Middle States. In the execution of this design they had been so fortunate as to secure, at small expense, the services of Dr. Hilgard, of St. Louis, by whom, in 1872, chiefly in the season most favourable for travelling, quite a large number of stations were occupied for the determination of the magnetic elements. These stations are mostly in the Southern States, and it is the intention of the committee to extend the work annually, northward and westward, as the income from the fund may allow.

The U.S. Army Signal Office has made preparations for a great extension of its valuable system of reports of the heights of rivers, particularly of all those opening into the Mississippi. Over twenty-five stations are now established at suitable points on these rivers, especially, of course, on the Ohio, Missouri, and Mississippi. They are provided in some instances with automatic self-recording apparatus, and at all other places the observation of the height of the water is taken eight times daily when floods are apprehended. By this most beautiful system every wave of high water is accurately followed in its course down stream, and the approach of dangerous high floods is easily foretold by the repeated telegraphic reports. The system of river reports, which has been in operation during the past year, has given such universal satisfaction to those navigating the Western waters that the demand for increased facilities can only be met by this new and far more elaborate system of stations.

The results of the explorations in the Gulf of St. Lawrence prosecuted during the months of July and August, 1872, by Messrs. Whiteaves and Bulger, have just been published. The area examined extended from a little above Cape Rozier to the Magdalen Islands. A depth of water somewhat over 200 fathoms was found near the centre of the mouth of the St. Lawrence, between Cape Rozier and the south-west point of Anticosti; the greatest depth actually met with was 313 fathoms, about half-way between the east point of Anticosti and the Bird Rocks. Large collections were made, embracing several species new to science. Among the novelties discovered was a sponge belonging to a genus but recently indicated in the "Depths of the Sea." About thirty-five species of corallines were obtained, large numbers of them being new. Numerous fine specimens of *Virgularia* were procured, the same kind having been found by Dr. Packard on the Georges Bank, and three species of sea-anemones were secured in addition to those of last year's collection. Two undescribed specimens of a coral (both dead) were also gathered at a considerable distance from each other. The relations of these new species are rather to the tropical forms than to those which we already know on the coast of the North Atlantic.

A shock of earthquake, lasting for several seconds, was felt at Attok on the morning of Sunday, April 27.

We have been favoured with a copy of the *Japan Gazette*, from which we take the following notes:—A huge cephalopod is now being shown in a house near the temple at Asaka, Yedo. It seems that a fishing-boat was seized by its tentacles whilst off the village of Kononoto, in the district of Kisaradzou, and that the boatmen killed the creature by repeated blows. Its length from the tail to the insertion of the tentacles is about sixteen feet; one of the arms is from its junction with the body to the sucker at its point nearly five feet. The polypus has shrunk since its death, so that living, it would probably measure considerably more.—The anomalous absence of earthquakes during the past winter has excited some speculation as to the causes of such quiet, in a country usually very tremulous towards the coming of spring. Whatever may be the real causes, the remarkable volcanic activity in Japan, during the past winter, and at present, is an interesting collateral phenomenon. From nearly all parts of the empire, during the last two months, have come tidings of

mountains quaking and bursting in fissures, volcanoes casting out stones, ashes, and mud, and in some instances flame and hot lava. Smoke and steam from Asamayama have been visible from Yedo, several times this winter. In addition to the eruptions in Yechiu, Mito and Higo, the latter being especially severe and damaging to the cultivated land around it,—another mountain is reported as being affected with volcanic symptoms. Kurokami-yama, near Nikko, which has, so far as is known, always been very quiet, was shaken with a great shock on March 12, at 3 P.M. The shock was accompanied by loud noise, and a strong smell of sulphur, which remained about six hours.

ADDITIONS to the Brighton Aquarium during the past week: a Porpoise (*Phocæna communis*) from Rye Bay; a Sturgeon (*Accipenser sturio*), 6 feet long, captured by the Bognor fishermen; Smooth Hounds or Skate-toothed Sharks (*Mustilus vulgaris*); White Hound or Toper (*Galeus canis*); Thornback Skate (*Raja clavata*); Sting Rays (*Trygon pastinaca*); Grey Mullet (*Mugil capito*); Flounders, fresh-water variety (*Pleuronectes flesus*); Butterfish or Gunnel (*Centronotus gunnellus*); Allis Shad (*Clupea alosa*); Salmon (*Salmo salar*); Ballan Wrasse (*Labrus maculatus*); Crabs (*Cancer pagurus*); (*Portunus puber*); (*Polybius Henslowi*); (*Carcinas Mœnas*); Zoophytes (*Actinoloba dianthus*); (*Tealia crassicornis*); (*Sagartia miniata*); (*S. nivea*).

THE additions to the Zoological Society's Gardens during the past week include a Bengalese Cat (*Felis bengalensis*) and two Indian Crows (*Corvus splendens*) from Arracan, presented by Mr. W. Dunn; a New Caledonian Rail (*Ocydromus lafresnayanus*), presented by Dr. G. Bennett; an Indian Porphyrio (*Porphyrio indicus*) from the Navigator's Islands, presented by Rev. J. Whitmee; a dwarf Chameleon (*Chameleon pumilis*) from South Africa, presented by Miss Siddons; an African Tantalus (*Tantalus ibis*); three Molucca Deer (*Cervus moluccensis*); a Vociferous Sea Eagle (*Haliaëtus vocifer*) from Africa; a European Lynx (*Felis lynx*), and a Glutton (*Gulo borealis*) from Norway; a collared Amazon (*Chrysotis collaria*) from Jamaica; two common Spoonbills (*Piatalea leucorodia*) from Europe, and two Wattled Cranes (*Grus carunculatus*) from South Africa, purchased; an American White Crane (*Grus americana*), received in exchange; three American Mocking Birds (*Mimus polyglottis*) hatched in the Gardens; and an Australian Thicknee (*Oedicnemus grallarius*) deposited.

SCIENCE IN ITALY

THE Transactions of the Academy of Sciences of the Institute of Bologna for the academical year 1871-2 contains twenty-nine memoirs read by members at the sittings of the Academy and several communications from without. I find it quite impossible to do justice to these without exceeding permissible limits, but will briefly refer to a few.

In a paper on a probable connection between solar eclipses and terrestrial magnetism, Dr. Michez, after describing the magnetic phenomena observed in Italy and more especially in Sicily during the eclipse of December 22, 1870, and pointing out the difficulty of separating the disturbances due to the eclipse from those otherwise produced, states the result of his laborious and careful study of the Greenwich magnetic records in relation to the passage of the lunar shadow over any part of the earth. Having determined the average *ordinary* declination and amount of agitation for the particular hour and season corresponding to that of each eclipse, he compares these with the declination and agitation observed while an eclipse was in progress, and collecting all these results and averaging the deviation of the eclipse periods from those of ordinary corresponding times, he concludes that an eclipse of the sun exercises a real influence on the declination needle, that this influence extends through several hours before and after the period of greatest solar obscuration, and that it is manifested by a greater agitation of the needle, and an eastward deviation. Upon theoretical considerations, Dr. Michez shows that the moon's shadow regarded in its relations to humidity should always produce an eastward deviation, but as regards the magnetic properties of oxygen should produce either an eastward or westward deviation, according to the position of the place of observation in relation to the shadow. Assuming that the latter, on a sufficiently large average, will neutralise each other, the residual phenomenon should be a slight eastward deviation.

In a paper on "The Climate of Europe during the Glacia Epoch," Dr. Bianconi, following De la Rive and Villeneuve, shows that the glacial extension of that period may have been due to greater humidity of climate rather than a lower mean temperature. Dr. Bianconi's conclusions are almost identical with those I suggested about fourteen years ago when describing a curious summer accumulation of ice in a previously unvisited Norwegian valley, where the snow line is actually lowered to an extent of about 3,000 feet, simply by a local increase of atmospheric humidity caused by the drifting spray of a double waterfall.* The subject was subsequently treated by Dr. Frankland in a lecture at the Royal Institution.

Prof. Filopanti contributed an interesting paper on the movements of the atmosphere, in which, after referring to the conclusions of Maury, that on both sides of the equator up to about the 30th parallel constant easterly winds prevail, from the 30th to the 35th variable winds, but still with the easterly predominating; from the 35th to the 40th, variable wind, with a commencement of westerly prevalence; and from the 40th to the Pole westerly winds decidedly prevailing. The object of Prof. Filopanti was to find a theoretical reason for these particular limits. To do this he regards the atmosphere as subject to the operation of two forces, viz. the resistance of the earth, and the mixture of aërial columns due to variations of temperature of the earth's surface. If only the first of these influences operated, the atmosphere would ultimately partake in every part of the velocity of the terrestrial parallel on which it rested, and there would be no sensible winds; if only of the second, the atmosphere would ultimately acquire throughout an absolutely equal velocity of rotation. He works out mathematically the amount of this velocity, and finds it equal to that of the surface of the earth at the latitude 35° 50′ 52″, which is a close approximation to the 35° of Maury. This he considers would be the uniform velocity of the air if the land and the sea were perfectly smooth, and he therefore designates the parallels of 35° on either hemisphere the "neutral parallels." Hence we are justified in theoretically anticipating that between the neutral parallels and the equator actual mean rotatory velocity of the air will be less than that of the earth, that is, the prevailing winds will be easterly, and that between the neutral parallels and the Poles the prevailing winds should be westerly, as there the mean rotatory velocity of the air should exceed that of the earth. The friction of the earth will be continually struggling to correct these differences of velocity, while the north and south movements, due to differences of temperature, will contest for their maintenance and augmentation. Prof. Filopanti goes further into details of special atmospheric currents to illustrate and confirm the above, but space will not permit me to follow him there. I have, however, so far sketched in abstract his leading idea as it appears to be an important contribution to the theory of atmospheric movements, and as far as I know is original. To some extent it is applicable to the vexed question of ocean currents.

The "Hermaphroditism" of eels has occupied a good deal of the attention of the Bolognese Academicians. Prof. Ercolani described a number of his own observations and experiments, showing that this hermaphroditism is "perfect," and the subject was further discussed at two subsequent meetings, when the results of previous researches of Vallisneri, Valsava, Allesandrini, Mondini, and others, were stated and compared. Besides the above and some others on subjects of general interest, are a few purely mathematical papers, and several on pathological, medical, and local subjects, which I must pass over.

Considering that Bologna itself is but a provincial town, and that the whole province of Bologna contains a population about equal to that of Birmingham, these Transactions of the Bologna Academy of Sciences indicate an amount of scientific activity in the highest direction of scientific research that we are unable to rival in any corresponding provincial district of Great Britain.

W. MATTIEU WILLIAMS

* "Through Norway with a Knapsack," Chap. xv.

SCIENTIFIC SERIALS

Bulletins de la Société d'Anthropologie de Paris, 1871-72.—We find from these reports that the French palæontologists have been unusually active during the last eighteen months in continuing the exploration of the numerous bone-caverns of their country and in testing the accuracy of the older classifications of their remains. M. Barabeau has been examining with great care the Dordogne district, which has become classic ground through the labours of Christie and Lartet. M. Saudon believes that the molars and maxilla recently found at Laugerie-Haute cannot be referred to the true horse—although they may provisionally, like similar remains found by M. Rivière in Italy—be accepted as belonging to some form of *equus*, for he does not think that the horse existed in Europe in pre-historic times. M. Mortillet, in obedience to the suggestions of M. Bertrand, Conservateur du Musée de S. Germain, has drawn up a chart of the palæolithic age in Gaul, the only work of the kind extant: in it are recorded 5 localities in which occur supposed traces of man in the tertiary; 43 alluvial deposits in the quaternary yielding human bones and industrial remains; and 278 caverns containing quaternary fauna with traces of pre-historic man. M. Mortillet thinks that we are no longer justified in assuming with E. Lartet that there was ever a special age of the bear or reindeer, all extinct animals having apparently lived through the whole palæolithic period. Amongst the numerous communications of M. Hamy, we may instance papers on the "Fossil Human Remains of d'Engihoul, near Liège;" "The Anthropology of Cambodia;" "The Quaternary Deposits of cut Silex recently discovered in the Pas de Calais;" "The Existence of Brachycephalic Negroes on the Western Coasts of Africa;" and "The Proportions of the Arm and Fore-arm to the different periods of Life." M. Doulish, from observations made at the close of 1871, in a bone cavern at Corgnac (Dordogne), believes that he has found incontrovertible proofs that man in the reindeer age had attained the art of *polishing* no less than of cutting stone.—M. Lagardelle communicates through M. Hamy, one of the Secretaries of the Society, some curious information in regard to the habitations of the degraded people known under the names of *Colliberts*, *huttiers*, &c., who for many ages occupied the marshy lands of Poitou, near the mouths of the Sèvre, and whose descendants were known till recently as *nioleurs*. This district was occupied by Gauls before the Norman Conquest, and after that event it became, from its inaccessible character, a place of refuge for fugitives. In the eleventh and twelfth centuries the Colliberts, whose special occupation was fishing, were dependent, as *homines conditionales*, on several religious houses, but were nevertheless left in a state of heathen, almost savage ignorance. Their huts were made of interlaced willow twigs, and their only means of locomotion before the formation of the network of canals, which have proved the chief agents in rescuing them from their isolation, were their long ash stilts and the so-called *nioles*, or light boats from which they took their name. The race is now merged in that of the contiguous *terra firma*.—M. Alph. Milne-Edwards has prosecuted an extensive series of observations on "The Embryology of the Lemurians and the zoological affinities of those animals;" and he finds that the placental system differs so widely from that of the Simiæ, with which they have been supposed to present very close relationships, that he is of opinion the Lemurs should take an intermediate, but wholly distinct, place between monkeys and carnivores.—M. Thorel's medical notes of his observations while serving in the exploring expedition to Meekong, in 1870, afford curious information in regard to the immunity to certain miasmatic affections presented by the people of Cochin China and other parts of Indo-China.—M. Sanson has laid before the Society his views on the Characterisation of Species, which are diametrically opposed to the Darwinian theory of evolution. The earlier numbers of the *Bulletins* for 1872, contain an unusually large proportion of papers on purely anatomical, psychological, medico-legal and similar subjects.—M. Broca considers, in a special mongraph, the importance of nasal configuration as a true ethnological character.—M. A. Roujou traces the analogies of the human type with that of the more ancient mammals, and proceeding to the length of concise definition, he fixes the probable appearance of the first lemurians at an epoch very remote from the secondary, and of monkeys—properly so called—before the tertiary, at the beginning of which period he thinks it not improbable that they engendered man.—The second and third numbers of vol. vii. of the *Bulletins* contain the exhaustive Treatise of M. Topinard on the indigenous races of Australia, with the valuable contributions and discussions in regard to the same subject by MM. Broca, Hamy, and Rochet. These numbers give us a general exposition of the progress and actual position of the science of Anthropology, and of the social advancement of our civilisation and its effect in obliterating ethnological characters and in elevating the lower type.

THE *Lens* for April commences with an analysis of the species of the genus *Amphora*, by Prof. H. L. Smith, in continuation of his Conspectus of the Diatomaceæ, accompanied by three excellent plates, and containing the description of nearly 100 species.—Dr. Danforth, of Chicago, describing "The Cell," developes Dr. Beale's theory respecting the nature of the nucleus, and discusses the action of carmine upon it.—Mr. H. Babcock, "On the Flora of Chicago and its Vicinity," catalogues the gramineæ and filices of that place very shortly.—There are also papers by Mr. J. H. Martin, "On the Similarity of various forms of Crystallisation to minute Organic Structures;" and by Mr. E. Colbert, "On the Figure of the Earth, and its Effect on Observations made in the Meridian."—The editor criticises the test employed by a committee of the Royal Microscopical Society of London in their decision respecting the angular aperture of Mr. Tolles's $\frac{1}{10}$th objective, thinking it unfair.

SOCIETIES AND ACADEMIES

LONDON

Royal Geographical Society, May 12.—Major-General Sir H. C. Rawlinson, K.C.B., president, in the chair.—The paper read was "Journey through Western Mongolia," by Mr. Ney Elias. The distance travelled over was 2,000 miles, accomplished between July 1872 and January 1873. The route from Kalgan (the starting-point in crossing the desert of Gobi by the usual route *viâ* Urga to Kiachta) was westerly to the Chinese frontier town of Kwei-hua, thence north-westerly to the river Onghin, and afterwards again westerly, along the foot of the Khangai Range, to the city of Uliassutai, which his observations showed to be 5,700 ft. above the sea-level. His further journey was impeded by the bands of Mahommedan Mongol rebels, the so-called Dungans, who, although badly armed, struck terror into the Chinese garrisons of the towns, and carried fire and slaughter wherever they went. He narrowly escaped the band, which a few days before his arrival destroyed the city of Kobdo, west of Uliassutai; arriving there, he saw the charred remains of the outer town and the unburied bodies of slaughtered people scattered over the streets. The Chinese garrison still occupied the fort, and received him and his party with kindness. All his endeavours, however, to obtain assistance for his further journey southward and westward to Kuldja were met by steady opposition, and he finally had to cross the frontier to the Russian town of Büsk. The president informed the meeting that Mr. Elias had not only accomplished a wonderful journey over a tract of Central Asia never visited by a European since the times of Marco Polo, but had executed, unaided, a survey of the whole route travelled. His very numerous observations for longitude and latitude had been computed by Mr. Ellis, of the Greenwich Observatory, and those for heights above the sea-level by Mr. Strachan, of the Meteorological Office. For this great service rendered to geographical science, the Council of the Society has just awarded him the Founder's Gold Medal for 1873.

Meteorological Society, May 21.—Dr. J. W. Tripe, president, in the chair. The discussion was resumed on the following questions, which had been submitted to the consideration of the Meteorological Conference at Leipzig in August last:—No. 18: Can uniform times of observation be introduced for the normal observations? Remarks were made by the president, Dr. Mann, Messrs. Glaisher, Symons, Sopwith, Scott, Bicknell, Salmon, and Strachan, as to whether local or Greenwich time should be used, and whether the hours of 9 A.M. and 9 P.M., or 9 A.M., 3 P.M., and 9 P.M. should be recommended to observers. The meeting was of opinion that the hours of observation should be 9 A.M. and 9 P.M., and that local time should be adopted. The next question considered was No. 20: Division of the year for the calculation of mean results. After some discussion Mr. Sopwith suggested that a committee should be appointed to draw up a series of questions on all matters connected with this subject, and that the same be sent to the Fellows of the Society requesting their reply on all or any of the questions; this suggestion was approved of and adopted by the meeting.—A

paper was then read on "Land and Sea Breezes," by Mr. J. K. Laughton, who was of opinion that sufficient attention had not been paid to the subject; and that more careful examination would show that the ordinary recorded theory is not in accordance with the facts observed; that these prove that sea and land breezes are seldom strong where the land is of that arid nature which gives rise to extreme differences of temperature, and that they frequently are strong where, from the verdant nature of the country, the differences of temperature are trifling; also that the sea breeze begins out at sea, and comes slowly in, and that the land-breeze comes, in the first instance, distinctly off the land, sometimes as sharp squalls. The necessary conclusion from these observations is that the breezes are winds of propulsion, not of aspiration; and whilst it seems probable that the propelling-force, in the case of the sea-breeze, is due to the rapid formation of vapour over the sea, the land-breeze may be the reaction, or return of the column of the air which has previously been forced upwards by the sea-breeze. A short paper by Rev. F. W. Stow, on the same subject, was read, giving an account of the observations he had made at Hawsker; after which Mr. R. H. Scott gave a description of a double rainbow observed at Kirkwall.

Institution of Civil Engineers, May 13.—Mr. T. Hawksley, president, in the chair.—The paper read, "On the Delta of the Danube, and the Provisional Works executed at the Sulina Mouth," by Sir Charles Augustus Hartley, was a sequel to a previous communication by the author on March 11, 1862. It described the mutations of the Sulina Bar from 1861 to the present time, and referred to the changes in the Sea outline of the Delta during sixteen years. Reference was made to the enormous growth of the northern part of the Kilia Delta in recent years, due to the greatly augmented volume of water which had lately flowed to the sea by the Ochakoff branch and New Stamboul Mouth; while a diminution in the advance of the southern extremity of the Kilia Delta was assigned to the impoverishment of the old Stamboul branch of the river. These changes, from natural causes, in the relative volumes of water delivered to the sea by the Kilia Mouths, were favourable circumstances in considering the problem of the number of years that would probably elapse before the Sulina Mouth would be absorbed in the shallows of the Kilia Delta. Since 1857, owing to the shoaling of the Toultcha and the St. George's branches, the outflow by the Kilia had increased, so that it now delivered two-thirds of the whole volume of the Danube to the sea. Fortunately for the navigation by the Sulina Mouth, the larger portion of the detritus was transported far to sea, and comparatively little went to swell the shallows of the Kilia Mouths. In the last fifteen years the advance of the 30-feet line of soundings had been strictly confined to the sandbanks facing the mouths of the Kilia, Sulina and St. George, and it was shown that an erosive action had been long at work on the shore line and sea bottom to the north and south of the Sulina Mouth.

Society of Biblical Archæology, June 3.—Dr. Birch, F.S.A., president, in the chair. The following papers were read:—"The Legend of Ishtor descending to Hades." By H. F. Talbot, D.C.L., F.R.S., &c.—In this valuable paper the author translates from the tablets the Goddess's voluntary descent into the Assyrian *Inferno*. In the cuneiform it is called the Land of No Return; and the Lord of Earth gives her a green bough of the *Li*. . .tree to protect her life (comp. Virgil's Æneid). Ishtar passes successfully through the seven gates, compelled to surrender her jewels, (1) her crown, (2) her ear-rings, (3) her head-jewels, (4) her frontlets, (5) her girdle, (6) her finger and toe rings, (7) her necklace. The Lord of Hades seeing her sends his messenger Namtar to greet her. But as she cannot return of her own accord to the upper regions, the heavenly triad Sun, Moon, and *Hea* or Hu (Lord of Mysteries) consult, and *Hea* raises a black phantom who performs a juggler's trick before the Lord of Hades; during which he gives to Ishtar a cup full of the Waters of Life, whereby she returns to the upper world, receiving at each Hades-portal the jewels she had been deprived of in her descent. The phantom is rewarded by the most exquisite meats, wines, &c. The Greek Fate *Atropos* is supposed by the author to mean No Return, and Hades (House of Eternity) is compared with the Hebrew *Od* and *Bet-Moed* of Job xxx. 23.—"On the Egyptian Preposition," by M. P. Le Page Renouf, F.R.S.L.—"On a Remarkable Babylonian Brick described in the Bible," by Richard Cull, F.S.A.

PHILADELPHIA

Academy of Natural Sciences, February 11.—Dr. Ruschenberger, the president, in the chair. Mr. Thomas Meehan presented an apple, which was borne by a tree at Kittaning, in Pennsylvania, and which tree never produced any flowers in the popular acceptation of the term; but always yielded an abundance of fruit. The specimen furnished a practical illustration of some morphological truths which could not often be demonstrated in the way this afforded the opportunity of doing. It was admitted that a fruit was a branch with its accessory leaves transformed. The apple fruit was made up of a series of whorls of leaves comprising five each. Cutting an apple through we found a series of five formed the carmels containing the seeds. Several series of whorls, very much retarded in development, probably formed the stamens, but this could not be well seen in the apple fruit, as they seemed to be almost absorbed in the corolla series. This was the next in order that appeared in the divided apple—the green curved fibrous line which we find in all apples midway between the "core" and the "rind" is the dividing line between the series which forms the corolla, and the outer series which forms the calyx. In this tree there are no pistils, the series which usually goes to make up this part of the fruit structure being either very rudimentary or entirely wanting. Hence there was no core to the fruit. The result of this want of development was that the usual calyx basin of the apple was in this case occupied by a cavity three-quarters of an inch across. There were no petals; but in place five gland or rather bud-scalelike processes, at regular distances, on the edge of the green fibrous outline before referred to. The outer whorl, which usually forms the calyx, was almost asepalous, as a mere scarious membrane marked the place where the calyx segments or sepals should have appeared. It was so easy in this specimen to trace the dividing line between the outer or calycine whorl and the inner or corolline whorl, which, uniting and becoming succulent, formed the popular apple fruit, that it was worthy of note in this connection. But the most interesting feature in this specimen was what were probably, from their similarity in appearance, cork cells, formed abundantly on the outside of the apple. It would seem that, with the lack of development in the inner series of whorls necessary to the perfect fruit, those which remained were liable to take on somewhat the character of bark structure.

February 18.—Dr. Ruschenberger, the president, in the chair.—The following paper was presented for publication:—"Description of Mexican Ichneumonidæ, Part II," by E. T. Cresson.—Mr. Thomas Meehan presented specimens of leaves of a Begonia on which minute folioles appeared as densely as hair all over the upper surface, while the leaf was on the growing plant. The little growths first appeared as succulent hairs, and these hair-like processes subsequently divided or produced the leafy blades from their apices. Mr. M. remarked that hairs were at any rate structurally but graded thorns, of which bristles were an intermediate stage. Spines often bore leaves, but it was unusual for thorns to do so. It might not be that these leaf-bearing processes were really hairs though they had that appearance.—Mr. Thomas G. Gentry called the attention of the Academy to what he considered to be an interesting case of a change of habits which had recently occurred in the life of an ordinary chickaree, the *Sciurus hudsonius* of Pallas. During the early part of last autumn, his attention was called to the fact that the birds in a certain designated locality of Mount Airy, during the hours of the night, were undergoing a system of wholesale destruction, the work of small animals which were supposed to belong to some species of Carnivora. Labouring under this impression, and being desirous of securing a specimen or two, he started for the scene of slaughter, bent upon discovering the name and character of the animal; when within a few rods of the place, the almost deafening noise that greeted his ears, from the tall trees, led him to suspect that all was not right. After reaching the spot, a few moments of anxious waiting sufficed to reveal to him the cause of the noise and the origin of the sacrifice above alluded to; for, sitting upon a twig just above his head, he observed a *chickaree*, holding in its paws a bird which it had captured, and from which it was very contentedly sucking the life current. It is a well-established fact, he further remarked, as far as he had been able to verify it, that the numerous species of Rodents, with but two exceptions at the most, subsist principally or entirely upon vegetable matter, especially the hard parts of plants, such as nuts, bark, and roots. This habit of imitating the propensities of the *Mustelidæ*, he thought might have arisen

from the habit which some squirrels possess, possibly the one under consideration, of sucking the eggs of birds; the blood-sucking habit he assumed to be an outgrowth from the other. This adoption of another's mode of life by *S. hudsonius*, he thought a discovery of some note, as usurpation of habits, leading to functional and structural changes in an animal's economy, is accounted an element of no mean weight in the *development hypothesis*, according to the testimony of able writers upon Evolution.—Prof Cope exhibited the cranium of the horned Proboscidian of Wyoming, *Loxolophodon cornutus*, and made some remarks on its affinities (see NATURE, vol. vii. p. 471).

CALIFORNIA

Academy of Sciences, April 21.—Prof. Davidson, president, in the chair.—Dr. Blake read a paper on the connection between the atomic weights of inorganic compounds and their physiological action. In a communication read before the Academy of Sciences of France, February 10, Messrs. Rabuteau and Ducoudray state that the poisonous effects of metals is greater as their atomic weight increases. When the different elements are grouped according to their isomorphous relations, there evidently exists a close connection between the *intensity* of their physiological action and relative atomic weights, and it is only under such conditions that the statement of Messrs. Rabuteau and Ducoudray is even approximately correct. That no absolute connection exists between the atomic weight of a metal and its physiological action is evident; for instance, the compounds of Beryllium with an atomic weight of 9 are far more poisonous than the salts of silver with an atomic weight of 103. As an example of the connection between the atomic weight and the poisonous qualities of a substance, the following table, drawn up from experiments which have not yet been published, furnishes strong evidence. The experiments were performed on rabbits, a solution of some salt of the metal being injected into the jugular vein.

Name of substance.	Atomic weight.	Quantity required to kill
Lithium	7	40 grs.
Sodium	23	20 ,,
Rubidium	85	6 ,,
Cæsium	133	8 ,,
Thalium	204	3 ,,

—Mr. Edwards presented a paper on the honey-making ant of Northern Mexico. The community is divided into three classes—the workers, carriers, and the honey-makers. The workers are much larger than the others, and of a black colour; they guard the nest and convey to it the materials from which the honey is made; these they deposit in a leaf over the centre of the nest, and from this leaf it is transported by the carriers to the honey-makers in the interior of the nest. The carriers are much smaller than the workers, and of a light brown colour. The honey-makers resemble the carriers in size and colour, with the exception of the enlarged abdomen. They are found in the centre of the nest, generally at a depth of two or three feet from the surface. They are supported on a sort of web made of closely woven fibres. Each ant occupies a superficial indentation in the web, in which it remains; in fact all locomotion in the honey makers is impossible, as the distended abdomen, which constitutes the honey-bag, is at least twenty times as large as the rest of the body. The honey is of a fine flavour, and much sought after by the natives.

PARIS

Academy of Sciences, May 26.—M. de Quatrefages, president, in the chair.—The Academy proceeded to the election of the candidates to be recommended to the Minister of Public Instruction for the four vacant posts in the Bureau des Longitudes. The following were the final results:—Member representing the Academy of Sciences, 1st line, M. Serret; 2nd line, M. O. Bonnet: Member of the Marine Department, 1st line, M. Mouchez; 2nd line, M. Bouquet de la Grye: Member of the War Department, 1st line, M. Perrier; 2nd line, M. Blondel: Geographical Member, 1st line, M. Janssen; 2nd line, M. d'Abbadie. The following papers were read:—On the assimilability of super-phosphates, by M. Joulie. The author found that "super-phosphate" consists of the following four bodies:—Free phosphoric acid, dihydric calcic phosphate, hydric dicalcic phosphate, and tricalcic phosphate. The first three of these can be taken up by plants; hence he decides, (*1*) that the amount of phosphoric acid soluble in water is not a true estimate of the value of the manure, but (2) that the amount soluble in alkaline ammonic citrate is; he therefore recommends the latter as the proper reagent for such estimations.—Rectification of a portion of the communication of M. Munk concerning the discovery of lunar variation, by M. L. A. Sédillot. This paper related to the disputed passage of Aboul Wefa.—On the calculus of the luminous phenomena produced in the interior of transparent media having a rapid motion of translation in those cases where the observer partakes of that motion, by M. J. Boussinesq.—On the electric balance and on electrostatic phenomena, by M. P. Volcipelli.—Researches on the electricity produced by mechanical action, by M. L. Joulin.—On the conditions of maximum magnetic effect in galvanometers and electro-magnets, by M. Raynaud.

DIARY

THURSDAY, JUNE 5.

LINNEAN SOCIETY, at 8.—On the Plants of Kilmanjaro: Dr. Hooker, F.R.S.—On the Lecythidaceæ: John Miers, F.R.S.

CHEMICAL SOCIETY, at 8.—On the Dioxides of Calcium and Strontium: Sir John Courcy, Bart.—On Iodine Monochloride: J. B. Hannay.—A new Ozone Generator will be exhibited by Mr. T. Wills.

ROYAL INSTITUTION, at 3.—Light: Prof. Tyndall.

FRIDAY, JUNE 6.

ROYAL INSTITUTION, at 9.—Lecture: Dr. Odling.

GEOLOGISTS' ASSOCIATION, at 8.—Ammonite Zones in the Upper Chalk of Margate, Kent: F. A. Bedwell.

ARCHÆOLOGICAL INSTITUTE, at 4.

GRESHAM LECTURES, at 7.—On Headaches: Dr. E. Symes Thompson.

SATURDAY, JUNE 7.

ROYAL INSTITUTION, at 3.—The Historical Method: John Morley.

GRESHAM LECTURES, at 7.—On Narcotics and Sedatives: Dr. E. Symes Thompson.

MONDAY, JUNE 9.

GEOGRAPHICAL SOCIETY, at 8.30.

TUESDAY, JUNE 10.

PHOTOGRAPHIC SOCIETY, at 8.—On Experiments with three wet processes: Jabez Hughes.—Notes on the Photo-collotype process: Capt. J. Waterhouse.—On some early Photo-engravings: W. H. Fox Talbot, F.R.S.

WEDNESDAY, JUNE 11.

GEOLOGICAL SOCIETY, at 8.—On the Nature and probable Origin of the superficial Deposits in the Valleys and Deserts of Central Persia: W. T. Blanford.—On *Caryophyllia Brodiei*, Milne-Edwards, from the Red Crag: Prof. P. Martin Duncan, F.R.S.—On the Cephalopoda-bed and the Oolite Sands of Dorset and part of Somerset: James Buckman.—*Cetarthrosaurus Walkeri*, Seeley, an Ichthyosaurian from the Cambridge Upper Greensand: H. G. Seeley.

ARCHÆOLOGICAL ASSOCIATION, at 8.

GEOLOGISTS' ASSOCIATION.—Excursion to Brighton.

THURSDAY, JUNE 12.

ROYAL SOCIETY, at 8.30.

SOCIETY OF ANTIQUARIES, at 8.30.

MATHEMATICAL SOCIETY, at 8.—Some general Theorems relating to Vibrations: Hon. J. W. Strutt.—Invariant conditions of three and four concurrence of three Conics: J. J. Walker.—Locus of the point of concourse of tangents to an epicycloid inclined to each other at a constant angle: Prof. Wolstenholme.

CONTENTS

ERRATA.—P. 85, col. 1, line 18 from bottom, for "disassociates" read "dissociates;" col. 2, line 14 from top, for "exact" read "&c.;" col. 2, line 28 from top, after "acid" insert "with tartaric acid;" col. 2, line 36 from bottom, for "solution. After boiling with acid a notable," read "solution after boiling with acid. A notable."