THURSDAY, NOVEMBER 28, 1889.

MR. STANLEY.

MR. STANLEY'S latest letters, which have been exciting universal attention, present as fascinating a record of travel, adventure, and geographical discovery as any that has ever awakened the interest of civilized mankind. It is impossible to read them without the warmest admiration for the writer's resolute energy, inexhaustible resource, and dauntless courage. No previous traveller can have been confronted by a greater number of formidable—often apparently insurmountable—difficulties. Mr. Stanley never allowed himself to be disheartened by the obstacles in his way, but pressed steadily on, varying his methods to meet changing needs, until the immediate object of his great enterprise was attained. Not the least serious of his perplexities sprang from the reluctance of Emin Pasha to be "rescued." It was not unnatural that Emin should hesitate to quit a region for which he had made so many sacrifices, and with regard to which he had entertained so many hopes; but it is certain that if he had remained he would soon have fallen a victim to treachery. Happily, Mr. Stanley, after many an argument, succeeded at last in overcoming his scruples and hesitations, and on April 10 the two men, accompanied by a party of about 1500 persons, including native carriers, started from the southern shore of Albert Nyanza on their homeward journey. No part of Mr. Stanley's narrative is more interesting than that in which he tells the story of his efforts to persuade Emin that he might with honour resign a task which had already been practically taken out of his hands. The tale brings out vividly a most striking contrast between two types of character, each of which in its own way commands our sympathy and respect.

The scientific results of Mr. Stanley's journey are full of interest, and form a most important addition to our knowledge of Central Africa. On April 11 (NATURE, vol. xxxix. p. 560) we gave an account of his geographical discoveries so far as they were then known; and anyone who will consult the map which we printed on that occasion will be able to trace without difficulty the main lines of the explorer's later course. In 1877 Mr. Stanley discovered Muta Nzige, which he now calls Lake Albert Edward. This lake is less extensive than was originally supposed. At the time of its discovery it could not be determined whether its waters were discharged into the Nile or the Congo, but now Mr. Stanley has found that it is one of the feeders of the former river. It receives all the streams of the south-western part of the Nile basin, just as Victoria Nyanza receives all the streams of the south-eastern part of the Nile basin. The two lakes discharge their waters into Albert Nyanza, whence flows the White Nile. Lake Albert Edward and Albert Nyanza are connected by a river called the Semliki, whose valley Mr. Stanley vividly describes.

Lake Albert Edward occupies the south-western end of a great area of depression, at the north-eastern end of which lies Albert Nyanza. This area of depression lies between 3° N. lat. and 1° S. lat., and is from 20 to 50 miles broad. East and west of it rise extensive uplands, those on the western side forming the water-parting between the Nile and the Congo. Towards the east, beyond the valley of the Semliki—that is, the central part of the line of subsidence—is a great mountain range called Ruwenzori, "the Mountains of the Moon," culminating in peaks which Mr. Stanley estimates to be between 18,000 and 19,000 feet. Past this splendid range the party advanced on their way southwards. Says Mr. Stanley:—"Much as we had flattered ourselves that we should see marvellous scenery, the Snow Mountain was very coy, and hard to see. On most days it loomed impending over us like a tropical storm-cloud ready to dissolve in rain and ruin on us. Near sunset a peak or two here, a crest there, a ridge beyond, white with snow, shot into view, jagged clouds whirling and eddying round them, and then the darkness of night. Often at sunrise, too, Ruwenzori would appear fresh, clean, brightly pure; profound blue voids above and around it; every line and dent, knoll, and turret-like crag deeply marked and clearly visible; but presently all would be buried under mass upon mass of mist until the immense mountain was no more visible than if we were thousands of miles away. And then, also, the Snow Mountain, being set deeply in the range, the nearer we approached the base of the range, the less we saw of it, for nigher ridges obtruded themselves and barred the view. Still we have obtained three remarkable views—one from the Nyanza Plain, another from Kavallis, and a third from the South Point."

Lieutenant Stairs tried hard to reach the loftiest summit, but succeeded only in attaining a height of 10,600 feet, which was separated from the snow-covered peaks by deep ravines. He is of opinion that the central mass of the Ruwenzori range is an extinct volcano, and that certain jutting pinnacles on the sides of the mountains are survivals of the time when volcanic forces were in full activity. So much of the *débris* is borne along by the Semliki that the southern part of Albert Nyanza is being rapidly filled up.

Mr. Stanley has much that is new to tell us, not only about Albert Nyanza and Lake Albert Edward, but about Victoria Nyanza, a great south-western extension of which he has discovered. About the many tribes through whose territories he passed he has also a vast amount of curious and suggestive information, offered with all the freshness due to his immediate contact with the facts he describes. Nothing could be better in its way than his account of the Wakonju, a tribe from whom he and his people received much kindness. They occupy the slopes of the Ruwenzori Mountains, on which some of their villages are built at a height of 8000 feet. Here they have taken refuge from their enemies the Warasura. It is noteworthy that in many parts of the Central African uplands which he visited Mr. Stanley found a physical type which he identified with that of the Abyssinians. On these and many other points of interest the world may expect soon to receive from him further enlightenment. Meanwhile, we desire to join most cordially in the expressions of high appreciation that have been everywhere evoked by his success, and by the great qualities of intellect and character by which it has been achieved. Such geographical labours as his are unsurpassed in hardship, and the results obtained make his work one of the most important and fruitful researches of the time.

THE HABITS OF THE SALMON.

The Habits of the Salmon. By John P. Traherne. (London: Chapman and Hall, 1889.)

THE Stormontfield breeding-ponds have taught us much of the history of the salmon from the eggs to the smolt stage. After that he passes to the sea, beyond the reach of observation, and, with the exception of what we have learned from the return to the rivers of fish that have been marked before their passage to the sea, all that purports to be knowledge of the habits of the fish is really only guesses at truth.

Theories by a practical salmon-fisher, of wide experience, are entitled to respectful examination. This Major Traherne can claim; more than that he does not claim. The arrangement of the chapters in the book is objectionable as tending to confusion. It would be preferable to take first the chapter on smolts, and then to follow the life of the fish through its grilse, salmon, and kelt stages.

Notwithstanding that "smolts bred in the Stormontfield, Howietown, and other fish ponds have never as yet been known to evince the least desire to go to sea before the spring months," yet Major Traherne is of opinion, and supports his opinion with good evidence, that there is a double emigration of smolts—autumn as well as spring. Smolts that are bred artificially are always the produce of ova spawned in November, and these form the spring migration. It is assumed that the later spawned ova form the autumn migration. If this be so, it may explain the mystery of the spring and summer run of fish. It is proved that smolts leaving Stormontfield ponds in the spring have returned to the river as grilses in July of the same year, having increased in weight from 3 to 9 pounds each, the grilse caught on July 1 weighing 3 pounds, and that caught on July 31 weighing 9½ pounds. The smolt would probably weigh about 2 ounces, and the rapidity of growth, without any expense for feeding, should make those who have charge of salmon legislation ponder over the problem of close time.

What, then, becomes of the autumn emigration of smolts? Do they come back as spring salmon? The first run of spring salmon, like the first run of grilse, is small in size. From 8 to 10 pounds would be the average weight of the first run of spring fish. The spring smolt takes three months to return a grilse; the autumn smolt would have five months to return a spring salmon.

We quite agree with Major Traherne that spring fish stay in the rivers to spawn. We also think, from the appearance of the fish, that the early, small spring fish are maiden fish that have never spawned. Are they not the autumn smolts?

But all rivers do not have a run of spring fish. Major Traherne says: "I notice that early ascending salmon are far more numerous in rivers that have an annual close time commencing on or before September 1, than in rivers where the close time commences after that date." This is simply a confusion of cause and effect. It is the early river that causes the early close time, not the early close time that causes the early river. What causes a river to be early? or, in other words, what causes spring fish to run up one river, and not to run up another? Major Traherne replies, the temperature of the river. He contrasts the early arrival of salmon in Loch Naver with their late arrival, by way of the Thurso, in Loch More, and he says that the River Naver, being fed by a large, deep loch, is warmer than the Thurso, which runs from a small shallow loch; therefore the earlier run of fish into Loch Naver! But the fish run as early up the Thurso River as they do up the Naver River; so this illustration fails. He afterwards refers to the Shin, the Cassley, and the Oykel, all of which rivers empty themselves into the Kyle of Sutherland. He says that the temperature of the water in the Shin—a river flowing from a very large lake—is higher than the temperature of the Cassley, or the Oykel, which are not fed by big lakes; and that this is the reason why the Shin is the only river, running into the Kyle of Sutherland, which produces early salmon. We reply by denying the premise. The Shin may be a rather better early salmon river than the Oykel, but it is not an earlier river. The opening day always finds clean fish in the Oykel, and, this year, from one bank, the Oykel yielded thirteen fish in March. Last year the yield of one bank of the Oykel in April was twenty-three fish; both banks of the Shin yielding thirty fish. Twenty fish in March would be a good yield for the Shin.

But to come back to the question, What causes a river to be early? Certainly it is not the absolute temperature of the river. On the north and east of Scotland the rivers are early, on the west coast they are late. The temperature of the rivers on the west is higher than that of the rivers on the north and east. Contrast the rivers Oykel and Inver. The former rises in the eastern slopes of Ben More in Assynt, and is fed in March and April by the melted snows. It has not any big lock as a reservoir, and in March is often frozen over. The Inver runs out of Loch Assynt at the western foot of Ben More. Little snow lies on the western side of the hill, and Loch Assynt is large and deep. The water of the Inver is higher in temperature than the water of the Oykel. The rivers lie opposite to one another in Sutherlandshire; the Oykel, icy cold in the spring, running east; the Inver, much warmer, running west. The cold river is an early river; the warm river is late. Major Traherne is therefore wrong when he says that the high temperature of a river makes it early. We say that the relative temperature of the river to the sea into which it empties itself determines the run of the salmon. If the temperature of the river closely approximates to the temperature of the sea the fish will run, no matter how cold both river and sea may be. On the west coast the sea is so warmed by the Gulf Stream that the rivers on that coast, although positively warmer than on the east coast, are, relatively to the sea, colder, and they are accordingly late rivers.

The relative temperature of the air and the water has a great effect, too, upon the feeding of the salmon. Major Traherne says: "I never expect to meet with a blank day in the coldest weather, if I know there are fish in the river." A cold mist coming on will always prevent fish from rising. On a fine April day, when the sun is bringing down snow water, the time to take fish is after the sun has warmed the river, but before the snow melted by the sun about the sources of the river has had time to run down and chill the water. In both cases it is a question of the relative temperature of the air to the water.

"Do salmon feed in fresh water?" is one of the questions the author asks. He answers it in the affirmative, as he cannot believe that fish rush at spinning baits, eat prawns, and chew up a bunch of lob-worms simply to gratify the angler's love of sport. It is difficult, indeed, to understand how the theory of salmon living for months in fresh water "on his own fat, which has been accumulated while feeding in salt water"—as Dr. Francis Day puts it—could have been accepted by him, or by the late Frank Buckland. Why are good salmon rivers bad brown trout rivers? Simply because the salmon feed on the trout.

The question of close time Major Traherne says "is the key to the situation; in other words, to the adjustment of the various claims of netting proprietors and anglers, as the prosperity of our salmon fisheries, and the increase or decrease of a most valuable article of food depends in great measure upon the periods fixed to suit each river." This means that the proper adjustment of close time to each river will divide the clean fish fairly between the upper and lower proprietors, and will also provide abundant spawning fish to fill the beds upon the upper waters. At present the weekly close time in England and Scotland, extending from 6 p.m. on Saturday to 6 a.m. on Monday, is too short to enable fish to run past all the nets on many of our rivers; the upper nets sweeping in on Monday morning most of the fish that left the salt water on Saturday night. Again, the rod fishing is kept open too late. We have constantly seen gravid fish taken in October, out of which the eggs or milt ran when the fish were landed—fish that were neither able to fight, nor fit for food. Late in the season the gravid fish will take any bait as voraciously as the kelts in early spring, and the angler is able to state that he killed his six or eight heavy fish a day. After being kippered they are just eatable, and that is the best that can be said for them. On the other hand, with each of the female fish—and most of the fish killed at the end of the season are hen fish—perish some 20,000 eggs fully developed. All that Major Traherne says about the weekly close time, as well as about the closing of the fishing in the autumn, deserves careful consideration.

AN ELEMENTARY TEXT-BOOK OF GEOLOGY.

An Elementary Text-book of Geology. By W. Jerome Harrison, F.G.S. (London: Blackie and Son, 1889.)

IT is well known that there are certain things, which, like reading and writing, come by nature, such as the driving of a gig, and the management of a small farm. These every man can do. And till lately it seems to have been very generally held, that, when a man or woman had shown by repeated failure that he or she was hopelessly incompetent to earn bread in any other way, there was nothing to forbid him or her from opening a school for small children: the laying of the foundations of an education was such a simple matter that it was within the reach of everyone. It looks also as if the writing of an elementary text-book on a scientific subject is very generally held to be an equally easy task, at least the bounteous profusion with which such books are showered upon us would appear to point to such a conclusion. But anyone who has tried to teach or to write a book that shall be used for teaching purposes, knows only too well that it is with the beginner and in the elements of his subject that the real difficulty lies. And besides the inevitable obstacles to success which from the nature of things he must meet with here, there are to be taken into account others of a more artificial kind. An elementary text-book must be cheap; neither author nor publisher can be expected to be wholly indifferent to profits, and only cheap books pay in science; but, setting this consideration aside, it is of the first importance that the work should be within the reach of the largest number possible of buyers. Cheap, and therefore small and sparingly illustrated. So here arises the first difficulty. What to leave out in the text and how far illustrations may be dispensed with.

Before these questions can be answered, the author must make up his mind what end he proposes the book shall be made to compass. For there are two most distinct purposes which a text-book may be intended to serve. It may be designed to educate the reader; or it may be put together in order to help him to get through an examination. And for books of the first kind there are two classes of readers to be provided for: some will never go beyond the elements of the subject; for others the text-book is only the first step on a journey which will lead them on through all the details and ramifications of its subject. But the needs of both classes are at the outset very much the same. Both want a basis, broad and flat in its simplicity, on which they can plant their feet firmly; not a surface so rough and jagged with complicated details that they are bewildered to know where, or whether anywhere, a secure foothold is to be found on it. For both the aim of the book must be to give fibre and sinew to the mind, not to pack into it a miscellaneous assortment of useful and interesting facts; the mastery of the book must involve not the mere exercise of memory, but the continuous use of observation and the logical faculty.

In every branch of science there are certain parts which are eminently fitted to serve these ends, and other parts which will most effectually defeat them if introduced into an elementary work. Now, in the Presidential address to the British Association at the recent meeting at Newcastle the objects which ought to be exhibited in a Museum intended for popular instruction were most lucidly marked off from those that ought not: an almost identical classification will divide those parts of a scientific subject which ought to find a place in an elementary text-book from those that ought not. In the same address an emphatic warning was given against overcrowding the cases. Equally must the writer of a text-book be on his guard against congested sentences or chapters.

Here, as in all education, the course of instruction, if it is to be of any value for mental discipline, must lead up from the simple to the complex, from the particular and concrete to the general and abstract. To start with the nebular hypothesis in geology may claim to be taking things in their historical order, but is like giving meat to a baby of three months old. To lay before the beginner a familiar object such as a lump of sandstone or limestone; to show him how to pull it to pieces and find what it is made of; to give him reasons for the belief that it has not existed from the beginning of all things, but is a naturally manufactured product; to drive him to rummage brook, river, pond, and sea, the whole field of outdoor nature, in hopes of finding some similar product now in process of manufacture,—some such treatment as this at the outset would seem to be the way to lead a beginner on to use his hands, his eyes, and his reasoning faculties—in a word, to educate him. And at this stage only well ascertained facts, and conclusions on the soundness of which no doubt can be thrown, ought to be introduced; incomplete observations and experiments, inferences which are no more than likely, all provisional and speculative hypotheses, and all controversial matters, ought to be kept carefully in the background. We do not trust a youngster among quicksands and shaking bogs till much walking over sound ground has given him sturdy legs, sure feet, a quick eye, and sound judgment. There is a bit of advice given in the preface to the book now before us, which is not likely to do much harm because it certainly will not be followed by those for whom the book is written; but one shudders to think of the mental chaos that would result from reading every book or article on geology which can be bought or borrowed, the controversy on the Taconic System included. To encourage so omnivorous an appetite is not according to knowledge.

The limits of an article will not allow of more than the fringe of the subject being just touched upon; but enough has been said to show what seem to be the things to be striven after and the things to be avoided in a book on elementary science which aims to educate its readers.

The other kind of text-book is necessarily constructed on a totally different principle. The author's aim is to satisfy the requirements of a syllabus or code; lucky it is if he is a slave to only one, and does not vainly struggle to meet the demands of many. The reader must be fortified against every possible form of question which the ingenuity of the examiner can devise without going outside the prescribed limits; and as that ingenuity is boundless, the number of such questions must be legion. Hence arises the necessity of packing into a small compass an endless variety of subjects, with the result that only a few words can be spared for each. Each also, instead of standing out crisp and sharp with an appropriate heading to call attention to it and emphasize its importance, shares with two or three others, with which it may have only a remote connection, the cramped quarters of a single sentence. What a risk there must be in such a case that matters of great moment may be passed by unheeded! Even in a crowd we may stumble on interesting folk, but it is not in a crowd that intimate acquaintance or lasting friendships usually begin.

There is another evil in books of this kind; they foster the dangerous belief that there are short cuts to learning—a notion welcome enough in this age of hurry and unrest, when everything is to be done quickly, well also if you can, but quickly at any cost.

An amusing illustration of the educational value of the ordinary text-book may perhaps be allowed a place here. A girl, sharp enough to be worth taking pains with, came to me for assistance in the preparation for her examination. She was happy in the possession of a text-book which professed to give all the information which her syllabus required on I know not how many branches of science. She was just beginning the section on chemistry and was much exercised as to the meaning of chemical symbols. I was able to remove her difficulties, and to send her away hopeful that further progress would be easy and rapid. The latter it certainly was, for at the end of a week she came again with a beaming face; she had finished chemistry, and made some way in meteorology. I naturally demurred to her getting her geology in this fashion, and substituted for the geological section of her book a well-known primer. She repaid me and showed her appreciation of what scientific writing ought to be, by declaring that this was as good as a story-book.

But it would not be fair to take the precious compendium from which, but for a lucky accident, this girl would have derived all her knowledge of science, as a fair sample of the average text-book. On many even of the second class it is possible to look with qualified satisfaction, and, though the work before us must be placed in this class, it is good of its kind. There is life and spirit in it, and here and there its points are happily put. No one who reads it attentively can fail to get from it information which not only will be serviceable in examinations, but may be used as a stepping-stone to further progress in its subject. But I should like to call the attention of the author to a few points in which there seems to be room for improvement.

The exigencies of space demand that there should be no repetition in a book of this kind. But there is more than one case in which our author says over again what has been already said on a previous page. For instance, on pp. 71 and 72 we have much that has been previously given in chapter ii. The amount of dissolved matter in the Thames is stated twice over, on p. 11 and again on p. 73. Other cases might be quoted. The general arrangement of chapter viii. does not seem to be commendable: it is hard to see why such simple matters as ripple-marks, rain-pittings, and sun-cracks should come after the more complicated structures of foliation and faulting; what would seem the natural arrangement, of beginning with the simple, is absolutely reversed. The term current-bedding is used and partially explained on p. 22, but we do not find a full definition till p. 45.

A few cases of incomplete information and even of looseness of statement may be noted. In speaking of the consolidation of sediment by pressure, only the weight of the overlying rock is mentioned on p. 18. Whether glaciers move solely by the force of gravity, as is implied on p. 76, is to say the least a moot point. The description of fire-clay as "a fairly pure variety of clay, *containing but little water*," can hardly be said either to be accurate or complete. Marl is not clay mixed with *lime*. It is surprising to find among so many really good illustrations the time-honoured section across the Jura on p. 42, which only deserves to be preserved as about the most successful effort that was ever made to represent things as they are not. The two paragraphs on contorted strata and inverted strata which follow are instances of the congestion which is unavoidable in text-books of the second class. It is impossible in so small a space to give the prominence which it deserves to the conception of horizontal thrust and compression, and very few readers would realize, from the few words devoted to them, the surprising character of the thrust-planes of the Scotch Highlands. It is scarcely fair to magnetite to say that it *sometimes* exhibits magnetic properties, and ferrous carbonate does not give a green, blue, grey, or purple colour to rocks (p. 70). One and only one more objection will I urge. There is a lamentable absence of geological sections. No verbal descriptions will suffice to convey to anyone, let alone a beginner, clear notions of the geological structure of a country without illustrative sections. The reader of the present work will gather from it the parts of the country in which the various formations are seen at the surface, but he will come away with very few notions as to the lie of the rocks. I cannot help feeling that the "imaginary scenes" during the several geological epochs might be usefully replaced by a set of geological sections.

A. H. GREEN.

THE FLORA OF DERBYSHIRE.

A Contribution to the Flora of Derbyshire; being an Account of the Flowering Plants, Ferns, and Characeæ found in the County. By the Rev. W. H. Painter. 8vo, pp. 156, with a Map. (London: George Bell and Sons, 1889.)

DERBYSHIRE is much the most interesting of our midland counties from a botanical and physico-geographical point of view. Geographical botanists, following Watson, divide the surface of Britain into two regions of climate—a lower or agrarian region, in which the cultivation of cereals and the potato is practicable, so far as climate is concerned; and an upper or Arctic region, in which no cultivation is possible. The agrarian region is divided into three zones, and whilst in Surrey, Hampshire, Wiltshire, and Kent, only one of these three zones is represented, in Derbyshire, Shropshire, and Cheshire, we get all three of them, and a greater area of super-agrarian zone in Derbyshire than in any other midland county. The plants of Britain, botanical geographers divide into two principal groups—the southern types, which have their head-quarters in Central Europe, and the boreal types, which have their head-quarters in Northern Europe, and grow only upon high mountains further south. The southern types are to the northern as six to one—about 1200 species against 200; but less than 50 species reach the midland counties. In Derbyshire we get a declination of surface from mountains nearly 2000 feet high down to a low level, so that it shows better than any other county how, in the centre of England, the boreal and austral elements of the flora meet and mingle together.

The whole area of the county is a little over a thousand square miles—about one-sixth that of Yorkshire. The Pennine chain, the backbone mountain-ridge of the north of England, extends for some distance into Derbyshire forming the watershed between the streams that flow into the German Ocean and the Irish Channel. We may divide the county into two unequal halves by a line that runs across it from west to east, from Ashbourne to Duffield. South of this line, with Derby in its centre, is a level tract underlaid by new red sandstone, with a flora like that of Leicestershire, Nottinghamshire, and Warwickshire. North of this line, all the rocks are Palæozoic, and the level gradually rises. The Carboniferous limestone occupies the lower levels about Castleton, Matlock, and Buxton. This is much the most interesting part of the county, and the best known to strangers, the region of lead mines, caverns, and romantic narrow dales, girdled by high cliffs of limestone: Miller's Dale, Monsal Dale, Ashwood Dale, Chee Tor, Chatsworth, Haddon Hall, are all familiar names alike to botanists and lovers of fine scenery; and Dovedale, Bakewell, and Rowsley are classic ground to anglers. The market-place at Buxton is over 1000 feet above sea-level, so that Buxton is on a par, so far as plants go, with Dundee or Aberdeen. The heights of Abraham, over Matlock, are about the same height above sea-level as the town of Buxton. About Castleton and Buxton the limestone reaches a height of 400 or 450 yards, and with it many plants of the lowlands; for instance, *Epilobium hirsutum*, *Galium cruciatum*, *G. verum*, *Lamium purpureum*, and *L. incisum*, reach a higher level than anywhere else in the country. On the whole, the botany of the Derbyshire limestone tract is most like that of Ribblesdale, Airedale, and Wensleydale. Above the limestone in the Peak country, and around Buxton and Castleton, there is a considerable thickness of shale and millstone grit. The flora of these higher levels is poor and monotonous, but we get the cloudberry (*Rubus Chamæmorus*) on Axe-edge, the bearberry (*Arctostaphylos Uva-ursi*) on the moors round the head of the Derwent, and the whortleberry (*Vaccinium Vitis-idæa*) in several places about Buxton and Glossop. East of all these is an area of coal-measure country, the flora of which seems to be very poor, and to resemble that of the country round Huddersfield, Sheffield, and Halifax.

Mr. Bagnall has already shown, in the *Journal of Botany*, that Mr. Painter's numerical analysis, on p. 4 of the "Derbyshire Plants," classed under their types of distribution, needs material revision. Out of 532 plants universal in Britain, Mr. Bagnall's estimate, founded on Mr. Painter's detailed list of species, is 486 species for Derbyshire. In all probability, most of the other 46 species will be found if they are carefully sought; but, of the 599 species which represent the characteristically southern element in the British flora, there are 238 species in Derbyshire, or less than half. I cannot understand why the figure of the Germanic, or characteristically south-eastern plants, which is 127 for Britain as a whole, 38 for North Yorkshire, 26 for Northumberland and Durham, should be as low as 14 for Derbyshire. Out of 201 boreal British species, there are 39 in Derbyshire against 104 for the Lakes, 93 for Northumberland and Durham, and 76 for North Yorkshire. What Watson called the intermediate type, is a very interesting group; they are concentrated in the north of England, and I suspect that the principal reason of this is, that they are Montane plants with a preference for limestone. The comparative figures are: 37 species for Britain as a whole, 33 for North Yorkshire, 21 for the Lakes, 21 for Northumberland and Durham, and 16 for Derbyshire. The total number of Derbyshire plants is 782 species out of 1425 recorded for the whole of Britain.

Mr. Painter's note (pp. 5-10) on the bibliography of the botany of Derbyshire is full and satisfactory. Unfortunately, many of the early records contained in Pilkington's "Derbyshire," and copied into the old "Botanist's Guide," are evidently inaccurate. But a great many trustworthy records, which stand on the personal authority of Mr. H.C. Watson and Mr. J.E. Bowman, are contained in the "New Botanist's Guide," of which Mr. Painter seldom takes notice. The curious *Achillea serrata*, a plant not known anywhere in a wild state, which Sir J. E. Smith describes and figures, in "English Botany," from the neighbourhood of Matlock, he does not mention at all.

As Mr. Painter explains in his preface and indicates in his title, his work is not put forward as a complete record of the flora of the county. It is not likely that much that is new will be found in the limestone tract and on the gritstone moors, but the exploration of the coal tract and level new red sandstone country is still very incomplete. A full and adequate flora of a county so interesting would be a very acceptable contribution to the literature of botanical geography. J. G. B.

OUR BOOK SHELF.

Science of Every-day Life. By J. A. Bower, F.C.S. (London: Cassell and Co., 1889.)

WE have here another attempt to simplify the acquirement of a knowledge of some of the elementary facts of science, but though there is much to be commended, some points certainly require revision. With reference to the well-known experiment in which bits of straw, wood, or cork come together when thrown into a basin of water (p. 22), the author has fallen into the common error of ascribing the effect to gravitation instead of to surface-tension. If a few wax-lights or other things not wetted by water be added, it will be found that a substance which is not wetted is *repelled* by a substance which is, and that only "birds of a feather flock together." Again, with young students, loose or incomplete statements cannot be too carefully guarded against; the statement on p. 59 that 15 pounds or 30 inches of mercury is "equal to a square inch column of air to *whatever height* it may extend" is of this class.

The book is apparently intended more especially for the young people's section of the National Home-Reading Union, but it is hardly likely that many of the branches will be furnished with the necessary apparatus for the experiments. The ground covered includes the properties of matter, and the physics and chemistry of air and water.

Elementary Physics. By M. R. Wright. (London: Longmans, Green, and Co., 1889.)

IN this book Mr. Wright has added to the more elementary part of his work on sound, light, and heat, the leading facts of other branches of physics, so as to form a general introduction to physical science. The subject is an essentially experimental one, and the author having learned by experience that a study of facts is the first duty of beginners, very little space is given to theoretical considerations. There is very little that is new, and indeed it is hardly to be expected. Most of the experiments are clearly described and are capable of easy performance, but one or two improvements may be suggested. On p. 4 the student is told to "cut a hole in an iron plate so that a flask filled with cold water just passes," an operation beyond most students, and we see no reason why a piece of card should not do equally well. Again, on p. 6, the making of a thermometer is hardly sufficiently detailed; having made a bulb at one end of the tube, the student is simply told to make one at the other end, but he will certainly not see his way to do this without further assistance. There are no less than 242 diagrams, but, needless to say, most of them have done good service before.

The book is excellently adapted for such a course of instruction as that laid down in the syllabus of alternative physics by the Science and Art Department.

Teacher's Manual of Geography. By J. W. Redway. (Boston, U.S.: D. C. Heath and Co., 1889.)

WE have of late heard a good deal on the subject of how geography should be taught, but now we find an author who believes "that less energy devoted to improvement of methods, and a little more to the quality of the material taught, would not be amiss." The author's view of the scope of geography is much broader than that generally accepted, and, in this country at least, the title "physical geography" would be regarded as more appropriate.

The first part of the book consists of "hints to teachers," and very valuable hints they are. Oral instruction and out-of-door lessons are strongly recommended, and the author attempts to make the subject a practical one by suggestions as to the use of the moulding board for representing the various features of a country. The free use of pictures and instructive stories from authentic books of travel, especially with primary pupils, is also recommended.

In the second part, common errors, such as the assertion that "lakes which have no outlet are salt," are corrected. There is also an interesting chapter on the history of geographical names. The book is quite unique, and teachers will find much to interest as well as instruct them.

Notes on the Pinks of Western Europe. By F. N. Williams, F.L.S. Pp. 47. (London: West, Newman, and Co., 1889.)

LAST week we noticed Mr. Williams's classified enumeration of all the known species of Dianthus. In the present pamphlet he gives Latin descriptions of, and English notes upon, the species of Western Europe. Out of a total of upwards of 200 species, there are altogether 55 in Western Europe, which are distributed through the different countries as follows, viz. 43 in Spain, 33 in France, 13 in Portugal, 7 in Germany, 5 each in Belgium and Holland, and 4 in England. His descriptions seem to be clear and explicit, and he has worked out carefully the geographical range of each species, but he does not give references either to published figures, or, with few exceptions, to the books and papers in which the plants have been originally described. As a rule, he admits species freely, but he unites the common European *Dianthus Seguieri* with the Chinese and Japanese *D. sinensis*, which is the parent of many cultivated forms. This gives the species a range from Portugal to Japan. Many of the West European forms are so puzzling, and the descriptions are so widely scattered, that it will be a boon both to botanists and gardeners to have them all brought together and worked out on one uniform plan.

American Resorts, with Notes upon their Climate. By Bushrod W. James, A.M., M.D. (Philadelphia and London: F. A. Davis, 1889.)

WHOEVER imagines, from the imposing exterior of this volume, that he will find much information within its covers on American health-resorts, is doomed to disappointment. In most cases he will be as well or better off if he consults a good gazetteer or geographical dictionary. It is true it contains a translation of some chapters of Dr. Woeikof's "Die Klimate der Erde"; indeed, this forms more than one-third of the volume—a singular method of producing an "original" work.

This translation no doubt contains a great deal of technical detail, but there is extremely little in it to help the ordinary inquirer to select a suitable winter or summer resort. If a possessor of this volume desired to obtain, for instance, some accurate and detailed information as to the climate of Southern California and its principal resorts, he would find the whole of this important region disposed of in less than four pages; while one of its most rising resorts, Santa Barbara, is disposed of with fourteen lines at p. 52, and exactly the same number of lines at p. 152; and another, Los Angeles, gets less than ten lines. No references to meteorological observations, and no climatological details of any kind, are contained in these extremely meagre accounts. In other parts of the book, seven or eight health-resorts are disposed of in a single page (pp. 33, 37, 44). Less than three pages are devoted to Florida and all its resorts. Again no meteorological details of any kind. Denver is disposed of in eight lines, Colorado Springs in a like number, and Salt Lake City in two lines.

It is scarcely necessary to deal seriously with a book put together in this fashion.

Idylls of the Field. By Francis A. Knight. (London: Elliot Stock, 1889.)

WITH the papers in this dainty volume readers of the *Daily News* are already familiar. In spirit and style they closely resemble the papers included in the same author's "By Leafy Ways." Mr. Knight has a genuine love for the poetic aspects of Nature, and in these "Idylls," as in his previous book, he gives many a vivid sketch of scenes and incidents by which he himself has been impressed. The text is illustrated by a number of photogravures from drawings by Mr. E. T. Compton.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

A New Logical Machine.

A STRANGE little instrument has been sent to me from Auckland, intended to illustrate the connection between the mathematical laws of thought and the laws of growth.

The machine itself is simple, and consists of two wheels so arranged that, by turning a horizontal one, a perpendicular one is made to revolve. The axle of this latter projects; and on it can be fastened a piece of cardboard. All the magic is in the precise forms of the cards sold with the machine; and of these I must now speak.

Mr. Betts, of the Government Survey, Auckland, devised a mode of stating arithmetically the main laws of thought. (He had not read George Boole's book; but his principle is, in the main, the same as that on which my husband worked.)

Mr. Betts wished to make diagrams which might represent his formulæ to the eye. Having arranged his scales, he proceeded to draw the diagrams; and found, to his surprise, that he was drawing the outlines of various leaves. These leaf-forms have been seen by many artists, who declare that they are not *conventionalizations* but true *simplifications* of leaves occurring in Nature. Mr. Betts next cut these leaf-forms out in white cardboard; cutting slits to mark the growth-lines. When one of these cards is fastened on the axle of his machine, and whirled, bands of colour appear, which differ according to the form of the leaf; but the preponderating colour is green.

When Mr. Betts told me of this by letter, I confess I hardly believed his account; but he has now sent me a machine and some cardboard leaves, and several friends have seen the colours.

Although I understand Mr. Betts's main principle, and am sure that it is identical with my husband's, I will not attempt to explain it, my object being to induce mathematicians here to put themselves in communication with this extraordinary mathematical logician, who, not knowing the calculus of Newton, has supplemented his deficiency by inventing a calculus of *form*, which is so far like in principle to that used by the Creator, as to have received from Nature the consecration of *colour*.

I have, of course, seen the colours; but, having bad sight, I distrusted my own impressions, till I had heard many persons, more fortunate than myself in this respect, describe what they saw.

The address is, Benjamin Betts, Esq., Milton Street, Mount Eden, Auckland, N.Z. MARY BOOLE.

103 Seymour Place, Bryanston Square.

Lamarck *versus* Weismann.

MR. WALLACE's note with the above title in NATURE (vol. xl. p. 619) contains an illustration of a kind of reasoning that is so common with the post-Darwinians (I know of no other concise expression to designate this class of thinkers) that I desire to call attention to it. His remarks are *àpropos* of the twist in the skull of the flat-fishes, and of Dr. Lankester's comments on the explanation of its origin offered in his book "Darwinism." Mr. Wallace has, as it appears to me justly, ascribed the rotation of the eye of these fishes to the "transmission of a series of slight shiftings of the eye acquired in successive generations by the muscular effort of the ancestors of our present flat-fish" (Lankester, in NATURE, vol. xl. p. 568). This, observes Lankester, pointedly, is "flat Lamarckism." Now Mr. Wallace explains that he has added the following language, which he thinks negatives the explanation cited by Dr. Lankester; "those usually surviving whose eyes retained more and more of the position into which the young fish tried to twist them." Mr. Wallace then says that the "survival of favourable variations is even here the real cause at work."

In the three sentences cited from Mr. Wallace, we have the whole question at issue between the post-Darwinians and the neo-Lamarckians in a nutshell. We have stated the "origin of the fittest" and its probable cause; the "survival of the fittest"; and the *non sequitur* of the post-Darwinians closely following. I point expressly to the words of Mr. Wallace, that the "survival of favourable variations is even here the real cause at work," as containing the paralogism (as Kant would say) which constitutes the error of post-Darwinian reasoning. That survival constitutes *a* cause is clear enough, since from survivors only, the succeeding generations are derived. But it is strange that it does not seem equally clear, that if whatever is acquired by one generation were not transmitted to the next, no progress in the evolution of a character could possibly occur. *Each generation would start exactly where the preceding one did, and the question of survival would never arise*, for there would be nothing to call out the operations of the law of natural selection. *Selection* cannot be the cause of those conditions which are prior to selection; in other words, a selection cannot explain the *origin* of anything, although it can and does explain survival of something already originated; and evolution consists in the origin of characters, as well as of their survival.

The attempt to produce variations by mutilations, or by abrupt modifications of the normal conditions of plants and animals, is not likely to prove successful, as it has evidently not been Nature's way of evolving characters, although some well-authenticated instances of such inheritance are on record. And the fact that we have not as yet an explanation of inheritance, may be applied with equal force against any and all theories of evolution that have been entertained. E. D. COPE.

Philadelphia, November 3.

Galls.

In his suggestive paper on Prof. Weismann's theory, Mr. Mivart says, while alluding to the formation of galls, "It would be interesting to learn how natural selection could have caused this plant to perform actions which, if not self-sacrificing (and there must be some expenditure of energy), are at least so disinterested."

Mr. Mivart here strikes what has always appeared to me one of the most important facts in organic nature with reference to the theory of natural selection. I have always so considered it, because it seems to me the one and only case in the whole range of organic nature where it can be truly said that we have unequivocal evidence of a structure occurring in one species for the exclusive benefit of another.

Moreover. the structure is here a highly elaborate one, entailing not only a drain on the physiological resources of the plant (as Mr. Mivart observes), but also an astonishing amount of morphological specialization. Indeed, the latter point is so astonishing, that when we study the number and variety of gall-formations in different species of plants—all severally adapted to the needs of as many different species of insects, and all presenting more or less elaborate provisions for ministering to such needs—it becomes idle to doubt that, if such cases had occurred elsewhere and with any frequency in organic nature, the theory of natural selection would have been untenable, at all events as a general theory of adaptations and a consequent theory of species. But seeing that the case of galls is unique in the relation which is now before us, it becomes reasonable to attribute the formation of galls to the agency of natural selection, if there be any conceivable manner in which such agency can here be brought to bear.

Now, although it is obvious that natural selection cannot operate upon the plants *directly*, so as to cause them to grow galls for the benefit of insects, I think it is quite possible to suppose that natural selection may operate to this end on the plants *indirectly through the insects*, viz. by always selecting those individual larvæ the character of whose excitatory emanations is such as will best cause the plant to grow the kind of morphological abnormality that is required.

This explanation encounters difficulties in some special cases of gall-formation, which I will not here occupy space by detailing; but as it is the explanation given in a course of lectures which I am at present delivering to the students here, I should like to take the opportunity, which Mr. Mivart's paper affords, of asking whether anybody else has a better explanation to offer.

George J. Romanes.

Edinburgh, November 18.

"Modern Views of Electricity."

Your reviewer (p. 5) takes rather high ground wherefrom to criticize a confessedly popular and expository book; and some of the charges of vagueness—as, for instance, that I do not definitely specify the velocity with which electricity travels in a given current—strike me as rather out of place, seeing that the same charge might be made against the treatise of Clerk-Maxwell. A want of definiteness about the constitution of the ether I must perforce admit; and I can hardly be surprised at your reviewer's want of sympathy with my struggles to convey to non-mathematicians some idea of the tendencies of modern inquiry, when I find that he thinks it "open to question whether attention has not of late years been too much diverted from the condition of the charged bodies in the electric field to that of the medium separating them."

But it is not so clear how, holding this view, he can say that the tentative theory attempted to be explained by me "is in its most important features almost identical with the old two-fluid [action at a distance] theory published by Symmer in 1759"; nevertheless, by taking a few statements from the earlier and introductory portion of my book, and caricaturing them a little, he does manage to make it appear as if the so-called "modern views" were merely a case of reversion to an ancestral type.

However, it is not on these general topics that I break a wholesome rule and reply to a review: it is because I am charged with four or five definitely misleading statements, and it is these I wish to either withdraw or justify.

First, concerning the relation between the Peltier effect and the E.M.F. at a junction. I have argued this matter out fully in the *Philosophical Magazine* for March 1886, p. 269, and have shown that the only "further assumption" needed is this:—*The measure of the E.M.F. at any section of a circuit is the work done per unit electricity conveyed past that section, or*, $dW = QdE$. Until this is disproved I regard it as axiomatic: and, so regarding it, I hold that what I have said about contact E.M.F. is true. My position in the matter is, at all events, perfectly clear and definite, and is fully explained in the *Philosophical Magazine* article referred to, as well as in several others of older date.

Second, as regards tourmaline. I certainly did not *intend* to explain pyro-electricity as due to unilateral conductivity solely, but perhaps my brief statements concerning it on p. 122 might be more cautiously worded so as to avoid any possible misconception.

Third, the "dead-water" argument against electric momentum (p. 103) is not *left* as a valid proof of its non-existence, though it is introduced as at first sight so tending; and all that my critic says against it resolves itself into a question of degree.

The same is true of what he says on the fourth point, concerning Fitzgerald and the Kerr effect; and his assertion that Fitzgerald's deductions do not coincide with the observations of Kerr and Kundt seems to me to convey a much falser impression than my nine-year-old statement (p. 323) to which he objects: "Mr. Fitzgerald, of Dublin, has examined the question mathematically, and has shown that Maxwell's theory would have enabled Dr. Kerr's result to be predicted."

Lastly, my suggested possible account of the Thomson effect (pp. 117, 120, 295), though it does not indeed altogether hold water (as both Prof. Everett and Prof. J. J. Thomson have kindly pointed out to me), breaks down for a reason entirely different from that supposed by your reviewer, who is estimating it only from his own caricature of an ether theory. The real weak point lies in forgetting that the condition required is unequal *impulse*, not simply unequal *force*.

In thus replying to objections raised, I by no means suppose that my critic has made them in any unfriendly spirit. I only feel that he has read the book rather unsympathetically, and (possibly on account of faults in the preface) has regarded it as more scientifically pretentious than its style and object at all warrant. Misleading statements as to matters of fact I have indeed strenuously endeavoured to eschew, and I trust that to very few of them shall I have, in a second edition, to plead guilty.

Oliver J. Lodge.

November 16.

Geometrical Teaching.

Mr. Woodall has called attention to an evil which, even at the present day, is more extensive and persistent than is generally supposed to be the case by those who imagine that "improved methods of geometrical teaching" are making themselves felt.

It is surprising that such a subject as Euclid, which of all subjects perhaps is best calculated to produce in the minds of young persons an exact method of reasoning, should be so badly taught. There can be, I should imagine, only one opinion as to the method of teaching described by Mr. Woodall, viz. that it is decidedly bad; and even worse, that it is perfectly useless.

It is often objected by this class of teachers that young people cannot be brought to appreciate the intricacies and subtleties of Euclid's propositions, and that, in consequence, if they be learnt at all they must be learnt by heart. But is not this a great mistake? My own experience has shown me that young persons *can* be induced to appreciate and take an intelligent interest in Euclid if it be taught intelligently. This demands some little trouble on the part of a teacher, and I suspect that a large proportion of our bad geometrical teaching is due to the disinclination of the teacher to take overmuch trouble in his work, coupled with the fact that it is often very difficult for him to get over the superstition of his own school-days, that a proposition, if it be learnt at all, must be learnt by heart, without any display of intelligent interest.

It does not seem to me to be necessary, at the outset at any rate, in order to improve the teaching, that the ordinary well-known edition of Euclid should be taken to pieces in order that a new and elaborate arrangement of the propositions may be made out of the fragments, according to some individualistic, arbitrary, or so-called scientific method. Sufficient for the day is the evil thereof. The effective teaching of Euclid may be conducted upon the old line, so well known to us in Potts and Todhunter; but to make it effective our teachers must be possessed of ordinary common-sense. So long as this is absent, all the elaborate and scientifically improved editions of Euclid's "Elements" in the world will not produce the much-to-be-desired change. Let the teacher go through any edition of the first book of Euclid's "Elements" in a common-sense manner with his pupils, and he will find that, instead of the apathy and general disgust exhibited by them when undergoing the ordinary process of Euclidian cram, there will be a general air of brightness, interest, and intelligent appreciation.

HAROLD WAGER.

The Yorkshire College, Leeds, November 25.

A Brilliant Meteor.

WHILE at my observatory to-night, at 9.37 p.m., I saw the largest and brightest meteor I have seen since November 1880. It became visible near ν Eridani, and disappeared near α Leporis. The colour was a bright greenish blue, and the brightness was twice or three times Venus at greatest brilliancy. It cast a distinct shadow.

J. COCKBURN.

St. Boswells, N.B., November 23.

STAR DISTANCES.[1]

THE festal offering contributed by Prof. Oudemans to the Pulkowa celebration is an especially appropriate one. The incidents of the long parallax-campaign can scarcely be recapitulated without recalling, in connection with the name of Friedrich Struve, the *quorum pars magna fui* of Æneas. He it was who, in Sir John Herschel's opinion (Memoirs R. Astronomical Society, vol. xii. p. 442), made the first real impression upon the problem by showing that not one of twenty-seven circumpolar stars discussed in 1819–21 could possibly have an annual parallax amounting to half a second of arc. Thenceforward, astronomers knew what they had to expect. Sanguine hopes of meeting comfortably large, and properly periodical residuals among ordinary observations, were checked, if not extinguished. The changes of stellar position reproducing, according to the laws of perspective, the movement of the earth in its orbit, were perceived to be on a scale so minute that their satisfactory disclosure lay, for the moment, beyond the range of what was feasible. Success in the enterprise, it was evident, was conditional upon the employment of more perfect instruments than had heretofore been available with a precision and vigilance of which the very idea was absent from all but a few prescient minds. Sir William Herschel seemed to have anticipated the conjuncture when he declared in 1782 the case to be "by no means desperate," although stellar parallax should fall short of a single second (*Phil. Trans.*, vol. lxxii. p. 83). The memorable "triple event," by which, almost simultaneously, at the Cape, at Königsberg, and at Pulkowa, his confidence was justified, is familiar to all readers of astronomical history. Its significance may be estimated from Bessel's admission that, until the yearly oscillations of 61 Cygni emerged from his measures in 1838, he was completely in the dark as to whether stellar parallax was to be reckoned by tenths or by thousandths of a second (*Astr. Nach.*, No. 385).

The value to students of Prof. Oudemans' synoptical view of what has since then been achieved in this direction can hardly be overstated. Not only does he record every individual result worth considering, but the tabulated particulars enable a fair judgment to be formed as to the value of each. There are, indeed, one or two cases in which a note of warning might with advantage have been added. Thus, Dr. Brünnow's small parallax for 85 Pegasi, to say the least, requires confirmation. A perfect *equability* in the mode of observing is essential in such delicate operations; but the Dunsink astronomer was himself conscious of, and noted with his usual care, a slight change, as the series flowed on, in his habit of "bisecting" the large star (*Dunsink Observations*, vol. ii. p. 38). The distance of this interesting binary system can hence scarcely be regarded as even approximately known.

Still less reliable, though for different reasons, are Johnson's measures of Castor, and Captain Jacob's of α Herculis. The parallax assigned to the latter star of 0″·062 relative to its fifth magnitude companion cannot be other than illusory, since the pair, as evidenced by a small, but well-ascertained common proper motion, are physically connected, and must therefore be at virtually the same distance from the earth.

Forty-nine stars, all save one measured within the last sixty years, are included in Prof. Oudemans' list. The exception deserves particular mention. Samuel Molyneux erected at his house in Kew Green in 1725, a zenith sector by Graham, with which he began, in combination with Bradley, a set of observations for parallax on γ Draconis. The same star had, in the previous century, been similarly experimented upon by Robert Hooke with something of a dubious success. The well-known eventual issue of Molyneux's observations was Bradley's discovery of the aberration of light; but they included besides an element of true parallactic change, brought out by Dr. Auwers's discussion in 1869,[1] after it had lain concealed among them for 142 years. The eye and hand must indeed have been faithful thus to record an ebb and flow of change profoundly submerged, at that comparatively remote epoch, in the reigning confusion betwen the real and the apparent places of the heavenly bodies.

A light-journey of sixty-five years (parallax = 0″·05) may be considered the present limit of really measurable stellar distance. Forty of the forty-nine objects so far investigated lie—most of them certainly, a few only probably—within it. Forty stars can thus be located with some definiteness in space—forty among, say, forty millions! The disproportion between our knowledge on the point and our ignorance is so exorbitant that general conclusions seem discredited beforehand, and negative ones at any rate can have no weight whatever. Nevertheless, one remark at least is fully warranted by the evidence.

It is this, that the largest stars are not always those nearest to the earth. For to the narrow category of stars at ascertained distances belong no less than seven invisible to the naked eye, one of them in closer vicinity to us than Sirius, all than Capella, Vega, Arcturus, or Canopus. A cursory view might almost suggest—irrespective of geometrical possibilities—that stellar brightness had nothing whatever to do with remoteness. The legitimate and certain conclusion to be derived from the facts, however, is that the disparities of stellar light-power are enormous. A farthing rushlight is not more insignificant compared with the electric arc than a faint compared with a potent sun. Sirius emits 6400 times as much light as a ninth magnitude star north of Charles's Wain (Argelander-Oeltzen 11,677); our own sun falls nearly as far short of the radiative strength of Arcturus. Inequalities of the same order between the members of revolving systems emphasize this result. Sirius shines like four thousand of its own companions; and the movements of other stars are perhaps swayed by almost totally obscure bodies.

The inference that the apparent lustre of individual stars tells us nothing as regards their distance was already

[1] "Uebersicht der in den letzten 60 Jahren ausgeführten Bestimmungen von Fixstern parallaxen." Von J. A. C. Oudemans. Eine Festgabe zum 50 jährigen Jubiläum der Sternwarte zu Pulkowa. *Astronomische Nachrichten*, Nos. 2915–16.

[1] *Monatsberichte*, Berlin, 1869. p. 630. The result places γ Draconis at a distance of $35\frac{1}{2}$ light-years, but with a very large "probable error" (parallax = $0''\cdot092 \pm 0''\cdot070$).

drawn by Dr. Huggins in 1866 (*Phil. Trans.*, vol. clvi. p. 393); it has been amply confirmed since, and cannot be too forcibly insisted upon. We are unable to place either an upper or a lower limit to stellar dimensions or intrinsic emissive intensity. Until Arcturus was proved to be immeasurably remote, few would have been disposed to credit the existence of a sun in space at least six thousand times as effulgent as ours is; but we know no reason why Arcturus itself should not be as vastly exceeded by some giant orb at the outskirts of the Milky Way; while we are equally debarred from asserting that among sixth, seventh, twelfth magnitude stars, there may not be found some minute bodies at half the distance from us of α Centauri.

But when we pass from particular to general reasoning, the aspect of the matter changes. No cause has yet been shown why the stars should be exempt from obedience to the "law of large numbers" which provides (as Prof. Edgeworth has ably shown) a clue to other labyrinths of facts. Statistics, it is true, are often misleading, but only when they are wrongly employed. The frequent misuse of a method does not justify its total rejection. And the statistical method is peculiarly liable to misuse. Attempts to get from it more than it will properly give inevitably fail; and what it will properly give are general statements which should only be generally applied. An average result may not be the less instructive because it is by its nature incapable of furnishing specific data.

The stars then *must*, on the whole, decrease in brightness as their distances increase, and they must do so according to an underlying fixed law which will be more and more closely conformed to the larger the number of instances included in the generalization. Each descent of one stellar magnitude represents a falling off in light in the proportion of $2\frac{1}{2}$ to 1; it represents, accordingly, an augmentation of distance in the proportion of the square root of $2\frac{1}{2}$, or 1·59 to 1. Theoretically, that is to say, stars of any given magnitude are 1·59 times more remote than those one magnitude superior, $2\frac{1}{2}$ times ($1·59 \times 1·59$), where the gap is of two magnitudes, and so on. This would be strictly and specifically true if all the stars were equal; but since they are enormously unequal, the rule may be grossly misleading in particular instances, and can only, by taking wide averages, be brought to approximate closely to actual fact.

The determination of individual parallaxes has always, with astronomical thinkers, been subordinate to the higher aim of obtaining a unit of measurement for sidereal space. Hence continual attempts to fix the "average parallaxes" of classes of stars, which, however, remained futile so long as precarious assumptions supplied the place of direct information. Nor could this be obtained until the exigencies of the research had evoked improved means of practically meeting them. The earlier observers chose the subjects of their experiments entirely with a view to their successful issue. Stars likely, owing to their brilliancy, their swift motion, or both combined, to be nearer the earth than most others, were picked out for measurement, with results, each by itself of high interest, but worthless for generalizing purposes. It is only a few years since increased skill in the handling of methods authorized an extension of the range of their application. The first systematic plan for investigating "mean parallax" was proposed by Dr. Gill in 1883, and is now in course of combined execution at Yale College and the Cape. The completion last year of a section of the work enabled Dr. Elkin to deduce an average distance of thirty-eight light-years for the ten first magnitude stars of the northern hemisphere; but it would of course be folly to regard this avowedly "provisional and partial" result as a satisfactory basis for definitive conclusions about the distances of more remote classes of stars. At the most, it makes a useful temporary starting-point for some trial-trips of thought through space. Before long, however, through the exertions of Dr. Gill and Prof. Pritchard, direct measures, not only of all the first, but of most of the second magnitude stars all over the sky, will have been executed; and the proportion between distance and brightness thus established may with some confidence be used as a fathom-line for sounding otherwise inaccessible sidereal abysses.

A. M. CLERKE.

DR. H. BURMEISTER ON THE FOSSIL HORSES AND OTHER MAMMALS OF ARGENTINA.[1]

THIS handsome volume is a continuation of the author's monograph on the fossil horses of the Pampean beds of Argentina, of which the first part was published at Buenos Ayres in 1875, and is stated to have been specially brought out for the Paris Exhibition. The author has, however, not done himself justice as regards the title of this portion of the work, since, in addition to the description of remains of the horses of the Pampean, he also describes and illustrates the osteology of *Megatherium*, *Mastodon*, and *Macrauchenia*, so that a better title for this volume would have been "The Fossil Horses and other Mammals of the Pampean Deposits."

Like the former part, the text of this volume is printed in parallel columns of Spanish and German; and the execution of the plates leaves nothing to be desired, so far as a clear delineation of the essential features of the specimens portrayed is concerned. All the specimens forming the subject of this monograph, are, as we learn from the introduction, preserved in the National Museum at Buenos Ayres, of which the learned author is the Director; and, so far as we may judge from the description and figures, that collection of fossil mammals must be unrivalled in the excellence and completeness of its specimens.

The first section of the work, or that to which the title alone properly applies, is devoted to the horses; and the author commences his description by observing that the *Equidæ* differ from all other Ungulates in that the premolars are larger than the true molars. For the more generalized species of the Pampean deposits, like *Equus principalis* of Lund, Dr. Burmeister adopts the Owenian genus *Hippidium* (*Hippidion*), remarking that these forms are distinguished from the modern horses by the shorter and more curved crowns of their cheek-teeth, which are of a more simple general structure, and also by a difference in the form of the narial aperture, as well as by their shorter limbs and stouter limb-bones. In the

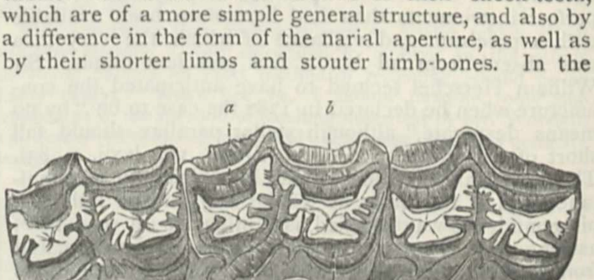


FIG. 1.—Three right upper cheek-teeth of *Hipparion*, *a*, posterior, and *b*, anterior outer crescent; *c*. anterior, and *d*, posterior inner crescent; *e*, anterior, and *f*, posterior pillar.

structure of their upper cheek-teeth the horses of this peculiar South American group make, indeed, a decided approach to the more generalized representatives of the family, such as *Hipparion*. In the latter the anterior pillar of these teeth (Fig. 1, *e*) forms, as is well known, a

[1] "Los Caballos Fósiles de la Pampa Argentina," Suplemento. ("Die fossilen Pferde der Pampasformation," Nachtrags Bericht.) By Dr. Hermann Burmeister. Folio, pp. 65, pls. 4. (Buenos Ayres, 1889.)

subcylindrical column totally unconnected with the anterior crescent (*c*); in *Hippidium* this pillar retains almost the same form as in *Hipparion*, but becomes connected with the crescent; while in the existing horses the same pillar has become greatly elongated in an antero-posterior direction. Further, in *Hippidium* the first premolar, which in modern horses is generally absent, and if present is minute and deciduous, is of very large size, and always persists.

The Pliocene *Equus stenonis* of Europe forms, however, a connecting link in respect of dental characters between the American *Hippidium* and the modern horses; and it is therefore to a great extent a matter of individual opinion whether or no the retention of *Hippidium* as a distinct genus is convenient. A new species referred to *Hippidium* is described from Tarija, in Bolivia. Of more typical horses the author describes additional remains of *Equus curvidens*, *E. argentinus*, and *E. andium;* and he adds to his description a useful word of warning in regard to the many forms of fossil horses from other parts of South America which have been described as distinct species, suggesting that all or several of these may be based merely on individual variations.

In the second section of the volume we have a description of remains of other mammals from the Pampean deposits recently acquired by the Museum at Buenos Ayres. The first of these additions is an entire skull of *Megatherium americanum*, which shows that our previous knowledge was incomplete. This skull formed part of a nearly entire skeleton of a very large individual found in August 1888 on the Rio Salado, but which is as yet but partially disinterred. It shows that instead of the aperture of the nares being bounded superiorly merely by short nasal bones which did not reach within a long distance of the premaxillæ, there was a large prenasal bone extending nearly as far as this point; while there was also a lateral process projecting forward from the upper part of the maxilla into the nasal aperture. This prenasal bone is $4\frac{1}{2}$ inches in length, and it is considered probable that it became united with the nasals in the adult. Still more remarkable, however, is the presence of another ossification extending upwards and backwards from the superior surface of the extremity of the premaxillæ towards the prenasal bone, from which it is only separated by a short interval. These two ossifications, we may observe, are evidently a rudiment of the complete bony arch connecting the premaxillæ with the nasals in *Mylodon darwini*, which was on that account generically separated by Reinhardt as *Grypotherium;* and they serve to support

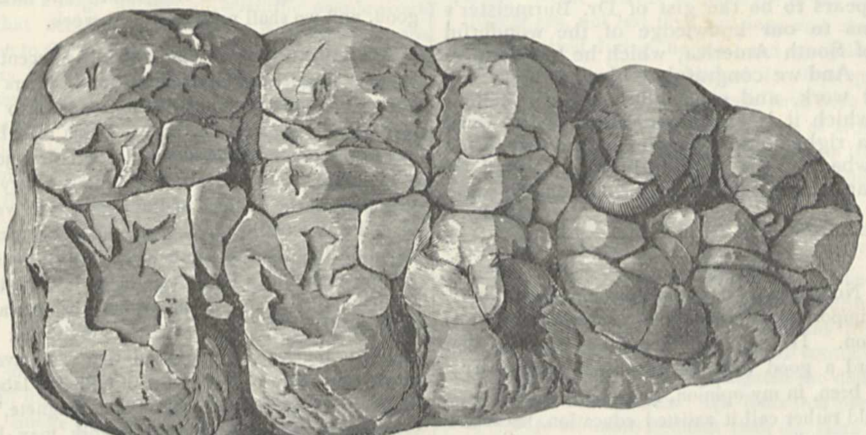


FIG. 1.—The third left upper true molar of *Mastodon humboldti*; from the Pampean of Buenos Ayres. Two-thirds natural size.

Prof. Flower's view that the last-named species is not separable from the genus in which it was originally placed.

The author next proceeds to the consideration of the skull of that species of *Mastodon* which he terms *M. antium*. No mention is made of the earlier name *M. cordillerum*, which appears to be the proper one for this species; and in amending the usual spelling *M. andium* to *M. antium*, one cannot help wondering why the same course was not adopted in the case of *Equus andium*. The object of this part of the work is to show that the reference by the late Dr. Falconer to *M. cordillerum* (as we will call it) of mandibles from Texas, furnished with long tusks is incorrect, and that this species really had, like its near ally *M. humboldti*, a mandibular symphysis of the same general type as that of the elephants, without any tusks at all in the adult. Figures are given of an immature and of an adult skull with the mandible *in situ* to support this redetermination. Dr. Burmeister then proceeds to institute a comparison between *M. cordillerum* and *M. humboldti*, in which he states that, although very similar, a careful examination shows very clearly the distinctness of the two forms. Here we may observe that it is to be regretted that no comment or reference is made to the notices and figures published by Falconer and other English writers in reference to these forms; but perhaps the real explanation of this omission is that the libraries at Buenos Ayres are not so well stocked as those of London. According to our author, *M. cordillerum* is the smaller of the two species; the length of the mandible from the condyle to the symphysis being 75 centimetres against 85 centimetres in *M. humboldti;* the last dimension agreeing with the British Museum skull of that species originally described by Falconer in *M. andium*. Falconer's observations as to the more complicated structure of the molars of *M. humbolti* are in the main confirmed. A small specimen of a last upper molar referred to this species in the British Museum is (with the permission of Dr. Woodward) figured in the accompanying woodcut, to show the complexity of the crown, in which the valleys are much blocked by accessory tubercles. In the early stage of wear of this specimen imperfect trefoils of dentine are shown only on the inner columns; but when more worn trefoils would evidently also appear on the outer columns. In the well-worn upper molar of *M. cordillerum*, represented in Plate x., Fig. 5, of the work before us, the absence of a distinct trefoil on the outer columns, which Falconer mentioned as one of the distinctive features of this species, is well shown. Dr. Burmeister further observes that the molars of *M. cordillerum* are characterized by their blackish enamel, and the brown or reddish colour of the dentine; while in *M. humboldti* the whole of the crown is of a yellowish or white hue, with darker roots. These distinctive colours are very noticeable in many of the specimens in the British Museum, which have been respectively referred to the two species in question.

The work concludes with descriptions of the remains of two species of the remarkable Perissodactylate genus *Macrauchenia*, viz. the typical *M. patachonica* of Owen, and *M. paranensis*, originally described by Bravard as *Palæotherium*. Of the former species an entire skeleton is figured, and the author concludes that the genus is, on the whole, most nearly allied to *Palæotherium*, although the skull presents some remarkable resemblances to that of the tapirs. It appears, moreover, from the presence of muscular impressions on the cranial bones, that the nose formed a short proboscis, as in the latter group. The author also gives us an elaborate description of the teeth, which are undoubtedly of a Palæotherioid type. It is further observed that in the author's opinion there appear to be no grounds for generically separating *M. paranensis* and the smaller *M. minuta* from the typical genus; and the author concludes his volume with some remarks on the proposal of Dr. F. Ameghino to regard the former as the type of the genus *Scalibrinitherium*, and to adopt the name of *Oxydon*[*to*]*therium* for the latter.

The above appears to be the gist of Dr. Burmeister's new contributions to our knowledge of the wonderful Tertiary fauna of South America, which he has done so much to enrich. And we congratulate him on the results of this his latest work, and especially on the excellent illustrations by which it is accompanied, since the want of such aids to a right comprehension of the text forms such a great drawback to the work hitherto published by other contemporary South American writers on the same subject. R. L.

NOTES.

IN his speech at Nottingham on Tuesday evening Lord Salisbury made a most important reference to the subject of what is called free education. He said:—"There is another question which we have heard a good deal discussed, and that is with regard to what has been, in my opinion, improperly termed free education. I should rather call it assisted education, because I do not know that anybody, however extreme his views, would desire that all the inhabitants of this country, whether rich or poor, whether capable of paying for the education of their children or not, should enjoy free education for those children at the cost of the Chancellor of the Exchequer. On the other hand, I have before expressed the opinion—I expressed it four years ago, before the two last general elections, at Newport—that by making education compulsory, by forcing the people to send their children to school whether they ask it or not, you were incurring a certain obligation to relieve the burden of that compulsion, where the circumstances of the parent were such that it was too heavy for him to bear. We believe that considerable progress in that direction may be made. We have already introduced measures to that effect in Scotland. I believe that with perfect consistency with sound principle, and merely recognizing the fact that where you enforce a duty upon a man you are bound to make it as easy for him as you can—I believe that it will be possible considerably to extend that principle in England, and very greatly to relieve the difficulties of the working man in that respect. But allow me to say that I consider the question as to its rapidity, and as to its progress, to be a question for the Chancellor of the Exchequer. If he has got the money I have no doubt he will do it, but if he has not got the money he will not. But it is an object to which I believe a great deal of the money of a Chancellor of the Exchequer may very fairly be applied." The Government is to be congratulated on the pledge thus given to consider the matter.

THE Royal Society will hold its anniversary meeting on Saturday. After the meeting the Fellows will dine together.

ON Tuesday the degree of D.C.L., *honoris causâ*, was conferred in Convocation, at Oxford, upon Mr. Alfred Russel Wallace. Prof. Holland presented him for the degree, and dwelt upon his labours as a naturalist in Brazil, the Malay Archipelago, and elsewhere; upon the now famous doctrines elucidated by him, and upon the relations between him and Mr. Darwin, reflecting equal honour upon both.

A CONFERENCE, called by the National Association for the Promotion of Technical Education, was held in the Manchester Town Hall on Tuesday. About 300 delegates were present from the different technical schools and associations throughout the Kingdom. The chair was occupied at first by the Mayor of Manchester, and subsequently by Mr. Rathbone, M.P. General Donnelly was present to represent the Science and Art Department, South Kensington. Sir Henry Roscoe, M.P., Sir Edmund Currie, Mr. A. H. D. Acland, M.P., and Mr. Mather, M.P., were among those present. The discussions related to the question of the working of the Technical Instruction Act, 1889. A report was read by Sir Henry Roscoe, showing that the Act was being adopted partly or wholly in a large number of towns throughout the Kingdom. The meeting will do great good, and we shall refer to it next week.

ACCORDING to a circular which has recently been sent to the leading physicists, electricians, and others interested in the history of English science, it is proposed to establish a Gilbert Club, the inaugural meeting of which has been convened this day in the rooms of the Society of Arts at 4.30 p.m. The object of the Club is to do justice to the memory of the illustrious President of the College of Physicians who was in the possession of, and was actually carrying on, the true experimental method of scientific inquiry at a time when Bacon was only talking and writing about it. There can be no doubt that the claims of William Gilbert, of Colchester, have been to a great extent overshadowed by the fame of the renowned Lord Chancellor, and it is much to be regretted that we have not had handed down to us more of the results of Gilbert's labours than are to be found in his celebrated work "De Magnete," published in the year 1600. Such as it is, this work may, however, be justly regarded as the earliest English scientific classic, and its author must be recognized as the first truly philosophical investigator in the now all-important subjects of electricity and magnetism. The Club has been organized for the object of bringing out an English edition of "De Magnete" as nearly as possible in the style of the original folio edition, and to arrange for a befitting celebration of the tercentenary of this work in the year 1900. To quote the circular:—"The publication of 'De Magnete' not only marked an epoch in the science of magnetism, but constituted the absolute starting-point of the science of electricity. It has been hitherto a reproach to British electricians that they too little recognized the merits of the founder of the science." The preliminary list of members already includes the names of Sir William Thomson, Lord Rayleigh, Prof. Tyndall, Sir John Lubbock, Prof. Rücker, Prof. Lodge, Mr. Preece, Prof. Reinold, Prof. Perry, Prof. G. Forbes, Prof. D. E. Hughes, Sir F. A. Abel, Sir F. Bramwell, Sir Douglas Galton, Sir H. Mance, Colonel Festing, Captain Abney, Prof. Carey Foster, Prof. W. G. Adams, Prof. J. C. Adams, Prof. Roberts-Austen, Prof. Thorpe, Prof. G. H. Darwin, Prof. Liveing, Prof. Dewar, Prof. W. N. Shaw, Prof. Poynting, Prof. Ray Lankester, Mr. Crookes, Mr. J. Hopkinson, Mr. Glazebrook, Mr. G. J. Symons, Dr. J. H. Gladstone, Dr. B. W. Richardson, Prof. Victor Horsley, Mr. Latimer Clark, &c.

DR. QUESNEVILLE, the French chemist, died on November 14, at the age of eighty. He took his degree of doctor of medicine in 1834, having studied chemistry under Chevreul. In 1840 he started the *Revue Scientifique*, a monthly periodical, which he afterwards called the *Moniteur Scientifique*. This periodical came to an end last month, Dr. Quesneville explaining that the task was rendered too severe by the infirmities of old age.

THE chemical laboratory, presented to the Stalybridge Mechanics' Institute by the late Mrs. Margaret Platt, was formally opened last week. The laboratory, which has been provided at a cost of about £600, was projected by Mrs. Platt—who always took a great interest in Stalybridge and its social and educational welfare—shortly before her death. Unfortunately she did not live to see the completion of this valuable addition to the work carried on by the institution, but her representatives have observed Mrs. Platt's wishes in every respect. The laboratory is fitted with all necessary appliances for the practical study of chemistry. At present there are twenty-two students undergoing a course of instruction.

THE ceremony of cutting the first sod on the site of the International Exhibition which is to be held in Edinburgh next year took place on Saturday last. The Lord Provost, who presided, said they were all aware that the Forth Bridge was to be opened soon, and a large number of scientific people would be present on that occasion. Therefore, it seemed a most opportune occasion to show a collection of matters connected with electricity such as had never been gathered together before. They had promises from all parts of the world, and the little difficulties that were in the way with the London Chamber of Commerce had, he believed, all been got over, and now there would be a unanimous feeling throughout the whole of the electrical world that this Exhibition should be made a great success.

THE Christmas lectures at the Royal Institution (adapted to a juvenile auditory) will this year be given by Prof. A. W. Rücker, F.R.S., on electricity. They will begin on Saturday, December 28.

THE following are the Science Lectures to be given at the Royal Victoria Hall during the month of December:—December 3, "Snakes and Snake-poison," by Dr. W. D. Halliburton; December 10, "A Visit to the Banks of the Rhine," by Mr. A. Hilliard Atteridge; December 17, "My Experiences in Cape Colony," by Prof. H. G. Seeley, F.R.S.

COUNT SALVADORI has just published the first part of a supplement to his famous work on the Birds of New Guinea and the Molucca Islands, entitled "Agguinte alla Ornitologia della Papuasia e delle Molucche." The present part consists of sixty-four pages, and relates to the *Accipitres*, *Psittaci*, and *Picariæ*, which were the orders treated of in his first volume of the "Ornitologia." During the seven years that have elapsed since the completion of Count Salvadori's work much has been done. Hunstein, who was an excellent collector, and whose untimely death by a tidal-wave in New Britain is deplored by all naturalists, made some valuable explorations in the Horse-shoe Range of the Astrolabe Mountains, and discovered the wonderful new Birds of Paradise, *Paradisornis rudolphi*, *Astrarchia stephaniæ*, and others. Mr. H. O. Forbes explored the same district, and also procured some novelties, and the adventurous expedition of the last-named naturalist and his wife to the Tenimber Islands is quite one of the exploits of the last decade. Mr. C. M. Woodford has likewise added many new species to the known avi-fauna of the Solomon Islands, so that altogether Count Salvadori has had ample material for his supplementary notes. Besides giving abundant information respecting the additional synonymy and geographical distribution of the members of the three orders treated of in the present supplement, the author adds twelve species of *Accipitres*, fourteen *Psittaci*, and nine *Picariæ*. Count Salvadori thinks that *Astur shebæ* of Sharpe from Guadalcanar is the same as *A. pulchellus* of Ramsay from Fauro, but as both species are represented in the British Museum such a mistake in identification is scarcely likely. He separates the Timor Laut *Astur*, supposed to be identical with *A. albiventris* of Bouru, as a new species, *Astur*, or as he calls it *Urospizias polionotus*. Several doubtful points among the Parrots, Count Salvadori will probably be able to settle when he comes to England and examines the series of skins in the British Museum. Of Cuckoos, he describes two new species (*Cacomantis arfakianus* and *Lamprococcyx poliurus*), and *Tanysptera meyeri* is a new Kingfisher.

IT is proposed that a meteorological station shall be established at the Bermuda Islands after the completion of the telegraph service between them and Nova Scotia. Many vessels leaving Halifax, the masters being unaware of the approach of storms from the West Indies, are dismantled before they have been out three days. The establishment of the proposed meteorological station would, therefore, be of great value, and the Canadian Government has willingly consented to bear half of the cost.

WE have received vol. xi. of "Aus dem Archiv der Deutschen Seewarte," containing the report of that institution for the year 1888. Great activity is displayed in the collection of observations at sea, not less than 740 logs and abstract journals having been received during the year, and synoptic charts of the North Atlantic have been published for four quarters, ending with August 1885. Several meetings have been held at the Seewarte for the purpose of preparing an atlas of clouds, and the work is now about to be published. In addition to several treatises on terrestrial magnetism, the volume contains (1) an article by Dr. Vettin on the volume of air flowing into or out of barometrical minima and maxima in different seasons, as determined from the direction, height, and velocity of clouds, observed at Berlin during the years 1882–83, in connection with the data afforded by the daily weather charts published by the Seewarte. (2) The rainfall conditions of Germany from 1876–85, by Dr. H. Meyer. The author has not been content with using the usual monthly values, but has investigated the daily observations from the original documents. He finds that periods of two to four rainy days are more frequent than the same periods of dry days. Periods of five or more wet days are more frequent on the coast than in the interior, but longer dry periods are more probable here than on the coast. On the coast the probability of a change from dry to wet is greater than a change from wet to dry, while the reverse holds in the interior. Periods of twenty or more wet days have occurred only in Western Germany, while the same periods of dry days are of the rarest occurrence in any part of the country.

THE Pilot Chart of the North Atlantic Ocean for November shows that, during the early part of the month of October, an extensive area of high barometer occupied the central regions of the North Atlantic; its position varied from day to day, but on the 12th its centre moved south of the 40th parallel, and low pressure prevailed over nearly the whole of the Transatlantic routes until the 19th. At this date an area of high barometer passed eastward from the American coast, and slowly traversed the ocean, reaching the British Isles towards the end of the month. Several storms occurred north of the 50th parallel, and also along the Transatlantic routes east of the 50th meridian. Two cyclones of great violence occurred off the Atlantic coast of the United States. One developed quite suddenly on the 14th, 150 miles east of Hatteras, and after lingering there for four days, started off rapidly to the eastward; the other storm, which was central off the Carolina coast on the 23rd, was remarkable for its violence and its increase of energy after reaching the Gulf Stream. Several other storms of minor importance occurred on that coast during the month. Comparatively little fog was experienced, but ocean ice prevailed in considerable quantity to the eastward of the Straits of Belle Isle, and to some extent on the Grand Banks, in marked contrast with what is usually experienced at this time of year.

A CURIOUS dwarf Japanese tree, *Thuja obtusa*, brought by Mr. Samuel from the Paris Exhibition, was exhibited at the meeting of the Royal Botanic Society on Saturday last. The specimen was only some two feet high, and was stated to be about 130 years old. The secretary said that these dwarf Japanese trees were good illustrations of the power of endurance of plants and trees under severe ill-treatment. In the Society's garden may be seen several specimens of the common oak, between forty and fifty years old, yet only some ten or twelve inches in height. They were planted as an edging to a flower border, and kept clipped like the old-fashioned box.

THE greatest depth found by Captain Spratt in the Western Mediterranean basin was between Sicily, Sardinia, and Africa (about 10,600 feet). Recent measurements in the eastern basin by Commander Magnaghi, of the Italian Navy (*Riv. Sci. Ind.*) have yielded, as maximum depth, 13,556 feet, between the Islands of Malta and Candia.

AT the annual meeting of the Severn Valley Field Club, at Wellington, in January last, Dr. Callaway, the President, was asked to prepare a report of the year's proceedings with a shorter account of the work of the preceding year. These reports have now been issued, and show that a resolute effort is being made to promote a taste for geology and natural history in the district, and to make the Field Club something better than a picnic society.

COLONEL WOODTHORPE recently delivered, at Simla, a lecture on the Aka Expedition of 1883. It may be remembered that this tribe, which inhabits the hills north of Assam, owing to some forest disputes and a supposed interference with their trade in rubber, seized two of our forest officers and carried them off. To recover these men, a small expedition was despatched, under the command of Colonel Woodthorpe. The Aka houses are built on piles raised above the ground, with a large space at one end, where the children play. The dress consists of a tunic of Tibetan cloth, and trousers, reaching to the feet, made of thin white material. Long trousers are worn to keep off the *dam-dum*, a troublesome little fly or mosquito. Bows and arrows and knives, with blades easily detachable from a bamboo handle, are the chief weapons. The barbs of the arrows are dipped in aconite, and are so treated that, when any attempt is made to pluck out the arrow, the barb breaks off and remains in the wound. The poison is so deadly, that even a buffalo usually falls, after running a few yards, when he has been struck by one. Some of the superstitions of the Akas are curious. If a river runs between an Aka's house and his burying-place, his soul can never go home after death. This inability of the spirit to cross water is, however, overcome, and, every year, Akas may be seen stretching a string across the stream that divides the grave from the house of the departed. The ghost can easily cross when the slightest foothold is given him.

IT is sometimes said about old trees (*e.g.* an old lime in the new Gardens at Potsdam) that the present branches are properly roots; and it has been reported that trees may be planted, and will grow, in the inverted position. A scientific inquiry into this matter has been made by Herr Kny, in Germany, taking a number of plants of wild vine (Ampelopsis) and ivy, about 3·5 metres high. In 1884 he planted these with both ends in the ground; and in the spring of 1885, after the tops had rooted, he cut the arch at its highest point. In the first year two of the plants died, but the others (twelve vine and fourteen ivy) grew vigorously, and were still alive this last spring. To test the extent of the inversion, he cut slips from the inverted plants, and planted them in a greenhouse, some with their natural, and some with their artificial upper end uppermost. It appeared that the callus, from which the roots spring, was formed at both ends, but more readily at the naturally lower end, whether this was above or below, in the experiment. Herr Kny considers that, notwithstanding several years' successful culture, the inversion was not thoroughly completed. He proposes to continue his investigation, and invites people who have gardens to make like experiments with other plants, recommending willows, poplars, and roses.

THE latest Colonial Report from Basutoland contains a statement by Sir Marshall Clarke on education in that State, written at the request of Lord Knutsford. The total amount granted by the Government during 1888 for educational work was £4581 amongst four missions, of which £2900 went to the Paris Evangelical Missions. The number of schools receiving Government aid was 100, with a nominal roll of 4053, and an average attendance of 3480. The education offered is, for the most part, of an elementary character, suitable to a people of agricultural pursuits, whose children are withdrawn early for labour in the field. It consists of reading and writing in Sesuto, and a little elementary arithmetic and English. A higher education is offered at the missionary centres. The number of schools under direct European supervision is 21, with about 1400 pupils on the attendance roll. At Morija, the head-quarters of the Paris Evangelical Missionary Society, the training school affords a sound English education, the staff being composed of well qualified Europeans. There is an interesting girls' school at Roma, the chief Roman Catholic mission station, where the pupils are instructed in carding, spinning, weaving, and the elements of dressmaking, as well as in English and Sesuto. Schools receiving Government aid are, from time to time, inspected by Government officers, who check the attendance rolls, examine the pupils, and, at the end of the year, submit reports from each district.

MR. H. Y. L. BROWN, the Government Geologist of South Australia, returned to the Angle Pole head camp from his exploration trip to the Musgrave Ranges on October 7. Accord- to the *Colonies and India*, the route was *viâ* Cootanoorina and Arkaringa Creek to Glen Ferdinand, a trigonometrical depot. The exploration extended among the ranges to longitude 131° E., latitude 26° S. Mr. Carruthers, the Government Trigonometrical Surveyor, starting from the depot, will continue the survey towards the western boundary, and expects to return in January. The Government Geologist returned *viâ* the River Alberga, striking the telegraph line at the Angle Pole.

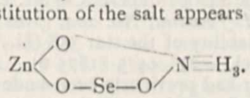
FROM the Report of the Ceylon Survey Department for the past year, which has just been issued, it appears that when the calculations of the northward running chain of the 13-inch triangulation were completed, it was found that the computed distance between the two stations at Delft Island differed from that of the Indian system to such an extent as to show a considerable error, probably in the Ceylon work. The resulting error is too small to be appreciable on maps even of the largest scale, but, from a geodetical point of view, the outcome of so much work extending over a large number of years is disappointing. In order to verify the previous work, Colonel Clarke purposes carrying at an early opportunity a new system of triangles along the west coast, utilizing as many as possible of the old stations. A tentative scheme for the triangulation of the west coast has been drawn up, and when an officer is available, he will be sent to inspect the country, and report on the feasibility of the scheme. In consequence of the incompleteness of the diagrams and other records, the construction of a new series of diagrams, in which will be inserted the information gained from an exhaustive examination of the record books, will be commenced. In the past year sixty-one sheets were scored under the superintendence of the Trigonometrical Assistant, each representing an area of 13·6 miles by 8·8 miles, and containing in all 1687 fixed stations. He has also prepared an elaborate map of the island, showing sheet line distances.

THE Report for the past year on the mining and mineral statistics of Canada, by Mr. H. P. Brumell, of the Dominion Geological Survey, has been received in this country. The total value of the production of minerals of all kinds for the year was $16,500,000—an increase of 1,500,000 as compared with 1887, and 6,000,000 against 1886. Coal is the largest mineral product of the Dominion, the value of last year's yield amounting to $1,098,610, as against $1,178,637, in 1887, and $1,330,442 in 1886. The decrease in the yield of gold has been anticipated for some years. Copper was mined to the value of $667,543, and these figures will in all probability be doubled this year, in view of the rapid development of the Sudbury and Lake Superior Mines. The asbestos yield amounted to $255,007, and the phosphate production shows an appreciable increase.

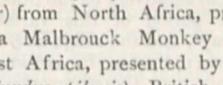
THE Smithsonian Institution has issued a "Preliminary Catalogue of the Shell-bearing Marine Mollusks and Brachiopods of the South-Eastern coast of the United States," by W. Healey Dall. The volume includes admirable illustrations of many species.

WE have received the sixty-second part of the first division of the "Encyclopædie der Wissenschaften," and the fifty-fourth and fifty-fifth parts of the second division of the same work (Breslau, Trewendt). The first of these three parts is a contribution to the hand-book of botany included in this Encyclopædia; the second and third conclude the seventh volume of the Encyclopædia's Dictionary of Chemistry.

A NEW series of well crystallized salts, ammoniacal selenites, are described by M. Boutzoureano in the current number of the *Annales de Chimie et de Physique*. Most normal selenites are found to be readily soluble in strong ammonia, and the solutions on evaporation either in the air or *in vacuo* deposit crystals of ammoniacal selenites. Four of these interesting salts have been studied in detail, those of zinc, cadmium, copper, and silver. Ammoniacal zinc selenite, $ZnO.SeO_2.NH_3$, is obtained by dissolving neutral zinc selenite, $ZnO.SeO_2$, a salt which crystallizes in rhombic prisms, in strong ammonia at the ordinary temperature. On allowing the solution to spontaneously evaporate, crystals of the ammoniacal salt are deposited in the form of fine long prisms capped by domo-prisms belonging to the rhombic system. The crystals are insoluble in water, which appears to exert no action whatever upon them. They are also unchanged by heating to 100° C., but when heated in a sealed tube the selenious oxide is reduced by the hydrogen of the ammonia with evolution of water vapour and sublimation of selenium. On ignition they are completely converted to zinc oxide. Acids readily dissolve the crystals even when largely diluted with water. The constitution of the salt appears to be



Normal cadmium selenite, $CdO.SeO_2$, is also soluble in ammonia, and the solution leaves on evaporation white rhombic crystals of an ammoniacal cadmium salt, $CdO.SeO_2.NH_3$, analogous to the zinc salt. These crystals are likewise unattacked by water, and are stable at 100°. They also give off water and vapour of selenium when heated in a sealed tube. The most beautiful salt of the series, however, is the ammoniacal copper selenite. Copper forms a normal selenite of the composition $3(CuO.SeO_2).H_2O$, which crystallizes in small green monoclinic crystals. These crystals readily dissolve in ammonia, forming a deep bluish-violet solution, which on slow evaporation in the air yields magnificent blue crystals of the ammoniacal salt belonging to the triclinic system. The salt is found to contain one molecule of water, and is represented by the formula $CuO.SeO_2.NH_3.H_2O$, the constitution being probably more nearly expressed in the following manner,



Unfortunately these fine crystals soon alter in contact with air, losing their water and ammonia and becoming covered with a green coating of basic copper selenite. Water has apparently no action upon them, but in reality there is a surface action, the coating of basic selenite thereby formed preventing any further decomposition. In a similar manner silver is found to form an ammoniacal selenite, the crystals belonging, like those of the copper salt, to the triclinic system. They are anhydrous, $Ag_2O.SeO_2.NH_3$, and are blackened by exposure to sunlight. Thus the series is seen to be a very well defined one, the members consisting of normal selenites combined with one molecule of NH_3, generally anhydrous, but occasionally, as in case of the copper salt, containing water of crystallization.

THE additions to the Zoological Society's Gardens during the past week include a Barbary Ape (*Macacus inuus* ♂), a Saker Falcon (*Falco sacer*) from North Africa, presented by Captain Augustus Kent; a Malbrouck Monkey (*Cercopithecus cynosurus* ♂) from West Africa, presented by Dr. Messiter Lang; two Fieldfares (*Turdus pilaris*), British, presented by Mr. J. Young, F.Z.S.; a Golden-naped Amazon (*Chrysotis auripalliata*) from Central America, purchased; a Molucca Deer (*Cervus moluccensis*), born in the Menagerie.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m., November 28 = 2h. 31m. 57s.

Name.	Mag	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G. C. 575	—	—	2 33 30	+38 19
(2) ρ Arietis	6	Yellowish-red.	2 49 37	+17 53
(3) ξ′ Ceti	5	Yellowish-white.	2 7 12	+ 8 20
(4) γ Ceti	3	White.	2 37 36	+ 2 46
(5) D M + 57° 647 ...	9	Reddish-yellow.	2 42 51	+57 24
(6) R Ursæ Minoris ...	Var.	Reddish-yellow.	16 31 18	+37 34
(7) V Geminorum ...	Var.	—	7 16 59	+13 18

Remarks.

(1) Sir John Herschel describes this nebula as: Very bright, very large, very much extended, very much brighter in the middle. Dr. Huggins noted, in 1866, that the spectrum was continuous, but pointed out in his remarks that this was not to be understood to mean more than that, when the slit was made as narrow as the feeble light permitted, the spectrum was not resolved into bright lines. Further observations are therefore required, for it may be that slight brightenings in the apparently continuous spectrum were overlooked in the early observations. The case of the nebula in Andromeda indicates that, in some of the nebulæ of this class, bright carbon flutings may be superposed upon the continuous spectrum, in which case they will not be very obvious. The carbon flutings seen in the spectrum of the flame of a spirit-lamp are convenient for comparison in an observation of this nature.

(2) This is a typical star of Group II. Dunér describes it as superb and brilliantly developed, the bands 1–9 being perfectly visible. The star therefore affords an opportunity of observing the bright carbon flutings and checking their positions. If they

are very bright, the compound structure, as seen in the spectrum of a spirit-lamp or the base of a candle-flame, may be looked for. The star falls in species 9 of the subdivision of the group, and is accordingly of about mean condensation. Dark metallic lines will probably be found to make their appearance about this temperature, and the presence or absence of *b*, D, or other lines should therefore be noted.

(3) Vogel classes this with stars of the solar type, but is doubtful whether it does not belong to Group II. It is most likely that it is at an intermediate stage—either a late stage of Group II. or an early stage of Group III. There are evidently traces of some of the dark flutings, and it is suggested that the distinguishing numbers of these and the relative intensities of the lines should be noted. The observations made by Prof. Lockyer and myself seem to indicate that the bands in the red are the most persistent as the temperature increases.

(4) According to Gothard this is a star of Group IV., and the usual observations are required.

(5) This is classed with stars of Group VI. in Dunér's catalogue, but it is stated that the type of spectrum is rather doubtful. Like the star given last week, it may possibly be intermediate between Groups V. and VI., and similar observations are suggested.

(6) This is a variable star which will be at its maximum on November 30. Gore gives the period as 281·2 days, and the range as 8 at maximum to < 11·5 at minimum. The spectrum is of the Group II. type, and the suggestions made for the observation of R Tauri (see p. 68) apply equally in this case. It may be further suggested that the spectrum be observed for some time after the maximum, special attention being given to the fading out of the carbon fluting in the green (517, a little more refrangible than *b*) relatively to the other bright spaces.

(7) Gore gives the period of this variable (maximum on December 4) as 276 days, and the range as 8·6 to < 13·5. The spectrum and colour have not yet, so far as I know, been recorded, and midnight observers may therefore take advantage of the approaching maximum. A. FOWLER.

THE TOTAL SOLAR ECLIPSE OF 1886.—The report of the observations of the total solar eclipse of August 29, 1886, made at the Island of Carriacou by the Rev. S. J. Perry, has been published. The two main questions that required spectroscopic observations to answer them were:—(1) Does the absorption, which produces the Fraunhofer lines, take place mainly in a single layer of the solar atmosphere, or in concentric layers? (2) Does carbon exist in the corona? With respect to the first point, Father Perry thinks that the differences in the length of the lines which he observed before totality on the less refrangible side of *b* seems somewhat to strengthen the view that the selective absorption takes place in concentric layers. During totality a search was made for the two principal bands of the carbon spectrum The part of the spectrum observed was from about *b* to λ560, but no trace was seen of the carbon bands. Father Perry, however, suggests that perhaps the intensity of the carbon spectrum may vary in each eclipse, and may have some direct connection with the amount of solar activity. Some sketches of the coronal streamers are appended to this report.

Mr. H. H. Turner's report of the observations of the same eclipse, made in the Island of Grenada, has also been received. The following is a list of the lines seen and the order in which they appeared:—

h. m. s.		
7 7 45	...	F line appeared.
7 8 55	...	4923 appeared; very short.
7 11 30	...	4923 and 4933. Immediately after, many lines appeared.
7 12 0	...	Totality.
7 20 50	...	Only F; 4923 and 4933 visible at times.
7 21 45	...	4923 still suspected, and 4956.
7 22 28	...	4956; certainly visible.
7 24 42	...	No line visible.

It will be seen that to some extent these observations lead to the same conclusion as that arrived at by Father Perry.

The corona was examined with a view to the detection of currents, but with a negative result.

PALERMO OBSERVATORY.—The fourth volume of observations made at Palermo has been issued by Prof. Riccò, and covers the period 1884–88. The observations of sun-spots during 1885 show that the limiting latitude in which the phenomena occurred were + 25° and − 30°. Two maxima are indicated by the curve of distribution that has been plotted, both extending from about 10° to 15° north and south of the equator, but the number of spots that have been observed in the latter hemisphere considerably exceeds that observed in the former. The minimum which occurs between these two maxima is in a latitude slightly north of the equator. Generally speaking, faculæ appear to have been equally distributed over the sun's surface. The spectroscopic observations that have been made of solar prominences in different latitudes demonstrate that the reversal of the coronal line 1474K and *b* was considerably more frequent a little to the south of the equator than in any other latitude, and was contained within the limits + 30° to − 30°, following somewhat the same line of distribution as that of spots.

Prof. Riccò has included some fine sunset observations made after the eruption at Krakatão, which support the view that, to a great extent, they were due to the suspension of volcanic dust in the atmosphere. A lengthy series of meteorological measurements, some observation of Nova Orionis, Nova Andromedæ, and various comets, are also contained in this publication.

THE VARIABLE STAR Y CYGNI.—The irregularities before observed in the period of this star have been verified by Mr. Chandler's more recent observations (*Astronomical Journal*, No. 204, October 1889). He finds that the period of the star, which increased by nearly two minutes during 1887 and 1888, is now decreasing at a similarly surprising rate. The reversal appears to have occurred about the middle of 1888, and the average value for the last twelve months has been about 1d. 11h. 56·7m. Assuming this average value for the period of the star, an ephemeris is subjoined. Only alternate minima are given.

Minima of Y Cygni. G.M.T.

	1889.	d. h. m.			1890.	d. h. m.
727	Dec.	2 12 38	...	747	Jan.	1 11 32·0
729	,,	5 12 31·4	...	749	,,	4 11 25·4
731	,,	8 12 24·8	...	751	,,	7 11 18·8
733	,,	11 12 18·2	...	753	,,	10 11 12·2
735	,,	14 12 11·6	...	755	,,	13 11 5·6
737	,,	17 12 5·0	...	757	,,	16 10 59·0
739	,,	20 11 58·4	...	759	,,	19 10 52·4
741	,,	23 11 51·8	...	761	,,	22 10 45·8
743	,,	26 11 45·2				
745	,,	29 11 38·6				

PARAMATTA OBSERVATORY.—The Government Astronomer at this Observatory, Mr. H. C. Russell, F.R.S., has collected and arranged in a concise form the history of what has been done in New South Wales for astronomy and meteorology since 1778. The paper may be found in the Proceedings of the Australasian Association for the Advancement of Science, Sydney, 1888, p. 45.

MINOR PLANET 282.—This planet, discovered by M. Charlois, January 28, 1889, has received the name of Clorinde.

COMET DAVIDSON (*e* 1889).—Ephemeris for Greenwich time:—

1889.		R.A. h. m. s.		Decl. ° ′
Nov. 29·5	...	19 17 21	...	+ 38 56
Dec. 1·5	...	,, 21 41	...	39 10
,, 3·5	...	,, 26 3	...	,, 25
,, 5·5	...	,, 30 25	...	,, 40

A NEW VARIABLE STAR IN HYDRA.—Mr. Edwin F. Sawyer, in the *Astronomical Journal*, No. 204, gives observations demonstrating the variability of the star 358 (U.A.) Hydræ, R.A. 13h. 41m. 59s., Decl. −27° 44′·5 (1875·0). An inspection of the observations that had previously been made of the magnitude of this star indicates fluctuations of about one unit, viz. 7m. to 8m., and the period would appear to be about one year. The star is quite red.

SUN-SPOTS IN HIGH SOUTHERN LATITUDES.—The Rev. S. J. Perry read a paper under this title at the meeting of the Royal Astronomical Society on November 8, in which he drew attention to some remarkable instances which have recently occurred of the appearance of sun-spots at a great distance from the equator. These took place on June 5, June 30, October 8, and October 10 respectively; that of June 30 being especially interesting, as the spot seen on that occasion attained a latitude of 40°, a circumstance for which there are only a very few recorded precedents. Besides these spots mentioned by Father Perry some much larger groups have also been seen at a less but still considerable distance from the equator. Thus on July 26 and 27 a group was noticed in lat. 24° S., while another and more important group in nearly the same latitude was observed during three successive rotations in August, September, and October. Bearing in mind that the mean distance from the equator of all spots in 1888 was scarcely more than 7°, and in the first five months of 1889, but little more than 5°, these outbreaks in high latitudes become very significant; and taken with the marked increase in number and size of spots during the months of June, July, August, and September, as compared with the earlier part of the year, point to the minimum being definitely passed. If this be so, the period of quiescence has been decidedly shorter, the run down from maximum swifter, and the turn towards recovery sharper than in the preceding cycle. Judging from the form of the spot curve on previous occasions when a short period of minimum has followed a maximum of low intensity, as was that of 1883, we may expect that the revival will be rapid, and the next maximum a strongly marked one.

PROPOSED MEMORIAL OF DR. JOULE.

A PUBLIC meeting was held on Monday in the Mayor's parlour at the Town Hall, Manchester, for the purpose of considering the proposal to erect a memorial of the late Dr. James Prescott Joule. The meeting was convened in response to a memorial influentially signed by residents in Manchester, Salford, and the neighbouring country who desire that the "deep sense of the benefits conferred on mankind for all time, as well as of the great honour which accrues to this district, by the scientific work of the late James Prescott Joule should be marked by the erection of some durable memorial of him in the city." The meeting was very numerously and influentially attended. The Mayor of Manchester presided, and amongst those present were Sir H. E. Roscoe, M.P., Mr. J. W. Maclure, M.P., Dr. Ward (Vice-Chancellor of the Victoria University), Dr. Greenwood (Principal of the Owens College), Prof. Osborne Reynolds, Prof. Munro, Dr. Tatham, Mr. F. J. Faraday, and many others.

A number of letters of apology for absence were read. Lord Derby wrote from London :—

"I cannot attend the meeting on Monday in aid of the Joule memorial, having business here, but I heartily sympathize with the object, and will with pleasure contribute."

Mr. William Mather wrote :—

"When the beautiful simplicity of Dr. Joule's life and character are regarded in conjunction with the world-wide fame his labours have acquired among the greatest intellects of our time, we in Manchester must feel that our late fellow-citizen's memory deserves to be kept ever fresh in our midst by a memorial alike worthy of this city and of the imperishable renown which Dr. Joule has won. Those of us who apply science to industry are deeply indebted for the means through which we work to the original thinkers who put the laws of Nature into our hands with clear definitions as to their purposes. I trust this sense of indebtedness may be felt throughout this district, and that funds may be generously supplied to enable the committee to raise a memorial amply testifying to our gratitude and to our admiration for the late Dr. Joule.

The Bishop of Manchester wrote :—

"I greatly regret that I am prevented by an engagement from attending the meeting in connection with the proposed memorial to Dr. Joule. I think that it would be an honour to any town to be the birthplace and home of the man who first proved the truth of the great principle of the conservation of energy. I most heartily sympathize with the movement which the meeting is called together to initiate, and I shall very gladly give a contribution to any fund which may be to-day established or recommended."

The Mayor, having spoken of the relations between Manchester and science in past times, said the scientific work of Dr. Joule had made the name of Manchester famous throughout the world, not merely as that of a great industrial and trading city, but as a centre of intellectual culture and home of genius. This great man was born in Salford, but he learnt his science as a boy from Dr. Dalton, in George Street in this city. There, he, for a period of nearly half a century, found the congenial society which stimulated his genius. He read many of his papers there; his experiments were performed in this city; and to the end he continued to reside in the suburbs, in a quiet and unostentatious way, his riches truly consisting, not in the extent of his possessions, but in the fewness of his wants. The last generation honoured the memory of Dalton by a statue in marble by Chantrey, which was considered to be one of the most beautiful works of art in the city, and it was suggested that they should show their appreciation of Dalton's great successor in a similar way.

Mr. Oliver Heywood moved :—

"That this meeting desires to mark its deep sense of the benefits conferred on mankind for all time, as well as of the great honour which has accrued to this district, by the scientific work of the late James Prescott Joule, by the erection of a durable memorial of him in Manchester, in the form of a white marble statue."

Sir H. E. Roscoe, M.P., said he felt it a pleasure and an honour in more ways than one to be asked to second the resolution, because, in the first place, he was one of the oldest scientific friends of the man whose memory they had met to honour, and because it had been his privilege not only to become acquainted with his important scientific labours, but to enjoy the friendship of one who might truly be said to have been a typical man of science, the simple straightforward searcher after truth for its own sake and that alone. Another reason was a more personal one. On the occasion of his first public utterance in Manchester, now more than thirty-two years ago, when he read his inaugural address on taking up the duties of the Chair of Chemistry in the Owens College, he drew attention to the great work accomplished by Joule. This was, so far as he could learn, the first occasion on which Joule's work and its importance was brought publicly before a Manchester audience, and he remembered as if it were yesterday being asked by several Manchester friends who this Dr. Joule was of whom he had spoken in such high terms, and what was the great discovery he had made. And then he remembered that, after explaining as well as he could to unscientific people the meaning of the mechanical equivalent of heat and the conservation of energy, he added in joke, in order to impress the matter on minds unaccustomed to deal with subjects scientific, that in the good time coming Manchester would be immortalized, not, as they thought, by being the seat of the cotton trade, but rather as being the place where John Dalton worked out the atomic theory of chemistry, and James Prescott Joule placed upon a sure experimental basis the grand principle of the conservation of energy. Since that time many things had happened, many changes had occurred, and the knowledge of Science and her doings was more widespread. We had acknowledged our indebtedness to Dr. Dalton, and we were now met to consider how we could best do the same for Joule. The memorial which had been presented to the Mayor was of itself proof that Manchester was anxious to recognize merit such as that of Dr. Joule, and to acknowledge that services thus quietly and unostentatiously rendered were sometimes of far greater value to the State than those about which much more was heard. This was not the occasion nor was that the place to enter into an elaborate discussion of Joule's scientific labours. It was sufficient now to remember that, just as Lavoisier, more than a century ago, proved the indestructibility of matter, so Joule nearly half a century ago proved the indestructibility of energy—that we could no more destroy or create energy than we could create or destroy matter. And "thereby hangs a tale"—a tale so interesting that it would take long to tell it; a tale so far-reaching that it concerned every great industry; a tale so important that without it all the modern applications of scientific discovery to the daily wants of mankind could not have been made. The events which formed the incidents in this tale had happened in our midst, and had taken place so quietly that but few had known of their existence. Like many great discoverers, Joule was far in advance of his time; and even the results of his most important research, that on the determination of the mechanical equivalent of heat, met with opposition, and were received with incredulity by men who ought to have known better. Indeed, it was an open secret that when Joule's first paper on this subject, an abstract of which had been read at the Cork meeting of the British Association on August 21, 1843, was presented to the Council of the Royal Society for publication in their Transactions, some of the members of that learned body openly expressed their opinion that the paper was nonsense from beginning to end, that the author, who was a mere amateur, living in some remote and rather uncivilized part of the country, out of the charmed circle of metropolitan and professional science, had been entirely mistaken, because he had, forsooth! neglected the whole question of friction, and had got hold of an absurd idea that the values of the various so-called imponderables could be expressed in quantitative terms, the one of the other. Fortunately for the credit of the Royal Society, someone more far-seeing than these critics, expressed the opinion that the Council had better take care what it was about, because if they acted on these ideas they might find that they, the highest scientific tribunal in the country, had refused to publish the most important scientific discovery of the century, and one which had already been received with acclamation by all Continental scientific authorities. And so the celebrated paper on the mechanical equivalent of heat was printed, seven years after its first announcement, in the Philosophical Transactions for 1850. But while this, with its immediate relations, was Joule's *magnum opus*, other portions of his work were of scarcely less importance, and to one only of these did he (Sir Henry) wish for a moment to revert, as it touched on a fundamental principle in the science of chemistry, and was therefore specially interesting to himself, whilst it served to show the wide area which Joule's researches covered. On January 24, 1843, Joule read a paper before the Literary and Philosophical Society in their rooms in George Street, hallowed by the memory of Dalton, entitled, "On the Heat evolved during the Electrolysis of Water." The results of this apparently trivial research were of the highest importance, as establishing the heat equivalence of chemical action. Dulong, in France, had already determined the amount of heat evolved during combustion, but he did not compare this with the heat evolved by the same combustion in the battery or elsewhere, and Joule's discovery, described in the above papers, was, that the heat which disappears during separation of the chemical elements was equal to that which made its appearance during their combination, on the principle that action and reaction were equal and opposite. And this was the discovery which established the law proving that chemical action was due to the clashing of the atoms, and that the same laws applied to those atoms singly as they did to them when taken in the aggregate, thus showing that chemistry was a branch of molecular physics. He trusted he had given good grounds for the acceptance by that meeting of the resolution he moved. He would humbly suggest that nothing short of a similar memorial to that erected to Dalton ought to be raised in Manchester in recognition of the labours of Joule. They had statues of Cobden, of Dalton, and of good Bishop Fraser; they would soon have one of Bright. Let them not place Joule in any less conspicuous position, for his work was as glorious as any of theirs. Let us have a marble statue as a companion to that beautiful one of Dalton, by Chantrey, in our Town Hall, and let us have a replica of it in bronze to place on our Infirmary flags, so that all who passed for generations might say, "That is the statue of our great Manchester man of science, James Prescott Joule, who did work in our midst not less important than that of his master, John Dalton, whose statue is hard by; both men were honoured by their contemporaries, and are even more honoured by us who follow them."

Prof. Osborne Reynolds, in supporting the motion, expressed regret that they had not present with them Sir William Thomson, who fought the battle with Dr. Joule. Sir William had written a letter, in the course of which he said: "Manchester is certainly, of all cities in the world, to be envied the honour of being able to erect a monument to Joule as one of its own citizens." Professor Reynolds also made a statement as to the action which had been taken by the Manchester Literary and Philosophical Society, with whom the proposal for a memorial of Dr. Joule originated.

On being put to the meeting, the motion was unanimously adopted.

Mr. Alderman W. H. Bailey moved the appointment of the following Committee to raise, by public subscription, a sufficient sum to carry the above resolution into effect, viz.:—Chairman—the Mayor of Manchester; Treasurer—Oliver Heywood; Thomas Ashton; the Ven. Archdeacon Anson; Sir William Cunliffe Brooks, Bart., M.P.; Alderman W. H. Bailey; Rev. St. Vincent Beechey; C. H. Bayley; Dr. James Bottomley; William Brockbank; J. H. Buxton: Rev. L. C. Casartelli; Councillor George Clay; R. S. Dale; Prof. W. Boyd Dawkins; Mr. Thomas Diggles; Samuel Dixon, President of the Manchester Society of Engineers; F. J. Faraday, Hon. Secretary of the Manchester Literary and Philosophical Society; Lavington E. Fletcher; R. F. Gwyther, Hon. Secretary of the Manchester Literary and Philosophical Society; Samuel Gratrix; Principal J. G. Greenwood; William Grimshaw; Charles J. Galloway; Sir W. H. Houldsworth, Bart., M.P.; T. C. Horsfall; Dr. Charles John Hall; Thomas Harker; Henry H. Howorth, M.P.; William W. Hulse; Henry P. Holt; Isaac Hoyle, M.P.; Dr. Edward Hopkinson; Canon Hicks; James Jardine, High Sheriff of Cheshire; W. H. Johnson; Thomas Kay; George King; Thomas Kay; Horace Lamb; Sir Joseph C. Lee; Ivan Levinstein; J. W. Maclure, M.P.; Councillor J. D. Milne; James Cosmo Melvill; Councillor Alexander M'Dougall, Jun.; Robert Montgomery; Dr. Morgan; William Mather, M.P.; Ludwig Mond (V.P. Chem. Soc.); Prof. J. E. C. Munro; Francis Nicholson; Councillor Charles O'Neill; Henry D. Pochin; W. O. Pooley; Sir H. E. Roscoe, M.P.,; Dr. Ransome; Prof. Osborne Reynolds; Henry Slatter; Dr. Schunck; Prof. Schuster; Councillor Dr. Henry Simpson; Colonel Thomas Sowler; William Thomson; Alderman Joseph Thompson; Councillor S. Chesters-Thompson; E. Leader Williams; Professor A. W. Ward; Thomas Worthington; Rev. Canon Charles W. Woodhouse. Convener of first meeting, Prof. Osborne Reynolds. In his remarks in support of the motion, Mr. Bailey said that speaking as an ex-President of the Manchester Society of Engineers he could testify that, however slow many people might have been to acknowledge Dr. Joule's work, the Society of Engineers had never forgotten Dr. Joule's labours and the benefit which those labours had conferred on the engineers of this country and on the industries of the world generally.

The motion was seconded by Colonel T. Sowler and unanimously adopted.

A vote of thanks to the Mayor for presiding and for the use of his parlour, accorded on the motion of Prof. Ward, seconded by Mr. C. Bailey, brought the proceedings to a close.

HOW PLANTS MAINTAIN THEMSELVES IN THE STRUGGLE FOR EXISTENCE.[1]

ORDINARY English scenery, so full of quiet and so suggestive of repose that one may not readily discover signs of a struggle for existence. In tropical scenery these signs are so clear that they have been recognized again and again by every thinking naturalist who has ever visited tropical regions.

Any comprehensive view of the phenomenon of life upon the globe clearly points to the one conclusion that all Nature is in a perpetual state of desperate warfare, and the keynote of this address must be: the utter remorselessness of Nature, the care for self; the absolute disregard for others. In all cases the weakest goes to the wall.

Evidences of Struggle for Existence in the Plant World.

Ficus parasitica. Seed dropped by bird germinates on fork of some tree, *e.g.* the jack fruit (*Artocarpus integrifolia*); sends long root into soil; gradually spreads itself over, and suffocates the unfortunate foster-mother.

Heracleum giganteum. Allowed to seed itself freely. On June 1, 1889, 573 seedlings had germinated; on August 19, 105 remained, the missing ones having been killed by the more vigorous survivors.

Bertholletia excelsa. Fifteen to twenty-four Brazil nuts are contained in each fruit, the fruit being indehiscent. All seeds germinate at once. The most vigorous gets first through a small hole at the top to the open air, and strangles and feeds upon all the rest.

What Plants struggle for.

Plants struggle for two main objects—viz. their own nutrition, and the reproduction of their species by means of offspring, which they leave behind them, and for which they make adequate provision. The two master functions, nutrition and reproduction, often stand out clearly marked the one from the other—*e.g.* in the Talipot palm (*Corypha umbraculifera*), where the period of leaf-bearing is succeeded by the period of fruiting, the latter being accompanied by the final death of the whole plant.

I.—NUTRITION.

Protective Adaptations associated with the mainly Nutritive Organs.

(1) *Mechanical contrivances.* Large forest trees (often 200 feet high) have buttressed trunks, *e.g.* *Canarium commune.*

[1] Abstract furnished by the Author, Prof. Walter Gardiner, of a lecture delivered at the Newcastle meeting of the British Association.

(2) Large leaves in palms (often 14 feet long), tied in at the leaf-base, *e.g. Didymospermum distichum.*

(3) Young buds of many tropical trees hang vertically downwards, so as to expose the least surface to sun, *e.g. Amherstia nobilis.*

(4) *Prickles and spines developed*, *e.g.* immense leaf of *Victoria regia* is protected from fish, &c., which, in rising from below, might rupture the leaf-tissue.

(5) *Patrols of ants attracted.* Ants provided with home, honey, and food, *e.g. Acacia sphærocephala.* Similarly, *Ipomœa paniculata* attracts ants by racemose glands supplied with definite ducts, two of which are present in each leaf, at junction of blade and stalk.

(6) During the unfolding and growth of the bud, special mechanisms exist. Thus, water-glands occur at the apex of each leaf-tooth (*Saxifraga crustata*), which provide for the escape of the superabundant water sucked up by the root: otherwise the delicate leaf-tissue might be ruptured. In fully developed leaves, on a cold night, drops may be seen escaping from the teeth, *e.g.* balsam (*Impatiens Balsamina*).

Other glands are also found which secrete mucilage or resin, and so protect the young structures from the effects of excessive drought, *e.g.* ferns (*Blechnum Braziliense*) and other plants (*Clusia sp.* and *Coprosma sp.*).

II.—Reproduction.

The importance of this process is sufficiently obvious from the enormous expenditure of material and energy plants lavish upon it. *Hodgsonia heteroclita*, an extraordinary Indian climber, with its complicated structure and great beauty, opens for one night only, and shrivels up and falls off the next day. *Amorphophallus Titanum*, with its huge inflorescence (the largest in the world), although it takes months to develop, opens only on one night, and then only for a few hours.

α.—*Flowers.*

(1) *Contrivances to insure fertilization. Masdevallia muscosa* (an orchid) has a sensitive labellum. An insect alighting on it and touching a certain part, is shot into the flower and held a prisoner for some time.

(2) *Protection by means of sticky hairs. Cuphea silenoides* is protected from the attacks of insects by very numerous hairs secreting a gum resin. Many insects are caught, and as many as 7280 may be counted on one plant.

(3) *Plant protected by ants, but flower fertilized by some other insect. Plumbago rosea* has nectaries on the leaves and flower-bracts which attract ants, but the ants are prevented by sticky hairs on the calyx from obtaining access to the honey in the flower.

β.—*Seeds and Fruits.*

Some plants depend upon the enormous quantity of seeds produced—*e.g.* the wild carrot (*Daucus carota*), which, moreover, sows its seeds by instalments and at different times. Others—*e.g. Voandzeia subterranea*—sacrifice the advantages obtained from a wide dispersal, and depend upon the formation of a few seeds suitably placed in the soil. This plant, in fact, has a mechanism for itself, sowing its own seeds beneath the soil.

For purposes of distribution, *Uncinia brevicaulis* (a sedge) has its fruit provided with small hooks. Small birds, unable to pull out the fruits, are occasionally caught and killed in Jamaica. The fruits of *Stipa pennata*, a grass, bore their way into the ground; and another species, *Stipa spartea*, is even liable to bore its way into the bodies of sheep which are so unfortunate as to come in its neighbourhood (prairies west of Red River Colony).

Contrivances for assisting plants to maintain themselves in the struggle for existence are by no means limited to the higher plants. They exist also in the Fungi and the Algæ, even in the smallest and most microscopic of them. Examples—

I. *Fungi.*—*Clathrus triscapus*, a Queensland fungus, has an orange-red colour, and the spores smell strongly and are embedded in a sweet mucilage. Colour, scent, and sweetness are the usual advertisements used by the higher plants in connection with pollen dispersion.

Erysiphe Alni. The mildew of the alder has wonderfully hooked fruits, which are possibly carried about by tiny *Acari*, &c. Spores are shot out with some force from the mycelial filaments of the fungus, which attacks and kills flies, *Empusa muscæ.* The ergot *Claviceps purpurea*, at the time of spore-formation, secretes a sugary nectar, so that flies are attracted, and eat and disseminate the spores, just as birds do stone fruits. The spores of *Sclerotina Vaccinii* have an almond smell; are gathered by bees with the pollen, and, being placed on the stigma of healthy flowers, infect the ovary and prevent the formation of seed. In the race between the pollen-grain tube (the rightful owner) and the fungus-spore mycelial-tube, the fungus always wins, and soon spreads itself throughout the tissue of the entire ovary, producing more spores for the bees to gather in mistake again.

II. *Algæ.*—The resting-spores of *Desmids*—microscopically small green Algæ—are frequently covered by a spiny siliceous coat. These probably prevent them from being eaten by *Amœbæ*, *Rhizopods*, &c. The protoplasm of certain cells of *Œdogonium ciliatum* (a fresh-water filamentous Alga) are in the habit of escaping from the cell-wall and beginning life anew. This production of the so-called *swarm-spore* is probably not wholly unconnected with the existence of unfavourable conditions, *e.g. Bacteria* on the cell-wall, deposits of lime on the cell-wall, &c.

Mesocarpus sp., another filamentous Alga, carefully protects its chlorophyll plate from too bright light by turning it so that it shall receive the proper amount only. Should external conditions be exceptionally unfavourable, the protoplasm of the various cells powerfully contracts, and the filament resolves itself into its various constituent units, which sink to the bottom of the river or pond, and there divide up and start afresh.

Special Points worthy of notice.

(1) *Various adaptations by members of the same order*, *e.g.* the *Cucurbitaceæ* (Cucumber family), in the matter of seed distribution.

In *Schizocarpum filiforme* the seeds escape through a number of slits in the wall of the fruit.

In *Ecbalium elatine* the seeds are violently and explosively shot out in consequence of the sudden rupture of the fruit stalk.

Sechium edule is indehiscent and contains only one seed.

Zanonia macrocarpa dehisces at the apex by means of valves, and lets out winged seeds of extraordinary beauty, which, aided by the wind, can cover very appreciable distances.

(2) *Various adaptations by members of the same genus*, *e.g.* the *Clerodendrons.*

Clerodendron Koemferi attracts ants by small glands on the leaf and calyx.

Clerodendron fistulosum does the same, but also provides a home for the ants in its hollow stem.

Clerodendron cephalanthum climbs by means of peculiarly modified leaf stalks; has a multiplicity of buds on the axil of each leaf (instead of the usual *one*) and also possesses glands upon its leaves.

Such families as this may well be regarded as accomplished, but at the same time their various contrivances are simply so many marks of a cruel and fierce fight.

(3) *Protective contrivances associated with new annual growth and germination.*

Dioscorea, sp. nov., at each new period of growth produces at first inconspicuous shoots with small leaves which are peculiarly modified into climbing organs. When well established and in the possession of a proper support large green leaves appear.

Hodgsonia heteroclita.—Here again the shoot on its first appearance is dark purple and inconspicuous, with the leaves present merely as scales. It can then scarcely be seen in the tropical forest. Moreover it is a lateral shoot and not the main terminal shoot which it first protrudes above ground. A second lateral and the main terminal are held in reserve against possible accident. When it has reached a certain height, it produces the normal large leaves.

(4) *The accumulation of protective contrivances in the same individual.*

Blumenbachia Hieronymi.—The flower is at first upright and is fertilized in that position. As the fruit develops, the flower-stalk elongates and the fruit is gradually and gently placed upon the ground. Until quite ripe, it is protected by stinging hairs. Later on, these wither, and the fruit is distributed by means of a second series of grapple hairs, which cling firmly to any passing animal.

Strophanthus hispidus.—Fruit, when ripe, opens, and lets out a number of magnificent plumed seeds, which are carried by the wind. The hairs forming the plume are sensitive to moisture and dryness, and are each capable of moving through an arc of 180°. The hairs spread out in dry weather, so that the seeds may be carried by the wind. They close up tightly when the rains come, so that they may not interfere with the placing of the seed close to the ground and its consequent germination. Sooner or later they break from the seed.

(5) *Particular adaptations contrived for particular classes of insects, &c.*

Ants are caught and killed at Kew by flowers of *Eria stricta* (an orchid). The ants are too large for the flower, but they visit it for the sake of the honey and get caught in the mucilage. Thus both flower and ant suffer.

(6) *The mutual adaptation of plants and animals.*

In some instances animals and plants appear to strive with each other, and, as the one develops a particular protective contrivance, the other likewise adopts some plan to counteract it and annul its efficiency: thus the canari nut (the fruit of *Canarium commune*) develops a hard shell which protects it from most enemies, but the black cockatoo (*Microglossus aterrimus*) reciprocates by developing a wonderfully strong beak, which appears indeed to be developed with a special view to the canari nut. Insects also often imitate parts of plants for their own benefit, *e.g.* leaf insects.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Senate has formally thanked Prof. Sedgwick for his munificent gift towards the new buildings for physiology, and the Museums and Lecture Rooms Syndicate has been authorized to contract for the buildings to be immediately begun.

The following stipends have been augmented: Dr. Gaskell, F.R.S., University Lecturer in Physiology, from £50 to £150; Mr. Gardiner, University Lecturer in Botany, from £50 to £100.

The Special Board for Biology and Geology, recommend the appointment of an additional University lecturer on botany, at a stipend of £100 per annum, after considering a strong appeal for increased teaching power, from the professor and lecturers in the subject. No teacher had practically been added since the departure of Prof. Vines for Oxford, and the regretted death of Mr. Vaizey.

Mr. W. Bateson, the Balfour Student, will give a course of lectures during Lent term, on the study of variation—a distinct and attractive novelty in the biological courses.

SCIENTIFIC SERIALS.

American Journal of Science, November.—This number opens with an interesting address by Mr. R. S. Woodward at the last meeting of the American Association, on the mathematical theories of the earth, in which emphasis is laid on the incompleteness of those hitherto advanced.—From a simple investigation, Mr. R. Hooke concludes that for planetary bodies assumed to have the same surface density (*i.e.* those in which solidification has taken place), the increase of the difference between the mean and surface density is proportional to the increase of the diameter. He tests this by computation of the mean densities of the inner planets from their assigned diameters, and further confirmation is derived from the case of Jupiter's satellites. He also applies the law to computing the ultimate diameters and mean densities (*i.e.* after solidification) of the sun and outer planets.—Regarding Tschermak's theory of the mica group as inadequate, Mr. F. W. Clarke offers the view that all the micas, vermiculites, chlorites, margarite, and the clintonite group, may be simply represented as isomorphous mixtures, every constituent being a substitution derivative of normal aluminium poly- or ortho-silicate.—Mr. E. O. Hovey studies the low trap ridges (some six lines of them) of the East Haven-Branford region in Connecticut; he considers all the trap intrusive, and the western dikes, at least, of later origin than the tilting of the sandstone.—Mr. C. Lea contends that subchloride, and not oxychloride, is the product of the action of light on silver chloride.—There are also papers on an improved standard Clark cell with low temperature coefficient, by Mr. H. S. Carhart; on pseudomorphs of native copper after azurite, from Grant County, New Mexico, by Mr. W. S. Yeates; and on the relation of volume, pressure, and temperature, in case of liquids, by Mr. C. Barus.

THE *American Meteorological Journal* for October contains:—A reprint of Prof. C. Abbe's paper on the determination of the amount of rainfall, read before the recent meeting of the British Association; the object of the paper is to determine the possible errors arising from the different shapes of the rain-gauges, and their height above the sea-level and the ground, &c.—Tornado statistics, by Lieut. Finley: (*a*) for the State of Louisiana, for the thirty-seven years 1852-88,—the total number of storms was only thirty, the month of greatest frequency being April; (*b*) for Texas, for the thirty years 1850-88,—the total number of storms was ninety-six, the month of greatest frequency being June.—Distribution of wind velocities in the United States, by Dr. F. Waldo. In the Eastern States there is a principal maximum and minimum in March and August respectively, with a secondary maximum in autumn, and a winter maximum. The same regularity which exists in the Eastern States does not occur in the other districts, but the region of the Lower Lakes has a little more wind in winter and a little less in summer than the region of the Upper Lakes. He also investigates the secular variation at selected stations, and finds that a period of about nine years is not improbable.—An analysis of a paper, by Dr. H. B. Baker, Secretary of the Michigan Board of Health, on the connection of intermittent fever with atmospheric temperature. For some years that Board has made a special feature of the collection of vital statistics, and publishes valuable reports on sanitary matters in general.

THE *Botanical Gazette* continues to publish valuable original contributions to botanical science, especially in the department of cryptogamy. The August number contains the first of a series of Prof. Farlow's notes on Fungi, and the September number an illustrated paper on the Uredo-stage of *Gymnosporangium*, by Mr. H. M. Richards.—Mr. H. L. Russell also contributes observations on the temperature of trees, illustrated by a diagram; his general conclusion being that the direct absorption of heat is the main cause of the higher temperature of trees, and that it is largely dependent on the character of the bark.

A LARGE proportion of the *Journal of Botany* for August, September, and October, is occupied by the conclusion of Mr. G. Murray's Catalogue of the marine Algæ of the West Indian region, and the continuation of Messrs. Britten and Boulger's Biographical Index of British and Irish botanists.—Mr. W. West's paper on the fresh-water Algæ of North Yorkshire is a valuable contribution to a department of botany in which there are but few workers; it is illustrated by a good plate, and contains descriptions of several new species.—Mr. W. H. Beeby contributes a useful account of some of the difficult and critical British forms of *Viola*.—There are other papers of interest, especially to students of British botany.

THE number of the *Nuovo Giornale Botanico Italiano* fo October is entirely occupied by papers read at the meetings o the Italian Botanical Society. They are chiefly devoted to records of local floras, and to descriptions of remarkable teratological forms.—Signor U. Martelli contributes a note on the injury inflicted on the peach by *Taphrina deformans*.

Bulletin de la Société Impériale des Naturalistes de Moscou, 1889, No. 1.—On the origin of the shooting-stars, by Th. Bredichin (in French), being an application of the author's theory of the *comes anomales* to the origin of shooting-stars. The paper will be continued by another on the origin of periodical comets.—On the Jurassic and Cretaceous deposits in Russia; Part 1, on the Upper Jurassic and Lower Cretaceous deposits in Russia and Great Britain, by Prof. A. Pavloff (in French, with three plates). The author's conclusions are to the effect that the Upper Jurassic deposits of Russia are so intimately connected with those of England that a common classification could easily be established. Several fossil species are described and figured on plates, three of them being new (*Olcostephanus blaki*, *O. swindonensis*, and *O. stenomphalus*).—Zoological exploration in the Transcaspian region, by N. Zaroudnoi (in French), being notes of travel, full of interesting information about the nature and fauna of the country.—On a natural way of penetration of superficial water into the depths of the earth, by Stanislas Meunier (in French).—On the *Sparganiæ* of Russia, by K. F. Meinshausen (in German). Ten species are described, two of them (*Sp. ratis* and *Sp. septentrionale*) being new.

SOCIETIES AND ACADEMIES.

London.

Entomological Society, November 6.—Prof. J. O. Westwood in the chair.—Mr. J. W. Douglas sent for exhibition specimens of *Anthocoris visci*, Dougl., a new species taken at Hereford, in September last, by Dr. T. A. Chapman; also specimens of *Psylla visei*, Curtis, taken by Dr. Chapman at the same time and place.—Mr. R. McLachlan, F.R.S., exhibited coloured drawings of a specimen of *Zygæna filipendulæ*, in which the left posterior leg is replaced by a fully-developed wing, similar to an ordinary hind wing, but less densely clothed with scales. Mr. McLachlan also exhibited a female specimen of the common earwig, *Forficula auricularia*, with a parasitic Gordius emerging from between the metathorax and abdomen. He said that it had been placed in his hands by Mr. A. B. Farn, by whom it was taken, and that other instances of similar parasitism by Gordius on earwigs had been recorded.—Mr. W. F. Kirby exhibited a gynandromorphous specimen of *Lycæna icarus*, having the characters of a male in the right wings and of a female in the left wings, caught at Keyingham, Yorkshire, in June last; also a specimen of a variety of *Crabro interruptus*, De Geer, found at Uxbridge.—Mr. W. L. Distant exhibited a male and female specimen of a species belonging to a new genus of *Discocephalinæ*, from Guatemala, in which the sexes were totally dissimilar, the female having abbreviated membranes, and being altogether larger than the male.—Dr. D. Sharp stated that he had observed that in the *Ipsinæ* division of *Nitidulidæ* there was present a stridulating organ in a position in which he had not noticed it in any other Coleoptera—viz. on the summit of the back of the head. He had found it to exist not only in the species of *Ips* and *Cryptarcha*, but also in other genera of the subfamily. He exhibited specimens of *Ips* and *Cryptarcha*, mounted to show the organ. Dr. Sharp also exhibited a number of *Rhynchota*, chiefly *Pentatomidæ*, in which the specimens were prepared so as to display the peculiarities of the terminal segment in the male sex.—Mr. R. Adkin exhibited for Mr. H. Murray, a fine series of *Polia xanthomista*, var. *nigrocincta*, from the Isle of Man, and *Cidaria reticulata* and *Emmelesia tæniata* from the Lake District.—Mr. W. White exhibited a living larva of *Zeuzera æsculi*, and called attention to the thoracic segments with several rows of minute serrations, which evidently assist progression. He stated that the larva exudes from its mouth, when irritated, a colourless fluid, which he had tested with litmus-paper and found to be strongly alkaline.—Captain H. J. Elwes exhibited a number of insects of various orders, part of the collection formed by the late Otto Möller, of Darjeeling.—Mons. A. Wailly exhibited the cocoon of an unknown species of *Antheræa* from Assam; also a number of cocoons and imagos of *Anophe venata* from Acugua, near the Gold Coast; specimens of *Lasiocampa otus*, a South European species, which was said to have been utilized by the Romans in the manufacture of silk; also a quantity of eggs of *Epeira madagascariensis*, a silk-producing spider from Madagascar, locally known by the name of "Halabe." He also read extracts from letters received from the Rev. P. Camboué, of Tananarivo, Madagascar, on the subject of this silk-producing spider.—Mr. H. Goss read a communication from Dr. S. H. Scudder, of Cambridge, Mass., U.S.A., on the subject of his recent discoveries of some thousands of fossil insects, chiefly Coleoptera, in Florissant, Western Colorado, and Wyoming. Prof. Westwood remarked on the extreme rarity of fossil Lepidoptera, and called attention to a recent paper by Mr. A. G. Butler, in the Proc. Zool. Soc., 1889, in which the au hor described a new genus of fossil moths belonging to the family *Euschemidæ*, from a specimen obtained at Gurnet Bay, Isle of Wight.—Mr. F. P. Pascoe read a paper entitled "Additional Notes on the genus *Hilipus*," and exhibited a number of new species belonging to that genus.—The Rev. Dr. Walker read a paper entitled "Notes on the Entomology of Iceland." Mr. R. Trimen, F.R.S., asked if any butterflies had been found in the island. Dr. Walker said that neither he nor Dr. P. B. Mason had seen any during their recent visit, nor were any species given in Dr. Staudinger's list. Dr. Mason said that during his recent visit to Iceland he had collected nearly one hundred species of insects, including about twenty Coleoptera. He added that several of the species had not been recorded either by Dr. Staudinger or Dr. Walker. Capt. Elwes inquired if Mr. J. J. Walker, with his great experience as a collector in all parts of the world, was aware of any land outside the Arctic Circle from which no butterflies had been recorded. Mr. J. J. Walker replied that the only place in the world which he had visited, in which butterflies were entirely absent was Pitcairn Island.

Royal Microscopical Society, October 9.—Dr. C. T. Hudson, F.R.S., President, in the chair.—The President referred to the deaths of the Rev. M. J. Berkeley and Dr. G. W. Royston-Pigott, the former an honorary, and the latter formerly an ordinary, Fellow of the Society.—Mr. Crisp announced that, owing to certain business arrangements, he was obliged to retire from the secretaryship of the Society and from the conduct of the Journal. It was with the very greatest reluctance that he had found it necessary to resign, but there would, he anticipated, be no difficulty in continuing the Journal on its present lines, while he was sure there were many Fellows both able and willing to undertake the duties of Microscopical Secretary.—Mr. John Meade's communication on stereoscopic photo-micrography was read.—The President brought for inspection three photo-micrographs of one of the new rotifers mentioned in his supplement—*Gomphogaster areolatus*.—Mr. E. M. Nelson exhibited a new elementary centering sub-stage which he thought was likely to be useful. It was fitted in the simplest manner by placing two legs under the main stage, and the movement was given to it with the finger; it was very inexpensive, and was only designed to render the ordinary student's microscope of a higher degree of efficiency by providing it with an easy method of correctly centering the condenser and diaphragm.—The President mentioned that *Pedalion* was to be had in many places in the neighbourhood of London about a month ago, where it had not been previously found.—Mr. Ahrens's description was read of his new patent polarizing binocular microscope for obviating the difficulty of using analyzing prisms with the double tube. The inventor uses for an analyzer a black glass prism, set above the objective with a horizontal side upwards. Two faces are symmetrically inclined to the optical axis at the polarizing angle. The pencil is thus reflected at the proper angle, and at the same time divided into two parts, which are then reflected up the two tubes either by prisms or by plane reflectors.—Prof. Abbe's paper, notes on the effect of illumination by means of wide-angled cones of light, was read.—Mr. T. F. Smith read a paper on the ultimate structure of the *Pleurosigma* valve.

Royal Meteorological Society, November 20.—Dr. W. Marcet, F.R.S., President, in the chair.—The following papers were read:—Second Report of the Thunderstorm Committee. This is a discussion by Mr. Marriott on the distribution of days of thunderstorms over England and Wales during the seventeen years 1871–87. Notices of sheet lightning are included in the term "thunderstorms." The years of greatest frequency were 1880, 1882, 1884, and 1872; and the years of least frequency 1887, 1874, 1879, and 1871. Years of greater or less frequency alternate regularly throughout nearly the whole of the period. The average yearly number of thunderstorms is about thirty-nine. The districts with the greatest yearly frequency are the south of England and extreme northern counties, and those with the least yearly frequency are Cheshire, Lancashire, and Yorkshire. The greatest number of thunderstorms occur in July, and the least in February and December.—On the change of temperature which accompanies thunderstorms in Southern England, by Mr. G. M. Whipple.—Note on the appearance of St. Elmo's fire at Walton-on-the-Naze, September 3, 1889, by Mr. W. H. Dines.—Notes on cirrus formation, by Mr. H. Helm Clayton. The author, who has made a special study of cloud forms and their changes, gives a number of notes and drawings on the formation of cirrus under various conditions, *e.g.* in a previously cloudless sky, cirrus bands with cross fibres, cirrus from cirro-cumulus clouds, cirrus drawn out from cumulus clouds, "mares-tail" cirrus, &c. Curved cirrus clouds when accompanied by decreasing barometric pressure frequently indicate that a storm of increasing energy is approaching.—A comparison between the Jordan and the Campbell-Stokes sunshine recorder, by Mr. F. C. Bayard. As a result of a year's comparison between these two instruments, the author found that the Jordan photographic recorder registered nearly 30 per cent. more sunshine than the Campbell burning recorder.—Sunshine, by Mr. A. B. MacDowall. This is a discussion of the hours of sunshine recorded at the stations of the Royal Meteorological Society.—On climatological observations at Ballyboley, co. Antrim, by Prof. S. A. Hill. This is the result of observations made during the five years 1884–88.

Geological Society, November 6.—W. T. Blanford, F.R.S., President, in the chair.—The following communications were read:—Contributions to our knowledge of the Dinosaurs of the Wealden and the Sauropterygians of the Purbeck and Oxford Clay, by R. Lydekker. The first section of this paper was devoted to the description of the remains of Iguanodonts from the Wadhurst Clay near Hastings collected by Mr. C. Dawson. They were considered to indicate two species, for which the names *Iguanodon hollingtoniensis* and *I. Fittoni* had been proposed in a preliminary notice. In the second section an imperfect metatarsus of a species of *Megalosaurus* from the Hastings Wealden was described, and shown to indicate a species quite distinct from the one to which a metatarsus from the Wealden of Cuckfield belonged. Two cervical vertebræ of a Sauropterygian from the Purbeck of the Isle of Portland were next described, and referred to *Cimoliosaurus portlandicus*, Owen, sp. The concluding section described an imperfect skeleton of a large Pliosaur from the Oxford Clay, in the collection of Mr. A. N. Leeds, which indicated a species intermediate between the typical Kimeridgian forms and the genus *Peloneustes*. These specimens were considered as probably referable to *Pliosaurus ferox*. Evidence was adduced to show that *Pliosaurus Evansi*, Seeley, should be transferred to *Peloneustes*.—Notes on a "dumb fault" or "wash-out" found in the Pleasley and Teversall Collieries, Derbyshire, by J. C. B. Hendy; communicated by the President.—On some Palæozoic Ostracoda from North America, Wales, and Ireland, by Prof. T. Rupert Jones, F.R.S. The specimens were described as nearly as possible in the order of their natural relationship, and thus, besides adding to the known forms, they were shown to illustrate the modifications exhibited by the genera and species of these minute bivalved Crustaceans, both in limited districts and in different regions. Amongst the forms described were the following new species and variety:—*Primitia mundula*, Jones, var. *cambrica*, nov.; *P. humilior*, sp. nov.; *P. Morgani*, sp. nov.; *P. Ulrichi*, sp. nov.; *P. Whitfieldi*, sp. nov.; *Entomis rhomboidea*, sp. nov.; *Strepula sigmoidalis*, sp. nov.; *Beyrichia Hallii*, sp. nov.; *Isochilina lineata*, sp. nov.; *I.? fabacea*, sp. nov.; *Leperditia Claypolei*, sp. nov.; *Xestoleberis Wrightii*, sp. nov.

Zoological Society, November 5.—Prof. W. H. Flower, F.R.S., President, in the chair.—The Secretary read a Report on the additions that had been made to the Society's Menagerie during the months of June, July, August, and September, 1889, and called attention to certain interesting accessions which had been received during that period. Amongst these were specially noted a Short Python (*Python curtus*), from Malacca, presented on July 2 by Mrs. Bertha M. L. Bonsor; and a Prêtre's Amazon (*Chrysotis prætrii*), purchased July 23: both new to the collection.—Mr. J. H. Gurney, Jun., exhibited and made remarks on a hybrid Wagtail, bred in confinement, between the Grey Wagtail (*Motacilla melanope*) and the Pied Wagtail (*M. lugubris*).—Mr. W. B. Tegetmeier exhibited and made remarks on some variations in the plumage of the Partridge (*Perdix cinerea*).—Prof. Bell exhibited and made remarks on two specimens of *Virgularia mirabilis*, recently dredged by the Hon. A. E. Gathorne Hardy, M.P., in Loch Craignish. He also exhibited two young living specimens of *Palinurus vulgaris*, received from Mr. Spencer, of Guernsey, in which the stridulating-organs were still capable of making sounds.—A communication was read from the Rev. Thomas R. R. Stebbing, containing an account of the Amphipodous Crustaceans of the genus *Urothoë*, and of a new allied genus proposed to be called *Urothoides*.—A communication was read from Colonel C. Swinhoe, containing descriptions of a large number of new Indian Lepidoptera, chiefly Heterocera.—Mr. P. L. Sclater gave an account of the birds collected by Mr. Ramage in St. Lucia, West Indies, which were referred to thirty species.—Mr. G. A. Boulenger read a note on the Short Python (*Python curtus*), a specimen of which was stated to be living in the Society's reptile house.—A communication was read from Dr. E. C. Stirling, of the University of Adelaide, on some points in the anatomy of the female organs of generation of the Kangaroo, especially in relation to the acts of impregnation and parturition.—Mr. F. E. Beddard read some notes on the anatomy of an Oligochætous Worm of the genus *Dero*, relating principally to its reproductive system.—A communication was read from Mr. Scott B. Wilson, in which were given the descriptions of four new species of Hawaiian birds, proposed to be called *Chrysometridops cæruleirostris*, *Loxops flammea*, *Himatione montana*, and *H. stejnegeri*.

Mathematical Society, November 14.—Sir J. Cockle, F.R.S., Vice-President, in the chair.—The following gentlemen were elected to form the Council for the ensuing session:—President: J. J. Walker, F.R.S. Vice-Presidents: Sir J. Cockle, F.R.S., E. B. Elliott, and Prof. Greenhill, F.R.S. Treasurer: A. B. Kempe, F.R.S. Honorary Secretaries: M. Jenkins and R. Tucker. Other members: A. B. Basset, F.R.S., Prof. W. Burnside, Prof. Cayley, F.R.S., Dr. Glaisher, F.R.S., J. Hammond, Dr. Larmor, C. Leudesdorf, Major Macmahon, R.A., and S. Roberts, F.R.S.—The following papers were read:—Isoscelian hexagrams, by Mr. R. Tucker.—On Euler's ϕ-function, two notes by Mr. H. F. Baker and Major Macmahon (the former communicated by Mr. Jenkins).—On the extension and flexure of a thin elastic plane plate, by Mr. A. B. Basset, F.R.S.

PARIS.

Academy of Sciences, November 18.—M. Hermite in the chair.—On animal heat and the heats of formation and of combustion of urea, by MM. Berthelot and P. Petit. In connection with the production of animal heat the study of urea is of special interest, for next to carbon dioxide it is the chief form under which carbon is eliminated from the system, while almost all the nitrogen is eliminated as urea. Hence it is important to know how the production of urea in the organs is related to the heat of formation of urea, and of the substances from which it is derived. In the present paper the authors deal with the first problem, for the heat of combustion of urea in free oxygen has not yet been measured. Three concordant combustions in the calorimetric bomb yielded 151·8 C. per gram-molecule, and the molecular heat of solution of urea at about 11° C. is found to be − 3·58 C., whence the heat of formation of urea is 80·8 C., and of its solution in water or urine is found to be + 77·2 C.—On the orbit of Winnecke's periodical comet, by M. H. Faye. These remarks are made in connection with a memoir presented to the Academy by Baron von Haerdtl, on the movements of Winnecke's periodical comet. He arrives at the conclusion that there is no trace of acceleration in the mean movement. He finds that the mass of Jupiter must be raised to 1 : 1047·152, and determines that of Mercury in round numbers at 1 : 5,010,000 ± 700,000. This agrees pretty closely with the value 1 : 5,310,000 already obtained by Le Verrier.—Experimental study of the transits and occultations of Jupiter's satellites, by M. Ch. André. These observations have been made by means of an apparatus specially constructed by MM. Brunner, and here fully described. Particular attention was paid to the phenomenon of the luminous ligament which is formed near the point of contact. It begins to appear when the satellite is about 2½ minutes from real contact, gradually increasing in size and intensity as the two bodies draw near, so that at the instant of geometrical contact they appear to be connected by a veritable luminous bridge about one-third the breadth of the diameter of the satellite. The moment of geometrical contact is accompanied by optical appearances sufficiently distinct to serve as a base for the direct observation of the phenomenon.—Researches on the application of the measurement of rotatory power to the study of compounds resulting from the action of malic acid on sodium molybdate, by M. D. Gernez. In a previous communication (*Comptes rendus*, cix. p. 151) the author showed that solutions of malic acid, with molybdate of ammonia added, show sundry changes in rotatory power, which may easily be explained by assuming that definite compounds are formed between the substances. His present researches, made with the same acid and neutral sodium molybdate, lead to still more varied results, clearly showing the production of compounds between simple numbers of molecules of these bodies. The results, which are here tabulated and described, demonstrate that definite compounds are formed in solution on increasing the amount of one of the compounds regularly. They also show the defect of analytical methods claiming to deduce the composition of an active liquid from the measurement of its rotation, at least so far as regards substances analogous to those here under consideration.—On the ophthalmoscopic examination of the base of the eye in hypnotic subjects, by MM. Luys and Bacchi. Nine subjects (six women and three men) were examined, first in the normal state and then in various phases of catalepsy, lucid somnambulism, and hallucination. In some instances the iris was found to be excessively dilated and almost insensible to light. Other appearances are described, but no general inferences are drawn from these preliminary observations.—The second part of vol. i. of MM. Houzeau and Lancaster's "Bibliothèque générale de l'Astronomie," was presented by M. Faye, who remarked that this great compilation would not be interrupted by the death of M. Houzeau. The present volume comprises biographies, didactic and general works, spherical and theoretical astronomy, astronomical tables for all epochs, and treatises on calendars.

Berlin.

Physical Society, October 25.—The President, Prof. Kundt, opened the meeting by a warm expression of regret at the loss sustained by the Society in the death of its late member, Dr. Robert von Helmholtz.—Prof. von Bezold spoke on the various causes which lead to the production of clouds and aqueous precipitates. Using the graphic methods which he had himself introduced into meteorology, he showed by means of diagrams that the older ideas on this subject are insufficient, and that, even in the case where both masses of air are saturated with aqueous vapour, the precipitation which may occur when they are mixed is not due to the mere mixing of warm and cold air: the temperature of the mixture is not the mean of that of the respective masses of air, but is somewhat higher, and the amount of water which is condensed on their mixing is very small. By means of his diagrams a simple solution is at once obtained of many problems which have reference to the temperature and humidity of masses of air when they are mixed together in unequal quantities. It appeared that under the most favourable conditions, when air saturated with aqueous vapour at 0° C. is mixed with air saturated at 20° C., under a pressure of 700 millimetres of mercury, only 0·6 grams of water is condensed out of 2 kilograms of the mixed portions of air. The same mass of water would be condensed out of the same mass of air saturated at 20° C. if its temperature were reduced to 19°·3 C., or if the air were to ascend through a height of 200 metres, in which case its temperature would fall to 18°·9 C. Much more massive aqueous precipitates are formed when moist air is either cooled directly, or has its pressure reduced by rising upwards, in which case a simultaneous cooling occurs. When air saturated at 20° C. is cooled down to 10°·7 C.,—a temperature which results from mixing air at 24° C. with air at 0° C.,—4·4 grams of water are precipitated out of each kilogram of air, and if the temperature is reduced to 0° C., 8 grams are precipitated. Similar falls of temperature may be obtained during an adiabatic rise in altitude. The conditions which hold good for super-saturated air may similarly be comprehended by this graphic method. Notwithstanding that the formation of aqueous precipitates by the mere mixing of two masses of air is thus shown to be very minimal in amount, still it does occur in nature as the result of this cause, as, for instance, in the case of cloud-caps formed when different winds meet, and in the case of the formation of ground-fogs. According to the speaker, clouds ought to be distinguished by reference to the way in which the precipitate of which they consist is formed, rather than by the casual appearance which they present to the eye; in any case, mist and clouds must in the future be studied from the above new point of view.—Prof. von Helmholtz added to the above communication some remarks on the way in which the mixing of two fluids of different specific gravities is brought about. Such mixing is only possible as the result of vortex movements or of "breaking" waves. He had already dealt with the production of vortices, and the production of waves has recently engaged his attention, inasmuch as this problem has, up to the present, only been regarded from a one-sided point of view with reference to water, without taking into account the influence of the air which is moving over its surface. When wind blows over the surface of water, or when lighter air streams over a mass of heavier air, waves are formed, whose size and rate of propagation depend upon the relationship of the two fluids which are moving one over the other. To obtain the mechanical equations of these movements was the problem which he had set before himself for solution in a communication which he had recently made to the Berlin Academy. This dealt first with waves on water, and then the conditions involved in these were transferred to the consideration of waves in air. Waves 1 metre long on the surface of water, which are frequently met with in nature, correspond to waves in air 21 metres long—that is to say, to air-waves which extend over a considerable stretch of land. Waves in air are only visible in the cases where they are accompanied by condensations of vapour, the latter occurring in the case where the air rises several hundred metres to the crest of a wave. Prof. Helmholtz pointed out that the most important outcome of the whole theoretical consideration of the problem was the following: a quiescent surface of water over which a wind is blowing is in a state of unstable equilibrium; as the result of this, waves are produced as soon as the wind acquires a sufficient velocity, and the energy required to raise the water from the trough to the crest of each wave, as well as to produce the onward motion of the wave, is derived from the more rapidly-moving lower layers of air of which the wind consists. Friction plays a very subordinate part in the whole process.

November 8.—Prof. du Bois Reymond, President, in the chair.—Dr. Pernet demonstrated the latest and newest form of Edison's phonograph, and gave a minute description of the apparatus, illustrating his remarks by means of two instruments which were exhibited to the Society. He prefaced his description by a short historical introduction, from which it appeared that several years before Edison's discovery, a Frenchman named Gros had deposited with the Paris Academy a sealed packet containing a statement of the essentials for the construction of a phonograph.

Physiological Society, November 1.—Prof. du Bois Reymond, President, in the chair.—Dr. René du Bois Reymond spoke on the striated muscles which occur in the small intestine of the tench. The exceptional occurrence of striated muscles in the small intestine of this fish has long been known, as also that when the intestine is stimulated electrically it contracts suddenly, as does a skeletal muscle. The whole intestine is surrounded by these striated fibres arranged both longitudinally and circularly. Further examination revealed a very thin layer of both longitudinal and circular non-striated muscle-fibres, lying internally to the striated fibres. The only other known case of a similar occurrence of striated muscle-fibres in the walls of the small intestine is found in Cobitis; but in this fish the fibres do not extend as far as the rectum, as they do in the tench. The speaker set aside the idea that these striated muscle-fibres are connected with the respiratory function of the intestine, by showing that other fish are also in the habit of swallowing air, and that in such fish the mucous membrane of the small intestine is extremely rich in blood-vessels, whereas this is not the case in the tench. He put forward the suggestion that the striated fibres in the intestine of the tench are a transitional form between unstriated and striated muscle-fibres, and based his views upon the observation that, firstly, the reaction of these muscles is alkaline, and, secondly, upon an analysis of an aqueous extract of them. An aqueous extract of striated muscles contains, as is well known, three different proteids; one which coagulates at 47° C., one which comes down at 56° C., and a third coagulating at 70° C. The proteid which coagulates at 47° C. does not occur in unstriated muscles, and was similarly found to be absent in the extract of the striated muscles of the intestine of the tench. The function of these last-named muscles has not as yet been made out.—Prof. Fritsch spoke on the sensory organs in the skin of fishes. Starting from the simplest forms in which they occur as end-bulbs or tiny dilatations in the nerves which supply the several somites in the embryos of fishes, the speaker described their gradual change of form during growth. The end-organ is always characterized by sensory cells—that is to say, by cells which have a pear-like shape and are provided with a sensory filament or hair, and are connected with nerve-fibres. The developmental change which takes place is as follows: at first the organ becomes protected by being set deeper into the skin, spaces are then developed superficially to the organ, and these are finally placed in communication with the surface of the skin by means of a minute orifice or somewhat lengthy canal. The lateral-line organs of fishes in several modified forms is developed as above described; the sense-organ, with its sensory cells and nerves, lying at its base. A further modification leads to the development of the closed vesicles of Savi, which are completely filled with a mucous secretion. In the further modification of structure met with in the ampullæ of Lorenzini, a change of functional activity is already marked, as shown by the fact that the sensory cells have lost their hairs and have been converted into secretory cells. The speaker expressed his concurrence with that view of the function of dermal sense-organs, according to which they are to be regarded as auditory organs in a low stage of evolution, set aside for the perception of vibrations and waves which are propagated through the water.

Meteorological Society, November 5.—Dr. Vettin, President, in the chair.—The President spoke on the interchange of air which takes place between regions of high and regions of low pressure. He first described his own measurements of the altitudes of the various most characteristic forms of clouds, finding them in complete accord with those of Abercromby and Ekholm. He then passed on to his determinations of the velocity of the wind at those several altitudes, using as a means of measurement the records afforded by the direction and rate of motion of the clouds. The mean values thus obtained for the rate of flow of the air-currents were compared in each case with the positions of maximal and minimal air-pressure; from this comparison the speaker found that the motion of the air between points of maximum and minimum pressure does not take place in the way in which it has usually been supposed to occur. He then gave a detailed account of the results of his observations, but these do not admit of being reproduced within the limits of a brief abstract.

SYDNEY.

Royal Society of New South Wales, August 21.—A "reception" of the members of the Society was held for conversational scientific discussion, and the exhibition of various objects of interest: upwards of 100 members were present.

September 4.—Prof. Liversidge, F.R.S., President, in the chair.—Mr. H. G. McKinney read a paper on irrigation in its relation to the pastoral industry in New South Wales, which was freely discussed.—Sir Alfred Roberts, Vice-President, exhibited a large collection of photo-micrographs taken by the late Captain Francis.

October 2.—Prof. Liversidge, F.R.S., President, in the chair.—The following papers were read:—The analysis of prickly pear; on the occurrence of arabin in the prickly pear (*Opuntia brasiliensis*), by W. M. Hamlet.—Personal recollections of the aboriginal tribes once inhabiting the Adelaide Plains of South Australia, by Edward Stephens.—The Chairman exhibited some interesting fungoid growths which had formed in water containing finely-divided gold in suspension. The gold had been precipitated from a weak solution of the chloride by phosphorus dissolved in ether; the mycelium of the fungoid growths had acquired a purple colour from the gold which it had absorbed; on incineration, a skeleton outline of the mycelium is left in gold.

AMSTERDAM.

Royal Academy of Sciences, October 26.—M. Mulder presented, for the Reports and Communications, an essay on tartarate of ethyl, and its relations to ethylate of sodium and potassium.—M. Grinwis spoke on two forms of energy occurring in rolling motion, and presented an essay on this subject for the Reports and Communications.—M. Rauwenhoff presented for the Transactions an essay in quarto, with plates, on the sexual generation of the Gleicheniaceæ, and communicated briefly the results to which his researches had led him.—M. van der Waals spoke of the equilibrium of solid compounds in presence of fluid and vapour mixtures, illustrated by the ψ surface of a mixture of two kinds of matter.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, NOVEMBER 28.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Electrical Engineering in America: G. L. Addenbrooke.

FRIDAY, NOVEMBER 29.

INSTITUTION OF CIVIL ENGINEERS, at 7.30.—Principles of Iron Foundry Practice: G. H. Sheffield.

SATURDAY, NOVEMBER 30.

ROYAL SOCIETY, at 4.—Anniversary.

ESSEX FIELD CLUB, at 7.—How to commence the Study of Botany: George Massee.

SUNDAY, DECEMBER 1.

SUNDAY LECTURE SOCIETY, at 4.—Invisible Stars: the Use of the Camera in the Observatory (with Oxyhydrogen Lantern Illustrations): Sir Robert S. Ball, F.R.S., Astronomer Royal, Ireland.

MONDAY, DECEMBER 2.

SOCIETY OF ARTS, at 8.—Modern Developments of Bread-making: William Jago.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Some Notes on Variations in the Products of the Destructive Distillation of Different Gas Coals, Heated Separately in the same Retort, and under Similar Conditions: Watson Smith.—Cresontinic Acid and its Applications: I. Hauff.

VICTORIA INSTITUTE, at 8.—Instinct and Reason: Dr. C. Collingwood.

ARISTOTELIAN SOCIETY, at 8.—The Æsthetic Theory of Ugliness: B. Bosanquet.

ROYAL INSTITUTION, at 5.—General Monthly Meeting.

TUESDAY, DECEMBER 3.

ZOOLOGICAL SOCIETY, at 8.30.—On the Anatomy of Burmeister's Cariama (Chunga burmeisteri).—On the Relations of the Fat-bodies of the Sauropsida: G. W. Butler.—List of the Reptiles, Batrachians, and Fresh-water Fishes, collected by Prof. Moesch in the District of Deli, Sumatra: G. A. Boulenger.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Ballot for the Election of Members.—Water-Tube Steam-Boilers for Marine Engines: John I. Thornycroft. (Discussion.)—The Triple-Expansion Engines at the Owens College, Manchester: Prof. Osborne Reynolds, F.R.S.

WEDNESDAY, DECEMBER 4.

SOCIETY OF ARTS, at 8.—Rabies and its Prevention: Dr. Armand Ruffer.

GEOLOGICAL SOCIETY, at 8.—On Remains of Small Sauropodous Dinosaurs from the Wealden: R. Lydekker.—On a Peculiar Horn-like Dinosaurian Bone from the Wealden: R. Lydekker.—The Igneous Constituents of the Triassic Breccias and Conglomerates of South Devon: R. N. Worth.—Notes on the Glaciation of Parts of the Valleys of the Jhelum and Sind Rivers in the Himalaya Mountains of Kashmir: Captain A. W. Stiffe.

ENTOMOLOGICAL SOCIETY, at 7.—Systematic Temperature Experiments on some Lepidoptera in all their stages: Frederic Merrifield.—Notes on Indian Longicornia, with Descriptions of New Species: Charles J. Gahan.—On the Peculiarities of the Terminal Segment in some Male Hemiptera: Dr. D. Sharp.—Notes on a Species of Lycænidæ: Lionel de Nicéville.

THURSDAY, DECEMBER 5.

LINNEAN SOCIETY, at 8.—Life History of a Stipitate Fresh-water Alga: G. Massee.—On the Anatomy of the Sand Grouse: G. Sim.

FRIDAY, DECEMBER 6.

GEOLOGISTS' ASSOCIATION, at 8.—*Conversazione.*

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Proposed Method of Recording Variations in the Direction of the Vertical: H.C. Russell.—The Storm of September 21, 1888: H. C. Russell.—O Therii Forem Bilinearnÿch: E. Weyr (V. Praze).—Journal of Physiology, vol. x., No. 6 (Cambridge).—Proceedings of the Linnean Society of New South Wales, vol. i., Part 1 (Sydney).—Quarterly Journal of the Geological Society, November 1889 (Longmans).—Papers and Proceedings of the Royal Society of Tasmania, 1888 (Hobart).—Proceedings of the Physical Society of London, vol. x., Part 2 (Taylor and Francis).—Transactions of the Seismological Society of Japan, vol. xiii., Part 1 (Yokohama).

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