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*"To the solid ground
Of Nature trusts the mind which builds for aye."*—WORDSWORTH

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A SCIENTIFIC CENSUS

CAN we reduce to the certainty of numbers the amount of interest taken in England in the advance of science? How many are there devoted to its pursuit? How many sufficiently concerned in its progress, as to be willing to make some sacrifices for its promotion? Interested in the results of science, ready to grasp its countless benefits, eager to catch its earliest gifts, we all are; but how many love science for its own sake, and are actively engaged in cultivating and promoting it? Are there not very many in this sordid age ready to exclaim with D'Ailly—

> Dieu me guarde d'être savant,
> D'une science si profonde .
> Les plus doctes, le plus souvent,
> Sont les plus sottes gens du monde !

The Census of 1861 gave the number of persons engaged in the learned professions, or in literature, art, and science; and classed as "scientific persons," officers of literary and scientific societies, curators of museums, analytical chemists, and a certain number who styled themselves naturalists, botanists, geologists, mineralogists, chronologists, and civil engineers. These, however, with a number of professors and teachers, pursue science as a vocation. We prefer drawing our materials from the membership of our learned societies. Many of their members are, it is true, professors and teachers, yet they appear in a more congenial character as members of our academies, or fellows of our learned societies; and though it can scarcely be said that their members are in all cases absolutely men of science, or that all the men of science in the country are to be found in their lists, in them we have, at least, a goodly band of men associated together for the advance of science. Judging from the facilities such societies afford for the association of persons of kindred mind and taste, the common use of technical libraries and instruments, and the publication of their transactions, we are safe in assuming that they attract, at least, the greater number of men anxious to labour for the promotion of science.

First and foremost among our learned societies is the Royal. The Institute of France and other foreign academies are, in a manner, the creatures of the State; and their members are mostly all salaried. The Royal Society was, from the first, a voluntary society, and never derived any support from the State, though it administers from year to year a certain amount given by the State for the promotion of science. In 1831 the Royal Society had 791 members, but by a change introduced in 1847 the membership has undergone considerable diminution; and in 1868 the number was reduced to 600, the number admitted every year being considerably less than the number dying or retiring. It is the vocation of the Royal Society to admit within its circle the most distinguished men in all the branches of science, and we might even hope that, like the Institute of France, its membership may be divided into five Academies, such as the "Académie Française" for literature, the "Académie des Inscriptions et Belles-lettres" for history, the "Académie des Sciences" for sciences and mathematics, the "Académie des Beaux Arts" for the fine arts, and the "Académie des Sciences Morales et Politiques" for mental philosophy and jurisprudence. It is not a question of altering the essential character of the Royal Society, as an integral one: it would be only a natural development of its organisation if its members were allowed to constitute themselves into sections for physics, mathematics, philosophy, history, and philology.

Physical and Mathematical Science, however, engages the labour of six other learned societies. There are the Astronomical Society with 528 members, the Chemical with 518, the Meteorological with 306, and the Geological with 1,204 members. We have also a Statistical Society with 371 members, and a Mathematical with 111. Collectively, these form seven societies, with 3,638 members, giving, in relation to the population of the United Kingdom, 1·21 in every 10,000 either a physicist or a mathematician in the highest sense. The next group of societies comprises those engaged in the advancement of the science of life, whether vegetable or animal. Biology is a favourite study, and many are intensely devoted in exploring the many problems which are taxing the mind of the philosopher and moralist. Connected with Vegetable Physiology are the Linnean Society with 482 members, the Botanic with 2,420, the Horticultural with 3,595, and the Agricultural with 5,500 members. And connected with Animal Physiology are the Zoological with 2,920 members, the Entomological with 208, the Ethnological with 219, and the Anthropological with 1,031 members; in all eight societies, having in the aggregate 16,300 members. It must be remembered, however, that the largest of these societies have their Gardens and Exhibitions, which attract numerous members, and it would demand an excess of charity to regard all the members in this group as strictly men of science. Archæology has numerous votaries. There is the Society of Antiquaries, the oldest of our scientific societies, founded nearly 300 years ago, in 1572, having now 651 members, but the number of fellows was in 1862 restricted to 600. We have also a British Archæological Institute with 697 members, and an Archæological Association with 484 members, besides a very large number of other archæological societies. Then comes the Geographical with its 2,150 members, the most popular of societies, owing much to its illustrious president, Sir Roderick Murchison, and still more to the great contributions to geographical science by Livingstone, Speke, Grant, and Baker. And next we find the large group of societies for the Promotion of Applied Science. There is the Society for the Encouragement of Art, Manufacture, and Commerce, so elastic, so active, and so enterprising, having 3,200 members; the Institute of Civil Engineers with 1,700 members, and the Institute of British Architects with 498 members, each of them comprising men engaged in active life, yet deeply interested in the advancement of science. Of a more miscellaneous character are the Microscopical Society with 360 members, the Philological with 200, the Numismatic with 160, the Asiatic with 320 members, and the United Service Institution with 3,800 members. And, besides these, there are the Royal and London Institutions, the British Association, and Social Science Association, each having its thousands of members, to say nothing of the medical societies, and the numerous scientific societies and philosophical institutions in all the leading towns.

Were all who in London and the provinces are associated for the promotion of science carefully calculated, we should find that there are now about 120 learned societies, with an aggregate of 60,000 members; and deducting from the number at least one-fourth for members who belong to more than one society, we arrive at the interesting fact that there are, in the United Kingdom, 45,000 men representing the scientific world, or in the proportion of fifteen in every ten thousand of the entire population; the "upper ten thousand" of the aristocracy of learning being thus three times as many as the "upper ten thousand" of the aristocracy of wealth. But are we satisfied with the result? Are all the societies equally active in encouraging the pursuit of science? Are their terms of admission too loose or too narrow? Without entering into the internal management of our learned societies, we might wish for a fuller and earlier publication of their transactions, for the collection of more complete technical libraries, properly catalogued and classified, and for a better action in the way of granting tokens of recognition to successful discoverers and investigators of the great arcana of Nature.

Within the last twenty years, at least half as many new societies have been formed for the promotion of science, and evidences are not wanting to show that an enormous stimulus has been given to science in every direction. In the number of scientific works published, and in the circulation which they have had; in the variety of scientific journals started and successfully maintained; in the respect paid to Science—ay, in the very popularity which greets Science, wherever it exhibits itself, we see abundant reason for congratulation. A brilliant future opens itself for the cultivation of science. Happy will it be when "many shall run to and fro, and knowledge shall be increased;" happy when men will realise that "pleasure is a shadow, wealth is vanity, and power a pageant; but knowledge is ecstatic in enjoyment, perennial in fame, unlimited in space, and infinite in duration." Truly, in the performance of this sacred office the man of science "fears no danger, spares no expense, looks in the volcano, dives into the ocean, perforates the earth, wings his flight into the skies, enriches the globe, explores sea and land, contemplates the distant, examines the minute, comprehends the great, ascends to the sublime, no place too remote for his grasp, no heaven too exalted for his reach."

LEONE LEVI

THE DEPTHS OF THE SEA

THE opening meeting of the Royal Society on Thursday last was attended by a numerous assemblage of men of science, especially attracted by the announcement that Dr. Carpenter, representing a committee consisting of Professor Wyville Thomson, Mr. Gwyn Jeffreys, and himself, would communicate the results of the deep-sea dredging explorations, carried out in the course of the past summer and autumn in the *Porcupine*, a vessel expressly fitted out and placed by the Government at the disposal of the committee for this purpose.

At the conclusion of Dr. Carpenter's lucid exposition, which was necessarily but a mere *résumé* of the report itself, it appeared quite evident that rumour had not at all exaggerated the scientific value of these explorations, for it is not too much to say that the results of this expedition must be classed with the most important which of late years have been brought before the notice of the scientific world.

More than a quarter of a century ago, the late Edward Forbes, one of the first naturalists who took the common oyster dredge from the hands of the fisherman to convert it into an instrument for extended scientific research, after employing it in the commencement along the shores of his native little Isle, and subsequently in the seas surrounding the British Islands, and in other parts of Europe, found, upon comparing his observations, that there appeared to be evidence in favour of the existence of a succession of natural zones of marine life according to depth, which zones, however, seemed to become more and more sterile in organisms in descending order; until at last it suggested itself that a zone might be arrived at, at a depth roughly estimated as exceeding 300 fathoms from the surface, containing but sparse traces of organic life, or even such an one as might be entitled to the appellation of Azoic.

This latter hypothesis was brought forward by him as a suggestion worthy of consideration, and not as a dogma or established principle, as he was fully aware that in the dredging explorations which he had been able to carry out up to that time, he had never reached so great a depth as even 300 fathoms, below which the sea-bottom was inferred to be comparatively or altogether sterile; on the contrary, whilst advancing the conclusions which seemed to be but natural deductions from the data then at his disposal, he continually kept pointing out that whether such an hypothesis was correct or not, it was of the highest importance to science to prosecute these researches further, so as to ascertain the true nature of the deep-sea bottom, for, to use his own words in his "History of the European Seas," "it is in its exploration that the finest field for marine discovery still remains."

Before the author of this suggestion had time or opportunity for carrying out such explorations as would have verified or disproved his hypothesis, he was unfortunately cut off by an early death; whilst the hypothesis, in the state in which he had left it, was without further investigation eagerly grasped at and accepted by men of science, both at home and abroad, for the special reason that it appeared to afford a simple explanation of various phenomena which had long remained enigmas to both palæontologists and geologists; as, for example, amongst others the occurrence, in various periods of the earth's history, of vast accumulations of sedimentary strata apparently altogether devoid of organic remains.

Although this hypothesis, when somewhat modified, may possibly be found to hold good in respect to certain forms and conditions of life, the results of some casts of the dredge made in depths of from 270 to 400 fathoms in Sir James Ross's Antartic Expedition, and subsequently, the deep-sea soundings described by Dr. Wallich as made in 1860, in the *Bulldog*, in vastly greater depths, demonstrated quite conclusively that it could no longer be retained as a generalisation.

It now appears strange to look back and observe what very little notice was taken of these new data; more especially of the important researches of Dr. Wallich on the North Atlantic sea-bed, which for years, if not all but overlooked, certainly do not appear to have received from zoölogists the full credit which they undoubtedly deserved: geologists and palæontologists were evidently loth to abandon an hypothesis which in many respects suited their requirements.

However long truth may remain dormant, it must eventually assert itself in science as in all other matters, and the advancing strides of Biology and Geology soon demanded that such problems should be definitely and conclusively solved, and that the depths of the sea also should be carefully searched for the missing links of evidence requisite to complete their respective chains of reasoning. This was not felt to be the case in England alone; already in Scandinavia we find the *savants* of Norway and Sweden working with their slender means in the right direction, and assisted by their Governments with a hearty good-will and determination which could not fail to ensure valuable results, such as have already been brought forward by Sars, Nordenschjold, Torrell, and others.

In England, men of science, equally impressed with the importance of this inquiry, wished, with an honourable pride, to see that the country which had so long claimed the empire of the sea, should, in a question of so purely marine investigation, do something worthy of herself; and, being fully alive to the impossibility of doing so without the aid of the Government, applied themselves first to the task of procuring such assistance. Since it is an acknowledged but melancholy fact, that science does not in England either obtain the high position in society, or the influence with the ruling powers of the country which is accorded to it on the Continent in general, it is a subject for congratulation that the urgent appeals made to the Government should have in this instance proved so successful; and after the Government had provided the ships and equipment necessary for the expeditions of last year and this, it is a further subject for congratulation that the direction of these scientific explorations should have been entrusted to such able men as Dr. Carpenter, Prof. Wyville Thomson, and Mr. Gwyn Jeffreys, who constitute the present committee.

The expedition of last year being the first of its kind, had, as might be anticipated, many difficulties to contend with; the ship itself, besides starting at a late season of the year, was ill suited to the undertaking, was provided with but extremely inefficient winding machinery, imperfect appliances and instruments, and moreover, the observers and their assistants had, as it were, to serve an apprenticeship in the management of such operations.

This year, besides being fortunate in securing unusually favourable weather during the major part of the operations, all the above-mentioned difficulties had been provided against; whilst, at the same time, the experience gained during the last year's cruise contributed very greatly to the complete success of the expedition as a whole.

As yet, it would be premature to attempt any description of the results of these explorations, for the Report which was commenced at the meeting of the Royal Society last Thursday is not yet concluded, but is to be continued at its next meeting; sufficient, however, has been already brought forward to prove satisfactorily the great importance of the data obtained to science in general. Besides corroborating, and in some respects correcting the conclusions deduced from the operations of the last year's expedition, many new facts and observations have been collected, whilst the supply of specimens and materials for examination which have been brought home will no doubt give full occupation to the members of the committee for some time to come, besides obliging them to bring to their assistance the services of the physicist, chemist, and mineralogist, each in their several departments.

The practicability of exploring even the deepest portions of the ocean bed may now be considered to be fully established; the conclusive proofs brought forward showing the existence of warm and cold areas of the deep-sea bottom, in close proximity to one another, each inhabited by its distinct and characteristic fauna, is as surprising as it is important in its scientific bearings, and particularly in its relations to geology and palæontology; whilst the investigations into the temperature of the different ocean zones, and the nature of the gases contained in the sea-water at various depths, are intensely interesting and suggestive.

The question as to the existence of an azoic ocean zone at *any* depth, must now be regarded as finally settled in the negative. The hypothesis which appeared to Edward Forbes to be warranted by all the data which the science of his day could supply, must now be abandoned; it is certain, however, that all who knew him will do his memory the justice of believing that, were he now alive, so far from regretting the necessity of withdrawing a suggestion which appeared to explain several important points in science now once more involved in obscurity, he would have been the first of the converts to the views now proved to be more correct, and the first to congratulate the members of the deep-sea dredging committee upon so successful and brilliant a termination of their labours.

DAVID FORBES.

PHYSICAL METEOROLOGY

I.—ITS PRESENT POSITION

IT is a well-known remark of the historian of science that our progress in astronomy has been made in exact accordance with certain laws which regulate the advancement of knowledge. Neither the march of the sun by day, nor that of the moon by night, is more rigidly surrounded and circumscribed by law than the march of that intellect which has successfully interpreted celestial motions.

We had first of all an observing age. Thousands of years ago in the plains of the East we had astronomers who, albeit with imperfect instruments, lacked neither zeal nor intelligence in their nightly study of the stars. Many of their theoretical ideas were untenable, nay, even absurd, but yet they served to bind together into a formal law the mass of observations which their nightly industry collected.

And so step by step our knowledge of celestial motions progressed, until it culminated in the discoveries of Copernicus and Kepler; and we were presented at last with a bird's-eye view of the solar system, taken, as it were, from without, in which that which appears to be, finally gave place to that which is. Thus the first stage was passed, and astronomers had now another question to put to the universe: it was no longer What are the real motions of the planets? but rather, Why do they move in orbits which we know to be ellipses having the sun in one of the foci? Hardly had this question been put, when a great genius answered it. The immortal Newton told us that the same law which regulates the motions of the planets round the sun, and that of the moon round the earth, determines also the path of a stone thrown by the hand, or the velocity of an apple falling from a tree.

One law was shown to hold throughout, and the expression of that law having been obtained, we were easily led to the third stage in the development of astronomy.

The problem was now—from our knowledge of the present places and motions of the heavenly bodies, and of the laws which regulate these, to determine their future places. In fact, the last or prophetical stage of the science had now been reached, and accordingly we had a race of prophets who compiled our nautical almanacs, culminating in two great prophets—one French and one English—who told us where to look for Neptune.

Thus in the most complete branch of physical inquiry there have been three stages of development. We have, first, the observational stage, the object of which was to discover the real motions of the planets of our system; next, we have the stage of generalisation, assigning the mechanical laws regulating these motions; and, lastly, we have the stage of deduction, which, from a knowledge of the places and laws of motion of the heavenly bodies, predicts their future courses.

Each of these stages had its own peculiar difficulty to encounter. That in ascertaining the actual motions of the heavenly bodies consisted in the fact that our point of view is a movable one, and it was only when this had been surmounted that the true explanation was obtained. Again, the difficulty in the generalisation accomplished by Newton consisted in recognising that the planets in their orbits are subject to the same mechanical laws which regulate motions on the earth's surface, and in ascertaining and applying these laws; while, again, the difficulty in the third or deductive stage was an analytical one, for it was necessary to possess a method of analysis sufficiently powerful to calculate the motions of a set of bodies mutually attracting one another.

Now these historical facts, connected with the progress of astronomy, are of very great value to us, especially with reference to those other branches of science not so far advanced. We have, as it were, given us a standard of growth and development, and by measuring the younger child against the elder, we may be able to know the exact advancement of our latest born, and also the course of discipline best calculated to ensure a vigorous growth. It is by this astronomical standard that I now wish very briefly to measure what has been done in meteorology, and during these remarks I may perhaps venture to suggest a course of diet and discipline. But here, alas! there is little advancement to chronicle: the first stage of progress—the observational one—is yet very incomplete; for, viewing meteorology as that science which treats of the physics of the earth's surface, and more particularly of the atmosphere—its motion, and its physical properties, it must be acknowledged that these are very imperfectly known. At the same time it must be owned, that there are very serious difficulties in the way of obtaining this knowledge, more and greater perhaps than there were in obtaining the true motions of the heavenly bodies.

It is not because, as in astronomy, our point of view is a movable one; but rather that we are so mixed up with the earth and its atmosphere, and the motions of the latter are on so large a scale, that we find the greatest possible difficulty in grasping their true import. We are like a soldier in the midst of a great battle, who can give but a very poor and partial account of it, attaching, as he does, undue importance to those passages of arms with which he is most concerned, and ignorant, as he must be, of the general plan of the whole. What is wanted is a bird's-eye view of the atmosphere, such as it might appear to the inhabitants of the moon, who enjoy peculiar advantages in studying the physical features of our earth, just as we do with respect to the surface of our satellite. But there is another difficulty, at least in oceanic regions. Here the scientific worker is very much in the same position as the Jews of old when rebuilding their temple, that is to say, he must work with the one hand and fight with the other, especially when there is any great commotion going on.

The commander of a vessel during a cyclone must first of all look after his vessel, and then, if he has any time to spare, it may be devoted to his barometer and thermometer. Indeed, whether on sea or land, the grand and interesting phenomena of nature carry in their train so much that is overwhelming, that the mind of the observer is not unfrequently unfitted for calm investigation. There is still a third difficulty, and that is the great improbability (despite the perseverance and industry shown by Glaisher and other meteorologists) of ever obtaining by observation a very complete knowledge of the upper regions of the earth's atmosphere.

So much for the difficulties in the way of observing, and now one word with regard to the instrumental means at our disposal. Of late years these have been greatly improved, and one of the most notable achievements in this way is the anemometer of Dr. Robinson, by means of which we can record continuously the horizontal velocity and direction of the wind. Another is the application of photography to meteorological observations, so successfully advocated and extended by the present distinguished President of the Royal Society, by means of which we obtain a continuous record of the pressure, temperature, and hygrometric condition of the air. Again, by means of certain electrical appliances due to Sir C. Wheatstone and others we may place our instrument, whatever it be, at the top of a mountain, or at the bottom of the sea, or in some equally inaccessible region, while the record of the instrument so placed may be read in the quiet and comfort of our own studies. Thus, instrumentally we are well equipped and rapidly improving, but the observations as yet made with complete instruments are very few indeed.

I come now to a very important point. Has the best use been made of the observations already obtained? Of course we all know that there has been a deplorable want of co-operation among observers, as well as of system in making their observations; but we may hope that, through the meteorological offices and societies established in all civilised countries of the world, a greater amount of method will by degrees be obtained. There is, however, something more than all this, and

I have taken advantage of the late meeting of the British Association, at Exeter, to bring the subject before meteorologists. It appears that the general term meteorology embraces two entirely distinct subjects, one of these having reference to physiology, while the other forms a branch of physical research.

The object of the one is to study the connexion between atmospheric conditions, and the health of such organisms (animal and vegetable) as are subjected to these conditions; while the other or physical question is particularly concerned with the movements of the earth's atmosphere, and with the causes thereof.

On both of these important branches we are in almost entire ignorance. With respect to the first, the amount of vapour present in the air is without doubt a very important element of climate, inasmuch as this affects in a marked manner the skin of the human body, and the leaves of plants; but I am not aware that it has yet been determined by the joint action of naturalists and meteorologists what is the precise physical function expressing proportionally the effect of moisture upon animal and vegetable life. Is it simply relative humidity? or does not a given relative humidity at a high temperature have a different effect from that which it has when the temperature is low? There is, in fact, an absence of information as to the precise physical formula which is wished by physiologists, as expressing the effect of moisture upon organic life.

If we come in the next place to consider the physical branch of meteorology, or that which regards the motions of the earth's atmosphere, this is almost as far behind. The explanation of the trades and anti-trades is the one great generalisation which we have accomplished. Certain laws regarding cyclonic storms have lately been discovered; but to this day we are in ignorance of that exact motion of air which constitutes a cyclone, some holding that the motion is entirely rotatory, while others maintain that there is a considerable indraught of air from the circumference to the centre. Again, there is no fact better established than the diurnal movements of the barometer; but what is the motion of air or its constituents implied by them is still a point open to dispute. Now, these are both matters of fact, and there must be some reason why we know so little about them. Nothing, of course, could be known until the instrumental difficulties of the problem had been surmounted, and a suitable anemometer constructed; but now, we have good instruments, and have begun to make good observations. What, then, is the remaining drawback? I believe it is to be found in the fact that while instrumental appliances and observations have progressed, methods of reduction, which naturally lag behind observations, have not yet progressed, but are only just beginning to move. Those hitherto in use combine the physiological with the physical element,—they are a cross between the two, and are subject, I venture to say, as all such crosses are, to the general law of barrenness. Still not much time has been lost, for in the dark ages of few and bad observations it would have been useless to divide the meteorological field: meteorology, then, might be likened to one of those organisms of very low development that had just begun to exhibit the slightest possible tendency to split into two; the application of the knife would then have been premature; but now it may be used with advantage, and the one half allowed to rush into the arms of physiology, while the other seeks the embrace of physical research. In plain language, if we want to obtain physiological results we must reduce our observations with especial reference to physiology, while if physical results be desired, they must be reduced with especial reference to physical laws.

I must, however, reserve for another article a description of a method of reduction having this latter object in view.

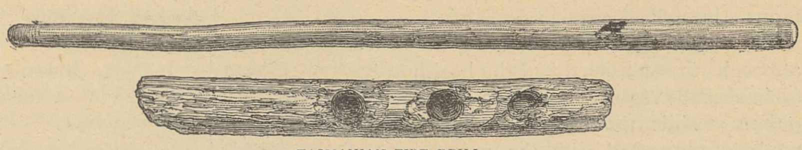
BALFOUR STEWART

PREHISTORIC TIMES

Prehistoric Times, as illustrated by Ancient Remains, and the Manners and Customs of Modern Savages. By Sir John Lubbock, Bart., F.R.S., &c. Second Edition. (London, 1869: Williams and Norgate.)

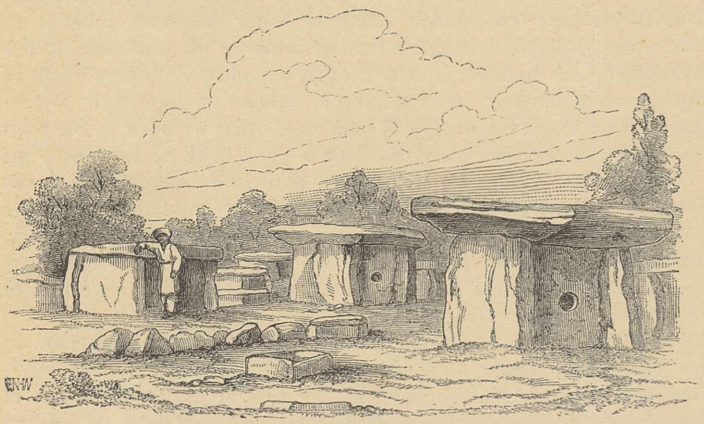
WE may be pardoned for not being cosmopolite enough to judge books without any regard to their nationality. Too often, though Englishman may have contributed much to some important subject, no systematic English treatise sums up the evidence, so that our students have to depend too much on foreign books of reference. On the present subject of prehistoric archæology, however, it is satisfactory that we have, in Sir John Lubbock's work, not only a good book of reference, but the best. Its well-known plan and argument need not be re-stated here, but it has to be pointed out that the present edition contains much important new matter, especially in the chapters relating to the Stone Age, Megalithic monuments, Cave-men, and the condition of modern savages.

It is a marked character of the recent researches in prehistoric archæology, and it is one of the reasons which justify the reception of the subject as a department of positive science, that the facts disclosed lend themselves to generalisations of a thoroughly scientific character; and that, moreover, when the generalisations are once made, new facts drop in and find their places ready. Various subjects discussed in the present work illustrate this: take, for instance, the stone-implement question. The finding of flakes, scrapers, spear-heads, &c. in different parts of the world, justified a general surmise that the Stone Age had once prevailed in all inhabited districts. A few years ago, however, there were regions whence stone implements seemed hardly forthcoming. India appeared to have none, but when properly looked for they proved abundant, as witness Mr. Bruce Foote's paper in the Transactions of the Norwich Congress of 1868. Africa also seemed almost outside the Stone Age world; but now the finding of stone implements in South Africa, and even legends of their use, give the primal Stone Age possessions there as elsewhere. No sooner, too, were the rude implements of the Drift type thoroughly recognised in the valley of the Somme, than it came into notice that such had long before been collected in England without knowledge of their special importance; and now Spain and India, and other districts, furnish specimens which come under the same class. So it was with the art of fire-making by friction of pieces of wood. Over most of the world, savage or civilised, the traces of its early prevalence were sufficient to justify its being generalised on as one of man's primitive arts. But there were some exceptional cases, as in Tasmania, where the natives were said to have had no means of producing fire before their acquaintance with Europeans, but to have only carried lighted brands from place to place. Sir John Lubbock, however, is now able to give (p. 440) a drawing of a Tasmanian fire-drill. It is just like the well-known instrument of Australia, Africa, and America.



TASMANIAN FIRE DRILL.

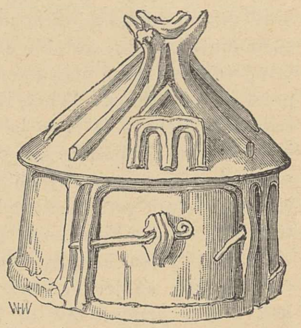
So again, in a less degree, with those rude stone menhirs, cromlechs, kistvaens, &c., which are classed under the head of Megalithic monuments. The range over which these interesting structures are found has been continually extending to new districts. Dr. Hooker's account, in his Himalayan Journals, of the modern setting up of Megalithic structures by indigenous tribes in India, received for years little notice, but has now become one of the leading facts of prehistoric archæology. As may especially be seen in Meadows Taylor's recent paper in the Journal of the Ethnological Society, monuments like our own Kit's Coty House, or Dance Main, are known in vast numbers in India, and are made the subject of careful study. A group from the reduced plate in Sir John Lubbock's work (p. 120) is given here.



MEGALITHIC STRUCTURES IN INDIA.

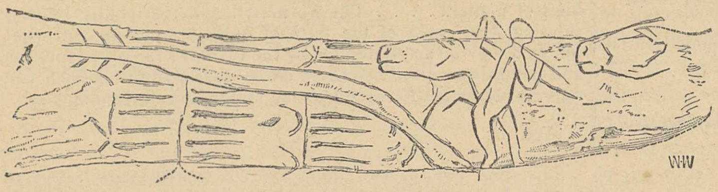
Was the civilisation of the lower races spread from a single centre, or from many? Is the correspondence of savage culture the result of common inheritance, or independent similar invention? This still most obscure problem is intimately connected with the evidence brought forward in Sir John Lubbock's generalisations, and especially with his details of modern savage tribes as representatives of older strata of prehistoric man. The point is one which especially strikes those who notice the surprising similarity of the implements of the lower races in the most different regions, as where, in the present work, three all but identical arrow-heads from modern North and South America and ancient France, are set side by side (p. 99); or modern savage flint scrapers are figured, undistinguishable from those of remote European antiquity. Sir John Lubbock insists with much force (p. 545) on the consideration that this similarity is due especially to similarity of materials; that the pointed bones used for awls are necessarily similar everywhere, that obsidian knives from Mexico are like the flint knives of our own country, not so much because the ancient Briton resembled the Aztec, as because the fracture of flint is like that of obsidian. And his remark (p. 121), that any child with a box of bricks will build dolmens and triliths is a highly reasonable protest against those antiquaries who interpret the similarity of Megalithic structures in different districts as proof that their builders were of kindred race.

With regard to a most interesting topic treated of by Sir John Lubbock, that of the existence of savage tribes destitute of religion, I am disposed to entertain a view different from his. To a great extent, indeed, our difference is rather nominal than real. He adopts a definition of religion more stringent than I do, and thus excludes from the catalogue of religious tribes many which on the same evidence I should include. Dieffenbach's evidence, for instance, is quoted as follows (p. 556): "If we take religion in its common meaning, as a definable system of certain dogmas and prescriptions, the New Zealanders have no religion. Their belief in the supernatural is confined to the action and influence of spirits on the destiny of men, mixed up with fables and traditions." This, from my point of view, is an admission that the New Zealanders have a religion; and, indeed, we know that they are strong believers in a future existence, and regard the names of their ancestors as tutelary spirits. Moreover, the assertions of travellers on this point not seldom break down on closer scrutiny. Thus mention is made here of a statement in the *Voyage de l'Astrolabe* that the Samoans have no religion; but the explorers' information was evidently insufficient, and an elaborate account of the Samoan deities, priests, temples, prayers, sacrifices, may be found in Turner's "Polynesia." Among Sir John Lubbock's list of evidence there are, indeed, cases which cannot be thus easily met. But while admitting theoretically that a state without religion may have prevailed among early tribes of men, and may still be represented by surviving savages, I fail to find as yet any indisputable case.



TERRA-COTTA URN FROM ALBANO

Among the special points of interest introduced in the present volume, it may be mentioned that the habitations men lived in during the Bronze Age are displayed in a very interesting way, in imitative terra-cotta urns of the period, such as this from Albano. We must probably go many ages back from the date of the Italians of the Bronze Age, who dwelt in these neat huts, to the date of the rude Stone Age cave-men of Central France, the contemporaries of the reindeer and the mammoth, which they delineated with such remarkable artistic vigour. One of these people's interesting drawings (p. 324) is given here, representing a snake or eel, two horses' heads, and a human figure (which Lord Monboddo would probably have claimed as special evidence). This may possibly be the earliest known portrait of man.


STONE-AGE SCULPTURES

The advocates of the theory that savages are degenerate descendants of civilised men, have still full scope in pointing out the imperfections of their adversaries' evidence and argument. But the new facts, as they come in month by month, tell steadily in one direction. The more widely and deeply the study of ethnography and prehistoric archæology is carried on, the stronger does the evidence become that the condition of mankind in the remote antiquity of the race is not unfairly represented by modern savage tribes.

E. B. TYLOR.

THE ORIGIN OF SPECIES CONTROVERSY.

Habit and Intelligence, in their Connection with the Laws of Matter and Force. A Series of Scientific Essays. By Joseph John Murphy. (Macmillan and Co., 1869.)

I.

THE flood of light that has been thrown on the obscurest and most recondite of the forces and forms of Nature by the researches of the last few years, has led many acute and speculative intellects to believe that the time has arrived when the hitherto insoluble problems of the origin of life and of mind may receive a possible and intelligible, if not a demonstrable, solution. The grand doctrine of the conservation of energy, the all-embracing theory of evolution, a more accurate conception of the relation of matter to force, the vast powers of spectrum analysis on one side, showing us as it does the minute anatomy of the universe, and the increased efficiency of the modern microscope on the other, which enables us to determine with confidence the structure, or absence of structure, in the minutest and lowest forms of life, furnish us with a converging battery of scientific weapons which we may well think no mystery of Nature can long withstand. Our literature accordingly teems with essays of more or less pretension on the development of living forms, the nature and origin of life, the unity of all force, physical and mental, and analogous subjects.

The work of which I now propose to give some account is a favourable specimen of the class of essays alluded to, for although it does not seem to be in any degree founded on original research, its author has studied with great care, and has, in most cases, thoroughly understood, the best writers on the various subjects he treats of, and has brought to the task a considerable amount of original thought and ingenious criticism. He thus effectually raises the character of his book above that of a mere compilation, which, in less able hands, it might have assumed.

The introductory chapter treats of the characteristics of modern scientific thought, and endeavours to show, "that the chief and most distinctive intellectual characteristic of this age consists in the prominence given to historical and genetic methods of research, which have made history scientific, and science historical: whence has arisen the conviction that we cannot really understand anything unless we know its origin; and whence also we have learned a more appreciative style of criticism, a deeper distrust, dislike, and dread, of revolutionary methods, and a more intelligent and profound love of both mental and political freedom." The first six chapters are devoted to a careful sketch of the great motive powers of the universe, of the laws of motion, and of the conservation of energy. The author here suggests the introduction of a useful word, *radiance*, to express the light, radiant heat, and actinism of the sun, which are evidently modifications of the same form of energy,—and a more precise definition of the words *force* and *strength*, the former for forces which are capable of producing motion, the latter for mere resistances like cohesion.

He enumerates the primary forces of Nature as, gravity, capillary attraction, and chemical affinity, and notices as an important generalisation "that *all primary forces are attractive*; there is no such thing in Nature as a primary repulsive force" (p. 43). Now here there seem to be two errors. Cohesion, which is entirely unnoticed, is surely as much a primary force as capillary attraction, and, in fact, is probably the more general force, of which the other is only a particular case; and elasticity is the effect of a primary repulsive force. In fact, at p. 26, we find the author arguing that *all matter is perfectly elastic*, for, when two balls strike together, the lost energy due to imperfect elasticity of the mass is transferred to the molecules, and becomes heat. But this surely implies repulsion of the molecules; and Mr. Bayma has shown, in his "Molecular Mechanics," that repulsion is as necessary a property of matter as attraction.

The eighth chapter discusses the phenomena of crystallisation; and the next two, the chemistry and dynamics of life. The reality of a "vital principle" is maintained as "the unknown and undiscoverable something which the properties of mere matter will not account for, and which constitutes the differentia of living beings." Besides the formation of organic compounds, we have the functions of organisation, instinct, feeling, and thought, which could not conceivably be resultants from the ordinary properties of matter. At the same time it is admitted that conceivableness is not a test of truth, and that all questions concerning the origin of life are questions of fact, and must be solved, not by reasoning, but by observation and experiment; but it is maintained that the facts render it most probable that "life, like matter and energy, had its origin in no secondary cause, but in the direct action of creative power." Chapters X. to XIV. treat of organisation and development, and give a summary of the most recent views on these subjects, concluding with the following tabular statement of organic functions :—

Formative or Vegetative Functions, essentially consisting in the Transformation of Matter.

Chemical	Formation of organic compounds.
Structural.	Formation of tissue.
	Formation of organs.

Animal Functions, consisting essentially in the Transformation of Energy.

Motor.	Spontaneous.
	Reflex.
	Consensual.
	Voluntary.
Sensory.	Sensation.
	Mind.

In the fifteenth chapter we first come to one of the author's special subjects,—the Laws of Habit. He defines habit as follows : "The definition of habit and its primary law, is that all vital actions tend to repeat themselves ; or, if they are not such as can repeat themselves, they tend to become easier on repetition." All habits are more or less hereditary, are somewhat changeable by circumstances, and are subject to spontaneous variations. The *prominence* of a habit depends upon its having been recently exercised ; its *tenacity* on the length of time (millions of generations it may be) during which it has been exercised. The habits of the species or genus are most tenacious, those of the individual often the most prominent. The latter may be quickly lost, the former may appear to be lost, but are often latent, and are liable to reappear, as in cases of reversion. The fact that active habits are strengthened, while passive impressions are weakened, by repetition, is due in both cases to the law of habit; for, in the latter, the organism acquires the habit of not responding to the impression. As an example, two men hear the same loud bell in the morning ; it calls the one to work, as he is accustomed to listen to it, and so it always wakes him ; the other has to rise an hour later, he is accustomed to disregard it, and so it soon ceases to have any effect upon him. Habit has produced in these two cases exactly opposite results. Habits are capable of any amount of change, but only a slight change is possible in a short time ; and in close relation with this law are the following laws of variation.

Changes of external circumstances are beneficial to organisms if they are slight ; but injurious if they are great, unless made gradually.

Changes of external circumstances are agreeable when slight, but disagreeable when great.

Mixture of different races is beneficial to the vigour of the offspring if the races mixed are but slightly different ; while very different races will produce either weak offspring, or infertile offspring, or none at all. Even the great law of sexuality, requiring the union of slightly different individuals to continue the race, seems to stand in close connection with the preceding laws.

The next seven chapters treat of the laws of variation, distribution, morphology, embryology, and classification, as all pointing to the origin of species by development ; and we then come to the causes of development, in which the author explains his views as follows :—

> These two causes, self-adaptation and natural selection, are the only *purely physical* causes that have been assigned, or that appear assignable, for the origin of organic structure and form. But I believe they will account for only part of the facts, and that no solution of the questions of the origin of organization, and the origin of organic species, can be adequate, which does not recognise an Organising Intelligence, over and above the common laws of matter. . . . . But we must begin the inquiry by considering *how much* of the facts of organic structure and vital function may be accounted for by the two laws of self-adaptation and natural selection, before we assert that any of those facts can only be accounted for by supposing an Organising Intelligence.

Again :

> Life does not suspend the action of the ordinary forces of matter,' but works through them. I believe that wherever there is life there is intelligence, and that intelligence is at work in every vital process whatever, but most discernibly in the highest. . . . Nutrition, circulation, and respiration are in a great degree to be explained as results of physical and chemical laws ;—but sensation, perception, and thought cannot be so explained. They belong exclusively to life ; and similarly the organs of those functions—the nerves, the brain, the eye, and the ear—can have originated, I believe, solely by the action of an Organising Intelligence.

Admitting Mr. Herbert Spencer's theory of the origin of the vascular system, and possibly of the muscular, by self-adaptation, he denies that any such merely physical theory will account for the origin of the special complexities of the visual apparatus :

> Neither the action of light on the eye, nor the actions of the eye itself, can have the slightest tendency to produce the wondrous complex histological structure of the retina ; nor to form the transparent humours of the eye into lenses ; nor to produce the deposit of black pigment that absorbs the stray rays that would otherwise hinder clear vision ; nor to produce the iris, and endow it with its power of closing under a strong light, so as to protect the retina, and expanding again when the light is withdrawn ; nor to give the iris its two nervous connections, one of which has its root in the sympathetic ganglia, and causes expansion, while the other has its root in the brain and causes contraction.

Nor will he allow that Natural Selection (which he admits may produce any simple organ, such as a bat's wing) is applicable to this case ; and he makes use of two arguments which have considerable weight. One is that of Mr. Herbert Spencer, who shows that in all the higher animals natural selection must be aided by self-adaptation, because an alteration in any part of a complex organ necessitates concomitant alterations in many other parts, and these cannot be supposed to occur by spontaneous variation. But in the case of the eye he shows that self-adaptation cannot occur, whence he conceives it may be proved to be almost an infinity of chances to one against the simultaneous variations necessary to produce an eye ever having occurred. The other argument is, that well-developed eyes occur in the higher orders of the three great groups, Annulosa, Mollusca, and Vertebrata, while the lower orders of each have rudimentary eyes or none ; so that the variations requisite to produce this wonderfully complicated organ must have occurred three times over independently of each other. In the first of these objections, he assumes that many variations must occur simultaneously, and on this assumption his whole argument rests. He notices Mr. Darwin's illustration of the greyhound having been brought to its present high state of perfection by breeders selecting for one point at a time, but does not think it possible "that any apparatus, consisting of lenses, can be improved by any method whatever, unless the alterations in the density and the curvature are perfectly simultaneous." This is an entire misconception. If a lens has too short or too long a focus, it may be amended *either* by an alteration of curvature, or an alteration of density; if the curvature be irregular, and the rays do not converge to a point, then any increased regularity of curvature will be an improvement. So the contraction of the iris and the muscular movements of the eye are neither of them essential to vision, but only improvements which might have been added and perfected at any stage of the construction of the instrument. Thus it does not seem at all impossible for spontaneous variations to have produced all the delicate adjustments of the eye, once given the rudiments of it, in nerves exquisitely sensitive to light and colour; but it does seem certain that it could only be effected with extreme slowness; and the fact that in all three of the primary groups, Mollusca, Annulosa, and Vertebrata, species with well-developed eyes occur so early as in the Silurian period, is certainly a difficulty in view of the strict limits physicists now place to the age of the solar system. A. R. WALLACE

THE PLANTS OF MIDDLESEX

Flora of Middlesex: a Topographical and Historical Account of the Plants found in the County; with Sketches of its Physical Geography and Climate, and of the Progress of Middlesex Botany during the last Three Centuries. By Henry Trimen, M.B., F.L.S., and W. T. Thiselton Dyer, B.A. Pp. xli., 428. (London: Hardwicke, 1869.)

THE first local Flora published in England gives a list of the plants of Hampstead Heath. It was prepared by Thomas Johnson, Apothecary on Snow Hill. Early on the morning of the 1st August, 1629, and accompanied by a few friends, he left London and proceeded on a simpling expedition to Hampstead, by way of Kentish Town and Highgate. A heavy shower arrested their progress for a little, but nothing daunted they made their way into the woods, and then on to the heath. The day's excursion was brought to a close in a country inn at Kentish Town, where the party dined together.

Johnson enumerated seventy-two plants as the result of the day's simpling. In subsequent expeditions he added sixty-nine others, so that in 1632 his *Enumeratio Plantarum in Ericeto Hampsted. cresc.* contained 141 species. This rare little volume, with its forgotten names—those of Gerarde and Lobel—is the earliest precursor of the Flora of Middlesex. Since its publication, the materials have been gradually accumulating for illustrating the Flora of the Metropolitan district, and one of the most valuable features in the work before us is, that its authors have, with great care and singular success, investigated and expounded all the ancient as well as the more recent plant-lore bearing on the subject.

The bi-nominal system of nomenclature and the Linnean classification introduced, somewhat more than a century ago, a new era into the science of Botany, and relegated to comparative obscurity the older authors. The difficulty of determining the value of their names, and the practice of neglecting all ante-Linnean synonymy, have caused their labours to be set aside. The authors of this volume have made the works of these earlier writers critically certain by the help of the Herbaria of Merrett, Petiver, Plukenet, Ray, and specially of Buddle, and of the manuscripts relating to them now preserved in the British Museum.

We have here given for the first time an authentic biography, so to speak, of the different plants so far as they are connected with Middlesex. The name of the observer who first recorded each plant, the date of the record, and the place where it was observed, are specified; while the chronologically-arranged localities where it has been at different times gathered, enable one frequently to trace its increasing rarity, and in not a few cases the biography terminates with the record of its complete extirpation. Thus Turner, the father of British Botany, first (1562) records Penny-royal (*Mentha Pulegium*, Linn.) from "beside Hundsley upon the Heth beside a watery place;" after him Gerarde (1597) tells us that it grew "on the common neere London called Miles ende, whence poore women bring plentie to sell in London Markets;" and then, through Blackstone, to our own time when it was found in plenty beside the Hampstead ponds, but finally disappeared from the county about twenty years ago. London Rocket, which Morison says might have been reaped like a crop of wheat on the ruins near St. Paul's after the Great Fire, was, up to the beginning of the present century, a common plant in Middlesex, but is now completely lost. The history of *Cucubalus*, from the Isle of Dogs, is much shorter. Known in England only in this locality, it flourished apparently in a wild state for twenty years, until building operations destroyed the habitat about twelve years ago.

Every page of the volume supplies similar interesting details in the history of Middlesex plants. This feature of the work is as novel as it is important. There is abundant evidence that the authors, in addition to their faithful and even loving exposition of the labours of their predecessors, possess a sound critical acquaintance with the species of British plants. Even in this aspect, the volume is not behind the best of our county Floras.

The influence of the geological condition of a district upon the organised bodies connected with it has lately been receiving the attention it deserves. Important conclusions have resulted from the Government inquiry into the relations subsisting between the diseases of man and the geological structure of the south-eastern corner of England. The connection between the indigenous vegetation and the geology of its habitat is not less interesting, and, when data have been sufficiently accumulated to warrant safe deductions, will yield valuable information. M. Thurmann, in an elaborate essay on the botany of the Jura, has shown that vegetation is influenced by the manner in which the particles of the rocks are combined, rather than by the nature of the materials of which they are composed. He has consequently classified rocks into two great groups, based on their mechanical constitution: the one he calls "Eugéogènes" (plentiful-detritus-yielding) and the other "Dysgéogènes" (sparing-detritus-yielding). The essential differences between the two groups are in respect to their hardness, their power of absorbing and retaining moisture in small masses, their permeability in extensive deposits, and the rate at which they form detritus resulting from the possession of these characteristics. Mr. Baker has applied the conclusions of the French botanist to Britain, in his Flora of North Yorkshire, and, more recently, in that of Northumberland and Durham. The limited extent of Middlesex, and the uniform character of its geology, give little scope for the application of these views to its Flora. The only Dysgeogenous rocks are the narrow outcrop of chalk in the north and north-west; the remainder of the county being composed of typical Eugeogenous strata. As far as it is possible, however, the authors have made good use of M. Thurmann's labours, and the limited application is to some extent compensated for by the accuracy of the details.

Appended to the volume is a valuable contribution to the history of British botany, covering to some extent the ground taken up by Pulteney in his "Sketches," and continuing it to the present day as far as the matter relates to Middlesex. Large additions are made to Pulteney's biographies of Turner, Johnson, Plukenet, Petiver, and Doody. New and interesting memoirs are given of Buddle, Blackstone, Curtis, and other less known investigators of Middlesex plants. It would be greatly to the advantage of science, if the authors, encouraged by the success which has attended their investigations into the progress of Middlesex botany, would continue their researches, and give us, not a new edition of Pulteney, but a new History of Botany in Britain.

W. CARRUTHERS

OUR BOOK SHELF

Van Heurck on the Microscope.—*Le Microscope, sa Construction, son Maniement, et son Application aux Études d'Anatomie végétale.* Henri van Heurck. 8vo. pp. 223, with Illustrations, price 3*s*. (Antwerp, 1869. London: Williams and Norgate.)

THE title-page of this little work, a mere fragment of which we have transcribed above, is perhaps its most objectionable feature. The ambitious superscription, however, need not affect its usefulness as an elementary descriptive treatise, and the English reader may add to his information by the perusal of a manual of microscopical manipulation written from a French or Belgian standpoint.

We have no manual in English of precisely similar scope and intention with which to compare M. van Heurck's; the one which it most resembles is, perhaps, Mr. Currey's translation of Dr. Schacht's excellent guide to the use of "the Microscope in Vegetable Physiology," the chief difference being in point of thoroughness: the former is a popular, the latter a scientific work.

M. van Heurck's book is divided into two portions, of about one hundred pages each: the first, on the construction and choice of a microscope; the second, on its application to vegetable anatomy. We may describe each section in a few words.

Naturally, the instruments of French makers have prominence assigned to them; and most of the well-known models manufactured by Hartnack, Chevalier, and Nachet are figured, together with one or two modifications we do not recollect having seen before. In too many of these, cheapness and simplicity go hand in hand with toy-like inefficiency. Some are of more interest, such as Chevalier's "Universal Microscope," and a "vertical," or rather "inverted," arrangement constructed by M. Nachet for photographic purposes. In the section devoted to manipulation, the subject of micro-photography is treated at greater length than has been customary in such works.

All notice of the microscopes of English makers appears to have been omitted in the first Edition of "Le Microscope," beyond a general intimation that their "price is exorbitant, and their complication excessive;" but, "at the request of subscribers," an appendix has been prepared to the present issue, containing a description of the instruments of Ross, R. and J. Beck, and Powell and Lealand. This seems to be written with only partial knowledge, and with very unequal justice.

The second portion of the book contains little of novelty in either fact, theory, or method. Beginners will find in it the sort of information they require to enable them to examine and mount vegetable tissues, and the numerous little woodcuts will enable them to understand the more important structures. There is also a section on the application of reagents, intended for those who have advanced a step farther in histological pursuits.

We may repeat that, though M. van Heurck's work will not bear comparison with several of our English manuals in completeness, the reader will scarcely rise from it without having gained a few useful hints.

H. B. BRADY

Bryologia Silesiaca. Von Dr. Julius Milde, Professor in Breslau. (Leipzig, 1869.)

THIS is a systematic description of the mosses, not only of Silesia, but also of Jutland, Holland, the Palatinate, Baden, Franconia, Bohemia, Moravia, and the neighbourhood of Munich. Special attention is, however, devoted to the Silesian flora. The work is prefaced by an account (for the use of beginners) of the most important organs of the musci in reference to the determination of species.

New Batrachians.—*Ueber neue und wenig bekannte Batrachier aus Australien und America.* Von W. Keferstein, Prof. in Göttingen. (Berlin, 1868.)

THE Göttingen Museum is rich in Australian frogs. Prof. Keferstein here describes, from the museum specimens, twenty-nine species. He also enumerates nineteen others, recorded as such in the literature of batrachiology, although their specific value appears, in many cases, to be doubtful. The frog-fauna of Australia, according to Prof. Keferstein, bears a great resemblance to that of South America. Some batrachians from Costa Rica are likewise described in this brochure. Five plates of figures are appended. It may be worth mentioning that the authorities of the museum will be glad to exchange some of their superfluous Australian species for other batrachians.

The Sandwich Islands.—*Ein Jahr auf den Sandwich-Inseln (Hawaiische-Inseln).* Von Dr. J. Bechtinger. (Wien, 1869.)

THE chief interest of this volume lies in its pictures of the social and moral condition of a primitive people in close contact with modern civilisation, and the subject for many years of unexampled missionary efforts. The author enters somewhat fully into the character of the climate, the nature of prevalent diseases, the physical and psychical characters of the people, and their probable ethnic affinities. Leprosy is a disease unfortunately very prevalent among the inhabitants, and their Government have hit upon a notable plan for putting the sufferers out of sight, and preventing the spread of the disease by contagion. In the island of Molokai there is a plain near the sea, and walled off from the rest of the island by mountains from two to four thousand feet high, and almost totally inaccessible. To this spot lepers are conveyed by a vessel which periodically leaves Honolulu for that purpose, and for the purpose of carrying food. Every other communication with the sufferers is strictly prohibited. Dr. Bechtinger had a very natural desire to visit this forbidden valley, and ascertain the condition of its inhabitants. Knowing, however, that great opposition would be made to his doing so, he resolved to go thither privately, and attempt to reach the valley over the mountain range at its back. Attended by a photographer, he succeeded in his project, and found the poor wretches (hundreds and hundreds of them) in a most horrible state, utterly neglected and almost entirely without the necessaries of life. It is satisfactory to know that the representations of the Italian doctor in the Honolulu newspaper procured for these outcasts some amelioration of their lot, although it procured for himself abuse and ill-will. As a frontispiece to the volume there is a woodcut, reproduced from a photograph, of the author surrounded by some of the lepers of Molokai. Other woodcuts are likewise given; but they are chiefly, if not solely, remarkable for their very primitive and inartistic character.

Chemical Lessons.—*Leçons de Chimie.* Deuxième edition. Par M. Alfred Riche. (Paris: Didot Frères, 1869.)

LIKE almost all French treatises on elementary science, M. Riche's book is clearly and concisely written, and the illustrations are perfect; but although introducing many of the newest discoveries in the science (perhaps somewhat too pointedly alluded to in the preface), M. Riche does not adopt the important new views lying at the basis of modern chemistry. He still adheres to the old equivalent notation, and therefore refuses to admit the cogency of the proofs which have carried conviction to the minds of almost all other chemists. The short historical introductions under Combustion, the Atmosphere, Dissociation, and the Atomic Theory are of interest to the student, especially an extract (p. 704) from a paper by Dumas on the history of chemical affinity since the time of Barckhausen, read before the Academy of Sciences last year.

H. E. R.

NOTES ON STALACTITES

THE mineralogist is acquainted with few objects of greater beauty than the stalactitic forms assumed by many minerals. So curious are these natural growths, that I venture to offer a few remarks upon their artificial production.

The dependent clusters which line limestone caverns are formed, as has often been explained, by the following process:—When water containing carbonate of lime oozes through a porous rock, each drop loses water and carbonic acid by evaporation. As water saturated with carbonic acid only retains 0·1 per cent. of carbonate of lime in solution, it follows that when the evaporation is continued beyond the point of saturation, carbonate of lime will be deposited. Globules of water on the roofs of limestone caverns are always covered with a thin film: this gradually thickens, and a tube is formed. This tube increases in size mainly by the deposition of carbonate of lime from water running over its surface. There are, however, many cavities containing tubes of arragonite in an horizontal position, and even of a curved form. Mr. Wallace has shown* that the growth of such stalactites has been from within outwards, the solution travelling along the self-constructed tube.

The following experiment affords a ready method of studying the somewhat rapid growth of similar forms:—Select a flat piece of porous sandstone, or, better, a slice of coke; saturate this with nitric acid. If a globule of mercury three or four millimetres in diameter be allowed to fall on the coke, the surface of the mass will be covered with minute beads of mercury. The nitric acid immediately attacks the under-surface of each sphere, producing an annular ring of nitrate of mercury. A short tube is thus formed, sustaining the metallic globule. As liquids rise in capillary tubes, but do not overflow the orifice, the periphery of the sphere is acted upon by the nitric acid, and lifted higher and higher by the deposited nitrate. The result is a tube of about twenty-five millimetres (one inch) in height, terminated by a minute sphere of mercury.

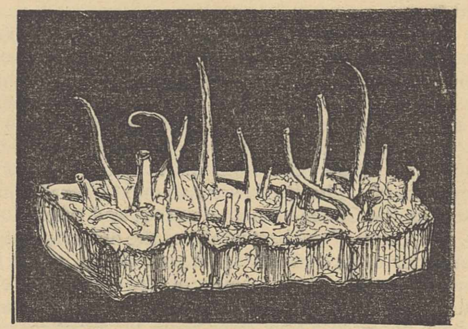
The cross-section of the stalactite is tubular; often, however, partially filled with interlacing crystalline planes. If nitrate of mercury is deposited more rapidly on one side, a twist is given, and a spiral tube is formed. Often a thin wall on one side predisposes the direction, and a curved stalactite is produced.

* Proc. Geo. Soc. 1865, 413.

It is well to consider briefly the stalactites that appear to have been formed mainly by deposition from water running over their surface. Of this class the siliceous stalactites well repay examination. Silica occurs in stalactite tubes of crystalline silicic anhydride, as in the specimens from Malwa, in Central India.

The chalcedonic form, however, is far more common, and the specimens from Trevascus Mine afford beautiful examples. The tubes are generally about two to three millimetres in diameter, and if a section through the length of the tube be made, the following structure will be easily made out by a hand lens or one inch objective. Firstly, we observe a slender opaque thread with a tube running down its entire length; over this opaque thread there is a covering of chalcedony. Frequently, but not invariably, the junction is marked by a vesicular structure.

To understand this it is necessary to turn to the artificial production of an aqueous solution of silica. By bringing together 112 grammes of silicate of soda, 67·2 grammes of dry hydrochloric acid, and 1 litre of water, and dialysing for four days, a solution containing 4·9 per cent. of silicic anhydride remains upon the dialyser; the chloride of sodium and excess of hydrochloric acid having diffused away. This solution becomes pectous somewhat rapidly, forming a solid jelly which dries in air into a glassy, lustrous hydrate. A solution containing 0·5 per cent. of silicic anhydride remains permanently limpid.



NITRATE OF MERCURY STALACTITES

The minutest trace of a soluble carbonate, or a bubble of carbonic acid, causes a solution of silica to gelatinise rapidly. Professor Church has shown the importance of this fact in the formation of siliceous pseudomorphs of corals. By passing water containing 0·15 per cent. of silica, dissolved carbonic acid, and air, over the coral, he replaced the carbonate of lime by hydrated silica.

In the Trevascus stalactite under consideration, probably the opaque thread was originally carbonate of lime. The carbonate would have arrested and gelatinised the silica, the covering thus produced affording a colloid septum for the diffusing away of crystalloid salts.

This view is supported by the vesicular junction with the chalcedonic layer, as the escape of carbonic acid would probably have produced bubbles in the yielding jelly. Whether this be so or not, it is easy to convert stalactites of arragonite into siliceous pseudomorphs that present a close resemblance to the natural mineral.

W. CHANDLER ROBERTS

THE SHARPEY PHYSIOLOGICAL SCHOLARSHIP

WE are most pleased to report that the movement for the establishment of a "Sharpey Physiological Scholarship" at University College, in honour of Prof. Sharpey, is meeting with all the success that it deserves. Already, by the more or less private efforts of the secretaries and other members of the committee, a sum of £1,500 has been subscribed: much more, however, will be required in order to carry out the wishes of the promoters of the "Sharpey Memorial" scheme.

Having held his present professorship since 1836, Dr. Sharpey is well known to, and as thoroughly esteemed by, a very large number of old students, who have not only experienced the benefit of his clear, logical, and thorough method of teaching, but have felt the genial influence of his kindly sympathy, and the value of that breadth and soundness of judgment for which he is so remarkable. The large majority of his old and present students will now doubtless be delighted to take part in a movement destined to do honour to their favourite professor; and we believe that many of those who have been associated with Dr. Sharpey in his various official capacities in connection with science and education will also gladly avail themselves of this opportunity of testifying to their high appreciation of the valuable services which he has performed in both these capacities, and also of bearing witness to the strong feelings of personal regard with which he has inspired them.

The proposed memorial is of a nature likely to be peculiarly gratifying to Dr. Sharpey. The future "Sharpey Physiological Scholar" is destined to work in the Physiological Laboratory of the College, in the practical departments of the science; and successive students who may obtain this honourable distinction will, it is hoped, come for some time under the immediate supervision of Dr. Sharpey himself. The Professor has most liberally offered to present to the College his anatomical and physiological library, consisting of the best works of the older anatomists, a useful series of foreign scientific periodicals, and a large number of monographs by some of the most active and learned observers of modern times. It is proposed to place these books in a new class-room for practical physiology, which is about to be fitted up under the name of the "Sharpey Physiological Laboratory and Library;" and which, as part of the memorial, is to be adorned by a portrait of the man to whom the subscribers wish to do honour now, and whose memory they desire to perpetuate in the future. If the amount of the "Memorial Fund" is sufficient, it is also proposed that a bust of Dr. Sharpey should be executed for presentation to the College. The plan seems an excellent one, combining as it does the feature of being a thorough personal tribute of the most gratifying nature to Dr. Sharpey, destined to convey to successive generations of students a notion of the high estimation in which his services in the cause of science and education were regarded by his contemporaries, whilst it is also a movement likely to result in the further extension of that branch of science to which he has himself principally contributed. It is hoped that the study of practical physiology will thus be helped on more than it has hitherto been in this country, and that in time a school of practical physiology—the precursor of many others—may be established, equal to any of the now celebrated continental schools. It is expected that many of the fellows of the Royal Society and of other scientific bodies will gladly take this opportunity of doing honour to a man whom they all esteem so highly, and for whom so many entertain warm feelings of personal regard. We are glad to find that several of the foremost amongst them have already given evidences of substantial co-operation, and we trust that many others will follow their example.

THE ISTHMIAN WAY TO INDIA

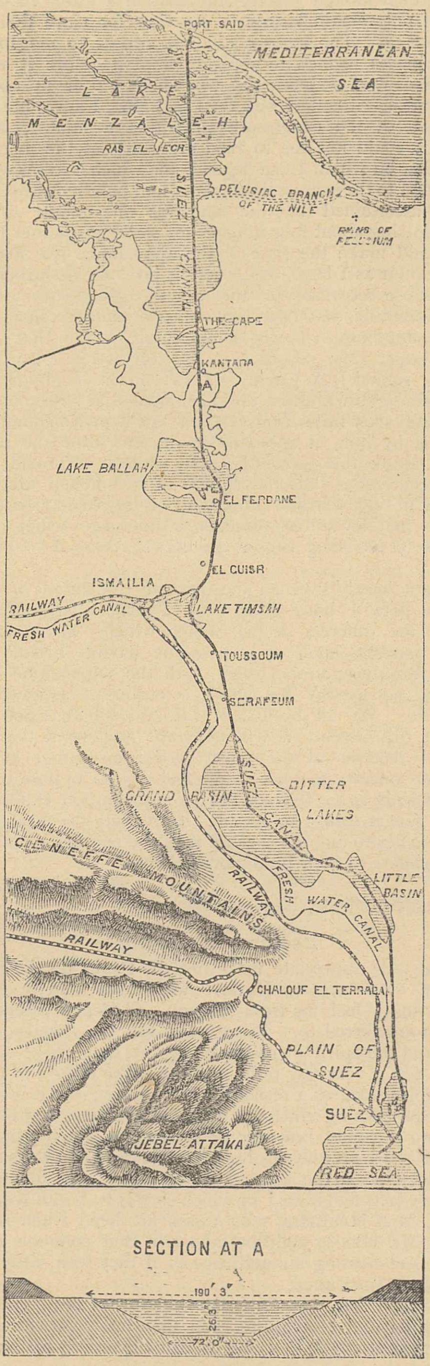
THE Canal has been opened. The flotilla, with its noble, royal, imperial, and scientific freight, has progressed along the new-made way from sea to sea. From Port Saïd, that new town between the sea and the wilderness, with its ten thousand inhabitants, and acres of workshops and building-yards, and busy steam-engines, the naval train floated through sandy wastes, across lakes of sludge and lakes of water filled from the Salt Sea; past levels where a few palm-trees adorn the scorched landscape; past hill-slopes on which the tamarisk waves its thready arms; past swamps where flocks of flamingoes, pelicans, and spoonbills, disturbed by the unwonted spectacle, sent up discordant cries; through deep excavations of hard sand or rock; across the low flat of the Suez lagoons, where Biblical topographers have searched for the track of the children of Israel; and so to the "red" waters of the great Gulf of Arabia. The flotilla has done its work: the Canal has been opened; and the distance by water to India is now 8,000 miles, instead of the 15,000 miles by the old route round the Cape of Good Hope.

It is a great achievement. So great, that we need not wonder that the capital of 8,000,000*l.* sterling with which it was commenced in 1859 was all expended, and as much more required, before the work was half accomplished. And perhaps we ought not to be too much overcome with pity for the 20,000 unlucky Egyptians—natives of the house of bondage—pressed every month up to the year 1863 by their paternal Government to labour, wherever required, along the line of excavations. How persistent are Oriental customs! Here we have in modern days—the days of power-looms, of steam printing-presses, and under-sea telegraphs—a touch of the old tyranny, the taskmasters and the groanings, associated in our memories with the very earliest of Egyptian history.

The length of the Canal is one hundred miles, and the depth, as the French engineers inform us, is to be everywhere twenty-eight feet, so as to admit of the passage of large vessels. It must not be supposed that an excavation of the depth above mentioned has been dug all across the Isthmus, for the level of the country is, for the most part, below that of the Mediterranean; consequently, miles of banks have been thrown up across the lowest tracts to form a channel for the water. In looking at a section of the whole route from Saïd to Suez—seventy-five miles in a direct line from sea to sea—the great extent of depression is well seen. In Lake Timsah it is about eighteen feet; in the Bitter Lakes, which stretch to a length of twenty-five miles, it is in places twenty-six feet. On the other hand, the elevations, though comparatively few, are somewhat formidable of aspect, particularly at El Guier and at Chalouf. The more this section is studied, the more forcible becomes the impression on the mind that a strait thickly studded with islands, as Behring's Strait, once separated Asia and Africa, and that by the drift from the Nile and the desert the sea has been filled up around the islands, with the exception of the lake depressions, until the present Isthmus was formed. Hence the difference of soil. The islands rising boldly up: El Guier, ten miles long, layers of sand and hard clay; Serapeum, three miles long, a kind of shelly limestone; and Chalouf, six miles long, composed of hard clay, sandstone rock, and conglomerate, the severest part of the excavation. Geologists have remarked upon the fact that the fossils found in the Chalouf ridge are identical with those of the London basin and the hill of Montmartre, whereby we learn that parts of Egypt, France, and England are of the same age.

The mountains of Abyssinia are every year diminished in size and height by the enormous periodical rains which wash down millions of cubic feet of mud and clay into the Nile. Vast clouds of sand are blown into the great river in its long course through the deserts; and these transported matters, caught by the strong current setting in from the Straits of Gibraltar, have been drifted to the eastward during immemorial ages, with consequences which are well known to those who have studied the geography and geology of the Isthmus. Such a transformation will be recognised as one of the ordinary operations of nature, when we remember that in 4,150 years the valley of the Nile has been raised eleven feet by deposits from the periodical floods, and that the land of Egypt is supposed to have been at one time a gulf stretching from the Mediterranean towards the Mountains of the Moon, but which became silted up by slow accumulations.

We may now form a clear notion of the region through



MAP AND SECTION OF THE SUEZ CANAL

which the Canal has been cut. A low, sandy shore is generally washed by a shallow sea. At Southend the pier extends for a mile and a quarter into the sea before meeting depth enough for an ordinary steamer; and the long piers at Lowestoft and other places on our eastern coast present themselves as illustrations in point. So shallow is the sea off Port Saïd, that the mouth of the harbour had to be commenced two miles from the shore, for there only did the required depth of twenty-six feet of water begin. Less than this will keep out vessels of the largest class. The western pier, the one against which the whole weight of the powerful current falls, projects more than two miles into the sea; the one to the east is half a mile shorter. These breakwaters have been built up of concrete blocks weighing twenty tons each, made on the spot from the sand dredged out of the harbour mixed with hydraulic lime brought from Marseilles. Spaces were left between the blocks to be filled up by the seadrift; but though there have been great deposits of sand and mud outside the breakwater, the filling up of the gaps has not been so speedy as was anticipated, and heaps of sand which drifted through have had to be dredged out again. Of course, while money for payment is forthcoming, any number of dredging-machines may be employed; but can that process be depended on when enthusiasm shall have evaporated, and there is nothing but the prosaic work of letting ships in or out to animate the promoters? Will it always be possible to prevent the formation of such soft banks as that on which the "Prince Consort" and the "Royal Oak" grounded on their arrival to take part in the opening of the Canal?

There is something instructive in the operations which have so diligently been carried on at the mouth of the Tyne, where a passage through the bar is essential. To maintain this passage, eighteen feet deep only, more than four million tons of sand must be dredged out every year. This has been going on for ten years or more, and the channel is not yet secure.

Not only the harbour of Port Saïd, but the greater part of the Canal itself, has been formed by dredging; and this, in soft ground or through the sludge of Lake Menzaleh, was comparatively easy work. The mud raised from the bottom was spread along each margin of the newly-scooped-out channel; but it would not stay there, and for a time the prospect of maintaining an open channel seemed as hopeless as George Stephenson's first attempt to carry the Liverpool and Manchester railway across Chat Moss. No sooner was the Menzaleh mud deposited in its new position, than it either slipped back into its former bed, or squeezed the soft soil on which it lay into the channel. The dredgers were in despair over a task in which no progress could be made, until one day one of the labourers showed that if, instead of great heaps, a thin layer of the mud were spread and left to harden in the sun, it would not slip back. So layer by layer the mud was spread, the banks were built up, and a way for the Canal was opened through such slime as was used in ancient days for the making of bricks.

In the hard ground the "bondagers" dug with pick and spade, and carried away the loosened soil in baskets. But when they were supplemented by European labourers, powerful excavating machinery was employed, and the line of works presented as busy a spectacle as an English railway in course of construction, or the main drainage works in their progress towards Barking Creek across the Essex marshes. The slopes of the cuttings were alive with labourers and machines, by which the excavated earth was lifted and run off to a distance. The power of the digging-machines may be judged of from the fact that some of them could dig out 80,000 cubic metres of soil every month, and that on one occasion the quantity was 120,000. A dozen or two of machines working at this rate would soon make a big gap through the high grounds before them.

The lakes of water on the Isthmus may be regarded as Nature's contribution towards the success of the Canal; for in them the only labour required is to dredge a channel which will give a depth of twenty-eight feet. Moreover, they may be used as ports. This is especially the case with Lake Timsah, on the shore of which stands the newly-built town of Ismaïlia, the half-way stopping place for travellers on the Canal. Here anchored the flotilla during the progress of the opening, and the dark-skinned children of the Prophet were seen mingled with throngs of fair-complexioned Giaours in friendly rejoicings.

Ismaïlia is an important place, for it is the pumping-station of the fresh-water canal which was first made in order to supply the thousands of labourers with drink, and water for their works. On this pumping-station all the country between Lake Timsah and Port Saïd depends for its supplies of the precious element.

The hollow of the Bitter Lakes, six miles wide in the widest part, is believed to have been at one time connected with the Red Sea. The level of the water in these lakes has been brought up to that of the sea by a re-opening of the connection. In March of the present year, all preparations being complete, the water was admitted, and a great stream, pouring in from the Mediterranean and from the Red Sea, gradually rose upon the arid saline slopes of the deep and desolate basin. For some weeks the flow went on, until, as was estimated, two thousand million cubic metres of water had flowed in, and the level was established. The area of the lakes will be largely increased by this contribution from the two seas; and it will be interesting to watch whether in connection with the two canals—the salt-water and fresh-water—any modification of the climate of the Isthmus may be produced. Much has been said, too, about the loss that will take place by evaporation under the sun of Egypt: the amount is so great as to be almost incredible. This loss will have to be provided for; as also the effect of blowing sands, which will accelerate the tendency of the bottom to grow towards the surface, always observable in canals.

Up to the last moment predictions from various quarters have been heard that no big ships would ever effect the passage of the canal. But while we write these lines, telegrams from the East inform us that *L'Aigle*, the French yacht, with her Majesty the Empress on board, had got through, and was anchored in the Red Sea. From the same source we learn that the Peninsular and Oriental steamer *Delta*, drawing 15½ feet of water, had arrived at Ismaïlia from Port Saïd, but had touched ground a few times on the way. The Egyptian vessel *Lattif* attempted the passage, but for want of sufficient depth had to return; difficulties occurred with other vessels, and the banks of the Canal were much damaged. But the Khédive has invested M. de Lesseps with the Grand Cross of the Order of the Osmanli, and the Emperor Napoleon has appointed him to the rank of Grand Cross of the Legion of Honour. We may therefore hope for the best in all that appertains to the Suez Canal, and that foreigners will believe that Englishmen are too ready to admire good work to feel jealous of the energetic hearts by whom it has been accomplished.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents.*]

The Meteor of November 6th

METEORS being in season just now, all facts respecting them will, I presume, be acceptable. The public have lately been treated to a great number of letters in newspapers descriptive of the remarkable meteor of Saturday, November 6th—perhaps I should rather say *a* instead of *the* remarkable meteor, because, from the discrepancies as to the time of the appearance and the differences in the description, I am inclined to believe that more than one meteor of unusual splendour was seen on that evening. I need hardly say how important it is to have observations of the visual direction of these bodies as viewed from stations widely separated from each other, because it is only observations of this kind which can afford data for judging of the distance of a meteor. In the hope of contributing information which may assist in clearing up this interesting question, I venture to add another letter to the many which have already appeared.

At five minutes before seven on Saturday evening, November 6th, while walking with my back towards the south, near the village of Rothbury in Northumberland, I was startled by a brilliant light behind me, and on turning I saw a magnificent meteor descending from the eastward at an angle of about 45° to the southern horizon. Its colour was a bluish-white, and it left a train which looked exactly like that of a large rocket, but which did not remain visible to my view for more than about fifteen seconds. The meteor did not appear to me to burst, although pieces seemed to separate from it before it expired. At the moment of extinction it was about 12° or 14° above the horizon, and its direction was then S.S.W. I am quite sure as to the time of the occurrence to within a minute, because, although I could not see to read my watch at the moment—a chronometer on which I can depend, and which I know was right—I hastened to the nearest light, about four hundred yards distant, where I ascertained that the time was one minute to seven, which, allowing about four minutes for walking the four hundred yards, would make the time of the appearance five minutes to seven. So far as I have seen, there is but one describer of this meteor whose record of the time exactly agrees with mine, and as it is incredible that two such unusual meteors should occur in the same minute, it is almost absolutely certain that he and I saw the same. My co-observer was the writer of a letter in the *Times*, signed J. A. Cayley, dated from the neighbourhood of Bristol, where he witnessed the phenomenon at a distance of two hundred and sixty miles from where I saw it in Northumberland. As viewed by him, it appeared to descend from the zenith to about 20° above the *western* horizon, while I, as already stated, saw it in the *south*. His description of the meteor differs from mine only in regard to the train, which is described as continuing visible to him for fifteen minutes, a difference which may be attributed to its being nearer and more overhead to him than to me.

I will not hazard even an approximate calculation of distance from the data I have given, but I confess my inability to reconcile the different angles under which this object was seen at opposite ends of a base-line having Bristol at one end and Rothbury at the other, with the supposition that its height did not exceed that which is ordinarily assigned to the atmosphere. At all events, if the atmosphere exists at the height of this meteor, it will be more attenuated than in the exhausted receiver of the most perfect air-pump, and it is difficult to conceive how air so rarefied can so oppose the flight of a solid body as to produce the intense ignition exhibited in a meteor. Yet it seems impossible to attribute the incandescence of these bodies to any other cause than the resistance opposed by the atmosphere to their prodigious velocity.

W. G. ARMSTRONG

Newcastle-on-Tyne, Nov. 22, 1869

Lectures to Ladies

No one can appreciate more heartily than I do the excellent article on "Lectures to Ladies" which appeared in NATURE No. II.; but I feel far from sanguine of success attending the efforts there referred to. If we put aside the impulse of dilettantism and the spirit of rivalry as against men, there will, let us hope, be left a very fair residue in the shape of love of learning, for learning's sake, as a reason for attendance; and it is only this pure love of learning which can make such lectures in the long run successful. It cannot, however, be such a love which brings to the lectures of the University College Professors, Lady Barbara, who sneers aloud when the lecturer wisely lays a sure foundation of elementary facts and ideas; or which carries to South Kensington the Hon. Miss Henrietta, who tosses her head when she finds the great Mr. Huxley paddling about in that common river the Thames, and treating his audience as if they were little girls at the Finsbury Institution.

I very much fear that the Lady Barbaras of the present generation are beyond redemption, and that many earnest men are wasting their strength in trying to win the minds of intellectual coquettes.

There is an order of women, however, having in their number, as I know full well, some of the brightest and best of the women of England, to whom such lectures would be as manna in the wilderness. To women struggling, as many of us are, to get their daily bread by the hard task of teaching, and in the struggle getting glimpses of the sweetness and the light of real knowledge, the chance of listening to real teachers would be an inestimable boon. These are the women to whom, it must be remembered, the early training of many children is entrusted; and if our children are to be properly trained, the teachers must first of all be faithfully taught.

Nearly all these women are practically shut out from the lectures both at South Kensington and University College, because none of the lectures are given in the evening.

At University College they don't pretend to care for such an audience. At South Kensington something is said about those engaged in teaching: a mere mockery; for how can any one who is hard at work all day go to a lecture in the forenoon? I trust, Sir, you will use your already powerful voice in urging, especially on our scientific teachers, the—to me it seems—great duty before them to help those who need and cry for help the most.

M.

NOTES

THE three annual medals of the Royal Society have been awarded thus: The Copley Medal goes to M. Regnault, one of the first among the many living French physicists and chemists: one of the Royal Medals has been conferred on Dr. Matthiessen, distinguished for his chemical and physical researches; while Sir Thomas Maclear, the Cape astronomer, with whose valuable contributions to science all are doubtless familiar, carries off the other. The medals will be presented on the 30th instant, at the annual meeting of the Society.

WE hear that Dr. Balfour Stewart, F.R.S., so well known for his many scientific researches, has resigned the appointment which he held under the Meteorological Committee. As the arrangements between the Meteorological and the Kew Committees are not well understood, we may mention that the exact appointment resigned is that of Secretary to the Committee, and Director of their Central Observatory.

ALL anxiety regarding the fate of Dr. Livingstone is, we are rejoiced to say, at an end. From a recent telegram we learn that in May last he was at Ujiji, on the east coast of Lake Tanganyika, in lat. 5° S. To this place his supplies had been sent. Burton gives the distance from the coast as 540 geographical miles, increased by the winding route pursued to 950 miles, occupying 150 days' march. It is the great mart for slaves and ivory and palm oil, and the most fertile place in that portion of Africa. The fair season lasts from May to September. While on this subject we would mention that the map which appeared in our last issue was drawn by the author of the paper, and did not emanate officially, as our expression might seem to indicate, from the Royal Geographical Society.

THE following is an extract from a letter addressed by Mr. Lyon Playfair, M.P., to the honorary secretary of the City of London Middle-class School:—"As part of your freehold I observed some inferior houses the site of which would be admirable for chemical laboratories and scientific museums in relation to commerce. I should like to see built upon this site a building suited for these purposes, open to the school during the day, and to the working classes in the evening. No boy with such advantages need leave the upper classes of the school without being able to examine the various kinds of merchandise which he will meet with in his occupations, so far, at least, as would enable him to test chemically their relative excellences, or detect their adulterations. No boy need then leave the school without having had his physical and political geography copiously illustrated by objects of natural history, in their relation to the imports and exports, upon which the prosperity of the country so largely depends. The cost and maintenance of such a building as that indicated may be estimated at a sum of from 12,000*l.* to 15,000*l.* But what would this sum be to the great London corporations, which, by their recent public meeting, have shown their anxiety to co-operate in the advancement of technical education? Abroad we see much larger sums spent in the erection of mere chemical laboratories to advance the industrial education of the people. Berlin and Bonn have recently erected them at the expense of 50,000*l.* each, and Leipsic, I understand, at a cost of about 30,000*l.* The much smaller sum that I have indicated as sufficient for your wants might be subscribed in a single day by such wealthy corporations as the Goldsmiths', Grocers', Mercers', Haberdashers', Fishmongers', Drapers', Skinners', Merchant Taylors', Clothworkers', and Salters' Companies, and others with which you must be more familiar than myself. They have expressed themselves zealous and willing, and I am sure could not engage in a more profitable expenditure." Here is a fair challenge, which we hope will be fairly met. The benefit which would result from adopting Mr. Playfair's suggestion is simply incalculable.

AT the Meeting of the French Academy of Sciences on the 15th inst., M. des Cloiseaux was elected a member of the Section of Mineralogy and Geology, in the place of the Vicomte d'Archiac.

THE volume of the Memoirs of the Royal Astronomical Society about to be issued will consist of Lieut.-Col. Tennant's Report on the Total Eclipse of the Sun of August 17-18, 1868. It will be copiously illustrated with engravings of the various phases of the Eclipse. The volume owes much to the scrupulous care with which Mr. Warren de la Rue, in the author's absence, has superintended its printing and the enlargement of the photographs.

THE American Government evince a great liberality in the encouragement they afford to scientific publications. It was thus that Dr. George Engelmann was enabled to produce the 72 exquisite plates which illustrate his paper on "The Cactaceæ of the Mexican Boundary Survey," a district which contains at least one-tenth of all the known species of cactus. There is another recent instance. Until 1867, the physical geography of the Californian peninsula may be said to have been unknown. In that year Mr. J. Ross Browne, Mr. W. M. Gabb, of the Geological Survey, and Dr. Von Lohr, of the School of Mines, Freiburg, made a scientific *reconnaissance*, with a corps of assistants, throughout the whole length of the peninsula. The account of their researches forms a valuable contribution to geographical knowledge, and will be found in Mr. Ross Browne's "Official Report on the Mineral Resources of the United States for 1868." The first correct map of the district, almost the whole of which was purchased cheap from Juarez by an American venture, the Californian Land Company, at a time when it was probable that Maximilian would be successful, was compiled from the labours of this party.

THE first meeting of the Oxford Ashmolean Society for the present Term will be held on Monday next, when a communication will be made to the society by Professor Lawson, "On the Nature of Chlorophyll, and the changes it undergoes." Mr. Heathcote Wyndham will explain also a modification of Galton's Altazimuth for Geological Surveying. Certain specimens recently added to the University collections will be exhibited at the meeting.

WE extract the following from the letter of a correspondent in Algeria:—"I was on the point of starting for Grand Kabylie, with the view of searching for ferns, &c., when one of those horrid tempests came on for which the N.W. point of the compass here is celebrated. It did great damage, and its effects at Oran were most disastrous. The magnificent new harbour recently finished there has been swept away as completely as a child's castle of cards, and, like the Temple of Jerusalem, not one stone stands on another. Great efforts were made to preserve it; the General Commanding the Provinces went down and sat before the waves in a chair, like Canute, with all the material of the engineer department, in the way of chains and tackle, around him. *Sa Grandeur* the Bishop came next, with bell, book, and candle, and blessed the sea; next came the Mahomedan Mufti with his Koran; but the waves laughed at them all, and toppled over the immense masses of concrete of which the breakwater was formed, like ninepins."

WE have received the following from our Dublin Correspondent:—The newly-appointed Professor of Geology at Trinity College, Dublin—Dr. Macalister—commenced a course of lectures on the Invertebrates last week. Referring in his introductory lecture to the researches of Pouchet, Pasteur, Massalongo, and others, on spontaneous generation, he seemed to regard the proofs of its existence as now fully established. The examination for the Natural and Experimental Moderatorship has just been concluded: the gold medals were awarded to Lloyd, West, and Wilson, and the silver medals to Colles, Tweedy, Hart, Rainsford, Abridge, and MacIvor. The subjects selected by the first gold medallist were chemistry, botany, zoology, and palæontology. The librarianship vacant by the death of the Rev. Dr. Todd has not yet been filled. The candidates are the Rev. Dr. Dickson, F.T.C.D., and the Rev. Dr. Reeves. The former is perhaps the more popular candidate, as, in spite of the high position held by Dr. Reeves as an archæologist, it is felt desirable that the librarian of so important a library should take as great if not a greater interest in modern than in ancient books. The University of Dublin has established Examinations for Women. Two examinations will be held annually, one for senior, the other for junior candidates. The examination for junior candidates will be open to all who are above 15 and under 18 years of age; the examination for senior candidates to all who are above 18 years of age. A committee, nominated by the board of Trinity College, will appoint examiners, determine the times, places, and subjects of examination, and make an annual report to the board. The senior lecturer of Trinity College will exercise a general supervision over the conduct of all the examinations. Examinations will be held at any place where a ladies' superintending committee shall be constituted, and at least twenty candidates guaranteed to present themselves. An examiner will be sent to each place, who, in conjunction with the Ladies' Committee, will arrange the details of the examination. Every candidate presenting herself for examination will be required to pay a fee of twenty shillings, together with the local fee, the amount of which is to be determined by the local committee. No class lists will be published; but, after each examination, notice of the result will be sent to the home of each candidate. Special excellence in any subject will be notified on the certificate. For a certificate of honour, superior answering in the compulsory and two optional subjects will be required. The first examination will be held at some time between the 25th of March and the 15th of April, 1870. Further information can be obtained by application to the senior lecturer, Trinity College, or to the secretaries of the ladies' local committees. No head of any educational establishment is to be a member of a Ladies' Committee.

THE Academy of Natural Sciences at Philadelphia have sent out the third part of Vol. VI. of their "Journal," a handsome imperial quarto which affords dimensions for ample illustrations. The part contains two papers—on the Distribution of Freshwater Fishes in the Alleghany Region of South Western Virginia, by Mr. E. D. Cope; and on shells, Unionidæ, Melindæ, &c., by the veteran Isaac Lea. The plates, numerous and well-executed, particularly the coloured representations of the fishes, exemplify at once the interest taken by the Academy in Natural History, and the painstaking of American artists. This large book is accompanied by the volume of "Proceedings" for 1868, in which we find papers and notices on more than fifty different subjects; and we gather from the annual report at the end of the volume, that the citizens of Philadelphia as well as the naturalists appreciate natural history, for during the year they visited the Academy's Museum to the number of 65,769 persons, and they have contributed 100,000 dollars towards the cost of a new building for the accommodation of the Academy and their collections. The library contains nearly 22,000 volumes, and, in common with the natural history collections, is continually increased by donations. Among those recently acquired were the large collections made by the Orton expedition to Equador and the Upper Amazon. We may fitly close this paragraph with a notice published by the Academy, that "the children of the late Augustus E. Jessup, wishing to carry out the intention of their father, pay to the Academy the sum of 480 dollars per annum, to be used for the support of one or more deserving poor young man or men, who may desire to devote the whole of his or their time and energies to the study of any of the Natural Sciences."

M. ELIE DE BEAUMONT has been elected vice-president of the Collége Français for the year 1869–70. M. Bastien has been appointed assistant naturalist to the chair of Pharmacy in the same institution in place of M. Pouchet.

THE chair of Geology and Mineralogy of the Faculty of Sciences at Lyons is vacant; also that of Chemical Toxicology at the École Supérieure of Paris.

OUR American friends intend holding an International Exhibition at New York in 1871.

ANOTHER edition of Hirt's Atlas of the three kingdoms of nature has been issued in commemoration of the Humboldt centenary.

BARON Claus von der Decken's Travels in East Africa has reached the third volume. The entire work, most exhaustive as it is in every particular, is expected to be complete in a year.

WE are promised shortly "the Scientific Results of a Journey in Brazil," which contain Professor L. Agassiz's observations on the natural history, and an account of Mr. F. Hart's examinations of the physical geography and geology, of the region traversed by the well-known recent exploring expedition.

A GEOGRAPHICAL congress is to be held at Anvers, in August, 1870.

WE believe that Mr. Charles Hamilton, well-known as the author of a work on Hunting in Southern Africa, and by his travels in Brazil, is about to undertake a scientific exploration of the Red River, and some of the Hudson Bay settlements, with a view to promote our knowledge of the zoology of the district.

WE have received from Mr. Browning four stereograms of the planet Mars; a chart of Mars on Mercator's projection; and descriptive remarks on the stereograms by Mr. Proctor—and very interesting they all are. We are glad that Mr. Proctor, who seems determined to become the chartographer of astronomy, has taken Mars under his wing, and with Mr. Browning's aid, has brought a discussion of all the observations of modern astronomers—the lamented Dawes being first and foremost among them—to such a beautiful and practical ending.

THE third fasciculus of the second volume of the "Archives du Musée Teyler" has just been published at Haarlem, in the same handsome style as the former parts. It contains papers, all by Dr. Van der Willigen, on subjects of much importance at present in optical and chemical science, as may be seen in the following list:—Sur la réfraction du quartz et du spath d'Islande; Sur la réfraction et la dispersion du flint-glass et du crown-glass; Les indices de réfraction des mélanges d'alcool et d'eau, et des mélanges de glycérine et d'eau; Les indices de réfraction de la benzine; Les indices de réfraction des dissolutions des chlorures de calcium, de sodium, d'ammonium, et de zinc, &c. Many of the results are given in a tabulated form which facilitates reference.

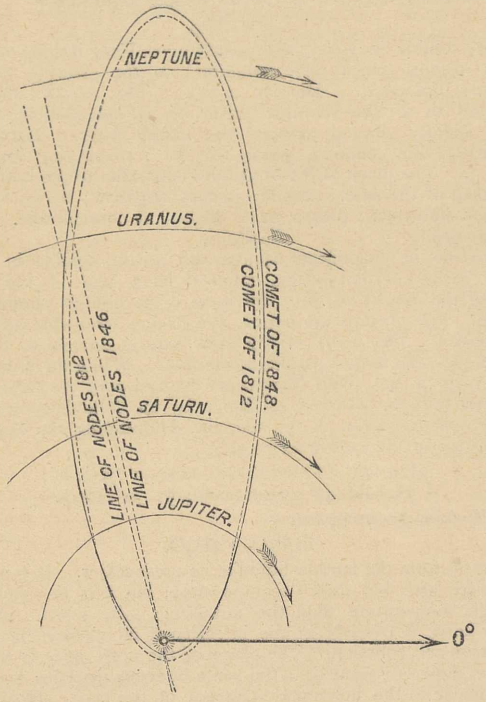
WE understand that Mr. B. Loewy, well known from his connection with the Kew sun-observations, is engaged in publishing a collection of problems in physical science, with their solutions, which will embrace all branches generally required for the various public examinations of our Universities.

ASTRONOMY

Kirkwood on the Origin of Comets

THE recent important investigations of Hoek on the origin of comets may be said to have opened out quite a new field of astronomical research of the highest importance. We are glad, therefore, to lay before our readers an abstract of a continuation of the work which we owe to Professor Kirkwood, who has communicated it to *Sillimans' Journal.* Professor Kirkwood has dealt with the comets 1812, i. and 1846, iv.

The wonderful similarity of the elements of these, except in the longitude of the ascending node, is very remarkable. It is also noticeable that the longitude of the *descending* node of the latter is very nearly coincident with that of the *ascending* node of the former. These remarkable coincidences are presented to the eye in the following diagram, where the dotted ellipse represents the orbit of the comet of 1812, and the continuous curve, that of the comet of 1846.



Dr. Kirkwood remarks :—

"It is infinitely improbable that these coincidences should be accidental : they point, undoubtedly, to a common origin of the two bodies." And adds :—

"The theory of comets now generally accepted is that they enter the solar system *ab extra*, move in parabolas or hyperbolas around the sun, and, if undisturbed by the planets, pass off beyond the limits of our system to be seen no more. If in their motion, however, they approach very near any of the larger planets, their direction is changed by planetary perturbations; their orbits being sometimes transformed into ellipses. The new orbits of such bodies would pass very nearly through the points at which their greatest perturbation occurred : and accordingly we find that the aphelia of a large proportion of the periodic comets are near the orbits of the major planets. 'I admit,' says M. Hoek, 'that the orbits of comets are by nature parabolas or hyperbolas, and that in the cases when elliptical orbits are met with, these are occasioned by planetary attractions, or derive their character from the uncertainty of our observations. To allow the contrary would be to admit some comets as permanent members of our planetary system, to which they ought to have belonged since its origin, and so to assert the simultaneous birth of that system and of these comets. As for me, I attribute to these a primitive wandering character. Travelling through space they move from one star to another in order to leave it again, provided they do not meet any obstacle that may force them to remain in its vicinity. Such an obstacle was *Jupiter*, in the neighbourhood of our sun, for the comets of Lexell and Brorsen, and probably for the greater part of periodical comets; the other part of which may be indebted for their elliptical orbits to the attractions of *Saturn* and the remaining planets.

"'Generally, then, comets come to us from some star or other. The attraction of our sun modifies their orbit, as had been done already by each star through whose sphere of attraction they had passed. We can put the question if they come as single bodies or united in systems. This is the point I have undertaken to investigate. Since some time already I had felt the truth of the following thesis :—

"'*There are systems of comets in space that are broken up by the attraction of our sun, and whose members attain, as isolated bodies, the vicinity of the Earth during a course of several years.*'

"In the researches here referred to it has been shown by M. Hoek that the comets of 1860 iii., 1863 i., and 1863 vi., formed a group in space previous to their entrance into our system. The same fact has also been demonstrated in regard to other comets which need not here be specified. Now, the comets of 1812 and 1846, iv. have their aphelions very near the orbit of Neptune, and hence the original parabolas in which they moved were probably transformed into ellipses by the perturbations of that planet. Before entering the solar domain they were doubtless members of a cometary system. Passing Neptune near the same time, and at some distance from each other, their different relative positions with regard to the disturbing body may account for the slight differences in the elements of their orbits.

"*At what epoch did they enter the solar system?* The mean between the longitudes of the aphelia of the two comets is 271° 41′. Neptune had this longitude in 1775; the comet of 1812, in 1777; and that of 1846, in 1809. Now, with the known period of Neptune and the periods of the comets as determined by Encke and Peirce, we find (neglecting perturbations) that—

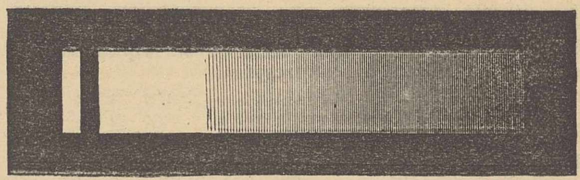
Neptune was in longitude 271° 41′ in the year 694 B.C.
The Comet of 1812 ,, ,, ,, 696 ,,
,, 1846, iv. ,, ,, ,, 696 ,,

It seems, therefore, that the three bodies were very nearly together about 695 years before the Christian era. It is consequently not improbable that the elliptical form of the two cometary orbits dates from this epoch."

BOTANY

Spectroscopic Examination of Diatoms

THE vegetable nature of the Diatomaceæ is now generally admitted, but if any further proof were needed we have it in marked results from the application of the spectroscope. Mr. H. L. Smith has been enabled to prove the absolute identity of *chlorophyll*, or the green endochrome of plants, with *diatomin*, or the olive yellow endochrome of the Diatomaceæ. The spectrum-microscope used was made by Browning, of London. Mr. Smith states that it is not at all difficult to obtain a characteristic spectrum from a living diatom, and to compare it directly with that of a desmid, or other plant. From about fifty comparisons of spectra, he concludes that the spectrum of chlorophyll is identical with that of diatomin. The spectrum in question is a characteristic one, and is figured below.



A very black, narrowish band in the extreme red, reading at the lower edge, which appears to be constant, about $\frac{7}{8}$ of Mr. Sorby's scale, is too characteristic to be mistaken. There are two other very faint bands, not easily seen, and somewhat more variable in position. The black band in the red is always present, and is remarkably constant in the position of its lower edge. In making comparisons of spectra it is of the utmost importance that the slit of the spectroscope should be absolutely in the focus of the achromatic eye lens. If this be not attended to there will be a slight parallax; and bands really identical in position, e.g., those of blood (scarlet cruorine), will not absolutely correspond when two spectra are formed, one from blood on the stage of the microscope, and the other from the same on the stage of the eye-piece.

The dark band of the chlorophyll spectrum is slightly variable in width—and the action of acids and alkalies sometimes causes a slight displacement, the former raising (moving toward the blue end) and the latter depressing. The endochrome of a diatom after treatment with acid is green, and the acid, in this case, produces scarcely any displacement of the band, which may be observed even in the dark reddish mass of the dead Diatomaceæ, almost identical in colour with the ferrous carbonate so often found in bogs where the larger diatoms are abundant; and what is more remarkable is, that the carbonate gives no absorption bands at all. As a general rule, alcoholic solutions of chlorophyll and diatomin have the band slightly depressed, reading 1 to 1½ on the interference scale.—[Amer. Jour. Sci. and Arts.]

CHEMISTRY

Thallium Salts.—I.

MM. LAMY AND DES CLOISEAUX have resumed the study of the principal thallium salts, with the view of ascertaining their chemical composition, optical properties, and crystalline form (Annales de Chimie et de Physique, xvii. 310). The method of obtaining crystals was that which M. Deville has for a considerable time been in the habit of employing in his laboratory. A given substance is placed in contact with water, or some other solvent, either in a closed or lightly covered vessel, and exposed to the usual conditions of temperature of an inhabited apartment; if these do not suffice, the liquid is heated every day for an hour to a certain extent. In course of time, even the most microscopic crystals, if submitted to this process, become large, well-formed, and transparent.

The thallium in these salts was determined as iodide; a compound which from its sparing solubility (especially in water containing a little potassic iodide), as well as on account of its great specific gravity and crystalline character, is very well adapted to the purpose. The density of thallous *sulphate*, Tl_2SO_4, is 6·603,* and its form a right rhomboidal prism, geometrically and optically isomorphous with ammonic sulphate. The crystals often appear unsymmetrical, on account of the unequal development of the different faces. The optic axes are wide apart; and the dispersion of the axes, as observed in oil, is feeble, with $\rho < \nu$. To the already known thallium *alums* may be added a mixed series, having the general formula:

$$(Al_2O_3 . Fe_2O_3)3SO_3 + (K_2O . Tl_2O)SO_3 + 24Aq.$$

Special attention is directed to one of these, which was obtained accidentally in the course of a lixiviation, and had the formula:

$$[(Al_2O_3)\tfrac{2}{3}(Fe_2O_3)\tfrac{1}{3}]3SO_3 + [(K_2O)\tfrac{3}{4}\ (Tl_2O)\tfrac{1}{4}]\ SO_3 + 24Aq.$$

Its colour is slightly yellow, and in solubility it much resembles potassic alum. After several solutions and recrystallisations, the whole of the iron is removed, and the following alum appears:

$$Al_2O_3 . 3SO_3 + [(K_2O)\tfrac{3}{4}(TlO)\tfrac{1}{4}]\ SO_3 + 24Aq.$$

Zinco-thallous sulphate—

$$Tl_2SO_4 + ZnSO_4 + 6H_2O,$$

which had already been described by Willm and Werther, belongs to the oblique rhomboidal prismatic system, and is geometrically isomorphous with ammonio-ferrous sulphate, potassic magnesio-sulphate &c. (as, indeed, Werther has shown); but it is optically different from these salts, both in orientation and in the sign of its acute bisectrix (negative).

Plane angle of the base	107° 5′ 14″
Plane angle of the lateral faces	99° 31′ 24″
Obliquity of the primitive prisms . .	106° 10′ 00″

The optic axes lie in the plane of symmetry. There is a strong proper dispersion with $\rho < \nu$. The *inclined* dispersion is weak, and only brought out by a difference in the brightness of the colours lying at the edges of the hyperbolæ of the two systems of rings. Thallous *nitrate*, $TlNO_3$, has the specific gravity 5·550, and occurs in right rhomboidal prisms of 125° 52′ (the corresponding angle for nitre is 118° 50′). The plane of the optic axes is perpendicular to the corresponding plane in potassic nitrate. The acute bisectrix is negative, and the dispersion of the axes considerable, with $\rho < \nu$. This salt had been already examined optically by Miller. In order to prepare thallous *carbonate*, (Tl_2CO_3), a saturated solution of thallous oxide in alcohol was exposed to air, in contact with a lamina of thallium. At the end of six months, very large crystals were obtained. These have an adamantine lustre, and a specific gravity 7·164; they belong to the clino-rhombic system, thus agreeing neither with plumbic, potassic, nor ammonic carbonate. Macles by hemitropy round one particular axis, are frequently observed. The plane of the optic axes is normal to the plane of symmetry, and almost exactly perpendicular to the base. The acute bisectrix is negative, and normal to the horizontal diagonal of the base; the double refraction energetic. The dispersion of the optic axes is well marked, with $\rho < \nu$; while the *horizontal* dispersion is, on the contrary, inappreciable. An attempt to prepare other thallous carbonates did not succeed.

Di-thallous *phosphate*—

$$2[Tl_2HPO_4] . H_2O,$$

is a very soluble salt, anhydrous at 200°, and crystallises in the rhombic system. Lustre vitreous. The dispersion of the optic axes is strong, with $\rho > \nu$. *Mono*-thallous *phosphate*—

$$TlH_2PO_4,$$

is very soluble in water, and readily crystallises in long voluminous needles which were submitted to the growing process already described. Density 4·723. The crystals may be referred to a clino-rhombic prism of 34° 59′, having a base only slightly sloping towards the lateral faces. Macles by hemitropy are common, giving rise to a re-entering angle of 176° 32′. The plane of the optic axes is parallel to the horizontal diagonal of the base. Acute bisectrix negative; horizontal dispersion indistinct; proper axial dispersion considerable. The *pyrophosphate*— $Tl_4P_2O_7$, crystallises in magnificent transparent prisms, soluble in water with partial decomposition, softened by a heat of 120°, and having the density 6·786. Its form is an oblique rhomboidal prism. The crystals are fragile, and have a somewhat adamantine lustre. The plane of the optic axes is normal to that of symmetry, and almost parallel to the base. While the horizontal dispersion is but slight, the proper dispersion of the axes is the greatest hitherto observed, as shown by the following means of measurements taken in oil and air, determining the apparent separation of the axes in air at 24°:

$$2E = 125° 48′ \text{ (red rays)};\ 112° 30′ \text{ (yellow)};$$
$$2E = 89° 47′ \text{ (green rays)};\ 52° 34′ \text{ (blue)}.$$

The *hydrous pyrophosphate*—

$$Tl_4P_2O_7 + 2H_2O,$$

separates from the mother-liquid of its predecessor. It is soluble in water with but little decomposition; but it is less stable at a high temperature than the anhydrous salt, which, on the other hand, it exceeds in the intensity of its vitreous lustre, its hardness and cohesion. The plane of the optic axes is normal to the plane of symmetry: the acute bisectrix negative and perpendicular to the horizontal diagonal of the base. Horizontal dispersion feeble; proper dispersion of the axes considerable, with $\rho < \nu$. The *ammoniacal thallous phosphate*—

$$3NH_3 . H_3PO_4 + 2NH_3 . H_2TlPO_4$$

is obtained by adding ammonia to the common phosphate, filtering to remove tri-thallous phosphate, and evaporating the mother-liquid. The crystals are very soluble in water, and completely isomorphous with ammonic phosphate. Their figure is that of a right prism with square base, elongated in the direction of the vertical axis, and terminated by an octohedron of 119° 50′. The double refraction is on a negative axis.

E. J. M.

* The temperature in this and following determinations is not given in the memoir.

PHYSICS

Pfaundler on the Regelation of Ice

THE fact observed by Faraday that two pieces of ice freeze together when brought into contact has met with various explanations. Helmholtz, for example, assumes that pressure is always at work in regelation; hence depression of the fusion point of the ice, and a cold sufficient to freeze a small portion of water in another part of the mass. Tyndall, on the other hand, admits the hypothesis of pressure only where it is actually observable; but, in other cases, explains the phenomena by a difference between the fusion-point inside and at the surface of the ice. Schultz has actually verified Tyndall's theory with water from which the air had been expelled.

Pfaundler has recently reconsidered this subject, and states the question as follows :—" Can a piece of ice, surrounded by water at 0°, preserve its shape if the water undergo no disturbance ?" So far as we know at present, both weight and figure remain unchanged. Either, then, a part of the ice must melt, or a part of the water freeze, or both of these phenomena happen together. Such alterations involve certain mutations of the amount of heat contained in the surrounding water, or, at least, of the equilibrium of temperature in different parts of the liquid. Now, Clausius's researches into the constitution of liquids show that, in the case of individual molecules, such an equilibrium does not exist. Moreover, the conditions of molecular movement at the free surface of the ice are evidently different from those that are within. Hence, the piece of ice must grow, in certain places and in certain directions, at the expense of other of its parts; the increment at one spot corresponding to the decrement at a different one. Two pieces of ice in contact, or even in close proximity, are therefore likely to freeze together.

By freezing water in a flask under a pressure of a decimetre of mercury, solidification was invariably promoted; and it not unfrequently took place in a direction which was definitely related to what may be called a great circle of the flask.

Pressure, however, is not the only source of regelation. According to the author's theory, the phenomenon may result from any *molecular* disturbance.

PHYSIOLOGY

Coagulation of Blood

PROF. MANTEGAZZA cuts the Gordian knot of the cause of the coagulation of the blood, by attributing it to an action of the white corpuscles of the blood. Admitting Schmidt's theory of fibrin being the product of fibrinoplastin and fibrinogen, he puts forward the idea that normal plasma of the blood contains fibrinogen only, but that the white corpuscles have the power, when irritated, of emitting, or we might almost say secreting, fibrinoplastin, and thus of causing coagulation. The shedding of blood, any contact with foreign substances, are causes of irritation to the white blood corpuscles, and hence these things become in turn causes of coagulation. In support of this theory he insists on the complete coincidence of the power of coagulation with the presence of white blood (or lymph) corpuscles; and on the fibrinoplastic properties of tissues, such as cornea, &c., which abound in cells similar at least in nature to white blood corpuscles.—(Ann. di Chim., July 1869.)

THE *Journal of Anatomy and Physiology*, No. 5, November 1869, contains many valuable papers, *e. g.* on the Muscles of the Limbs of the Anteater, &c., by Professor Humphry; on the Movements of the Chest, by Dr. Arthur Ransome; on the Chemical Composition of the Nuclei of Blood Corpuscles, by Dr. Brunton; an abstract of Mr. E. Ray Lankester's Report on the Spectroscopic Examination of Animal Substances; and a long paper by Dr. T. A. Carter, on the Distal Communication of the Blood-vessels with the Lymphatics. The abstracts of Anatomy and Physiology are still continued with the completeness, accuracy, and critical intelligence which render them the best things of the kind to be found anywhere. Dr. Moore, the indefatigable translator from Dutch and other unusual tongues, supplies a translation of a very interesting paper by Engelmann, on the Periodical Development of Gas in the Protoplasm of Living Arcellæ. We may congratulate ourselves on the fact that the journal is able to make its way, in spite of the difficulties with which in this country Anatomy and Physiology have to contend.

SOCIETIES AND ACADEMIES

LONDON

Royal Geographical Society, November 22.—Sir Roderick Murchison in the chair. A paper was read detailing the results of an exploration of the new course of the Hoang-Ho, or Yellow River, made in 1868, by Mr. Elias, a young merchant of Shanghai, illustrated by a map, the positions in which had been carefully laid down from observations taken by that gentleman. The Chinese records, which are very copious in relation to this turbulent river, mention nine changes of its course, dating from 602 B.C. to the last in 1853, during which its outlet has shifted from 34° to 40° north latitude, the present being the former mouth of the river Tsa-Tsing, in the Gulf of Pecheli. The gradual elevation of the bed of the river caused the waters to press against the upper portion of the embankments, and as neither the dykes were raised, nor the bed deepened, the waters effected a breach in 1851, which was enlarged in the following year, till in 1853 the whole stream flowed through the mile-wide breach, in a north and east direction, leaving the old course dry. From this breach at Lung-Menkau, the river flowed in an ancient bed for 52 miles, but from that point a tract 96 miles long was inundated to a width of 15 miles. Ruined houses, broken bridges in the midst of the waters, and the remains of the banks of two canals forming the northern and southern channels, and here and there vast stretches of mud—were all that told of a once fertile and populous district. The deserted houses were in many cases silted up to the eaves by the alluvial deposit. In the dry season fifteen inches of water were scarcely found in some places. At Yushan the waters converged into the bed of the former river, Tsa-Tsing, now usurped by the Yellow River. The Grand Canal crossed this flooded district, but its banks have been carried away and its communication to the north destroyed. Proceeding down, a broken bridge of seventy arches obstructed the stream it could not span. For 150 miles a fertile and garden-like country was passed through, to which succeeded a barren treeless waste, except for the belt adjoining the river, which was fertile and cultivated; the ground, however, even with the growing crops, and in one place the town wall, was undermined and carried away piecemeal by the encroaching river. A barren, marshy tract of reeds, tenanted by wildfowl, extended for about twenty miles from the sea. This change of course, has, it is said, cost the Chinese Empire fifty to sixty millions of its population, the country lying on the old course having been ruined by the drying up of the river, and that in the new by the floods. The new course is unfit for navigation. Vessels drawing six feet of water might cross the bar, and proceed with difficulty to Yushan, but none beyond.—Captain Sherard Osborn remarked that in 1818 the Chinese Censors had called the Imperial attention to the impossibility of effectually controlling the Yellow River; although the expense of the maintenance of the dykes had been quintupled. The maladministration which had resulted in this calamitous change could not, therefore, be chargeable to British interference with China. British engineers, if employed, would soon restrain the Hoang-Ho within due bounds, and utilise its waters for navigation and irrigation. The Chinese water-systems were beginning to be better known, and he hoped that the Upper Yangtse would soon be opened to our steamers, for every forward footstep of Englishmen would, he believed, be a blessing to China.—Mr. Wylie, the first Englishman who saw the results of the diversion of the river from its course, gave an account of his crossing the river bed, then become a sandy highroad covered with passengers, and some particulars of a journey made by him to the sources of the Han River, in which he identified the pass described by Marco Polo as the White Horse Pass.

Royal Asiatic Society, November 15.—This was the first meeting of the Society after the recess. Mr. W. E. Frere occupied the chair. A paper was read containing an Account of the Bheel Tribes of the Vindhya and Satpura Ranges, by Lieut. J. Waterhouse. The writer starts from a popular tradition among those tribes, according to which the originator of the Bheel race is said to have been a vicious and deformed son of Mahadeva, who, on account of his having killed his father's favourite bull, was sent off to the jungle and uninhabited wastes, and told to cultivate where he chose. From this tradition, combined with the well-known legend of the Mahabharata and Shrî Bhagavata, by which the Nishadas are said to have descended from the Rajput king Vena, Mr. Waterhouse concludes that the Bheels had originally been settled in Judhpur and Marvar, but being driven thence by Rajputs, they emigrated southwards and established themselves in the mountains of Malwa and Candeish, in the Vindhya and Satpura ranges, and on the rugged banks of the Nerbudda and Tapti, where, protected by the natural conditions of the country, they had since dwelt, subsisting partly on their own industry, but mainly by inroads into the surrounding plains. Moreover, it was stated in the history of the princes of Judhpur and Oodeypur, that the Rajputs originally conquered their country from the Bheels. These are then divided by the writer into three classes—the Village, the Cultivating, and the Mountain Bheels. The first are said to consist of a few only, who, being scattered over the villages on the plains, were generally considered as honest and trustworthy, and often employed as the watchmen of their villages. The Cultivating Bheels continued to live peacefully in hamlets under the rule of their Turwees, though still preserving traces of a ruder and wilder state, such as was prevalent among the Mountain Bheels, who, owing to the difficult nature of the places inhabited by them, had never been altogether subdued, and subsisted only by plunder. Notwithstanding these distinctions the Bheels were one people, and their different tribes intermarried, though with certain restrictions. Polygamy was the rule with them, and it was by no means uncommon to find men with four or five wives. Many children were born, but a large portion died young, owing perhaps, in a great measure, to the malaria in the jungles, where fever and diseases of the spleen were common. The writer then proceeds to give a brief description of their dress and arms, their language and some of their customs. The Bheels are said to be very vindictive and to keep up feuds for many years, sometimes for generations. "Blood for blood" is their general maxim. The life of a man can, however, be made good to his relatives by payment in kind or money of 120 rupees, or of a woman of 60 rupees. In each community the head Bheel is called Turwee. His office is hereditary, and the police arrangements of the village are carried out by him. On the succession of any of the Rajput chiefs it is considered essential the head Bheel Turwee should make a mark with his blood on the forehead of the chief, without which ceremony no succession is considered complete. By the Rajputs intermarrying with the Bheel women, a race results called Bheelalahs, to which most of the chiefs of the Vindhya Bheels belong. In consequence of their descent from the Rajput conquerors they obtain superior rank and authority among the Bheels, though, as is generally the result of a blending of different races, they seem to combine the viciousness and roguery of the subdued Bheels with the arrogance and haughty bearing of the conquering Rajput. The reading of Mr. Waterhouse's paper was followed by a lively discussion, in which several of the members present took part, who, from a residence in the places occupied by the tribes in question, were able to supply some new and interesting particulars with regard to their dialect and manners. It was then announced by the chairman that the next meeting would be held on Monday the 29th inst.

Royal Horticultural Society. *Scientific Committee*, Nov. 16.—Mr. W. W. Saunders, F.R.S., in the chair. The Rev. M. J. Berkeley exhibited some walnuts, in which the outer rind was completely blackened and shrivelled by frost, the nut in the interior being unaffected. Mr. Glaisher remarked that during winter the temperature of the atmosphere was usually considerably warmer at a level of 20—50ft. above the surface than at a lower altitude. He expressed his opinion that the peculiar appearances presented by the walnuts were due rather to dryness of the atmosphere than to actual frost. Prof. Ansted called attention to the effect of wind in blackening the leaves on one side of a tree, while on the unexposed side they retained their green colour. The chairman stated that an illustration of this fact might recently have been seen in Somersetshire, where the trees for a distance of thirty miles or more were thus affected. Mr. A. Murray then alluded to a peculiar beetle preying on the foliage of orchids introduced from widely diverse countries, and pointed out many interesting facts. Dr. Masters, who spoke on the part of the sub-committee appointed to watch the progress of the plants in the experimental ground at Chiswick, exhibited a series of diagrams, showing in a graphic form the relative degrees of vigour exhibited by the plants at the various dates of observation, and the fluctuations in the intervals between them. Similar tables had been prepared, showing the amount of heat and rainfall during the entire period of observation, and the fluctuations in the intervals between each separate observation. The most striking results shown in the diagrams were as follows:—In almost every case the plants in the unmanured boxes were the least vigorous. The application of purely mineral manures was productive of little or no result in the case of the grasses, but was much more effective in promoting vigour in the case of the clovers. A striking contrast was exhibited in the case of almost all the twelve separate kinds of plants treated with ammonia salts, or with nitrate of soda respectively. It was shown in Dr. Masters' tables that almost invariably when the plants treated with ammonia salts manifested an increased degree of vigour, those treated with nitrate of soda showed a corresponding decrease. These contrasted fluctuations occurred at a time when the weather tables showed a high rainfall and a decreased temperature. Similar antagonistic results, but manifesting themselves at a later period, when the temperature was higher and the rainfall less, prevailed to a less extent in the boxes manured with a combination of mineral manures and nitrate of soda, and of mineral manures and ammonia respectively. Dr. Gilbert remarked that the experiments, as conducted this year, were serviceable rather as indications of what to avoid in the coming year, than for any immediate use at present. The soil made use of was too fertile, and in consequence the plants made undue growth. The contrasting conditions alluded to by Dr. Masters probably depended on variations in the relative power of diffusion of the several salts, and the range of the roots. Nitrate of soda was distributed with great rapidity. The ammonia salts were converted into nitrates before absorption by the plant, and were thus distributed at a lower depth. Dr. Voelcker corroborated Dr. Gilbert as to the necessity of caution in drawing general inferences from this season's experiments, and advised that in future the plants should be grown in pots, so as to be more under control, and less subject to disturbing influences. Mr. Glaisher alluded to the effects produced by the roots of plants in increasing the temperature of the soil, and suggested that a thermometer should be inserted into each of the seventy-two boxes. These thermometers, moreover, should be made with great care, and the mercury in all should be derived from the same source, so as to secure uniformity of expansion.—A report from Mr. Barron, on various experiments that have been carried on as to grafting on various stocks, was then read. The results had been very varied, and were of a very interesting character. In those cases where failure had resulted, the want of success was attributed to one or more of the following causes:—Imperfection in the mode of operating; the too advanced condition of the stocks or of the buds before the operation; the want of correspondence in point of time between the growth of stock and scion, &c. This report will be published *in extenso*.—A communication from Mr. Barber, forwarded by Dr. Hooker, relating to the culture of Aloes, was then read. The Chairman remarked that the rocky nature of the country in which Aloes grew was serviceable in preventing excessive or long-continued moisture. He had ascertained from Mr. Cooper that many of the Haworthias grew naturally closely environed by herbage, and that when this was eaten by the sheep the plants became unduly exposed to the sun, and died in consequence; hence the sheep were only indirectly injurious (not directly, as Mr. Barber had stated) by removing the herbage. Mr. Saunders in practice substituted a fold of thin paper or muslin for the grass, and thus tempered the light, to the great advantage of the plants.—A report from Mr. Moore on the experiments carried out at Chiswick with various chemical manures on variegated zonal and other *Pelargoniums*, with a view to ascertain the effect of the manures on the colouration of the leaves and the production of flowers, was then read.—A lengthy communication on the cultivation of Tea, by Mr. McPherson, was laid on the table, on which the secretary was instructed to report to a future meeting.—Dr. Masters exhibited, on the part of Mr. D. T. Fish, a sample of soil in which there was a thin layer of lime about six inches below the surface. This had evidently been put on as a top-dressing. Mr. Fish attributed the position of the lime beneath the surface to an annual superposition of a layer of carbonaceous matter on the surface, and to the decomposition of the roots. He advanced this view in opposition to that of Mr. Darwin, who attributes similar effects to the agency of worms. Dr. Voelcker remarked that lime so applied was always washed down gradually in the manner described.

Ethnological Society, Nov. 23.—Prof. Huxley, F.R.S., President, in the chair.—Dr. G. W. Leitner gave an account of his visit in 1866 to Ladak, Little Tibet, Kashmere, and the unvisited country of Ghilghit. He succeeded, by a new route crossing the Shingun and Maraug, in reaching Ladak six weeks before the usual passes were open. The Abbot of Pugdal—the Buddhist monastery where Csoma de Körös spent five years—agreed with him to secure the safe passage of any English or Hungarian traveller to Lassa; offering to give a near relative of his own as hostage for the safety of the visitor. The Punjab Government having commissioned him to obtain information respecting the Chilasi people, with a view of tracing a connection between them and the Darada, and the Hindu Olympus, the Kaylas, he crossed the frontier and penetrated into Ghilghit, four marches beyond any previous European travellers. Out of fifty, only two of his followers accompanied him to the country of the dreaded Dards. Dr. Leitner gave an account of the legends of this people, whom he judges to be a remnant of the most ancient Aryan stock, speaking a highly inflexional and perfect, though unwritten language, and preserving ancient mythologies and traditions of their origin. A singular exception to the Dard dialects is found in the Khajuna spoken by the Hunza people—the robbers of Kunjut—and Nagyr, which is like no other known language. Dr. Leitner has brought a large collection of Thibetan and Dard curiosities, and an intelligent Yarkandi, who as soldier and trader has traversed nearly all Eastern Turkistan: it is to be hoped that he may be given, during his stay in England, opportunities of learning something of our manufactures and commerce, so that he may carry back to Yarkand a good report of English power, and, we will add, of English hospitality and friendship, which will assuredly bear good fruit in the future conduct of the Yarkandis, who are already well disposed to receive and trade with our countrymen.

Entomological Society, November 15.—Mr. H. W. Bates, President, in the chair. The following gentlemen were elected: Messrs. French and Websdale as members; and Messrs. Barnes, Brown, E. M. Janson, O. E. Janson, Pearson, and Robinson, as subscribers. Exhibitions of insects were made by Messrs. F. Smith, Pascoe, Briggs, Davis, and Salvin; and the discussion which ensued thereon was participated in by the President, Messrs. Westwood, Wallace, Müller, Weir, Janson, McLachlan, Eaton, Wormald, Horne, Verrall, and Dunning. The following papers were read:—"New Genera and Species of *Coleoptera* from Chontales, Nicaragua," by the President. "Description of New Genera and Species of *Hispidæ;* with notes on some previously-described species," by Mr. J. S. Baly. "A Synopsis of the Genus *Clothilda*," by Mr. Osbert Salvin.

Statistical Society, November 16.—A large body of Fellows assembled to hear the President, Mr. W. Newmarch, F.R.S., deliver his inaugural address, in which he reviewed the progress that had been made in statistical science since the foundation of the Society in 1834. He pointed out that at that time, with perhaps two or three partial exceptions, foreign Governments and Legislatures had not arrived at even the faintest notion of the desirableness of systematic statistical evidence, but that during the last twenty-five years this state of things had almost disappeared, and in several foreign states there were now in full activity statistical departments, and a vigour of statistical research by independent persons, that almost reduced the United Kingdom to a second place. Having enumerated the branches of inquiry in which this country had made most decisive and gratifying progress during the last thirty-five years, he stated that the following fields of statistical research seemed to him to require early attention:—1. The annual consumption per head among different classes, and by the nation as a whole, of the chief articles of food—corn, butchers' meat, tea, coffee, sugar, tobacco, wine, spirits, and beer. 2. The annual production in agriculture, minerals, metals, ships, and manufactures. 3. The comparative wages, house-rent, and cost of living in different parts of the country. 4. The total annual income and earnings and the total annual accumulations of different classes, and of the country as a whole. 5. The relative taxation of different classes in this country, as compared with the same classes in those foreign countries, the competition of which England has to understand and meet—carefully attending in the inquiry to the comparative merits of direct and indirect taxation. 6. The financial and economical cost and burdens entailed by extensive warlike armaments. 7. Periodical statistics of public hospitals in the metropolis and larger towns, with a view to the comparison of the efficiency and cost of the relief afforded in each. 8. Periodical returns of the income and operations of charitable trusts and endowments, for relief and education. 9. A statistical ascertainment of the numerical strength of the different religious churches and sects. 10. Statistical evidence of the cost to the community in sickness, excessive mortality, and poor-rate expenditure of defective dwellings, and sanitary regulations. 11. Statistical evidence of the gain to the community of instruction in popular schools in the rudiments of political economy, in the commoner industrial arts, and in military exercises. 12. Statistical evidence of the consequences in this country of the emigration from it. 13. Investigations relative to the advantages and cost to this country of the occupation of India. 14. An investigation on grounds of fact of the effect of commercial treaties, especially of the French Treaty of 1860. 15. A similar investigation of the consequences produced in the United States by the rigid system of protective tariffs. 16. And by the protracted suspension of specie payments. 17. Statistical inquiries relative to the effects produced in Europe on commerce, accumulation, invention, prices, and the rate of interest, by the gold discoveries in California and Australia. 18. Investigations of the mathematics and logic of statistical evidence; that is to say, the true construction and use of averages, the deduction of probabilities, the exclusion of superfluous integers, and the discovery of the laws of such social phenomena as can only be exhibited by a numerical notation.

DUBLIN

Royal Dublin Society, November 15.—The first meeting of the 139th session. Mr. W. Andrews read a paper on Deep-Sea Soundings. The author stated that he did not mean to refer to the deep-sea dredgings of the *Lightning* and *Porcupine*, but to some soundings of his own, extending to the moderate depths of eighty fathoms off the Blasquet Islands, on the west coast of Ireland, which were chiefly undertaken in connection with the subject of Irish fisheries. There was a rock near Dingle harbour known as the Barrack Rock to the fishermen, the position and bearings of which had never been determined, no notice of it appearing in the corrected charts of 1860. In July of the present year he had succeeded in taking its bearings and soundings; at low water and at extreme springs there are barely three fathoms covering the rock, and yet in the charts the soundings over it were marked at from 38 to 40 fathoms. The author then proceeded to notice some of the more interesting animals taken by him off the west coast of Ireland during this and other soundings; such as, *Paracyathus taxilianus* and *P. thulensis*, the animals of which he had examined [these two species were first described by Gosse, from single Scotch specimens, and the animals belonging to them were up to the present unknown]; *Eschara foliacea*, which he inclines to think is very different from the true *Millepora cervicornis*, which latter coral he took living in 39 fathoms off the little Skellig Island. [*E. foliacea* is not uncommon off the west coast of Ireland; but we suspect some strange mistake here, as *Eschara* is a well-known genus of the Polyzoa, whereas *Millepora* is almost without doubt a *Hydrozoön*, and has never yet been met with, we believe, north of a mean winter temperature of the sea of 66° F.]

Mr. W. F. Kirby read an account of a natural history excursion made to the continent of Europe in the spring of the present year, detailing his captures at Hilden, Basle, the Righi, St. Gothard, and the Val da Foin.—Mr. A. G. More read an account of an excursion, zoological and botanical, to Connemara, county Galway.—Mr. H. Grubb gave an account of a remarkable meteor seen in the heavens over Dublin between 6 and 7 o'clock, P.M., on the 6th inst.

Royal Irish Academy, November 8.—The first meeting of the present session. The council announced that Lord Talbot de Malahide had, owing to his intended sojourn abroad for the winter and spring months, sent in his resignation of the office of President; this resignation was, with regret, accepted. Of the names of those mentioned as likely to succeed to the post, that of the Earl of Dunraven would appear to be the most popular. A paper was read by Mr. G. H. Kinahan on the ruins of Ardillaun, county Galway.

The following numbers of the Transactions have been published since the session closed in July.—Mr. W. Andrews on *Ziphius Sowerbyi*. [Trans. vol. xxiv. Science, part X.]—Prof. W. King on the Histology of the Test of the class Palliobranchiata. [Trans. vol. xxiv. Science, part XI.]—John Casey, A.B., on Bicircular Quartics. [Trans. vol. xxiv. Science, part XII.]—Professor E. Perceval Wright, contributions toward a knowledge of the Flora of the Seychelles, with four plates. [Trans. vol. xxiv. Science, part XIII.]

MANCHESTER

Literary and Philosophical Society, November 2.—J. P. Joule, LL.D., F.R.S., &c., President, in the chair. William Boyd Dawkins, M.A., F.R.S., and Thomas Edward Thorpe, Ph.D., were elected ordinary members of the Society. Professor H. E. Roscoe, Ph.D., F.R.S., presented a paper on a new Chromium Oxychloride, by T. E. Thorpe, Ph.D., assistant in the laboratory of Owen's College. When chromyl dichloride, CrO_2Cl_2, prepared by heating a mixture of potassium dichromate, sodium chloride, and sulphuric acid, is maintained at a temperature of 180°—190° C. in a sealed tube for three or four hours, it is almost completely converted into a black solid substance, and on opening the tube when cold a considerable quantity of free chlorine escapes. By exhausting the tubes containing the liquid chloride before subjecting them to heat, the author ascertained that chlorine was the only gaseous product of this decomposition. The black compound invariably contained more or less of the liquid chloride which had escaped decomposition; the greater part of this was easily expelled on gently heating the mass after opening the tube. In order to free it completely from the latter body the black substance was transferred to a clean tube, and heated to 120° C. (*i.e.* about 2° above the boiling point of chromyl dichloride) in a current of dry carbonic acid gas until its weight appeared constant. A determination of the amount of chlorine contained in the volatile portion showed that it was simply chromyl dichloride which remained undecomposed. The solid substance, dried in the manner above described, appeared as a black uncrystalline powder, which, when exposed to the air, rapidly deliquesced to a dark reddish brown syrupy liquid, smelling of free chlorine. When thrown into water it quickly dissolved, forming a dark brown solution, which, on standing, also evolved chlorine. In nitric acid solution hypochlorous acid appeared to be produced. In strong hydrochloric acid the substance dissolved with a dark brown colouration, and on boiling the solution chlorine was evolved, the liquid became greenish yellow, and ultimately changed to the dark green colour, peculiar to a solution of chromium sesquioxide in hydrochloric acid. When thrown into dilute ammonia, chromic acid was dissolved, together with all the chlorine, and a precipitate was formed, possessing the properties of the chromate of chrome sesquioxide ($Cr_2O_3CrO_3$) described by Storer and Eliot. Upon this decomposition is based the method which the author employed for the estimation of the amount of chlorine contained in this body. The weighed quantity of the substance was treated with very dilute ammonia, the solution boiled for a few minutes, filtered, the precipitate well washed by hot water, an excess of nitric acid added to the filtrate, and the chlorine precipitated by the addition of silver nitrate. Two determinations of chlorine, carried out in this manner on preparations made at different times, gave 21·06 per cent. of chlorine as the mean. In order to determine the amount of chromium, a weighed portion of the substance was repeatedly heated with strong hydrochloric acid on a water-bath until the evolution of chlorine entirely ceased; the solution was then diluted with water, heated to boiling, ammonia added in slight excess, and again boiled until the supernatant liquid appeared perfectly colourless. The precipitated chrome sesquioxide was then filtered, dried, and weighed. The mean of two determinations indicated 48·91 per cent. of chromium. These results come very near to the percentage composition calculated for the empirical formula $Cr_3O_6Cl_2$. In conformity with the analytical results, the new oxychloride may be regarded as a compound of chromous chloride with two equivalents of chromium trioxide, and represented by the formula $CrCl_2 2CrO_3$, analogous to the formulæ assigned by Péligot to a series of chlorochromates. Experiment, however, led the author to believe that the constitution of his chromium chlorochromate, and of the salts described by Péligot, is not correctly represented by such formulæ, and in his paper he gives elaborate structural formulæ, which seem to him to agree better with experimental facts, and to show the relation of these compounds to chromyl dichloride.

Paris.

Academy of Sciences, November 15.—M. E. Becquerel communicated the fifth memoir of his researches upon the luminous effects resulting from the action of light upon bodies, containing his investigation of the influence of the waves of light of different refrangibilities. His paper, which is of the greatest interest and importance to physicists, describes his experiments upon the behaviour of a number of phosphorescent bodies in various parts of the spectrum. No idea of its contents could be given in a short abstract, but we shall probably revert to it on another occasion.—In a note on "The Explosions of Bolides and the Falls of Aerolites which accompany them," M. Delaunay suggested that the explosion of a bolide is caused by the pressure of the atmosphere in front of it taking advantage of any irregularities in the structure of the body, the latter being probably, in many cases, caused or increased by the influence of the great superficial heat. The same atmospheric pressure, in M. Delaunay's opinion, stops the onward motion of the detached fragments, which then fall to the ground. The black crust of the surface of aerolites was ascribed by the author to the passage of the fragments at the moment of their being detached through the compressed and heated air. General Morin remarked upon the compression of the air in front of projectiles and below falling bodies.—M. Chapelas presented a note on the meteors of November 1869, in which he stated that on the 12th and 13th of this month the number of meteors observed was—on the 12th, 6·8, and on the 13th 24·8, per hour. The maximum occurred in the early part of the night.—A notice of the partial explosion of a bolide by M. J. Silbermann was communicated. This meteor was observed on the 11th November, at 10·55 p.m., in the constellation of Ursa Major. It descended obliquely towards the horizon N.N.E. of Paris, and passed through a space of about 34°. Its trajectory, at first nearly straight, soon became undulated between the stars ψ and ω, *Ursæ Majoris;* its rapidity of movement diminished considerably, and a violent explosion took place, the apparent volume and brilliancy of the body having previously increased greatly. After the explosion it continued in a straight course for some distance. The explosion was very brilliant, and sparks were scattered in all directions. The author concluded that this explosion was only partial. M. H. Lartigues, who also observed this meteor, spoke of it as having disappeared after dividing into fifteen or twenty fragments. He described some of these as coloured, which was denied by M. Silbermann; and the latter gives the meteor a duration of at most 1¾ seconds, whilst according to M. Lartigues it was visible for four seconds.—M. H. Sainte-Claire Deville presented the correction of an error in the formulæ for calculating the co-efficients of dilatation in some of his memoirs.—M. E. J. Maumené communicated some facts observed with regard to inverted sugar. The author stated that inverted sugar consists not of equal quantities of glucose and levulose, as supposed by Dubrunfaut, but of 12·14 of the former and 87·86 of the latter. Crystals of glucosate of sodium-chloride obtained from inverted sugar, presented the same composition and primitive crystalline form as crystals obtained from diabetic sugar, but their solution effected what M. Maumené calls the *deversion* of the rotatory power in an hour and three-quarters, whilst the solution of the same compound prepared from diabetic sugar requires seven hours to produce the same effect. The author also remarked upon some other points connected with inverted sugar and the glucosate of sodium chloride.—Of two geological papers presented to the meeting, the first was by Mr. Gaston Planté on "The Lower Lignites of the Plastic Clay of the Paris Basin." The author described a section near Meudon, where the lower lignite beds had been exposed. It showed in descending order—(1) the lower beds of the *Calcaire grossier;* (2) a bed of plastic clay with a black lignitiferous vein (the upper lignite bed); (3) a red marbled clay bed; (4) a dark clay bed containing lignites (the lower lignite bed); and (5) conglomerate. The lower lignite beds furnished parts of the lower jaw of *Crocodilus depressifrons* (Blaino), and a femur belonging to the same species; two vertebræ, probably of *Coryphodon;* and the lower extremity of a bone, probably the humerus of a mammal, having the whole of the osseous tissue converted into gypsum in small crystals. The bed contained numerous coprolites of crocodiles. The subjacent conglomerate furnished numerous fossils, including teeth and fragments of crocodiles and mammals, portions of tortoises, and scales of *Lepidosteus.* The teeth of mammalia appear to indicate the genera *Coryphodon*, *Palæonictis*, and *Pachynolopyus.*—The second geological paper was by M. E. Guignet, and treated of the chemical composition and formation of the beds of the great oolite and forest marble of the Haute Marne. The author discussed the distribution of these formations and the influence exerted by their presence upon agriculture.—M. Croullerois presented a note on a "Theorem of Electro-Dynamics and the Explanation of an Electrical Phenomenon;" and M. Milne Edwards four notes on some zoological observations made in his laboratory at the Museum.—In the first of these, M. Jobert described the structure and anatomical relations of the nasal glands in birds; the second, by M. Oustalet, contained a minute description of the respiratory organs in the pupæ of dragon-flies; the third consisted of observations on the salivary glands of *Myrmecophaga tamandu*, by M. J. Chatin; and the fourth was an anatomical and zoological investigation of the species of the genus *Equus* allied to the *Hemione*, by M. George.—A letter from Mr. A. Mayer, accompanying his photographs of the late total eclipse of the sun, was communicated by M. Delaunay.—M. E. Mathieu presented a memoir on the equation with partial differences of the fourth order $\Delta \Delta u = o$, and on the equilibrium of elasticity of a solid body.—A portion of a letter from M. E. Duclaux was read, in which he announced that by exposing the eggs of silkworms to cold in August, he had caused an early development of the embryos, which were hatched in November.

—M. E. Prillieux described some experiments by which he has demonstrated that etiolated plants acquire their healthy green colour more rapidly when shaded than when exposed to the direct rays of the sun.—M. L. Colin communicated a note on the etiology of intermittent fevers, or "telluric intoxication," in which he ascribed them entirely to the toxical action of the soil, and declared that residence in large cities has a remarkable prophylactic effect.—Several other notes, of which only the titles are given, were read.

VIENNA

Imperial Academy of Sciences, October 21.—A memoir was communicated from Dr. W. F. Gintl on Ratanhine and its Compounds.—Dr. F. Steindachner presented a report on a collection of fishes made by Baron Ransonnet, at Singapore. The collection contained 60 species, some of them of particular interest, as having been previously obtained only from Japan or Eastern Africa. Four species were described as new, belonging to the genera *Platyglossus* (2), *Pseudochromis*, and *Gerres*.—A memoir, on the origin of the fatty oil in the olive, by M. C. O. Harz, was presented, in which the author states that at first this secretion does not possess the properties of a fatty oil, but its constituents are surrounded by a membrane, and therefore represent true secretion-cells, until the approach of maturity. These secretion-cells are not simple vesicles, but contain numerous daughter-cells, which, with the membrane of the mother-cell, all finally become converted into oil. The presence of the membrane is best demonstrated by treatment with Miller's Salt solution of aniline and chloriodide of zinc successively; the membrane acquires a fine dark-blue colour.—The table of meteorological and magnetical observations at the Central Observatory for the month of September was presented.

November 4.—M. F. Maly communicated a memoir entitled Theorems upon Straight Lines in Space.—Dr. Fitzinger presented the concluding part of his memoir on the cynopterine family of bats; and Dr. A. Boué made some remarks on the geography of the basins of the Drin and Vardar in North Albania and Macedonia.

November 11.—Prof. Lang communicated a memoir describing an experimental investigation of the velocity of light in quartz. Quartz, unlike other uniaxial crystals, possesses a doubly refractive power in the direction of its longitudinal axis. The author has already stated theoretically that in quartz there is no ordinary undulation, and even the extraordinary undulation changes according to a different law from that prevailing in the ordinary uniaxial crystals. His present paper contains the observational proof of this theoretical result. Dr. C. Jelineck reported upon a self-registering thermometer, constructed by M. Hipp, of Neuchâtel. Dr. F. Steindachner presented the first part of his ichthyological report upon a journey to Senegambia. It referred to the brackish-water fishes of the Senegal, and contained descriptions of 21 species, most of which are among the greatest rarities in European museums, and several of them are only known from the Guinea coast. The species belong to the families *Percidæ*, *Pristipomatidæ*, and *Carangidæ*. The author stated that *Otolithus senegalensis* is identical with *Pseudolithus typus* (Bleek.), *Pristipoma macrophthalmum* (Bleek.) with *Larimus auritus* (Cuv. and Val.), *Trachynotus myrias* and *maxillosus* with *T. goreensis* (Cuv. and Val.), and *Trachynotus goreensis* (Bleek.) with *T. ovatus* (Lin.), and that *Pristipoma Rangii* (Cuv. and Val.) is only a young form of *P. suillum* of the same authors.—Prof. Ditscheiner communicated a note upon the dispersion of the optic axes in rhombic crystals, in which he showed that both the true and the apparent angle of the optic axes may be represented by Cauchy's dispersion formula:—

$$\frac{\phi}{2} = A + B\frac{1}{\lambda^2}$$

as a function of the wave-length λ. The table of observations for the month of October, at the Imperial Central Institution for meteorology and terrestrial magnetism, was communicated.

BERLIN

German Chemical Society, November 8.—The following papers were read.—Schultsen and Nenky on the formation of Urea in the Body.—Liebreich on an Antidote against Strychnia.—Oppenheim on Iodo-bromide of Mercury.—Baeyer: Remarks on Thomsen's Criticism of Hermann's Calculation of the Heat of Combustion.—Hoffmann on some Derivatives of Sulphuretted Ureas.—Von Somaruga on Cresylopurpuric Acid.—Weidel on Sandal-wood.—Weselsky on Double Cyanides.—Thomsen (1) on the Preparation of the Hydrate of Chloral; (2) on Selenious and Selenic Acids.—Henry on Ethylated Derivatives of Alcohols and of Polyatomic Acids.—Henry on the Preparation of Pure Iodine from Iodide of Mercury.—Henry and Radzicewsky: Correction of a Former Note on Paratoluidine.—Friedel: Scientific Correspondence from Paris.—Merz and Weith on a new method of forming Triphenylated Guanidine.

PHILADELPHIA

Academy of Natural Sciences, May 4.—A paper entitled "A Review of the Species of Plethodontidæ and Desmognathidæ," by E. D. Cope, was presented for publication.—Mr. J. H. Redfield stated that on the 22nd of April, in company with Mr. C. F. Parker, he had visited Cedar Bridge, Ocean County, New Jersey, in search of *Corema Conradii*. This plant occurs in Newfoundland, on islands near Bath, Maine, at Plymouth, Cape Cod, and near Islip, Long Island, and was first discovered at Cedar Bridge by Prof. S. W. Conrad. This locality was visited by Dr. Long about 1835, and carefully indicated by him in Ann. N. Y. Lyc. Nat. Hist. iv., 83, so that there was no difficulty in finding the precise points mentioned; but Mr. Redfield was sorry that no trace of the plant could be found there; and it has doubtless been eradicated by animals or by unscrupulous collectors, or has been otherwise unable to maintain its foothold in "the struggle for existence." The vicinity also was carefully examined, but without success. The plant is said to have once existed near Pemberton Mills, New Jersey; but as that neighbourhood is now entirely under cultivation, there is no evidence that the *Corema Conradii* now exists south of Long Island. If it is again to be discovered in New Jersey, it will probably be in the wide sandy waste a few miles west of Cedar Bridge, near the boundary between Burlington and Ocean counties, where a succession of elevated ancient ocean beaches offer conditions similar to those of Cape Cod.—Prof. Cope exhibited bones and teeth of a large extinct Chinchilla of the island of Anguilla, West Indies, *Amblyrhiza inundata;* and with them teeth of a second and new species, which he called *Loxomylus longidens*. It was also allied to the Chinchillas, and of large size. They were accompanied by a shell implement of human manufacture, which was (so far as discovery in earthy matrix, the colour, &c., were evidence) of the same age as the Rodent.

May 11 and 18.—The following papers were presented for publication:—"Further notes on Microscopic Crystals"; by Isaac Lea, LL.D.—"Sexual Law in the Conifera"; by Thomas Meehan.—"An attempt to ascertain the average weight of the brain in the different races of mankind"; by Joseph Barnard Davis.

June 1.—Prof. Cope exhibited some interesting specimens of extinct reptiles; one of these was the cranium, minus a portion of the muzzle of a gavial, from the New Jersey Greensand, previously described under the name of *Thoracosaurus brinispinus*, but which this specimen demonstrated to belong to another genus, since it did not present the lachrymal foramina of the former. He applied the name *Holops* to it, and stated that he had evidence that *Crocodilus tenebrosus* Leidy, and probably *C. obscurus* L. also belonged to it. He also exhibited drawings, with measurements of portions of the limbs, of a very large Dinosaur, in the collection of Dr. Samuel Lockwood, of Keyport, Monmouth county, New Jersey. It was discovered by this gentleman in the lower cretaceous clays on the shores of Rassitan Bay. It consisted of the extremity of the tibia, with astragalus and fibula. He said it indicated the second genus of his suborder Symphypoda, and was thus allied to Compsognathus, differing in the remaining indication of suture between astragalus and tibia, which disappeared in Compsognathus. The astragalus thus entirely anchylosed was also confluent with the calcaneum, forming a continuous condyloid surface for the tibia. In an anterior projection externally, the extremity of the fibula reposed by a condyloid extremity, the shaft lapping over the outline of the tibia. This demonstrated what he had already stated, that the fibulæ of Iguanodon and Hadrasaurus had been reversed. The length of the fragment was sixteen inches, the fractured section was a transverse oval, the medullary cavity nearly filled with cancellous tissue. The transverse width of the extremity 12 in.; oblique diameter 14 in. This form he called *Ornithotarsus immanis*, and placed it between Hadrasaurus and Compsognathus. It indicated one of the most gigantic of the Dinosaurs yet discovered. He made some observations on a fine fragment of the muzzle of a large Mosasauroid, which pertained to a cranium of near five feet in length. The pterygoid bones were separated from each other, and support nine teeth, A peculiarity of physiognomy was produced by the cylindric prolongation of the premaxillary bone beyond the teeth, and a similar flat prolongation of the extremity of the dentary. He referred the species to *Macrasaurus* Owen, under the name of *M. pririger*. The specimen he stated belonged to Prof. Agassiz, who obtained it from Western Kansas, probably from the No. 3 of the Upper Cretaceous of Hayden. The following paper was presented for publication:—"Description of new Carboniferous Fossils from the United States"; by F. B. Meek and A. H. Worthen.

June 8.—The following paper was presented for publication: "On the production of Bractæ in *Larix*"; by Thos. Meehan.

June 22.—The following paper was presented for publication: "Notice of certain obscurely known species of American Birds, based on specimens in the museum of the Smithsonian Institution"; by Robert Ridgway.

June 29.—The report of the Biological and Miscroscopical Section was presented, and referred to the Publication Committee. On permission being granted, Mr. Warner spoke upon the mathematical representation of organic forms. Such limitations, he said, might seem to narrow the field of research into the physical causes of organic forms, and perhaps furnish the suggestion of a rational theory of these causes. If no other advantage were desirable from investigations of this kind, they might, he thought, be useful for description and classification. He exhibited a representation of the longitudinal section of an egg by a curve which he called the hyper-ellipse, and of the section of an embryo by another curve, which he termed a deformed lemniscate. Of the egg curve he said that it very closely resembled an ideal section of an egg, taken from a standard modern work. Of the curve representing the embryo he said that it not improbably marked the boundary of matter lying within it in a different state of temperature, density, or tension from the matter lying without. These representations were verified by the members present. The speaker expressed the intention of making these representations the subject of a future paper, in which he would give drawings and formulæ.

July 18.—Mr. Thos. Meehan presented leaves of the peach and cherry, and said it had fallen to him to point out that the leaf-blades of plants were developed in proportion as vigorous vitality was released, and that they were adherent or decurrent in proportion as vigorous vitality was thoroughly developed in the central axis or stem. By following out the same line of observation he had discovered the law which governed the production of sexes in plants, and he now wished to call attention to the operation of the same cause in the production of glands on the leaf-stalks of the peach and cherry. A careful examination of the gland-bearing variety of either of these would show that these glands were simply germs of the cellular matter which formed the leaf-blade. They might be seen in every stage of development, from dense full globes on the petioles to very small dots on the apex of the tolerably well-expanded matter, and it would be further seen that in proportion as vitality was weak were these germs and glands developed. Leaves from the shaded centre of the tree, or from shoots weak or enfeebled from any other cause, produced glandless leaves, while the stronger the shoot the stronger and more numerous were the glands or undeveloped parts. Remembering that these glands were but undeveloped leaf-blades, and that it had been previously proved by the author that plants developed these less freely in proportion to a vigorous axial or stem growth, it should necessarily follow that a weakened vitality would be indicated by an absence of glands. That this was so in the cases referred to, the weak and glandless leaves showed. The author had had a very remarkable confirmation of these recent physiological discoveries. Many varieties of peaches have no glands, and these had been found by the growers of southern Illinois, as he was informed by Dr. Hull, of Alton, in all cases to be the first to succumb to diseases or unfavourable circumstances. It was very seldom that the developments of science and untutored observations went along together, and so thoroughly accorded. To the author it was one of the most interesting facts he had met with in support of his theory, that the degree of separation of the leaf-blade from the main stems was wholly a question of vitality.—Mr. Meehan exhibited some fibre obtained from Mr. Roezel, of Vera Cruz, which was finer and stronger than that furnished by the "Ramie." Mr. Roezel obtained it from a plant which he had found in the Alleghanies, and which he believed to be a new species of Boehmeria. Mr. Meehan had, however, since found it abundantly along the Missouri River, and it proves to be only *Urtica purpurascens*, Nuttall.

EDW. D. COPE, *Corresponding Secretary*.

DIARY

THURSDAY, NOVEMBER 25.

ROYAL SOCIETY, at 8.30.—Preliminary Report of the Scientific Exploration of the Deep Sea in H.M. surveying vessel *Porcupine*, during the summer of 1869, conducted by Dr. Carpenter, V.P.R.S., Mr. J. Gwyn Jeffreys, F.R.S., and Prof. Wyville Thompson, LL.D., F.R.S. (conclusion). Spectroscopic Observations of the Sun; No. 5: J. N. Lockyer, F.R.S. Researches on Gaseous Spectra in Relation to the Physical Constitution of the Sun, Stars, and Nebulæ. Note 3: Dr. Frankland, F.R.S., and J. N. Lockyer, F.R.S. And other papers.

SOCIETY OF ANTIQUARIES, at 8.30.—Ancient British Barrows of Wiltshire and the adjacent counties: J. Thurnam, M.D., F.S.A.

ZOOLOGICAL SOCIETY, at 8.30—Notes on some Spiders and Scorpions from St. Helena, with descriptions of new Species: Rev. O. P. Cambridge. On a small collection of Birds from the Tonga Islands: Dr. O. Finsch and Dr. G. Hartlaub.

MATHEMATICAL SOCIETY, at 8.

LONDON INSTITUTION, at 7.30.—Architecture: Prof. R. Kerr.

PHILOSOPHICAL CLUB, at 6.

FRIDAY, NOVEMBER 26.

QUEKETT MICROSCOPICAL CLUB, at 8.

SATURDAY, NOVEMBER 27.

ROYAL BOTANIC SOCIETY, at 3.45.

MONDAY, NOVEMBER 29.

INSTITUTE OF BRITISH ARCHITECTS, at 8.

INSTITUTE OF ACTUARIES, at 7.—Translation by Mr. Bumsted of "Suggestions for a Law to regulate the Calculation and Investment of the Reserve in Life Assurance Companies:" Herr Hopf.

MEDICAL SOCIETY, at 8.

ROYAL ASIATIC SOCIETY, at 3.

LONDON INSTITUTION, at 4.—Elementary Physics: Prof. Guthrie.

TUESDAY, NOVEMBER 30.

ROYAL SOCIETY, at 4.—Anniversary.

INSTITUTE OF CIVIL ENGINEERS, at 8.—Renewed Discussion upon Mr. Gandard's paper on the Strength and Resistance of Materials. On the Public Works of the Province of Canterbury, New Zealand: Mr. Edwd. Dobson, Assoc. Inst. C.E.

ANTHROPOLOGICAL SOCIETY, at 8.—The Shina People (described for the first time): Dr. G. W. Leitner.

WEDNESDAY, DECEMBER 1.

PHARMACEUTICAL SOCIETY, at 8.

OBSTETRICAL SOCIETY, at 8.

THURSDAY, DECEMBER 2.

LINNEAN SOCIETY, at 8.30.

CHEMICAL SOCIETY, at 8.30.

BOOKS RECEIVED

ENGLISH.—Dictionary of Scientific Terms: Dr. Nuttall (Strahan and Co.) Dr. Buckland's Bridgwater Treatise: Geology and Mineralogy as exhibiting the Power, Wisdom, and Goodness of God, fourth edition, edited by Francis T. Buckland (Bell and Daldy).—The Development of the Idea of Chemical Composition: Prof. A. Crum Brown (Edinburgh: Edmonston and Douglas).—Country Walks of a Naturalist with his Children: Rev. W. Haughton (Groombridge and Sons).—Hereditary Genius; and Inquiry into its Laws and Consequences: Francis Galton, F.R.S. (Macmillan).—The Origin of the Seasons considered from a Geological Point of View: Samuel Mossman (Blackwood and Sons).—As regards Protoplasm in relation to Prof. Huxley's Essay on the Physical Basis of Life: James Hutchinson Stirling (Blackwood and Sons).

FOREIGN.—Manuel de Chimie Médicale et Pharmaceutique: Alfred Riche.—Des Bases Organiques, naturelles et artificielles, au point de vue chimique, physiologique et médicale: Dr. A. Lacote.—Ein Jahr auf den Sandwich-Inseln: Dr. J. Bechtinger.—Bryologia Silesiaca: Dr. Julius Milde.—Lehrbuch der Chemie: A. Geuther.—Leçons de Chimie: A. Riche.—Neue Probleme der vergleichenden Erdkunde als versuch einer Morphologie der Erdoberfläche: Oscar Peschél.—Etude sur la Physique du Globe: R. Bruck.—Die Abhängigkeit der Pflanzengestalt von Klima und Boden. (Through Williams and Norgate.)

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