THURSDAY, JULY 4, 1872

SENSATION AND SCIENCE

II.

THERE lies before us, as we write, a work of exceptionally high merit as a mere literary composition, entitled, *Ueber die Natur der Cometen, Beiträge zur Geschichte und Theorie der Erkenntniss.* Von J. C. F. Zöllner, Professor an der Universität, Leipzig. The title does all it can to indicate the sensational character of the work, which deals not alone with the nature of comets, the inferiority of British to German physicists, and the grave offence of which a German is guilty when he sees anything to admire except at home; but also with the errors of Thomas Buckle, the relations of Science to Labour and Manufacture, and the analogies of development in Languages and in Religions!

It is impossible for us in a brief article to give the reader even a general glance at the numberless sources of amusement which the work affords. We will, therefore, confine our detailed remarks to a few of the parts which have most interested us, merely premising that we cannot pretend to give anything resembling a complete analysis of the contents of this astounding volume.

The skeleton, or framework, upon which the fabric is supported, consists of some scientific papers by Zöllner, extracted from the Transactions of the Royal Society of Leipzig. Along with these are reprints of the descriptions given by Olbers and Bessel of the Comet of 1811 and Halley's Comet, with the speculations of these great astronomers as to the nature of the forces under which the various parts of a comet move, especially with regard to the supposed repulsive force exerted by the sun on the matter of the tails of all comets but the smallest, and by the heads of the large comets upon their tails.

We must not pause to criticise these speculations, else we should be treating of Science, extremely hypothetical no doubt, but still Science; whereas we have undertaken to give the reader some information about the progress of the *Sensational* in Science. But there is one remark which must be made. Prof. Zöllner is loud in his denunciations of Sir J. Herschel's remarks on comet's tails, especially where he says in his "Outlines of Astronomy," "There is beyond question some profound secret and mystery of nature concerned." On this Zöllner remarks, "Could Sir J. Herschel have foreseen what mischief his mystical comparisons about comets were to do to the brains of his countrymen he would certainly have refrained from employing them." But with marvellous consistency he shortly afterwards quotes with approval the following passage from Olbers, as far as we can see quite as strong as anything of Herschel's:—"The particles which we see glittering in the comet's tail are thus not always the same. No; incessantly from its nucleus and from its proper atmosphere new materials develop themselves, and stream off from the comet with astounding (*erstaunenswürdig*) velocity to be lost in the vast expanse of heaven."

We must confess that the perusal of the *scientific* part of Prof. Zöllner's work has not impressed us with the highest respect for his originality or even his exactitude. "Who drives fat oxen should himself be fat;" so that when we found Sir W. Thomson, Helmholtz, and Hofmann figuring everywhere among his playthings, we eagerly looked to his original paper, the kernel of the volume, for something of the very highest order of mathematical and experimental inquiry. But, alas, in vain! We found some ordinary "second-year" mathematics (not always correct) and *one* sole experimental illustration, of a ludicrously obvious case of Newton's Third Law of Motion! Any mathematical student should surely know, that it does not require profound knowledge to calculate the distribution of gas or vapour about a spherical body if the law of attraction and that connecting pressure and density be assigned. But we must again recollect that our business at present is not with science, even the feeblest, unless accompanied by sensation.

Our difficulty now lies in selecting. Hundreds of racy passages must be omitted, else we should exceed all endurable limits. For, after the nucleus of the work, comes a long and ferocious attack upon *John* (*sic*) *Tyndall's Cometen-Theorie*, which may in the natural course of events draw down on poor Zöllner a castigation he will never live to forget. In the words of Bürger, who imagined his prototype in a much less perilous position—

O Zöllner! O Zöllner! Entfleuch geschwind.

It is drawn up in heads like a catechism, and is at least as metaphysical; but we have almost enough of it in the first of these heads, which we do our best to translate as "The fountain head of scientific knowledge, and its practical signification." A perfect volley of *Continuität, Schamgefühl, Individuum, Causalität, Theorie der Erscheinung, Lust und Unlust*, &c., all in italics, fills many subsequent pages. We have not read them, save so far as to see (by a cursory examination) that Prof. Zöllner employs language no doubt intended to be bitterly sarcastic, but which is so savage as to defeat its purpose, and which would be utterly unjustifiable, even if his half-made, half-implied, accusations had any foundation in fact. Section 13 has the appalling title, "Allgemeine Ursachen abnormer Erscheinungen begründet im Zeitgeiste. Verhältniss der Wissenschaft zur Technik und Industrie." Like a true Mephistopheles the author next confesses that he is tired of this dry tone, and must bring his victim (the reader, poor wretch) into merry company, and show him how jollily one can live. Whereupon he rises into the third heaven of vapulatory eloquence about the *Hofmann-Feier zu Berlin*. This seems to have been a sort of scientific high-jinks, perfectly harmless from every point of view. But Prof. Zöllner is a realisation in the flesh of Sydney Smith's ridiculously inapt description of a Scotsman, he cannot see a joke—perhaps even the surgical operation would be thrown away upon him.

We next come to a mighty chapter, headed "Aphorismen zur Geschichte und Theorie der Erkenntniss." Here we get back again to the "trocknen Ton" and deal with *Causalität, Causalverhältniss, Lust und Unlust*, &c., more bewilderingly than before; and we find that it appears to the gifted author that "the Phenomenon of Sensation is a more fundamental fact of observation than the

Mobility of Matter." Here we confess we felt nonplussed, and as the rest of the work (pp. 321-523) seems, on a hasty glance, to be of the same sort, varied only by occasional extravagant eulogy of some philosophers and denunciation of others, we leave it unnoticed, except as regards one particular which will afterwards be referred to.

We now come to the richest part of the volume, the preface and introduction, written (as we are told) later than the rest, and therefore when the author had managed thoroughly to divest himself of all the usual amenities, as well as of regard for at least the scientific character of certain living philosophers.

From the introduction we paraphrase as follows (the passage follows some fierce remarks about Dr. Tyndall) :—

"I can assert that, when I read the addresses of Sir W. Thomson and Prof. Tait to the British Association, and when on my return to Leipzig I found on my table among the scientific novelties the German edition of their 'Natural Philosophy,' edited by Helmholtz and Wertheim (including particularly section 385), then, indeed, the appearance of my work seemed to be a *Naturprocess*; something necessary in the chain of scientific development, of which even I myself scarce knew how it had arisen, and what was my share in it. In fact, the desire to bring to light in this book what is more or less struggling to appear in German science, what is bringing out a hollow sound now from one string, anon from another; this desire, I say, has been with me to the latest scratch of my pen. I therefore doubt not that, simultaneously with mine, other heads have been working at the same problem, and perhaps in unconscious coincidence have arrived at the same solution. May then such facts ever more forcibly impress us with the conviction that the claims of personal services belong much more to the Age and to the Race than to the individual, and that no ever so clear conscious selection of means can be compared with that wonderful harmony with which Nature seeks to farther, and at the same time more surely to reach, her to us unknown ends."

To understand the bearing of the above passage, which is simply a literal assertion of

> Deutschland, Deutschland über Alles,
> Ueber Alles in der Welt,

the reader must refer to the preface, where he will find (along with much metaphysics) a war-dance over the mangled scientific reputation of Sir W. Thomson. The celebrated "moss-grown fragments from the ruins of another world" was a joke taken in earnest by many even in this country; so we can hardly blame Prof. Zöllner for falling into the trap; but why "bewachsene" instead of "bemooste" in translating the passage for thy countrymen, O Zöllner? Prof. Zöllner's remarks upon British philosophers as a class must be given in his own words :—"Allein die Speculation ist in der gegenwärtigen Entwickelungsphase der Naturwissenschaft ein so tief empfundenes Bedürfniss, dass selbst hein eut fast nur noch *inductiv* thätiges Volk, wie die Engländer, der Versuchung nicht widerstehen kann, sogar über *mathematisch-bhysikalischen Hypothesen* zu speculiren."

Then we have the old question about the discovery of Spectrum Analysis, Stokes and Balfour Stewart now coming in along with Thomson for their share of the *grêle de coups*. So severely accurate a judge as Zöllner should, however, have known that Stewart has pointed out that Kirchhoff mistook his meaning when he charged him with error as to the expression for internal radiation in terms of the refractive index. A sentence from Prof. Tait's address to Section A, last August, is used as a sort of weapon against British scientific men. Prof. Zöllner here quotes the part that suits him, leaving out altogether the portion (immediately following) which turns the charge entirely the other way.

Another indefensible style of controversy we must allude to as exhibited by our author. In the above extract from his introduction it will be noticed that he specially alludes to Section 385 of Thomson's and Tait's book. In the preface we find the following condemnation of it, which is calculated to ensure notoriety. "I venture deliberately to assert that in the whole of German physical literature there cannot be found one single text-book which, in the short space of only thirty lines, contains such a plentitude of *absolute* nonsense." It is true there is a jokelet in this (now) celebrated section, something about catching a luminous corpuscle and examining it—it forms the text for a good many severe remarks; but Prof. Zöllner goes further, and accuses the authors of the work of discourtesy to Weber, which certainly no one who understands the original or the German translation (which we have taken the trouble to consult) will find in either.

Whether Thomson and Tait, with Helmholtz and Clerk-Maxwell on their side, or Weber with the assistance of Neumann (and Zöllner), shall ultimately be found correct on a purely scientific question, it is not our present business to inquire; what we do object to is the sensational imputation of discourtesy, if not of something worse, especially when the object of this imagined insult is a venerable philosopher who will undoubtedly leave a permanent mark on the history of his time.

It would next be our task to show how heartily Helmholtz is pitched into for having sanctioned by his name the Geman translation of the work in question, and for his worthy recognition of Sir W. Thomson's scientific discoveries; but enough—Deutschland über Alles, and down with every Deutscher who sees aught to admire or to respect beyond the limits of Germany!

CONCRETE ARITHMETIC

Concrete Arithmetic; an Introduction to the Elements of the Abstract Science of Number. For young Children. By Temple Augustus Orme. (Groombridge and Sons, 1872.)

"SIR, according to the custom of this town, he is of age when he knows how to count up to twelve pence; and he shall answer in a writ of right when he is of that age."* The work before us will not only enable a pupil to do this, but further gives an excellent account of the first six processes enumerated in the old poem†:—

> Septem sunt partes, non plures, istius artis;
> Addere, subtrahere, duplareque dimidiare
> Sextaque dividere est, sed quinta est multiplicare
> Radicem extrahere pars septima dicitur esse.

* Year-book of Edward I., A.D. 1292. Salop Iter., edited by Horwood, p. 220.

† The *De Algorismo* quoted from Halliwell's "Rara Mathematica," by De Morgan, "Arithmetical Books," p. 15.

The passage from the one rule to the next is very gradual, but never tedious; there is copious explanation, but yet we think no superfluous verbiage. Every page is to the point, and marks the writer as one who has had practically to deal with the sort of young minds for whom his work is primarily if not solely intended. The book is a thoroughly rational one, though at first sight the reader may think he has stumbled by mistake upon an elaborate treatise on the subject of dominoes, for the method of teaching is based on a combination of what has been called "palpable" with written arithmetic. In actual teaching the palpable method is the one adopted. Mr. Orme's own words are, "Teachers are strongly recommended to take every available opportunity of using suitable blocks of wood to represent units, tens, hundreds, and thousands, and I should wish it to be distinctly understood that, without these blocks or some substitute for them, the subject will become too abstract to be comprehended by those for whose sole benefit this book has been compiled" (Preface, p. 4); and on p. 7 the resemblance of each diagram to a domino suggests the remark, "Learn to play at the game called dominoes; this will teach you how to tell the number of dots in a figure very quickly."

The main divisions are occupied with units, or single unpacked things; tens, or single unpacked deca-units; hundreds, or single unpacked hecto-units; and thousands, or single unpacked kilo-units. From some of the terms here employed, it might be supposed that the work treats principally of questions concerned with metres, decimetres, and other quantities, which require an acquaintance with the metric system; but this is not the case, though it is well fitted to serve as an introduction to the use of such a system. Special reference to this system is confined to two pages of "Directions," where the dimensions of a square centimetre are represented in a figure.

The following extract from the Preface will serve to show the spirit by which the writer is actuated:—"If the teacher proceeds in this way (*i.e.*, by the palpable method of using blocks) he will be amply rewarded by finding that children, not so stupid as they are often said to be, will frequently make out processes of their own for arriving at truths, having been taught to rely not on rules, but on reason; and occasionally the youngest pupil will unconsciously show his teacher how to teach. . . . . More good will arise from the introduction of a scientific method into the teaching of the ordinary subjects of education than will accrue from object lessons, or the freely-accepted dicta of men of science." In thus letting Mr. Orme speak for himself, we shall best put before our readers the object aimed at in his book—an object which he seems to us to have compassed; and as we think it is a right one, it is on this ground we venture to recommend the work to all who may be in search of a good elementary introduction to arithmetic. If they carefully follow out the advice given, and pursue the plan laid down, they will convey a sound and accurate view of the subject, and that without wearying the young student. There is good store of simple and varied exercises in this handy volume, which may readily be curtailed or enlarged, according to each individual case. The only typographical faults we have to point out occur on pp. 30, 104, and 105, and are readily corrected. We commend the book as the work of a "cunning" arithmetician. "It is pitie that commonlie more care is had, yea, and that emonges verie wise men, to finde out rather a cunnynge man for their horse, than a cunnyng man for their children."*

OUR BOOK SHELF

Contribution to the Biology and History of the Development of the Ustilagineæ. By Dr. A. Fischer von Waldheim. Translated for the Transactions of the New York State Agricultural Society for 1870. From "Pringsheim's Jahrbücher," vol. ii. part 1, 2, 1869. (Albany, New York: 1872.)

THE section of Fungi to which the Ustilagines belong has occupied considerable attention from mycologists during the past quarter of a century. Old notions of the autonomy of species have been dispersed, and at the present time all the old genera are suspected, some are condemned, and not a few amalgamated. The present condition of the classification of the Uredinous Coniomycetes is eminently transitional; so much has been written, so many observations made that await confirmation, or require further researches to render the work complete, that no one would be rash enough to predict what another twenty years may accomplish towards settling the relations of the genera in this group to each other. From the vague notions and doubts of Unger's "Exantheme" in 1833, Leveille's researches in 1839, Tulasne's first memoir in 1847, De Bary's "Brandpilze" in 1853, Tulasne's second memoir in 1854, there has been a regular advance in the accumulation of observations and the record of facts up to the publication of Fischer von Waldheim's communication in 1869. The relations of *Trichobasis* to *Puccinia*, of some species of *Lecythea* to *Melampsora*, of others to *Phragmidium*, are admitted on every hand; but whether *Trichobasis*, *Puccinia*, *Uromyces*, and *Æcidium*, shall all give way to an amalgamated genus, in which the four forms shall be recognised as four conditions of the same plant, though accepted by some, cannot yet be considered as settled beyond a doubt. The more sceptical of mycologists suspend their judgment, and await the confirmation of certain observations. Whatever the result may be, there can be but one opinion that such men as Tulasne, Leveille, De Bary, and others, deserve all commendation for the work they have accomplished. Whilst the Uredines Proper have suffered greatly in the stability of their generic distinctions, the Ustilaginous group has at present maintained its character for the autonomy of its species. Up to the present *Tilletia*, *Ustilago*, *Thecaphora*, and *Urocystis*, seem to represent comparatively stable genera. It is not impossible that this is more *seeming* than *real*, and that future workers may reveal affinities more close than as yet are suspected. The "contribution" of Fischer von Waldheim dates as far back as 1869, although now presented for the first time in an English dress, and we have to thank our Transatlantic cousins for having accomplished this fact. The New York State Agricultural Society is wise to diffuse this and all similar information amongst its members. None are more deeply interested in the development, conditions of growth, and metamorphisms (if any) of the "Smuts" than agriculturists, and to no societies should we look with more confidence for the publication of such memoirs as the present. How far they have accomplished this belongs to the past, and has become history; what they may do in the future lies within their own power. The memoir now published commences with a very good digest of the literature of the subject, after which follow the personal observations of the author on the mycelium and spore

* Ascham, "The Schoolmaster," Book I.

growth in *Tilletia*, *Ustilago*, and *Urocystis*. The synopsis of the Ustilagineæ in relation to their supporting plants and the place of their spore formation will be very useful to students, as will also the counter-synopsis of the supporting plants, and the Ustilagineæ occurring on them. The details of the germination of spores, direction and character of the promycelia, the effects of moisture, light, &c., measurements of threads and spores, all combine to render this a useful contribution to the literature of the Smuts, although not containing any startling discoveries. It is just what it professes to be, the record of observations on the germination of the spores of several of the Ustilagines under artificial cultivation, as a supplement to Tulasne's memoir in which this history of development was deficient. It would have been an advantage had this "Contribution" made its appearance in the trade as a separate publication with a London publisher, at a fixed price, so that all persons interested in the subject in this country might have obtained copies, and recommended the work to their mycological, horticultural, and agricultural friends. M. C. C.

LETTERS TO THE EDITOR

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

The Philippine Islands

ENCLOSED you will find:—1. A list of Earthquakes on the Philippine Islands from January to March 1872. As communication is very bad here, and meteorological observations are seldom made and noted down, I may say that most of the earthquakes do not come to our knowledge at all. I believe I do not say too much in expressing my opinion that there may be, at least, one earthquake every day at some one spot in this Archipelago. 2. Description of a Typhoon, which I witnessed at Cebu.

EARTHQUAKES ON THE PHILIPPINE ISLANDS

Since my last communication to the list of earthquakes to your journal (Feb. 5, 1872) I have noted the following:—

1872

Jan. 27, Zambales in Luzon, E.-W., many and strong shocks.
Feb. 7, Camarines on Luzon, twice.
Mar. 5, Manila, weak, 9 A.M. } These two were
6, Province Laguna in Luzon, 9 A.M. } perhaps on the same day, and a mistake has been made in the letter which announced the second.
22, Manila, several very strong shocks.
,, Province Batangas in Luzon.

TYPHOON AT CEBU

April 4, I witnessed a Typhoon in the harbour of Cebu, Philippine Islands, on board H.M.S. *Nassau*, Captain Chimmo. The following gives a short description of it, hoping that the officers of that ship will publish a detailed account of this interesting storm:—

	Barometer	
8^h	A.M. 29·96	Strong N.W. winds, heavy rains.
2^h	P.M. 29·82	
3^h30^m	,, 29·74	
6^h	,, 29·54	Wind, N.W. (4 to 8) rain.
7^h	,, 29·40	Wind and rain ceasing, till
8^h	,, 29·30	some heavy squalls from N.W., followed by perfect calm.
8^h15^m	,, 29·28	Lowest marking of the barometer, till most furious squall from S.E. (11) with heavy rains and lightning. This furious storm lasted about ten minutes, and then, varying from S.E. to S.W. (hardest from S.) diminished slightly; barometer rising rapidly.
10^h	,, 29·76	Wind steadier, squalls less frequent, and heavy rain ceased.
12^h	,, 29·86	Wind steady from S.S.E. (5) dying away till daylight.

About eighteen vessels were thrown on shore, more or less damaged, many houses unroofed, and native huts blown away throughout the island Cebu, and several lives lost. At Horlo in Panay the storm did a great deal of damage too; at Manila it was not observed at all. It is said that there must have been at the same time a storm at Sargoon. Typhoons are very rare as far south as Cebu, and are said not to have been observed for twenty years. This storm proves to be a real typhoon, according to the variation of the wind and the calm betwen it, showing that the centre passed Cuba.

Manila, April 15 ADOLF BERNHARD MEYER

The Conservation of Energy not a Fact, but a Heresy of Science

PERMIT me a few words in reply to Mr. Brooke's strictures in your journal (No. 137) upon my article on "The Heresies of Science" in the *London Quarterly Review* of July last.

Mr. Brooke asserts that in the article "two widely different principles are oddly linked together as heretical dogmas, the doctrine of Evolution and the Conservation of Energy." Now, so far from these doctrines being oddly linked together as heresies, they are not linked at all. It is not the doctrine of Evolution, but the hypothesis of Natural Selection that I affirm to be one of the great heresies of modern science. Evolution is dealt with only so far as is found necessary to prove that the theory of Natural Selection is false. The two heresies named are connected in the article because I found so many physicists employing them to overthrow some of the best established truths in philosophy. Of this Mr. Brooke is perfectly aware, since he expresses regret that "the principle of the Conservation of Energy has by some been misapplied in a fruitless endeavour to supersede the necessity of a creative intelligence."

"The Conservation of Energy a Fact, not a Heresy of Science," is the title of Mr. Brooke's paper. To this assertion I need only oppose some of his own admissions. He complains that the proposition—viz., "that the amount of energy in the world is unchangeable, the sum of the actual or kinetic and potential energies being a constant quantity—has been by some writers rather overstrained." "It may," he adds, "be taken as a postulate, and is probably true, but it is a proposition that is equally incapable of proof or of disproof, because the amount of potential energy in a body can be determined only by its development into actual energy, and cannot therefore be predicated."

Are then our judgments respecting that which Mr. Brooke asserts to be a fact of science only probably true? Surely there is contradiction here. I take it that science is knowledge, and that consequently judgments not accompanied by a conviction of certainty, but merely possessing a higher or lower degree of probability, are altogether outside the sphere of science. As Mr. Brooke accepts the doctrine of the Conservation of Energy as a truth of science, it is not competent for him to maintain that the proposition—viz., "that the amount of energy in the world is unchangeable, the sum of the actual or kinetic and potential energies being a constant quantity"—is equally incapable of proof or disproof, unless he can show that it expresses one of those primary convictions of the mind which constitute the very starting points of human thought. Let Mr. Brooke do this, and there is an end to all discussion on the subject. By one of the laws of thought a proposition which can neither be proved nor disproved, but by other propositions not more evident or more certain, must, by all rational minds, be accepted as true. In this region doubt becomes suicidal by self-contradiction. It is easy to show that the proposition which constitutes the scientific expression of the doctrine of the Conservation of Energy is not the symbol of a primary synthetical judgment. It is really nothing but a truism rendering to the scientific inquirer no higher service than the statement that "every effect must have a cause." In all such cases we grant the truth of the proposition when we grant the definition of either of its related terms. "That everything which begins to be has been produced, immediately or mediately by the power of an intelligent being," is the only philosophic expression of the great law of causation. Stated thus it becomes the appropriate symbol of a primary and necessary synthetical judgment of which every sane mind is conscious. No less a thinker than the late Sir John Herschel held that the doctrine of the Conservation of Energy is a mere truism. It is so as the result of the introduction of what he terms the unfortunate phrase "potential energy."

Mr. Brooke says that "energy is the power of doing work." He does not tell us what he means by work. If he means motion in any of its modes, then he confounds what he holds to

be distinct realities, viz., Force and Energy. Further, he states that "the term 'potential' applied to Force or Energy means inactive, but capable of being called into action. Thus, if a weight be raised, a certain amount of energy is expended in raising it, and so long as the body is supported the energy expended in raising it remains potential in it, but when allowed to fall freely *in vacuo* to the level from which it was raised, the body acquires exactly the amount of energy that was expended in raising it." This too is the view of Tyndall and Balfour Stewart. According to this doctrine, if I throw a stone upwards, say to the height of twenty feet, the energy expended is not lost, but gradually changed in form as the stone ascends. When the stone leaves the hand its energy is actual, at its maximum height it is potential. As a form of potential energy it is a kind of power existent in the stone, but unexerted until the stone begins to descend. According to the theory of conservation this unexerted power is not a reality which abides in the stone by virtue of its constitution, but a power that may be lost, and lost as quickly as it was gained. When the stone reaches the ground it possesses no energy beyond a portion of the heat generated by the collision. The advocates of the conservation hypothesis tell us that the potential energy of the stone at its maximum height is a power to do work. We inquire what work, and are gravely assured that the stone has power to fall, which it could not do when it rested upon the ground! Let us suppose that when the stone leaves my hand I was standing on a covered coal-pit two thousand feet deep, and that I remove the cover as the stone descends, if, as Mr. Brooke affirms, the Conservation of Energy is a fact, it follows that when the stone has fallen through twenty feet it will remain suspended over the pit. By its ascent it acquired power to fall only twenty feet, not two thousand and twenty feet. The metaphysicians, so much belaboured by Prof. Tait and other physicists, have ventured to think that the force of gravity has something to do with the fall of the stone. I have certainly found myself unable, even with the aid of the scientific imagination, to form an intelligible idea of the reality supposed to be symbolised by the term "potential energy." The theory of the Conservation of Energy as now maintained by physicists is opposed in several respects to the doctrine of the conservation of force as held by Faraday. Stewart, Brooke, and others teach most explicitly that energy is not only constantly changing its form, but always shifting about from one portion of matter to another. If I mistake not, Faraday asserts the very opposite respecting force. He seems to teach that each material particle, into whatever combinations it may enter, retains all its original forces. "A particle of oxygen," he says, "is ever a particle of oxygen."

Mr. Brooke makes other admissions which are as inconsistent with the truth of the doctrine of the conservation as the one I have examined. These, however, I must leave for the present. I feel that the most satisfactory reply to Mr. Brooke's strictures would be to quote here, with two trifling exceptions, the portion of my article which relates to the conservation of energy. Those exceptions I will now name. First, I withdraw what I have said respecting Mr. Brooke's view of the nature of latent heat. My sole reason for not in this connection quoting more was that I had assumed his perfect agreement with Prof. Tait. In this it seems I was wrong, since Mr. Brooke declares that he is unable to derive any definite idea from Prof. Tait's statement. I am sorry that Mr. Brooke should have supposed that the omission of the sentence named was due to a lack of literary honesty. I wonder that it did not occur to him that another and more charitable explanation was possible. Secondly, I was in error as to the weights employed by Dr. Joule in one of his experiments for determining the mechanical equivalent of heat. But this error relates merely to the form, not to the ultimate result of the experiment; and consequently in no way invalidates my reasoning. Holding, as I do, that forces are both conserved and correlated, I feel no difficulty whatever in accepting the facts established by Dr. Joule. He avoids speculation regarding the nature of force in itself, and deals exclusively with its manifestations. Thus, his discovery of "the mechanical equivalent of heat" is the discovery of a relation between two classes of effects.

There is one misrepresentation in Mr. Brooke's review of my article I must here point out. He says, "the reviewer thus quaintly expresses the relations of force, energy, and motion:—A given motion viewed as a cause is force, while the very same motion thought as an effect is energy." But this is not my doctrine. I am here dealing with the consequences of one of Mr. Justice Grove's assumptions, viz., that if we attempt to analyse our conception of force, viewed as the cause of any perceived motion, we can get nothing beyond some antecedent motion. Mr. Brooke complains that the misapplication of the term "force" has led to great confusion in physics. His own statements are nevertheless unsatisfactory, if not contradictory. He accepts the definition of force given by Faraday. But this so-called definition by Faraday is not definition at all. It merely tells us what force does, not what force is. Mr. Brooke adds that the definition "may perhaps with advantage be thus amplified:—Force is a mutual action between the atoms or molecules of matter."

But these molecular actions or motions are the effects of force, but not force itself. In no instance whatever can force be resolved into molecular motion. Mr. Brooke says, "One finds oneself occasionally brought by circumstances into an unwelcome generalisation. Thus the reviewer, speaking of the supporters of 'conservation' in the lump, says 'they take it for granted that force is motion and nothing but motion.' This the writer entirely and absolutely denies." Will Mr. Brooke show that this denial is in harmony with his assertion that "force is a mutual action between the atoms or molecules of matter?" I cannot. My reasons for rejecting the assumptions on which the doctrine of the conservation of energy rests are not noticed by Mr. Brooke. These assumptions I have shown belong to false and exploded metaphysics." A false philosophy of causation, it is easy to prove, has greatly retarded the progress of science.

I perceive that Mr. Brooke has used for reference one of a small number of copies of my article printed for private circulation. Unfortunately the paging does not correspond with that of the review. Had I only anticipated the pleasure of an encounter with Mr. Brooke, I would gladly have sent him the review itself. As Mr. Brooke is aware of what passed at a very recent meeting of the Victoria Institute, I cannot longer withhold my name.

Sale, near Manchester, June 26 JOHN MOORE

Water Analysis

IN NATURE for June 27, 1872, Mr. Wanklyn directs attention to the facts that his paper on water analysis appeared in 1867, and that in 1868 he gave some absolute errors obtained with his process.

Mr. Wanklyn then proceeds to say:—"We have never said that distillation of albumin with alkaline permanganate converted the whole of the nitrogen of the albumin into ammonia. The assertion in your article is therefore untrue." Mr. Wanklyn's ideas of truth are probably peculiar, for if he will refer to his paper of June 20, 1867 (Chem. Soc. Jour. vol. v. N.S. p. 448), he will find the following:—"Direct experiments in which a known quantity of urea, gelatin, and albumin were taken, have shown that all the nitrogen in these substances is obtainable in the form of ammonia when they are subjected to the treatment about to be described, and has disclosed the very singular fact that boiling with a caustic alkali liberates one-third of the nitrogen, both of albumin and of gelatin, in the form of ammonia, and that a subsequent boiling with permanganate of potash liberates the other two-thirds."

Not a word is said in the paper about carrying on the permanganate treatment to dryness, and the only reference to such treatment is on page 450, where it is stated that boiling to dryness with potash alone causes the evolution of a "full third" of the nitrogen as ammonia.

THE WRITER OF THE ARTICLE

Scintillation

CAN any of your scientific correspondents tell me whether the following observation has been published, and, if so, where?

By very slight squinting, or (as suggested to me by a friend) by a slight pressure on one eye, we obtain two images of a star as viewed simultaneously from two stations a few inches apart. We made the experiment some nights ago, and could detect no relation whatever between the scintillations of the two. This seems to explain how little trace of the phenomenon remains when a telescope is used, for in that case we have a sort of integration performed over the whole aperture of the object-glass.

G. H.

To Entomologists

HOW often is it that the entomologist has to regret the want of his net? The rare butterfly, by some curious perversity, is

certain to be seen when the net is not at hand. How, under such circumstances, is the butterfly to be caught? I reply, wait till it settles, and then pick it up. Perhaps most of your readers will reply "Absurd, no butterfly will sit to be caught in that way." Try and see. Whenever the butterfly settles you may walk quickly up to within a short distance from it; the distance will depend on the nature of the butterfly. Arrived at a short distance from the butterfly, the motion must now be slow and even, and as the hand is slowly and steadily advanced towards the butterfly, it will take little or no notice of it, and may be easily picked up with the fingers. In Italy this spring I picked up in this manner both varieties of swallow-tails, as many as five when walking one afternoon. I have also caught in this way, whites, red admirals, painted ladies, peacocks, and many other smaller varieties. This manner of catching butterflies does look suspiciously like the old story of catching birds by putting salt on their tails. Before anyone condemns it, I ask him to give it a fair trial, and I have no doubt he will be astonished at his success. The only thing to guard against is any jerkiness in your motions. All your motions when near the butterfly must be slow and regular. Perhaps the butterfly may not sit long enough for you to approach it by such slow motions. If the butterfly does rise take care not to change your slow and steady motions, and it will take no notice of you, and will often settle again within a few inches of your hand. Often the butterfly takes no notice of you; at other times it seems sensible of danger, but generally contents itself by folding its wings as close as possible, as if to escape notice. When the wings are in this position the butterfly is caught with least damage to its plumage. But in some cases the wings are open. When that is the case I have sometimes folded the wings before picking them up, in order to save the plumage, so tame are they under this treatment. At first I thought it was necessary to approach the butterfly from behind, and keep out of sight as much as possible, but this I find, though an advantage, is not essential. Of course I do not advocate this plan of catching butterflies when a net can be got, as it is much slower and not so certain. Yet it has its advantages. You get the butterfly without breaking its wings or ruffling a feather, and if not a good specimen you can let it away unhurt.

J. A.

ERNEST T. CHAPMAN

MR. E. T. CHAPMAN has met his death by an explosion in his laboratory at Rübeland in the Hartz. A letter containing this sad news has the following particulars:—

"As you are probably aware, Mr. Chapman's work was always in the laboratory, and it was there on the 25th inst. (June) that the accident occurred. On the morning of that day Mr. Chapman had a conversation with the gentlemen here, and shortly after this, at 11 A.M., the bomb-proof building in which he was with three workmen exploded with a tremendous crash. Mr. Chapman may perhaps have informed you that latterly he has been chiefly engaged with the production of nitric methyl-æther, with which he has been making various experiments, and we cannot explain the catastrophe otherwise than that he was not thoroughly aware of the great explosibility of this substance. The workmen present having also all perished, it is unfortunately not possible to obtain any details. The force of the explosion was so tremendous that all the surrounding buildings have been more or less injured, and about ten people seriously wounded."

The substance I presume was nitrate of methyl. If so, this lamentable accident furnishes another proof of the treacherous nature of explosives which, like nitro-glycerine and gun-cotton, contain hydrogen and carbon associated with nitrogen oxides.

Mr. Chapman was only in his twenty-seventh year when his career was thus prematurely closed. A pupil of Hoffmann and Kolbe, he was a prolific author of original researches in organic chemistry. Perhaps the best known of Mr. Chapman's researches is his study of limited oxidation. This process, in his hands and those of others, furnished chemists with a valuable method of chemical diagnosis. The little work on the Analysis of Potable Waters, by Mr. Chapman and Mr. Wanklyn, is a well-known work of reference on this important subject.

Mr. Chapman was an enthusiastic worker. His manipulative skill was of a high order, and his acquaintance with organic chemistry very extensive, his researches in this branch of science being very numerous. If he had lived, and had an opportunity of continuous scientific work, it is impossible to doubt that he would have contributed his quota towards rescuing our country from the too just reproach of rapidly becoming more and more sterile in chemical discoveries.

His intimate friends esteemed him highly, for he was a man of varied culture and singular conversational power. It was always a matter of regret to all true friends of science that a man of such proved ability and promise should have been compelled in a manner to banish himself in order to gain a livelihood. His letters show that even in the remote place of his exile his brain was busy with chemical and physical questions. He must have been killed instantly, and therefore without pain. And certainly as a brave and loyal soldier of science slain on the battle-field of the laboratory, his death, like his life, showed his unwearied devotion to science. We can ill afford to lose such men.

FREDERICK GUTHRIE

*DR. WILLIAM STIMPSON**

DIED, at Ilchester, Maryland, May 26, of consumption, Dr. William Stimpson, Secretary of the Chicago Academy of Sciences, in the forty-second year of his age.

The announcement of the death of Dr. Stimpson will be received with profound regret, not only by a wide circle of friends here, but throughout the country. Science has lost an assiduous cultivator, the value of whose labours was recognised in both hemispheres.

For the second time in the course of a few years the Chicago Academy is called upon to mourn the loss of an accomplished secretary. Under Dr. Stimpson's energetic supervision, the collections gathered within its walls at the time of the great fire, in magnitude and importance ranked fifth in the United States, and so admirable were his arrangements that they were flowing in from every quarter of the world. Their total destruction on the morning of the 9th of October last was a terrible blow to the secretary. His private losses, too, were beyond computation, embracing as they did a choice scientific library, gathered at different intervals—many of the volumes being out of print, and many of them being presentation copies from the authors—and also all his manuscripts, including those of the Government Japan Expedition, of which he was the naturalist, which were written out for publication, and were copiously illustrated by drawings, many of which were engraved. Thus, in an hour, perished the results of twenty years' unremitting scientific labour.

To show the high estimation in which Dr. Stimpson was held by men engaged in kindred pursuits, it may be stated that, at the instigation of Agassiz, the results of the deep-sea dredgings of the United States Coast Survey were passed over to him for description—a task calling for the most exact and extensive knowledge.

After the terrible calamity to which we have referred, Dr. Stimpson remarked that he had not the heart to attempt to enter upon his life-work again, but would devote all his energies to the restoration of the Academy.

* From the Chicago *Inter-Ocean*. Communicated by Mr. J. Gwyn Jeffreys.

"If," said he, "I live to the ordinary age, I will gather a nobler collection than we have lost." The Smithsonian Institute, which from the first had been the generous patron of the Academy, was ready to transfer to him duplicates; the Museum of Comparative Anatomy, at Cambridge, through Agassiz, its director, had invited him to go there and select from its ample stores what he desired; and learned societies at home and abroad, in response to his appeals, were forwarding to his care copies of their Transactions. Under such auspices, the members of the Academy felt that its losses would soon be restored, and that its prestige would be more commanding than ever before. They now feel that in the death of their secretary they sustain a loss which is irreparable.

Dr. Stimpson had for some years the premonitions of the disease to which he has just succumbed. Two years ago he passed the winter on the Florida coast, making extensive collections of the flora and fauna of that region. The moist, warm breath of the ocean, he thought, invigorated him. Last autumn he repaired, in company with Dr. Veille, to the same region, embarking on board one of the Coast Survey steamers to superintend the deep-sea dredgings; but he had returns of hæmorrhage, which so far prostrated him as to defeat his purposes. For seventy days he remained on board, with nothing but ship fare to eat, at which his stomach revolted. Gaining the land, he was transferred to a hotel, but his physical powers were past the rallying point. Accompanied by Dr. Veille, he was at length placed on board a steamer, which landed him in Baltimore, from which place, by a short journey in a carriage, he was conveyed to Ilchester, where reside his wife's friends. Here he lingered a few weeks, dictating letters and pencilling short ones to his most intimate friends. And now comes the intelligence that the grave has closed over him, and that in his dying hours his thoughts centred on the Academy.

Dr. Stimpson had qualities which attracted, by the strongest ties, all who had personal relations with him. Modest and retiring in his disposition, the casual acquaintance little knew the vast range and the minute accuracy of his information—information gathered not simply from books, but from personal observation in every quarter of the globe. He has published enough already to create for his name an honourable place in the scientific opinion of the world; but if the full results of his labours could have been brought out, few scientific men in the country would have occupied a more commanding position. J. W. F.

THE CEYLON ELEPHANT AT THE OXFORD MUSEUM

THERE has just arrived at the Oxford Museum the skeleton of a full-grown male Ceylon elephant. During the visit of the Duke of Edinburgh to Ceylon there were two elephant drives, or kraals, held, of which full accounts were given in the daily papers at the time. It may be remembered that at one of these kraals a large male elephant, a rogue, was driven into the terminal enclosure, together with several other smaller wild elephants. The rogue charged the tame elephants introduced amongst the wild ones, knocking them over repeatedly, and effectually preventing the process of noosing. It was at length found necessary to shoot him, in order that the remainder of the elephants might be secured.

The Governor of the island, Sir Hercules Robinson, desired that the skeleton of the animal should be preserved, and the Hon. P. C. Layard undertook the task. The elephant was covered slightly with earth, so as to protect the bones from rapacious birds; and the mound thus formed was fenced round to keep off jackals, &c. As soon as the bones were cleaned, they were collected and transported to Colombo. Mr. Layard, with his well-known zeal for the promotion of science, took immense pains that the small bones should not be lost, and the skeleton is wonderfully perfect considering the great disadvantages under which it was prepared.

The bones were presented by Sir Hercules Robinson to the Oxford Museum, and all expenses of preparation and packing were defrayed by the colony. The skeleton was packed in two rum puncheons, under my superintendence. In packing heavy bones such as these for a long sea voyage great care must be taken, as, unless they are securely wedged into their places, they will grind against one another and get spoiled. There is nothing better than a cask for packing bones. Straw bands should first be wound round each of the large bones, and, the head having been taken out of the cask, these large bones should be jammed in as closely as possible. The interstices should be filled with smaller bones and straw, which latter should be rammed in tight with sticks. As soon as the cask is quite full the head should be put in, and that end strained up tight with its hoops. The other end of the cask should now be turned uppermost, the hoops knocked off and the bottom taken out. It will be found that a good many more bones may now be introduced from this end, which must be rammed quite full like the other. By thus packing a cask from both ends, almost absolute immobility may be secured for the contents. The elephant's skeleton is a very fine one, and I believe the only one in England of a wild specimen. The ordinary museum specimens are all from menagerie animals, the muscular ridges and tuberosities of the bones of which are always badly marked. The elephant had what is called a tush, *i. e.*, a small short tusk on the left side. This tush is in the collection of the Duke of Edinburgh.

With the elephant arrived a Dugong, also presented to the Oxford Museum by Sir Hercules Robinson. The animal, which is a young one about 5 ft. long, was procured by Mr. Twinam, Government Agent at Jaffna. It was filled with salt and packed in charcoal. It has remained more than a year thus packed up, and is unfortunately in a very pulpy condition, although its external form is remarkably well preserved. Mr. Robertson hopes, with care, to be able to make a skeleton of it.

A case containing some human skulls, and the skeletons and skulls of various smaller animals collected by me in Ceylon, arrived at the same time; and a fourth case, containing skulls of all the non-European races now inhabiting Ceylon, including some of undoubted jungle Weddo, collected by Mr. B. Hartshorne, of Panwila, and late of Pembroke College, Oxford, who has for a long time been investigating the language and habits of this very interesting race, and will shortly publish a paper on the subject.

The shipping arrangements of all the cases except the last, and their transmission through the Custom-house, were carried out by Messrs. Green and Co., of Colombo, who most liberally gave their services free of expense in the cause of science.

H. N. MOSELEY

SUPERFLUOUS DEVELOPMENTS AND HETEROGENESIS

THE remarkable and suggestive results of experimental research obtained by Prof. Charlton Bastian, together with the no less striking arguments which he has recently put forth in the pages of the *British Medical Journal* in favour of the doctrine of Evolution, appear calculated to throw light on certain phenomena in Biology which have hitherto received but scant attention. Even if Dr. Bastian's views do not gain general acceptance, so bold an enunciation of them can scarcely fail to be productive of the very best results, since (as has ever been held by philosophers) truth is only elicited and advanced by conflict of opinion.

Not merely in the lower, but also in the higher forms of animal life the microscopist is constantly encountering anomalous appearances, structures, "bodies," &c.; some of these developments being regarded as normal, whilst others are relegated to the category of pathological products. In very many cases the mysterious organisms in question have been described as "glands;" the variable character of this system of structures affording a convenient refuge for the destitute. More astute observers, however, refuse to adopt such subterfuges, and have accordingly been satisfied either merely to note their characters without forming any definite conclusions, or they have gone only a step further by placing them within the territory of superfluous developments.

To take a few familiar instances occurring within the domain of helminthology. We have the so-called Raineyan sacs, regarded as the earliest stages of Cysticerci by their discoverer. Similar bodies were previously described as the products of muscular degeneration by Hessling. Finally, they were pronounced by Leuckart to be psorosperms. In the year 1856 I detected granular bodies in the early stage of development of the eggs of *Tæniæ*, respecting the nature of which I had then no means of forming any definite opinion. These were subsequently described by Weinland and Leuckart; the latter authority looking upon them as masses cast off from the primitive yelk, and thus differentiated to form an organ concerned in the production of the chitinous envelope of the egg. Then, again, Leuckart speaks of certain "croupy masses" (resulting from the enteritis produced by *Trichiniasis*) as capable of resolving themselves into psorospermiæ: and I have myself witnessed what I presumed to be the actual conversion of the granular and molecular contents of the eggs of *Fasciola hepatica* into amæboids. Leuckart, however, from prior and independent observation, had considered these bodies to be the parasitic confervoid zoospores of *Chytridium*.

Undoubtedly, appearances of this varied description are very puzzling; not so much, however, in the view of determining their actual character and nature as for the correct interpretation of their true mode of origination. Perhaps, if one were not, in a measure, dominated by the preconceived idea that these last-named bodies must have sprung from invisible germs, the apparent ocular evidence to the contrary would at once be held as a sufficient explanation. Be this as it may, I may refer in this connection to some interesting facts which have recently been recorded by Profs. F. Sommer and L. Landois. To their interesting "Beiträge zur Anatomie der Plattwürmer" I shall again have occasion to allude for other purposes, but for the present I merely quote the following short passage. Speaking of structures observed in the segments or proglottides of *Bothriocephalus latus*, they say (p. 16):—

"On a level with the folds of the seminal ducts, either close to or lying between them, we observed in the majority of instances within the sexually mature segments round or oval hollow spaces from 0·055 to 0·288m. in diameter.* Their margins were sharply defined, most of them being filled with a finely granular molecular mass; in others the contents appeared coarsely granular, highly refracting. In an especial manner carmine tinctured the finely granular contents vividly red, whilst the coarse granules effected the reduction of osmic acid (*Ueberosmiumsäure*) in a very marked degree; on the other hand the reduction by the fine granules was less marked. Further research showed that these granules consisted of very minute fat particles which, since they were little affected by the direct application of ether, appear to possess an albumenoid covering capable of being slightly tinctured by carmine. We did not observe any of these formations in immature joints; their number also varied much in the ripe segments; of such we counted from one to six in a joint; other sexually mature proglottides being altogether free. They appeared especially in the neighbourhood of the lower end of the seminal duct in front and behind, where the seminal passage approaches the cistern-like seminal reservoir. We regard these formations as detached portions of the seminal canal, namely, of the larger ducts, whose contents are in a state of fatty degeneration."

* About $\frac{1}{180}$" to $\frac{1}{90}$" Eng. measurement.—T. S. C.

Such are the facts. Are the bodies in question really pathological products, or are they not, rather, superfluous developments? It cannot be said they are necessary constituents of the parasite; and it will, perhaps, be denied that they are in any sense heterogenetically formed organisms. At all events, these cast-off bodies have a gregariniform look about them, judging from the representations given by Drs. Sommer and Landois. The expression "hollow spaces" (*Hohlraüme*) is certainly rather misleading; the more so since they are rendered somewhat opaque by the crowding of their granular contents

If it be true, as some teach, that protoplasms only beget their own kinds of protoplasm, one is at a loss to understand many of the ordinary phenomena of metamorphosis. for myself, I look upon certain of these obscure developments as the result of a law of what I term "vegetative deterioration." Under ordinary circumstances (as for example in the case of the "innovations" produced from abortive prothallia in Ferns) the law of Pangenesis ensures a repetition of parts in all respects similar to those whence the buddings have arisen; but surely it is not necessary to regard all anomalous and detached structures either as morbid products on the one hand, or as germ-begotten entities on the other. Without letting the imagination run wild, it appears to me perfectly conceivable that "bodies" of a kind more organised than Drs. Sommers' and Landois' "formations," may result from the operation of this law of degradational metamorphosis or "vegetative deterioration."

T. SPENCER COBBOLD

DR. LIVINGSTONE'S DISCOVERIES

FROM Mr. Stanley's despatches to the *New York Herald*, which, by the courtesy of the English representative of that paper, have appeared in the *Times*, we gather some important and definite information as to the exact nature of Livingstone's discoveries; and more than this, we have a full explanation of the circumstances which kept our great traveller so long out of the reach of civilisation, and of the work he still hopes to accomplish

Mr. Stanley's account of his meeting with Livingstone is a touching one. After many delays, on the 3rd of November, 1871, he came in sight of the outlying houses of Ujiji, and, anxious to enter the African town with as much *éclat* as possible, he disposed his little band in such a manner as to form a somewhat imposing procession. At the head was borne the American flag; next came the armed escort, who were directed to discharge their firearms with as much rapidity as possible; following these were the baggage men, the horses, and asses; and in the rear of all came Mr. Stanley himself. The din of the firing aroused the inhabitants of Ujiji to the fact that strangers were approaching, and they flocked out in great crowds, filling the air with deafening shouts, and beating violently on their rude musical instruments.

As the procession entered the town Mr. Stanley observed a group of Arabs on the right, in the centre of whom was a pale-looking, grey-bearded, white man, whose fair skin contrasted with the sunburnt visages of those by whom he was surrounded. Passing from the rear of the procession to the front, the American traveller noticed the white man was clad in a red woollen jacket, and wore upon his

head a naval cap with a faded gilt band round it. In an instant he recognised the European as none other than Dr. Livingstone himself; and he was about to rush forward and embrace him, when the thought occurred he was in the presence of Arabs, who, being accustomed to conceal their feelings, were very likely to found their estimate of a man upon the manner in which he conceals his own. A dignified Arab chieftain, moreover, stood by, and this confirmed Mr. Stanley in his resolution to show no symptoms of rejoicing or excitement. Slowly advancing towards the great traveller, he bowed and said, "Dr. Livingstone, I presume?" to which address the latter, who was fully equal to the occasion, simply smiled and replied "Yes." It was not till some hours afterwards, when alone together, seated on a goat skin, that the two white men exchanged those congratulations which both were eager to express, and recounted their respective difficulties and adventures.

Mr. Stanley's statement is that Dr. Livingstone appeared to be in remarkably good health, stout and strong, quite undismayed by all that he had gone through, and eager only to finish the task he had imposed upon himself.

Dr. Livingstone's story of his adventure was to the following effect:—In March 1866, he started from Zanzibar. The expedition which he led consisted of twelve Sepoys, nine Johanna men, seven liberated slaves, and two Zambesi men—in all thirty persons. At first Dr. Livingstone travelled along the left bank of the Rovuma River; but, as he pursued his way, his men began to grow disaffected and frightened, and, in spite of all his efforts to manage and keep them together, most of them left him and returned to their homes, spreading everywhere the report of his death as a reason for their reappearance there. In August 1866, he arrived in the territory of Mponda, a chief who rules over a tribe living near the N'yassa Lake; and here Wikoteni, a *protégé* of the Doctor's, insisted upon being absolved from going any further. After resting for a short time in Mponda's ground, Dr. Livingstone proceeded to inspect the "heel" of the N'yassa Lake; and it was while carrying out this enterprise that the Johanna men, who had till now remained faithful, deserted him. In December 1866, having collected a number of natives, Dr. Livingstone decided upon advancing in a northerly direction; and, in pursuance of this determination, he traversed the countries of Babisa, Bobembene, and Borunga, as well as the region of Londa.

Approaching King Cazembe's territory, he crossed a thin stream called the Chambezi; and here he found himself in great difficulty, being for a long while unable to discover to what the river belonged. The confusion which he experienced was greatly increased by the fact that Portuguese travellers had previously reported the existence of such a stream, and had asserted that it was a tributary of the great Zambesi river, having no connection whatever with the Nile. These statements Dr. Livingstone was disinclined to believe, and, determined to satisfy himself as to the rise and falling of the Chambezi, he made up his mind to devote himself to the task at once. From the beginning of 1867 to the middle of March 1869, he traversed the banks of the mysterious stream, tracing it where it ran, correcting the errors of the Portuguese travellers, and proving conclusively that the Chambezi was not the head of the Zambezi river, as had been hitherto supposed. So constantly did he remain at this work, and so frequent were the inquiries which he made in every direction, that the natives, in astonishment at his persistence, supposed him to be insane; and their frequent remark was, "The man is mad; he must have water on the brain." Their ridicule had, however, no effect upon him, for he continued his work in spite of every opposition, and as the result of his labours in this region, coupled with his further researches, he has established conclusively (1) that the Portuguese Zambezi and the Chambezi are totally distinct streams; and (2) that the Chambezi is the head waters of the Nile. He found that starting from 11° south, the River Nile rolled on until it attained the extraordinary length of 2,600 miles.

In the midst of his wanderings Livingstone came upon Lake Liemba, which he discovered to be fed by Lake Tanganyika. His map of the last-mentioned lake shows that the southern portion of it resembles in shape the lower part of the kingdom of Italy. He found that it rises in 8° 42″ south, is 325 miles in length, being thus seventy-three miles longer than was supposed by Captain Burton and Captain Speke. Leaving Tanganyika, the Doctor crossed Marungua, and came in sight of a small lake, called Lake Muero, which he found to be six miles in length, and to be fed by the Chambezi. In his way he traced the Chambezi running through three degrees of latitude, and having thus satisfied himself of the total independence of the Zambezi, he returned to King Cazembe's country, and then made his way to Ujiji, where, early in 1869, he wrote letters and despatched them by messengers. A short rest was made at Ujiji, and having explored the head of the Tanganyika lake, and thus finding out that the River Rusizi flowed into the lake, and not out of it, as had been supposed, he made preparations for another, and as he then hoped, a final journey of exploration.

Leaving Ujiji in June 1869, he pushed through the Uguhba country, and after fifteen days' march he came to Mamgema, which he found to be a virgin country, the interior of which seemed utterly unknown to anybody. As he was about to proceed, however, he was seized with an illness which at one time almost threatened to put an end to his explorations. Ulcers formed in his feet, and for six weary months he was obliged to rest and wait. As soon as he had recovered he started off in a northerly direction, and came shortly afterwards to a broad river called Lualaba, which flowed in a northerly, westerly, and southerly direction. Strongly suspecting that this river was but a continuation of the Chambezi, which enters the Banguereolo, Luapula, and Muero lakes, he retraced his steps to Lake Kamolondo, and thence working his way to lat. 4° south, and after a long and difficult journey, he found the point where the Lualaba and Chambezi joined, and proved them to be both one and the same river.

He followed the course of the latter river for several hundred miles, and had come within 180 miles of that part of the Nile which has already been traced, when the men he had with him mutinied, and deserted him. Having now neither stores nor followers, he was obliged to retire to Ujiji, weary and destitute. It was soon after this that Mr. Stanley found him. In fact, the English explorer arrived at Ujiji on the 16th of October, 1871, and it was, as already stated, no later than the 3rd of November when the American searcher made his entrance into Ujiji.

On Nov. 20 Dr. Livingstone and Mr. Stanley left Ujiji in company, and explored the northern end of Lake Tanganyika, confirming by a second inspection the observations which Dr. Livingstone had previously made; and after 28 days thus pleasantly spent, they returned to Ujiji, and there passed Christmas Day together. On Dec. 26 they left for Unyanyembe, and, arriving there, stayed together till March 14, when Mr. Stanley, intrusted with letters from Dr. Livingstone, started for the coast, leaving the explorer to continue his searches for some time longer.

Dr. Livingstone states that he considers he has yet two problems to solve in connection with the Nile. The first, the complete exploration of the remaining 180 miles which lie between the spot where he was compelled to turn back and the part already traced; and he should investigate the truth of a report which has several times reached him respecting four fountains, which he has been told, supply a large volume of water to the Lualaba. To complete this task, Livingstone estimates that he will require sixteen or eighteen months. Mr. Stanley, however, is of opinion that it will occupy a longer period.

MY GARDEN*

WITHIN about twelve miles of London Bridge as the crow flies, at Beddington, in Surrey, Mr. Smee has a garden, and the description and history of this garden are the subject of as pretty and entertaining a book as we have met with for a long time. In thus describing the book, we advisedly use terms which do not imply that it has any great scientific value in the sense of being the medium of publication of new facts ; nor, indeed, does it put forward any such pretensions. Mr. Smee, whose reputation as an original investigator in electrical science, and as the inventor of the galvanic battery which bears his name, is thirty years old, is in the domain of natural history essentially an amateur, and the work which he now publishes is an amateur's book. To rank it in the same class as Gilbert White's "Natural History of Selborne" is very high praise, but in some respects it certainly deserves it. Faults the book undoubtedly has ; some would call it egotistic, but it is a kindly sort of egotism, which interests the reader in the author and everything connected with him ; and here and there the critical reader will detect a slip betraying want of accurate scientific knowledge ; but these are very few compared with the amount of information contained in its pages.

Mr. Smee's garden consists of about eight acres,

FIG. 1.—VALLEY OF FERNS

bounded on one side by an artificial lake, and watered by the river Wandle. When first brought into cultivation the land was a peat-morass ; but is now made to produce every variety of scenery that ornamental gardening can display. Here we have umbrageous forest-trees, and here a rustic bridge ; here a fern-glen, and here a nightingale bower ; here a rockery of Alpine plants, and here a glimpse of beautiful water scenery. Indeed, in looking at the exquisite drawings with which the book is embellished, it is difficult to realise that the scenes they depict can be reached from London in half-an-hour. The following passage, in Mr. Smee's own words, gives his ideas on the proper mode of laying out a garden :—

"It is a common notion that gardens should be laid out for one general effect ; but the result of such a plan is to produce a single view, and the whole can be seen at a glance. This is, however, monotonous, and my liking is to have many pictures ; so that my visitors have to walk a long way before they can see the many beautiful views which my garden affords ; and little spots of cultivated wildness, or of special cultivation, are found when they are least expected.

* "My Garden : its Plan and Culture, together with a General Description of its Geology, Botany, and Natural History." By Alfred Smee, F.R.S. Illustrated with 1,250 engravings. (London : Bell and Daldy. 1872.)

"In all my designs, I have tried to suggest to the mind that it must be so; and even when my arrangements are most artificial—as when a walk doubles upon itself—it looks that the arrangement has been made because no other plan was really practicable; and when this idea is carried out, the garden looks natural.

"Throughout my garden my vegetables, flowers, and fruit-trees are blended together in one harmonious whole:

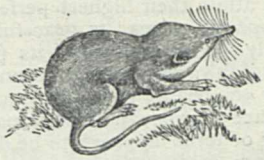

FIG. 2.—SHREW MOUSE

FIG. 3.—THE GOLDFINCH

FIG. 4.—HARVEST MOUSE

a plot of carrots and a row of flowering peas are beautiful objects in themselves, and hence plots of vegetables and fruit-trees alternate with rosaries, ferneries, alpineries, and flower-beds. . . .

FIG. 5.—ROAD NEAR BEDDINGTON

"A long straight line is, in a proper place, very pleasing, and my pear-tree walk is about 150 yards long, parallel with the Park palings. This walk is overarched, at intervals, with climbing roses; and planted on one side with

FIG. 6.—HYMENOPHYLLUM DEMISSUM

FIG. 7.—ADIANTUM CAPILLUS-VENERIS

FIG. 8.—HYMENOPHYLLUM TUNBRIDGENSE

pyramid pear-trees. The general effect is in the highest degree charming, when we come upon it from paths of curved lines, and view the chequered shade upon the path.

"Again, my fern glade is straight, and has a straight grass walk by its side. The nut bushes, on one side, are parallel with the stream; and the grass walk and rows of apple-trees, on the other side, are also straight. In this

case also it would have looked unnatural to have had curved lines; and, although I once was tempted to try it, and had made preparations for curving the river, I ordered the materials away, so satisfied was I that straight lines alone would look natural for the occasion.

"With the exception of places where straight lines look natural, I eschew them, and also geometric figures, such as ovals, circles, octagons, as not suitable to the horticulturist, and unpleasing to the eye.

"In using curved lines beauty appears to consist in an ever-varying amount of curve. They should be parts of no regular figure, and the Indians have supplied us, in the patterns of their shawls, with forms which ever please us. In arranging them we must be guided by the eye, and frequently a variation of an inch or two makes an important difference in the effect which is produced."

But the charm of the book is the minuteness with which every detail of the garden is described; not only the flowers and fruits grown in it, the varieties which are found to answer best, and the best mode of cultivating them, but the animals, birds, beasts, and insects, which frequent it, or which have been occasionally seen in it. Mr. Smee thus gossips pleasantly about his ferneries:—

"For some years past ferns and ferneries have been much admired, and have received great attention from amateur cultivators; and with good reason, as their graceful forms are most attractive, their mode of growth interesting, and the colour of their fronds enchanting. Ferns should be grown by themselves, and not mixed with other plants, for several reasons, the principal being the necessity of a special situation for them, and their dislike to be interfered with. However, the rhododendron, and especially the scarlet varieties of it, may be planted along with ferns as a fitting accompaniment; a climbing rose growing wild, or a single-flowering scarlet thorn, may also be employed with advantage. Before the fronds shoot out in spring I like to see the ground, in large patches, covered with masses of primroses at one spot, masses of snowdrops at another, masses of the wild oxalis at a third, and at other places carpeted with the wild hyacinth. It is not usual for me to mix these flowers together, as masses of colour, such as these flowers afford in their native woods, give variety to the scenery of the garden. . . . ."

"Experience has taught me that ferns like an abundance of light, although it is necessary to screen them from cold winds. For this reason I always contrive that a belt of trees, or of rootwork or rockwork, shall surround my ferneries, and at the same time that the light of the sky may fall upon them from above without their being directly exposed to the fiery rays of the sun.

"My Fern Glade is placed on one bank of the backwater, and is screened from the sun by a row of nut-bushes to the south. Here many of the larger varieties of lady-ferns, interspersed with polystichums, broad ferns, mountain ferns, and scolopendriums, are grown. The royal fern flourishes near the river, but it is advisable to keep the crowns well above the water, as their roots like damp soil rather than wet. In the driest spots we grow polypody (*Polypodium vulgare*), and in the wettest the marsh fern (*Lastræa Thelypteris*).

"The Fern Glen is a more elaborate artistic production, affording many delightful little views and growing fine ferns. The whole is well sunk into the ground, with little rivulets running through, affording one or two boggy places. It is protected on the north by a bank, with a hedge interspersed with trees, and on the south by trees. A large willow-tree (*Salix alba*) on the south-west shades the sun's rays, but still there is ample sky light overhead, which I find so desirable for the growth of all ferns. . . .

"My Fern Glade has given me so much pleasure, that I strongly advise every one who has a waste piece of land near his garden to make a fern glen. It will be a pastime in the winter evenings to design it; the construction of it—the transforming of the ideal conception of the mind into a living reality—will afford much pleasure; many a country trip in the woods will be required to furnish it; and when furnished it will afford a spot for contemplation and enjoyment, in which the designer may fancy that the robins, warblers, and nightingales, which never fail to dwell there, are pouring forth their gratitude for the construction of such a delightful retreat.

"My Valley of Ferns is another spot in which I greatly delight. It has a stream through the centre, and it is well surrounded by trees. Here two or three varieties of male ferns and of polystichums attain their highest perfection. The magnificent *Struthiopteris* raises its graceful and delicate fronds in the early spring, and shows its finely-coloured foliage when dying down in the early autumn.

"In the heat of summer the beauty of a great mass of ferny foliage, such as this place affords, cannot be surpassed. The success of this valley of ferns appears to be due to the protection afforded from cold winds by surrounding trees, whilst the plants themselves luxuriate under light and sunshine, with free exposure to air without draught . . .

"At this moment I have nearly every British fern growing out of doors, but I could never succeed in cultivating the *Asplenium marinum* in that situation. This fern grows wild by the sea-coast as far north as Aberdeen; nevertheless I have never been able to grow one in any of my outdoor ferneries. It is a remarkable fact that the *Adiantum Capillus-Veneris* (Fig. 9) has never proved to be hardy with me, although I have it now growing well in the Fern cave. I have seen it along the Mediterranean coast beyond Mentone, but only in particular situations, such as on a bed of sandstone, which is permeable by water; in this situation the fronds were severely frosted in winter. I saw a plant growing at the top of the Cathedral at Genoa, at a time when all the fountains in the city were frozen. I noticed it again to be plentiful at Pompeii and at Herculaneum, and also in the ruins of Nero's Palace at Rome. But nowhere was the maidenhair seen in such perfection as in the ruined amphitheatre at Posilippo, near Naples. The underground rooms and passages formerly used by the gladiators, and for the working machinery of the amphitheatre (which is the most perfect of any now existing), forms a series of caves, through the walls of which moisture continually oozes, and here the maidenhair luxuriates in all its glory. Some of the fronds were eighteen or more inches in length, and the earthen walls were covered with sheets of this lovely fern, standing out at right angles from the wall or hanging down from the roof. I must confess that, when I beheld this great and glorious sight, I was more impressed with it than with the thought that I was present on a spot where dramas of blood were enacted centuries before. I speedily collected a number of plants, to the no small disgust of the *cicerone* who could not do the amphitheatre at his usual gallop, and who shrugged his shoulders at my utter want of taste in gathering useless weeds. Some of these plants now grow at my garden in the Fern cave. The *Adiantum* is said to luxuriate in the orange groves in Spain, in which country the fronds are used to make the syrup of capillaire, a pleasant beverage drunk mixed with water in hot weather."

Probably few are aware that in the clefts of that remarkable formation known as the "limestone pavement," in the west of Co. Clare, Ireland, the maidenhair fern may be gathered flourishing with a luxuriance of growth fully equal to that here described in Italy.

Mr. Smee's "My Garden" is, indeed, a book which ought to be in the hands of every one who is fortunate enough to possess a garden of his own; he is certain to find some things in it from which he may profit. The mode in which the work is got out—the paper, the printing, and the binding—leaves nothing to be desired. The style of the larger illustrations may be judged from the sample we have given; the smaller figures are in most

instances equally good, the botanical ones from the pencil of Mr. Worthington Smith, and they abound on almost every page. Some of them might certainly have been spared, as, for instance, the drawings of Mr. Smee's garden roller and water-pot, which do not appear to differ essentially from similar instruments which might be found in any other garden. But these are small defects, which scarcely depreciate from the value of the work in helping to promote among the inhabitants of our great cities a healthy love of country pursuits, and of the study of Nature herself. A. W. B.

NOTES

SIR JOHN LUBBOCK, Bart., M.P., F.R.S., has been elected Vice-Chancellor of the University of London in the room of Sir Edward Ryan, who accepted the office for a year only on the death of the late Mr. Grote. We may congratulate ourselves that by this appointment the interests of Science will be well looked after in the future career of the metropolitan University.

DR. H. W. ACLAND, Regius Professor of Medicine, and Dr. G. Rolleston, Linacre Professor of Physiology, have been nominated to represent the University of Oxford on the Committee of Reference for the Medical Examining Board for England.

AT the examination for the degree of D.Sc. just concluded at the University of London, the following gentlemen passed to the satisfaction of the examiners:—In Branch VI.—Electricity, Alexander Muirhead; in Branch IX.—Animal Physiology, Henry Newell Martin, M.B.

THE following despatch from Dr. Kirk respecting Dr. Livingstone, dated Zanzibar, May 2, is published in the *Times of India*:—"Letters have been received from Unyanyembe, and Mr. Stanley is now within a few days of the coast on his return, having with him a large box full of correspondence and papers. Arabs state that Dr. Livingstone has visited Uvira, and found the River Rusiri flowing into the lake; but on this point we must await Dr. Livingstone's own report. He then returned to Ujiji, and was met by Mr. Stanley. Dr. Livingstone has gone to Unyanyembe, where he remains. He is in good health, and intends further explorations south after arrival of additional stores from the coast. Two of the Nassick boys who started some years ago with him are in his company, and he is said to be still using the sextant, and taking observations regularly. All his letters are in Mr. Stanley's care." Another despatch, published in the *Bombay Gazette*, dated Zanzibar, May 3, says:—"Dr. Livingstone has reached Unyanyembe. At Ujiji he was met by Mr. Stanley, who is expected daily at Zanzibar, having in his hands a large case of correspondence that will fully explain Dr. Livingstone's recent travels, embracing the north end of the Tanganyika Lake, and solving the Nile problem. Dr. Livingstone is said to remain still in the Unyamwazi country, and to intend further discoveries to the southward on the receipt from Zanzibar of additional supplies and stores. The Livingstone Relief Expedition is now on the African coast ready with all the necessaries for African travel, and Dr. Livingstone's son forms one of its members."

IT is with regret that we have to record the death, on the 27th ult., of Mr. Charles Hill, at his residence, Cotham Grove, Bristol. The deceased gentleman was in his 78th year, and for a long time had taken much interest in astronomical matters. Mr. Hill was in the possession of an excellent observatory, and his scientific instruments were of the first order.

AT the provincial meeting of the Horticultural Society, held at Birmingham last week, Prof. Thiselton Dyer read an address on the bearing of recent scientific investigations on horticulture.

IN his third and concluding lecture at the College of Surgeons, Prof. Humphry continued his exposition of the morphology and homology of the muscles of the limbs in man. Though arranged in accordance with the movements of the several joints of the limbs upon the flexor and extensor aspects, yet the extensor muscles not unfrequently incline on the sides of the joints, from the extensor to the flexor aspects, and so, irrespective of their nerve-supply, acquire a flexor action. This he believed to be the case with the biceps flexis cruris, which he has shown, from the anatomy of the Cryptobranch in the last number of the *Journal of Anatomy*, to be a derivative from the extensor mass in the thigh. Occasionally, also, as in the case of the *lumbricales*, flexor muscles acquire an extensor action. He spoke of the tendinous intersection in the semitendinosus as being the representative of a similar intersection in the Cryptobranch found at the junction of the caudal with the femoral muscle; and believed it to be present in man for the purpose of dividing the fibres of this muscle, which are of unusual length in consequence of the range of action required of them by the insertion of the tendon at a greater distance from the centre of motion at the knee than the other hamstrings. The ulnar origin of the pronator teres is a representative of the pronator intermedius of reptiles. It is found in the chimpanzee as well as in man, and serves to carry on pronation of the forearm in the flexed position of the elbow in which the remainder of the muscle is relaxed. In like manner the accessorius in the foot serves to maintain the flexion of the toes, while the flexor digitorum is relaxed by the bending of the ankle. This muscle has no representative in the upper limb of man, or in the fore limb of mammals, but it is well represented in the fore limb of Saurians. The great difference in the construction of the two limbs is caused by the pronation and supination in the fore arm and hand, and by the projection of the heel; and the representatives of the muscles, which in the upper limb affect the movements of pronation and of flexion of the fingers, are in the lower limbs, to a considerable extent, concentrated upon the knee. In instituting the comparison between a hand and foot, the Professor observed that it is necessary to eliminate from the consideration those features which ordinarily distinguish the one limb from the other; and this has not been done with sufficient care by some of those who have recently discussed the subject. We should first determine the points in which the hand of man differs from the terminal part of the ordinary fore limb of a mammal; and we may apply the term "hand" to the terminal part of either limb which presents a corresponding modification. This may take place in the hind limb, although the heel may project, and though a peroneus longus muscle, and a short flexor, and a short extensor of the digits may be present. These have been insisted on as the anatomical features of a foot as distinguished from a hand. But in reality they are rather the features of a hind limb as distinguished from a fore limb; and their presence is quite compatible with a modification of the hind limb corresponding with that modification of the fore limb which constitutes the hand of man. Judged in this way the terminal part of the hind limb of a gorilla or a chimpanzee has as much claim to be called a hand as has the terminal part of the fore limb in the same animals. Hence the term "quadrumanous" is, on anatomical ground, fairly applicable to these animals and their allies, as there is no sufficient reason to deny to man the prerogative of special subdivision of labour in the parts of his frame, and, consequently, of high organisation which is significantly implied by the term "bimanous." These lectures are in course of publication in full in the *British Medical Journal*.

THE concluding excursions of the Geologists' Association for the present season will be as follows:—Monday, July 8, excursion to Walton-on-the-Naze; director, Prof. Morris. Saturday, July 13, visit to the International Exhibition; director, Prof.

Tennant. Monday, July 22, and five following days, excursion to Ludlow and the Longmynds; directors, Prof. Morris, Mr. Robert Lightbody, and Rev. J. D La Touche. This excursion is intended to afford members an opportunity of studying Silurian and Cambrian Strata, and will be of great value to students of the Palæozoic Rocks. On Monday, after arrival at Ludlow, the party will examine the exposures of the Ludlow group of rocks in the immediate vicinity of the town. On Tuesday the objects of attraction will be the outcrop of the Upper Ludlow on the road to Wigmore, the Aymestry Limestone, and the Lower Ludlow. After passing Elton Hall, examine fine and Fossiliferous Section of the Lower Ludlow, at Evenhays (Vinal Ridge). Proceed then to Burrington (Wenlock Shale), Bank of the Teme (good section of Wenlock Shale), and Church Hill Quarry, Leintwardine, famed for Echinoderm remains. On Wednesday, leave Ludlow for Hayton's Bent, where the Old Red sandstone is exposed, and may be examined with advantage. On Thursday, proceed by Bishop's Castle Railway for the south end of the Longmynds, where the Wenlock Shales will be examined, and the physiography of the district formed by the Llandeilo Rocks observed. Walk back through the Valley of the Onney, observing on the way sections of Silurian Rocks from the Lower Caradoc to the Wenlock. On Friday, proceed by rail to Lydham Heath, thence to Shelve (Lower Llandeilo). Walk over the Stiperstone and Longmynd Ranges to Church Stretton, and examine junction of Cambrian and Silurians. On Saturday, from Craven Arms walk to Norton Camp, observing by the way Wenlock and Ludlow Sections, and at Norton inspect a good exposure of the "Bone Bed." Should time permit, proceed to Onibury, and inspect junction of Silurians and Devonians, and a fossiliferous section of Lower Ludlow Shale.

A NEW work on Electrostatics by Sir William Thomson will be published by Messrs. Macmillan and Co. early in August. It will consist chiefly of articles which originally appeared at different times during the last thirty years, in the *Cambridge Mathematical Journal*, the *Cambridge and Dublin Mathematical Journal*, Liouville's *Journal de Mathématiques*, the *Philosophical Magazine*, Nichol's Cyclopædia, the Reports of the British Association, the Proceedings of the Royal Societies of London and Edinburgh, of the Royal Institution of Great Britain, and of the Philosophical Societies of Manchester and Glasgow; and which will now be first collected and published together. The rest, constituting about a quarter of the whole, will be printed from manuscript, which, except a small part about twenty years old, entitled "Electromagnets," has been written for the present publication, to fill up roughly gaps in the collection.

THE two modes of photographic printing known as the Albert and Woodbury processes have both been employed by Prof. Agassiz in the illustration of his forthcoming "Revision of the Echini." Prof. Agassiz has kindly permitted us to see specimens of both modes of illustration. They are simply exquisite, portraying every marking on the surface of the shells with the accuracy of nature printing, and with the beauty of a lithograph. The practical working of these new modes of photographic printing must speedily work a complete revolution in the illustration of works on Natural History.

A VALUABLE report, prepared by Mr. R. D. Cutts, of the United States Coast Survey, upon commerce in the products of the sea, has just been published by the Senate, and is considered a valuable contribution to the statistics of the fisheries of America and of the rest of the world. In this the different marketable products are described in detail, and the relative rank which they occupy in commerce indicated. In addition to this, there is given the area, population, most important ports, and commercial tonnage of the principal nations of the world; the imports and exports of the products of the sea; showing the capacity of the markets and the countries supplied; and also the catch, consumption, and balance of trade, from official statistics. This Report was prepared in 1869 by request of the Secretary of State, and transmitted in February of that year, but the order to print was not made till receetly.

THE Report of the Government Cinchona Plantations at Ootacamund in India for 1870-71 states that the growth of the plants has been very satisfactory. The older shrubs have grown into trees 22ft. to 23ft. high, and 18in. to 21in. in girth. Of the *Cinchona succirubra* the finest samples reach a height of 30ft., with a girth of 3ft. Among the new species of plants lately introduced is the Pitayo bark, which appears hardy and well suited to the climate. During the year 51,353lbs. of fresh bark were supplied to Mr. Broughton, the Government quinologist, for the manufacture of amorphous quinine. From 1,000 eight-year-old plants of the *Cinchona succirubra*, as much as 2,560lbs. may be expected to be extracted this year. This average of more than 2½lbs. to each tree will yield at the present rate of 2*s*. 8*d*. to 3*s*. per lb., a clear profit of at least 2*s*. per lb.

PROF. LEIDY, at a meeting of the Philadelphia Academy of Seciences, on February 6, exhibited specimens of corundum from Macon County, North Carolina, which, he said, were especially interesting, as they consisted of fragments of large crystals of gray corundum, containing in the interior dark blue sapphire, and coated on the exterior with bright red ruby. One pyramid of a large crystal from the same locality recently brought to that city weighs 300 pounds.

AT the meeting of the American Fish-Culturists' Association, held at Albany, it was voted to present to Congress a memorial for aid from Government in stocking the rivers of the United States with useful food fishes. Mr. George Page Shepherd, of New Jersey, was appointed to present the memorial, and had an opportunity not long since of expressing his views before the House Committee on Appropriations.

ACCORDING to Dr. Uhler, of Baltimore, the European cabbage butterfly (*Pontia Brassicæ*), the pest of the agriculturist, has reached Baltimore in its invasion of the United States. It has been known for some years more to the eastward, and has been slowly but surely creeping along, until it bids fair to involve the whole country in its ravages.

WE reprint the following interesting note from *Harper's Weekly*:—"As is well known, grouse, pheasants, ptarmigans, and some other gallinacea have a red patch or wattle above the eye, this being so conspicuous in some species as to resemble a piece of red flannel. This has been lately subjected to a careful analysis by Dr. Wurm, who ascertains that it contains a new organic colouring material, which he calls *Tetronerythrin*, or grouse red. It seems to lie in the deeper strata of the epidermis, like the colouring matter of the human skin, and to be partly dissolved in the deep layers of the cells, and partly to common with the colouring matter of the blood. The fact has been well known to hunters that if a white cloth be rubbed over this red process the colour will come off."

THE *New York Journal of Commerce* gives circulation to a story of an extraordinary fall of fish-bones (?) in Louisiana, covering the ground over a considerable area.

LATE Chilian papers announce the discovery of important mines of coal in that country, especially along the Gulf of Aranco, near the mouth of the Carampangue River. According to an official report, one of these veins is five feet thick, and is estimated to contain four million tons of coal.

THE SCIENTIFIC RELATIONS OF GERMANY, FRANCE, AND ENGLAND

THE following extracts from M. Berthelot's recent excellent article in the *Temps*, on the Relations which should exist between Germany and France, are taken from a recent number of the *Pharmaceutical Journal* :—

We know that modern civilisation depends upon three nations, which should at all times and at any cost remain united—namely, France, Germany, and England, each with its peculiar genius and its share in the historic development of the human race. From the seventeenth century each of these nations has taken an active and prominent part in the progress of science.

To speak first of physical and mathematical sciences. Though the initiative was due principally to a few men of other countries —Galileo, an Italian, and Copernicus, a Pole, being the founders of modern astronomy and mechanics—yet the development of these sciences was concentrated chiefly in France, Germany, and England. In France, Descartes discovered the methods of geometric analysis, which have proved more durable than his philosophical and cosmogonical theories. In Germany, Kepler invented the laws of planetary movement; and Leibnitz, who by education and the clearness of his conceptions was perhaps more French than German, laid down the rules of the differential calculus under a form in which they still exist amongst us. At the same time, England produced Newton, greater, perhaps, in the science of nature than either Descartes, Kepler, or Leibnitz; for Newton discovered both new methods of calculation and the laws of astronomy, and since his time we have scarcely done more than develop his ideas and doctrines in studying the movement of the stars.

This same concourse of the three great nations of modern times is seen also in the foundation of chemical science, which in the present day plays so important a part, whether it be in the theories relative to atoms and the constitution of matter, to the formation of stars and of the successive layers of the terrestrial globe, to the origin of life itself; or, on the other hand, in the applications of human industry, dealing with metals, colouring matters, remedies, agriculture, and manufactures.

Towards the end of the eighteenth, and at the commencement of the nineteenth centuries, chemistry was established upon a durable basis, after having floated during nearly two thousand years amongst mystical, obscure, and incoherent notions. It was a Frenchman, Lavoisier, who fixed these indecisive ideas, by the definite principle of the stability of matter, invariable in the nature and weight of its simple bodies. Perhaps, as has been asserted, Lavoisier did not discover any particular fact; but, according to Aristotle, principles and causes are things which are of more scientific importance, for by them we arrive at other knowledge. Now Lavoisier discovered the fundamental principle of chemistry; the science dates from him.

Is this saying that Lavoisier divined all, perceived all, traced for all time the plan of chemical science? Not at all; no more than that Newton alone founded astronomy. For this the inevitable concourse of the great nations was required. Whilst Lavoisier published his immortal researches, the English Priestley and Cavendish discovered the principal gases and the nature of water—inventions that were seized immediately by Lavoisier to support his theory. The Swedish Scheele brought also his precious contingent to the common work. Some years afterwards, an Englishman of genius, Humphry Davy, completed the edifice by the discovery of the alkaline metals, which he obtained by the application to chemical decompositions of the pile recently discovered by a great Italian, Volta.

Germany equally marked its place in the foundation of the new science. It was in the law of numbers that its work was principally characterised: Richter, Wenzel, and the great Berzelius (a Swede) established the law of chemical equivalents, that is to say, a law as general and as absolute in chemistry as the law of Newton in astronomy. It is remarkable that the part of the Germans in this discovery has been principally experimental and practical, contrary to the opinion generally received of German genius. On the contrary, the atomic theory, properly so-called, of a character more abstract and more litigious, is due to an Englishman, Dalton; whilst its demonstration by the physical study of the gases has been accomplished by a Frenchman, Gay-Lussac. This shows that the geniuses of the European races are not so different as has been asserted. Give them a common and equally high culture, and from each will proceed inventions equally original.

This conjunction of Germany, France, and England is to be seen in every great epoch in the history of modern science. The demonstration could be carried down to the present time, proving that neither of these three nations has degenerated from its past: the doctrine of substitutions, the theory of the ethers, that of the polyatomic alcohols, dissociation, the idea of organic ferments, the methods of synthesis of organic principles, have been principally established by French discoveries; the theory of the radicals and that of the polyatomic elements are rather to be attributed to German discoveries; whilst the electro-chemical theory and the method of double decompositions have been invented in England. Finally, the great doctrine of the equivalence of the natural forces, more particularly designated under the name of the mechanical theory of heat, was first discerned by a German, Mayer, and an Englishman, Joule. Developed afterwards by a German mathematician, it has been established in chemistry principally by the experiments of French, English, and Danish scientific men. But it would not be wise to dilate upon the science of the present day; we are too near to it, and are too much engaged in it, for any estimate to escape suspicion of partiality.

In looking back over this short sketch of the progress of the science with which I am best acquainted, I would not ignore the part of Italy, which in the past was so great (may it resume its importance in the future!), nor that of the United States, nor of Russia. But, I repeat, the initiative of the ideas and discoveries has rested for more two centuries in the bosom of three nations —English, French, and German. Their union and their reciprocal sympathy is indispensable, under the penalty of a general loss to civilisation.

INSTRUCTIONS FOR PREPARING BIRDS' EGGS *

I WISH to say a few words for the benefit of those engaged in collecting oological specimens.

Twenty years ago all eggs were blown with two holes—one at each end, and until within ten years most eggs have been emptied with two holes as above, or at the side. Very many of the eggs which I now receive in my exchanges are similarly prepared. At the present time no experienced collector ever makes but one hole to remove the contents of the egg, using a blowpipe in some form to accomplish this object. The following rules should invariably be followed:—

1. Prepare your eggs neat and clean. There is no excuse for having a dirty set of eggs where water, soap, and a tooth-brush can be found. Some eggs will not bear washing, as the shell is so calcareous that the characteristic markings will wash away. There are, however, but few of this class, and I believe this peculiarity is confined to the water-birds. You can see it in any of the species (Smithsonian Catalogue) from 615 to 628 inclusive, and also in the eggs of the Grebes and Flamingo, and some others. Having once seen it you will never mistake it for anything else.

2. Make but one hole, and that a small one in the middle of the egg; cover this hole, when the contents are removed, and the specimen is dry, with gold-beater skin or the paper number indicating the bird. Use an egg drill or a pointed wire of four or six sides to make the opening.

3. If the blowpipe does not readily remove the contents of the egg, inject water and shake the specimen thoroughly, then blow again, and repeat the operation until every particle of the egg is removed.

4. If the embryo is too far advanced to remove through a moderate sized hole, blow out what you can of the liquid part and fill the egg with water, wipe it dry and put it away in a covered box in some warm place, and every twenty-four or forty-eight hours shake it well and remove what you can, and then refill with water. Repeat this operation several times, and after a few days the contents will become sufficiently decomposed to take away.

5. After removing the contents of any egg, cleanse the shell thoroughly. Fill it with clean water and shake vigorously, blow out the contents and repeat the operation until the specimen is perfectly clean. This is particularly desirable in white eggs, as black spots will show through the shell after a time if the least particle of the egg or blood stains remains inside.

* By William Wood, M.D. Reprinted from the *American Naturalist*.

6. Save all your eggs in sets—that is, keep all the eggs each bird lays by themselves. This is the only way to form a correct knowledge of the eggs of any species, as a single egg, particularly of the blotched ones, frequently gives a very erroneous idea of the general markings—a very unsatisfactory representative of a set. For instance, in my collection are four eggs of the *Buteo lineatus*, found in the same nest, two of which are pure white and two blotched. It is not very uncommon to find great variations in markings in the same species and in the same nest.

7. Keep a memorandum of the place and date of collecting each set of eggs.

8. Use some kind of blowpipe in preparing your eggs for the cabinet. The common blowpipe, with the addition of a fine pointed tip, will answer; yet it is a severe tax on the lungs and brain if you have many eggs to blow. I have many a time been dizzy and almost blind from overtaxing my lungs in this operation. Within a few years Mr. E. W. Ellsworth, of East Windsor Hill, Conn., has invented a blowpipe which is operated by the thumb and finger, which works very perfectly and expeditiously. I would not be without it on any account. After using it for a time, and then letting it remain unused until the leather packing becomes dry, the instrument does not work satisfactorily to those unaccustomed to it. The remedy is simple. Take off the blowpipe and work the instrument submerged in a bowl of warm soap suds, when the leather packing becomes pliable and works as well as new. I have used the same instrument for years, and it works to-day as well as when new, by following the above directions. The printed directions which accompany each instrument are intended to be a sufficient guide in case repairs are needed, and the maker can be referred to for any further information required.

SCIENTIFIC SERIALS

THE *Geological Magazine* for May (No. 95) opens with an important article (illustrated with a plate) on some coniferous remains from the Lithographic Stone of Solenhofen by Mr. Dyer, in continuation of a former paper on the same subject. This paper includes the description of a new species of *Pinites* (*P. solenhofenensis*), a revision of the genus *Athrotaxites*, with descriptions of two new species (*A. longirameus* and *A. ? laxus*), and a notice of a new genus, *Condylites*, probably belonging to the Cupressine group, and including a single new species, *C. squamatus*.—MM. H. B. Woodward and J. H. Blake communicate a valuable paper on the relations of the Rhætic beds to the Lower Lias and Keuper formations in Somersetshire, in which they cite additional evidence and arguments in support of the view that the Rhætic beds constitute true passage-beds between the Keuper and Liassic series.—Principal Dawson gives us the results of a new examination of the geological structure of Prince Edward's Island in the Gulf of St. Lawrence; and Mr. Alfred Bell a paper on the succession of the Crags, the latter containing a criticism of Mr. Prestwich's recently-published memoirs on the same subject.—Mr. James Geikie communicates a sixth paper on changes of climate during the glacial epoch, and the number concludes with an interesting lecture on meteorites by Mr. David Forbes.

THE *Monthly Microscopical Journal*, No. 42, for June, completing the seventh volume, contains communications on "An Improved Reflex Illuminator for the Highest Powers of the Microscope," by W. H. Wenham; on "A Silvered Prism for the Successive Polarisation of Light," by J. W. Stephenson; "Structure of Battledore Scales," by J. Anthony, M.D., detailing fresh investigations by a new method of of illumination, the results of which confirmed those of a previous communication; "Beale's Nerve Researches: the Reply of Dr. Beale to Dr. Klein;" "On Bog-Mosses," by R. Braithwaite, M.D., part iv., devoted to *Sphagnum tenellum* Ehrh., and its varieties. This is the *S. molluscum* of Wilson's "Bryologia;" "Crystallisation of Metals by Electricity," by Philip Braham; "On the Means of Distinguishing the Fibres of New Zealand Flax from those of Manilla or Sizal, by the Microscope," by Captain Hutton. The average length and diameter of the ultimate fibres are held to be distinctive, as well as some other less important points, in the discrimination of these fibres. The residue of this number is occupied, as usual, with brief notices of new books, notes on microscopical subjects, and the proceedings of microscopical societies.

SOCIETIES AND ACADEMIES

LONDON

Geological Society, June 19.—Prof. Ramsay, V.P., in the chair.—The following communications were read:—1. "On *Trochocyathus anglicus*, a new species of Madreporaria from the Red Crag," by Mr. P. Martin Duncan, M.B., F.R.S. The author described a coral, of which a single specimen had been found in the Red Crag, in the grounds of Great Bealings Rectory, Norfolk. He stated that it belonged to the genus *Trochocyathus*, and was distinguished from the other species of that genus by its dense epitheca, its small and prominent columella, and its inverted calicular margin. He proposed to name it *Trochocyathus anglicus*, and stated that its nearest alliance is with the Australian Upper Tertiary form described by him under the name of *T. meridionalis*. Mr. Prestwich inquired whether the fossil bore any resemblance to any of the French Eocene forms, and whether there was any possibility of its being derivative. Prof. Duncan replied that the specimen was but little worn, and was therefore probably not *remanié*, though this point was not absolutely certain. 2. "On the Discovery of Palæolithic Implements in association with *Elephas primigenius* in the High-terrace Gravels at Acton and Ealing," by Colonel A. Lane Fox, F.G.S. The gravels in the neighbourhood of Acton have been divided by Mr. Prestwich into two principal groups—viz., the high-level gravels on the hills above the valley, and the valley-gravels on the sides and bottom of the valley itself. The valley-gravels have been again divided by Mr. Whitaker into three terraces—viz., a high terrace, between 50ft. and 100ft. above the Ordnance datum, a mid terrace, between 20ft. and 40ft. high, and a low terrace, at an average height of 10ft., occupying the low ground in the bends of the river. On both sides of the river the high terrace is separated from the mid terrace by a strip of the London Clay, which is laid bare at an average level of 50ft. The London Clay is also laid bare on the sides of the tributary streams running into the valley on both sides of the river, thus dividing the high-terrace gravel into patches. The mid terrace is continuous, and follows the sinuosities of the valley on both sides up to the strip of London Clay. The author accounts for this distribution of the gravels by supposing that a large body of water must at one time have stood at the 50-feet level, and the denudation of the high terrace have been caused by the waves beating on the sides of the valley, and by drainage into this body of water. The mid terrace he conceives may have been caused in part by accumulations beneath this body of water. The position of the high-terrace gravel at Acton corresponded so closely to that of the implement-bearing gravels of the Somme and the Ouse that the author was led to examine carefully the excavations made in it for the construction of houses. He discovered a number of implements of the drift-type, together with flakes and cores, and a few roughly-formed scrapers; all these were found in close contact with the London Clay, and beneath the gravel. Fragments of fern (*Osmunda regalis*) and of wood (*Pinus sylvestris*) were also found with the implements at the same level. Two implements were found at Ealing Dean, two miles westward, on nearly the same level as those at Acton—viz., 90ft.; and these also came from the bottom of the gravel. Another implement was found south of the river at Battersea Rise, in the same position above the strip of London Clay as at Acton, and at about 60ft. above the Ordnance datum. The implements are of the pointed and oval types. The only animal remains discovered in the high terrace consisted of a tooth of *Elephas primigenius* in the Acton gravel. The position of this the author believes to be reliable, although he did not discover it himself *in situ*. In the mid-terrace gravel a number of pits were examined between Shepherd's Bush and Hammersmith, and in the neighbourhood of Turnham Green, which resulted in the discovery, at the latter place, of a large quantity of animal remains (noticed by Mr. Busk in the following paper), all of which, like the implements of the high terrace, were at the bottom of the gravel; but no evidence of human workmanship was found in the mid terrace. All these were found together, in the same seam of gravel, 12ft. beneath the surface, and all appeared to have been deposited at the same time. The surface was here 25ft. above the Ordnance datum, and consequently about 50ft. lower than the implements of the high terrace, 1½ mile to the north. The section across the valley, taken through the two places, here shows the strip of the London Clay intervening between the two terraces. The chief points of interest which the author submitted to the judgment of geologists consisted in the presence of drift imple-

ments in the high terrace, their absence in the mid terrace, and reappearance in the existing bed of the Thames; the great rarity or absence of animal remains in the high terrace, and their abundance in the mid terrace, and the occurrence of both implements and animal remains at the bottom of the gravel in both terraces. The writer concluded by adducing proofs of the great antiquity of the present river-bed, which it was shown must have run in its present meandering course in the bottom of the valley for at least 2,000 years. 3. "On the Animal Remains found by Col. Lane Fox in the High and Low-level Gravels at Acton and Turnham Green," by Mr. George Busk, F.R.S. The author described the mammalian bones referred to in the preceding paper. The remains from the high-level gravels at Acton belong to the genera *Bos*, *Ovis*, *Equus*, and *Elephas*? The greater part belong to the first-named genus, and are probably modern, as are also those of *Ovis*. The remains of *Equus* may be of greater antiquity. The other bones found may belong either to Elephant, Rhinoceros, or Hippopotamus; they include a large portion of an Elephant's molar, and are much rolled. The remains from the mid-level gravel at Turnham Green generally present the characters of great antiquity. They include bones of *Rhinoceros hemitœchus*, *Equus caballus*, *Hippopotamus major* (one of them the left frontal of a very young animal almost unworn), *Bos* (probably *B. primigenius*, and some perhaps *Bison priscus*), *Cervus* (*C. clactonensis*, Falc. = *C. Browni* Dawk., *C. elaphus*, and *C. tarandus*), *Ursus ferox priscus*, and *Elephas primigenius*. Mr. Prestwich complimented the author on the exactness and completeness of his description of the classical district which he had investigated, in which mammalian bones had been found and described by Mr. Trimmer so early as 1815. In that case Hippopotamus remains, very fresh and unworn, had also been discovered. Prof. Morris had also described a deposit near Brentford in which numerous remains of Reindeer were present, showing how variable was the distribution of mammalian remains even in a limited area, and how unsafe it was to base theories upon merely negative evidence. It was to be hoped that other investigators would extend similar discoveries to other parts of the valley of the Thames. Mr. Godwin-Austen did not think that the presence of the young Hippopotamus was absolutely conclusive of its having been born in this country. With regard to the presence of remains of Reindeer and Hippopotamus in the same beds, not only might there have been an overlapping of fauna such as has been pointed out by Sir Charles Lyell, but there also might be an intermingling of the included remains from two beds of different ages. He was not altogether satisfied with the evidence as to the coexistence of man with *Elephas primigenius*, nor as to the artificial character of some of the presumed implements. He did not attach any great importance to the merely fragmentary bones. Mr. Evans maintained that the implements exhibited were of necessity artificial, and commented on the nature of the evidence as to the coexistence of man with the Pleistocene fauna. Under any circumstances the gravels containing the implements could only have been deposited at a time when the Thames valley had not been excavated to anything like its present depth; and they were therefore of great antiquity. There was, moreover, a notable absence in them of a number of the animals usually found associated with Neolithic implements; and if man had not subsisted on the animals the remains of which were found associated with his handiworks in the gravels, it was a question on what food he had had to depend. The absence of implements in the low-level gravels seemed to him significant of a diminution in the number of the human beings who frequented the banks of the river. Mr. Carruthers said that as the rhizome, whether it was that of *Aspidium* or *Osmunda*, was an aërial, and not a subterranean rhizome, it must have been carried to its present position; and it consequently indicated, as Col. Lane Fox had pointed out, the direction of the stream. Mr. Flower regarded Col. Lane Fox's memoir as of great interest, as affording an additional instance of that perfect similarity of these deposits, whether in France or England, which in places so wide apart might reasonably be taken to indicate a common origin. It was indeed generally assumed that these deposits were brought down by rivers; but this, according to his view, was by no means certain. Col. Lane Fox had described the valley as 4½ miles wide; but there was at Croydon, 12 miles distant, a deposit of gravel capped with loess, containing elephant remains, and exactly resembling the Thames valley-gravels, and communicating with them. This evidently formed part of the Thames valley system, whatever that system might be taken to be; and if so, he thought it incredible that the loess should have been distributed by river-action over an area 12 or 15 miles in width. In conclusion, he was quite content to adhere to the opinion held by the French geologists, and formerly by several of our own most able writers, that the distribution of these superficial drifts was in the first instance diluvial rather than fluvial. Col. A. Lane Fox, in reply, pointed out the artificial character of the implements, and the manner in which the mammalian remains occurred. He thought that the lower terrace of gravel might have been formed at the bottom of a lake. Mr. Busk, in proof of the animal remains not having been brought from a distance, showed that the remains of the same animal were found in close proximity to each other. Prof. Ramsay made some remarks on the undoubtedly artificial character of the implements, and on their position at the base of the gravels. The origin of the Thames valley he had already maintained to be of Postmiocene age; and though there was at present no evidence of man's existence at that time, it was still possible. Of the extreme antiquity of the human race there could, however, be no doubt. 4. "On the Evidence for the Ice-sheet in North Lancashire and adjoining parts of Yorkshire and Westmoreland," by R. H. Tiddeman. The country of which the earlier glacial phenomena were described in this paper lies between the Lake-district on the north and the plains of South Lancashire and Cheshire on the south, and extends from the great watershed of England to the Irish Sea. On the west is a seaside plain rising to levels of less than 200 feet. On the north-east is a portion of the Pennine Chain, comprising Ingleborough, Pennigent, and other Fells, rising to heights of from 2,000 to 2,400 feet. Between these, from north to south, we pass over (1) a range of moorlands from 1,000 to 1,500 feet high, called the Rossendale Anticlinal, which forms the watershed between the basins of the Mersey and the Ribble; (2), the valley of the Burnley and Blackburn Coal-field, which drains north through gorges in (3) the Pendle chain of hills into (4) the broad valley of the Ribble; (5), a group of Fells rising to a general level of 1,800 feet, between the valleys of the Ribble and the Lune, called, for the purpose of this paper, "The Central Fells;" (6), north of this the valley of the Lune and the estuary of the Kent. The main direction of all these features between the seaside plain and the Pennine Chain, is from north-east to south-west. The paper was illustrated by a map of the district on the scale of 1 inch to a mile, coloured to represent elevations, the level contours having been reduced from the 6-inch scale. Upon this all the ice-scratches found on the solid rocks were inserted. A diagram illustrating the proportional number of scratches in different directions showed that 20 per cent. of them were due south, although the general direction of the valleys was to the south-west. An instance was mentioned of a ridge of 1,400 feet in height, which had scratches at the top running directly across it to the south, although no land of equal height occurred north of it within a distance of seven miles. A similar instance was shown to exist on the ridge north-east of Pendle Hill. A *roche moutonnée* in the gorge of the Calder at Whalley was shown to have been formed by ice working from the north, although the river drains from the south. Other systems of scratches were mentioned in detail. All these tended to show that, though the general slope and drainage of the district is to the south-west, the movement of the ice at the period of maximum cold was to the S. or S.S.E., or nearly parallel to the watershed. The author goes on to describe certain disturbances at the surface of the rocks, which are dipping at high angles to the south, they having been overturned by some force coming from the north. Such surface-disturbances are not found on rocks dipping to the north; and this fact may be explained by an illustration: in one case the brushing was with the nap, in the other against it. In was shown that these phenomena could not be attributed to any other agent but a great ice-sheet pushing on from its northern gathering grounds, recruited by the greater elevations on its course, but overriding the lesser, grinding down and smoothing by its friction rocks presenting but a gentle incline, tearing up and turning over the basset edges confronting its approach. The author next described the arrangement of the Till as to colour and material, and endeavoured to show that all the facts which he has observed are in favour of the existence of an ice-sheet travelling south in this district. Mr. Cumming's observations in the Isle of Man were considered to confirm these views. He describes the general glaciation of the island as being from the E.N.E. or Lake-country, and describes many large blocks of granite which had been carried from their parent rock up the high hill of South Barruh and down on the other side. This was referred by Mr. Cumming at the time to a great "wave of

translation;" but the facts are quite easily explained by an ice-sheet. Other observations of Mr. Cumming upon the drifts of the Isle of Man were taken by the author as confirmatory of his views. Mr. Morton's observations on the glaciation of the Mersey basin were touched upon; and it was suggested that the glaciation of that district was produced by an ice-sheet, not coming from the south-east, as Mr. Morton holds, but working to the south-east from the Lake-country, and across a part of what is now the Irish Sea. Prof. Ramsay's observations on the glaciation of Anglesey being to the S.S.W. instead of from the Snowdon group, as might be expected, were considered by the author to be confirmatory of his views of a great ice-sheet having filled what is now the Irish Sea, and emptied itself by St. George's Channel on the one hand, and by the Cheshire plain on the other, as well as by some of the passes in the Pennine Chain.—5. "On the Mammalia of the Drift of Paris and its Outskirts." By Prof. Albert Gaudry, F.C.G.S. In this paper the author briefly indicated those mammals the remains of which have been discovered in the Pleistocene or Quaternary deposits of Paris and its vicinity. His list includes flint implements as evidences of the existence of man, and bones of the following species:—*Canis lupus*, *Hyæna crocuta* (*spelæa*), *Felis leo* (*spelæa*), *Castor trogontherium* and *fiber*, *Elephas primigenius* and *antiquus*, *Hippopotamus amphibius*, *Rhinoceros tichorhinus* (a Rhinoceros of doubtful species), *Sus scrofa*, *Equus asinus* and *caballus*, *Bos primigenius*, *taurus* (?), and *indicus* (?), *Bison priscus* and *europæus*, and *Cervus tarandus*, *Belgrandi*, *megaceros*, *canadensis* (?), *elaphus*, and a small species.

Zoological Society, June 18.—Mr. John Gould, F.R.S., vice-president, in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of May, 1872. The most noticeable of these were two Argus Pheasants (*Argus giganteus*), presented to the Society by Mr. J. G. Fanshawe.—Mr. P. L. Sclater exhibited a pair of Ceylonese birds sent to him for determination by Mr. W. Vincent Legge. These birds Mr. Sclater considered to belong to a new species of the genus *Prionochilus*, which he proposed to call *P. vincens*, after one of the names of its discoverer.—Mr. Edwin Ward exhibited the horns of a Barasinga Deer (*Cervus duvaucelii*) with twenty points, and a very handsome and peculiarly grown specimen of the Gaur or Indian Bison, from Central India.—Mr. St. George Mivart read a paper "On the Axial Skeleton of the Ostrich" (*Struthio camelus*).—Dr. J. Murie read a paper "On the Cranial Appendages and Wattles of the Horned Tragopan" (*Ceriornis satyra*). After alluding to the phenomena of display during courtship, he went on to show that rudimentary horns are found in the female. In the male the pseudo-horns are composed of firm fibro-elastic substance, and are not due to vascular erection. The wattle, on the contrary, is a true erectile vascular organ.—A communication was read from Prof. H. H. Giglioli, containing an account of the Cetacea observed during the voyage round the world of the *Magenta* in the years 1865–68. In this were contained descriptions of several new or little known species, and of a new genus and species of Fin-backed Whale, proposed to be called *Amphiptera pacifica*.—Dr. J. Murie continued the series of his observations on the Macaques, commenced at the last meeting. The species selected for special notice were *M. arctoides* of Is. Geoff., which he showed to be identical with *M. brunneus* of Anderson:—The Formosan or Round-faced Monkey (*M. cyclopis*), and the Japanese Monkey (*M. speciosus*). Points in the anatomy and skeleton of each of these species were described.—A communication was read from Dr. J. E. Gray, containing the description of the younger skull of Steller's Sea Bear (*Eumetopias stelleri*).—A communication was read from the Rev. O. P. Cambridge, giving descriptions of twenty-four new species of Spiders of the genus *Erigone*.—A second communication from Dr. J. E. Gray, F.R.S., contained additional notes on new corals from the Southern and Antarctic Seas.—A further communication from Dr. Gray contained additional notes on *Arctocephalus cinereus*, and on *Gypsophoca*, from the coast of New Zealand.—Mr. A. H. Garrod read a description of the tongue of *Nestor hypopolius*, which showed that *Nestor* does not belong to the Trichoglossine group of Psittacidæ.

Mathematical Society, June 13.—Mr. W. Spottiswoode, Treas. R.S., president, in the chair. Prof. Cayley, vice-president, gave an account of his paper, "On the surfaces divisible into squares by their curves of curvature." Sir W. Thomson, Mr. Merrifield, and Prof. Clifford, asked for information on one or two points in the communication.—Mr. S. Roberts, vice-president, gave some details of his paper, "Prof. Cremona's transformation between two planes and tables relating thereto."—Reference was made to a paper by Prof. Cayley. "On the rational transformation between two spaces" (Proceedings Lond. Math. Society, vol. iii. pp. 127, &c.).—Dr. Hirst briefly sketched out a few results arrived at in his communication, entitled "A manifold correspondence of two planes." Sir W. Thomson explained the object of his short paper "On the simultaneous reduction of two prodynamical quadratics to sums of squares." He referred to papers by Prof. Cayley (Camb. and Dub. Math. Jour., Feb. 1869, and Quarterly Math. Jour. 1858), and to Conaby's problem "Sur l'équation à l'aide de laquelle on détermine les inégalités séculaires des planètes," treated of in vol. iv. of that writer's "Exercises." The Hon. J. W. Strutt referred the author to a memoir bearing on the subject of his paper.

Anthropological Institute, June 17.—Sir John Lubbock, Bart., president, in the chair.—Mr. A. W. Franks exhibited and described photographs of the tattooed man from Birmah—The following papers were read: "On the Hill Tribes of North Aracan," by Mr. St. Andrew St. John; "The Ainos of Yeso," by Commander H. C. St. John, R.N. (communicated by the Admiralty); "Indian Picture Writing in British Guiana," by Mr. Chas. B. Brown; "Report on Australian Languages and Traditions," by the Rev. W. Ridley, M.A. (communicated by the Colonial Office); "Report of the Anthropological Section of the Arctic Exploration Committee."

Linnean Society, June 20.—Mr. G. Bentham, president, in the chair.—Mr. A. W. Bennett communicated a short note on the mode of fertilisation in *Impatiens parviflora*. On the structural peculiarities of the Bell-bird (*Chasmorhyncus*), by Dr. Murie.

Geologists' Association, June 7.—Rev. J. Wiltshire, president, in the chair.—"On the Classification of the Cambrian and Silurian Rocks," by Henry Hicks. The author, after mentioning the groups now known to comprise the Cambrian and Silurian rocks, as exhibited in the British Isles, and the usual mode, hitherto, of dividing and subdividing these formations, stated that it was impossible in a science so progressive as geology, where new discoveries were continually being made, to accept at present any of these arrangements, which for the most part had been made some twenty or thirty years ago, unless with considerable modifications. The classification approved by the author has already been, to a great extent, adopted by Sir Charles Lyell in his "Students' Manual," and by the late Mr. Salter, and the author in papers to the British Association; and is based on the most recent palæontological and stratigraphical evidence. In a table exhibited for the purpose of illustrating these facts, the classification of Prof. Sedgwick, and of Sir R. Murchison, were placed side by side along with the one proposed. The columns in the table showed (1) the lithological characters of the beds comprising each group; (2) the thickness of the strata; (3) the organic remains contained in each group; (4) the number of genera and species which are known to reach from one group into another; (5) the order of the appearance of animal life upon the globe, and (6) the localities where the several groups are best seen in England. By means of the evidence set forth in these columns, the author was enabled to show the most natural divisions and subdivisions, so far as recent researches are capable of explaining them. The following are the chief divisions accepted as being the most satisfactory at present:—The *Lower Cambrian* to include the Longmynd (Harlech grits and Llanberris slates, and the rocks at Bay Head, &c.) and the Menevian groups, which were shown to be intimately connected palæontologically, and to be entirely distinct in their faunas from the overlying rocks. The *Upper Cambrian* to include the Lingula flags (lower, middle, and upper, called also Maenturog, Festiniog, and Dolgelly or Malvern) and the Tremadoc groups. These were also shown to be connected closely by some of the genera, especially by Olenus, Conocoryphe, and Dikelocephalus. The *Lower Silurian* to comprise the Arenig (Lower and Upper, the former a series only recently known through the researches of the author, and forming a connecting link between the Tremadocs and the true Arenig rocks), the Llandeilo (Upper and Lower, the former being black shales or slates, and the latter calcareous), and the Bala or Caradoc groups. The *Upper Silurian* to consist of the Llandovery (Upper and Lower), the Wenlock and the Ludlow groups. The whole of the Llandovery group was placed in the Upper Silurian in accordance with the evidence cited by Prof. Ramsay in his memoir on North Wales, along with the facts explained by the table, and which went to prove that when it was to be separated entirely

from the other groups, as a Middle Silurian division, this was the most natural and proper position.—"On the Silurian Rocks of the English Lake District," by Prof. Alleyne Nicholson. In this paper the author classified the Silurian rocks of the English Lake District as follows, commencing with the lowest:—(1) The Skiddaw Slates, (2) the Borrowdale Series, or Green Slates and Porphyries, (3) the Coniston Limestone and associated shales, (4) the Graptolitic Mudstones, (5) the Coniston Flags, (6) the Coniston Grits, (7) the Ludlow Rocks. Each of these members of the series was described lithologically and palæontologically, and its geological position discussed, not only with reference to the other beds of the district, but also to the Silurians of Wales and North America.

Society of Biblical Archæology, June 4.—Dr. Birch, F.R.S., president, in the chair. "On a Religious and Political Revolution which took place in Egypt prior to the reign of Rameses III., having a probable connection with the rise of the Jewish religion. From the text of the Harris Papyrus," by Dr. August Eisenlohr. This magnificent Papyrus contains an account of the reign of Rameses III. and the events preceding his accession to the throne. Among these he finds a most marvellous account of a politico-theological revolution made by a Syrian hero, who, after a period of general disorder, made himself chief of the whole country, and abolished the existing religion and the sacrifices then in use. The father of Rameses III., King Seti-nekht, suppressed this revolution and restored the country to its former religious institutions. The striking resemblance of this story with the narrative of the return of the Hykshos, which was extracted by Josephus from Manetho's work, and was held by nearly all authorities to be connected with the establishment of the Jewish religion is very remarkable. Dr. Eisenlohr considered these passages in the Harris Papyrus as representing the Egyptian view of this and other great events which were the immediate cause of the Exodus, in which case the Papyrus would constitute the first Old Egyptian document hitherto discovered to bear upon the subjects treated of in the Book of Exodus. And it is therefore an additional gratification to learn that the Trustees of the British Museum have recommended to the Treasury the purchase of this invaluable document.—"Observations on the Dimensions of the Great Pyramid and the Royal Coffer," by Mr. Solomon M. Drach.—"The XXXVII. Aamu in the Tomb of Chnum-Hotep, at Beni-Hassan, identified with the family of Israel," by the Rev. Daniel H. Haigh. The learned author maintained that the said group, representing 37 Aamu or Mestemmu from the land of Shu, depicted no other than the patriarch Jacob and the thirty-six legitimate members of his family (the offspring of his wives Leah and Rachel), who entered Egypt at Joseph's invitation; the concubines and their children holding a decidedly inferior rank, and regarded as slaves and slave-born, not being counted, reducing the legitimate family of Jacob to that number. Shu he supposed to be the "East;" Mestemmu he compared with Beto-Mestham (Judith iv. 6), in the territory of Dothan, conquered by Jacob (Gen. xlviii, 22). In a supplement to this paper, Mr. Haigh described a Babylonian cylinder brought from Hidah, engraved by Mr. Layard in his "Travels," and translated the cuneiform inscription as representing Terah and his children, Abraham, &c. The names Iscah and Milcah (Queen) he considered might be one name in duplicate, the result of a marginal gloss (one sign in the cuneiform writing representing the sounds *is* and *mil*).

GLASGOW

Geological Society, May 2.—Mr. James Thomson read some notes "On an Undescribed *Platycrinus* from the Mountain Limestone of Fifeshire," which he had found in a quarry to the west of Kirkcaldy. It differs in several respects from M'Coy's *Platycrinus punctatus*. The plates of the test of that author's form are punctate, while those of the form exhibited are smooth and destitute of surface ornamentation. It also differs in the form of the plates.—Mr. Thomson also laid before the Society a curious shell, which he discovered on the same occasion. It was of somewhat large dimensions, being 10 in. long, by 7½ in. in width at the broadest part. At first sight it seemed to be a variety of Nautilus, but he could not find any trace of the septa which characterise that important group of Cephalopoda. He was, however, disposed to view it as belonging to that group, but one which, so far as he was aware, had not been described in any work on Palæontology.—Mr. David Robertson read the following papers:—1. "On the Clay Beds at Kilchattan in Bute." Mr. Robertson gave an enumeration of 86 species which had been obtained from the locality, including 40 species of Mollusca, 16 of Ostracoda, 18 of Forminifera, and 12 of other orders. The prevailing shells of the deposit are *Tellina calcarea*, *Axinus flexuosus*, *Scobricularia prismatica*, *Cyprina islandica*, *Mya truncata*, and *Utriculus obtusus*. 2. "On a Fossiliferous Clay Deposit near Campbeltown." The chief interest of this section is that, contrary to the usual position of the boulder clay in the West of Scotland, here it overlies shell-bearing clay. The latter is dark grey in colour, and contrasts strongly with the overlying boulder clay, which is of a full reddish brown. The shell-bearing clay, as exposed in the bed of a little burn or streamlet in Tangy Glen, about six miles from Campbeltown, is seen standing up in the boulder clay like a little knoll, and has doubtless been brought to that form by abrasion. It can be traced for a distance of 60 or 70 yards; its exact depth could not be ascertained, but as the rock is seen at a short distance on either hand, it is probably not more than a few feet deeper than what is exposed. The boulder clay overlies it to a height of 50 or 60 feet. The latter consists of 50 per cent. of fine mud and 50 per cent. of sand and gravel, while the shell-bearing clay gives 80 per cent. of fine mud and only 20 of sand and gravel. The fossils are but thinly met with in this deposit—molluscs in particular are comparatively rare, the few found being chiefly *Leda pygmæa*, with an occasional *Leda pernula* and a few fragments of other species. Ostracoda and Foraminifera are better represented, 18 species of the former and 26 of the latter having been obtained. A remarkable feature of the Ostracoda in this deposit is that they have much in common with those found in the clays on the east coast of Scotland, which have been held to represent more strongly Arctic types than those generally found in the West. Amongst these are *Cytheropteron Montrosiense*, *Cytheropteron vespertilio*, and *Cytheropteron Sorbyana*. None of these have hitherto been met with in the clays of the West of Scotland, with the exception of one specimen of *C. Montrosiense*, which had been found in the excavations for Messrs. Randolph and Elder's new dock near Govan. This specimen was found at a depth of 18 feet in a lower bed of clay dipping away from the river. An upper bed, which dipped to the river, contained only more recent forms common to our raised beaches and present seas. He might add that *C. vespertilio* and *C. Sorbyana* are common species in the clays of Norway. The chairman observed that this additional discovery of Arctic marine shells below the lower boulder clay of the West of Scotland was a further confirmation of the interesting fact that an Arctic or northern fauna had spread over certain tracts of the existing sea bottom before the lower Till of the country was deposited.

PHILADELPHIA

Academy of Natural Sciences, Oct. 17, 1871.—The president, Dr. Ruschenberger, in the chair. "Remarks on Fossils from Oregon."—Prof. Leidy directed attention to some fossils, part of a collection from Oregon, submitted to his examination by the Rev. Thomas Condon, and indicated in the "Proceedings" of Oct. 18, 1870. One of the fossils, a brain cast, or rather a cast of the interior of the cranium of a large mammal, has about the same form and size as that of the horse. The cerebral hemispheres are nearly as much convoluted as in the latter, and measure about 4½ inches in length and breadth. It may pertain to a large tapiroid animal, though I suspect it belonged to an oreodont. A large atlas, perhaps belonging to the same animal as the former specimen, measures 5 inches in breadth between the outer prominent borders of the articular concavities for the occipital condyles, and it is about 4½ inches from the neural tubercle to the hypapophysis. It differs in several important points from the atlas of the rhinoceros, horse, ox, &c., and the want of sufficient means of comparison prevents a determination of its near relationship. Another fossil, labelled "Alkali Flats," consists of the greater part of the crown, apparently of a last upper premolar, or perhaps of a transverse pair of lobes of a true molar, of an animal as large as that to which the preceding specimens belonged. The tooth approaches in character the corresponding portion in the oreodonts, but differs in the proportionately less degree of development of the inner lobe of the crown as compared with the outer one, and in the greater degree of development of the inner basal ridge. The crown measures 1⅓ inches in transverse diameter. These fossils appear to indicate an unknown pachyderm, which may be designated by the name of *Hadrohyus supremus*. Among the Oregon fossils there are a number of imperfect remains, of which it was

formerly remarked they indicated at least two species of rhinoceros. One of these was thought to be the same as the *R. occidentalis*; the other was suspected to be the same as the Californian species, *R. hesperius*. Some additional specimens indicate the second species to have been intermediate in size to that last named and the *R. crassus* of the Niobrara river. One of the specimens from Bridge Creek, consisting of a mutilated upper jaw fragment, with portions of the fangs of the true molars, shows these to have occupied the space of about 5 inches. An isolated tooth from Alkali Flat, apparently a last upper premolar, probably belongs to the same animal. From the outer part of its crown three folds project into the bottom of the median valley. The tooth measures 1 inch and 10 lines wide. The species may be named *Rhinoceros pacificus*. Another fossil specimen, labelled "Crooked River," consists of an isolated vertebral plate of a large turtle, apparently the eighth bone of the series. It has the same shape as in *Stylemys niobrarensis*, but is proportionately much shorter in relation with its breadth. It measures 2 inches wide, 1 inch 7 lines long, and 7 lines thick. The specimen probably indicates an undescribed species, which may be named *Stylemys oregonensis*. Two additional fossils are brain casts, probably of *Oreodon superbus*. The cerebral hemispheres are 10 inches 8 lines long, and together about 2½ inches broad.

PARIS

Academy of Sciences, June 17.—A note by M. E. Combescure on a point in the theory of surfaces was presented by M. Chasles.—M. E. Roger read a third memoir on the theory of capillary phenomena.—Father Secchi forwarded a reply to the observations recently presented by M. Respighi in opposition to his remarks on some peculiarities in the constitution of the sun.—M. A. Genocchi read a paper on the intensity of the heat of the sun in polar regions, in which he discussed the calculation of the annual mean heat of the sun within the polar circles.—M. C. Martins communicated a note on the stormy nature and unequal distribution of the rains on the surface of the department of Hérault.—M. A. Bérigny forwarded a note describing the effects produced by the striking of a house by lightning at Versailles on the night of June 6.—M. Lartigue presented an explanation of the mistral.—M. H. Sainte-Claire Deville presented a note by M. Laurence on a compound of oxide of tin with anhydrous acetic acid, produced by heating the two substances together in a sealed tube to 302° F. Upon this paper M. Elie de Beaumont made some remarks, in which he put forward the notion that in the early ages of the world nature may have employed a chemistry different from that which we now see in action in volcanoes and in atmospheric phenomena.—M. Sainte-Claire Deville also presented a note by M. G. Saillard on a new phosphoplatinic derivative of toluidine obtained by heating an alcoholic solution of Schützenberger's ether Ph $(C^2 H^5O)^3 Pt Cl^2$, with an excess of crystallised toluidine.—M. Blanchard communicated a note by M. C. Dareste on the natural affinities of the fishes of the family Balistidæ, which he regards as most nearly allied to the Teuthyidæ.—M. Garrigou presented further observations on the constitution of the Pyrenees in reply to a note by M. Leymerie, and in support of his previous remarks on the same subject; and M. A. Brongniart communicated a note by M. G. de Saporta on a revision of the fossil flora of the gypseous deposits of Aix.

June 24.—M. O. Bonnet communicated a note by M. A. Ribaucour on the theory of lines of curvature.—M. Delaunay presented a note by M. Bresse on the determination of the trajectory of a point for which a certain integral is the minimum.—M. J. Morin read a notice of a new voltaic battery with continuous action, acting by sulphate of copper. This consists of a hollow cylinder of copper, in the centre of which is the cylinder of zinc, he two being separated by a cylinder of filtering paper, and the space between the copper and paper being filled with grit, and that between the paper and the zinc with flowers of sulphur. Batteries of this construction have been in operation for twenty months without being replenished.—M. Piarron de Mondésir forwarded a note on the theoretical value of the relation between the two specific heats of permanent gases.—M. de Saint-Venant presented a note by M. J. Boussinesq on the calculation of the velocity of light in bodies in motion.—M. Delaunay communicated a paper by M. F. Tisserand on movements relative to the surface of the earth.—A note was read by M. T. Schlœsing on the solution of carbonate of lime by carbonic acid, containing the results of series of experiments made by the author on this important subject.—A note by MM. Girard and De Laire on the manufacture of aniline colours, was read.—M. P. Champion presented a note on some compounds of paraffin, in which he described an acid, paraffinic acid, with the formula $C^{25} H^{25} NO^{10}$ derived from paraffin by the action of nitrosulphuric acid, and noticed the action of chlorine and bromine upon paraffin.—M. Milne-Edwards presented a note by M. Fischer on the geographical distribution of the podophthalmous crustacea of the Bay of Biscay, in which the author compared this part of the fauna of the Bay with that of the British coast on the one hand, and that of the Mediterranean on the other.—M. C. Bernard presented a further note by M. Oré on M. Liebreich's opinion that strychnine is to be regarded as an antidote to chloral; and a paper by M. Brémond containing an account of some experiments on cutaneous absorption.—M. Duchartre communicated a note by M. Prillieux on the disease of the peach tree known in France under the name of *cloque*, which the author ascribes to the action of a parasitic fungus, described by Tulasne under the name of *Taphrina deformans*.—M. Daubrée presented an examination of the rock-masses of native iron, discovered by Prof. Nordenskjöld in Greenland, of one of which he gives an analysis.—M. Daubrée presented a report on a recent memoir by M. Delesse on the deformations which the strata of France have undergone.—M. de Quatrefages communicated an interesting paper by M. J. de Baye, "On the Prehistoric Caverns of the Marne, belonging to the Neolithic period;" and a second note by M. E. Rivière on the fossil man of the Mentone caves.

BOOKS RECEIVED

ENGLISH.—Concrete Arithmetic: T. H. Orme (Groombridge and Sons).

AMERICAN.—Description of the Balænoptera musculus: T. Dwight, jun., M.D. (Boston Soc. Nat. Hist.).

FOREIGN.—(Through Williams and Norgate.)—Theoretische Maschinenlehre: D. F. Grashof. 1er Band, 1te Lieferung.—Des Préparations microscopiques tirées du régne végétal: Grönland, Cornu, and Rivet.—Lehrbuch der anorganischen Chemie, 3te Abtheilung: Dr. Büchner (Schluss).

DIARY

FRIDAY, JULY 5.

GEOLOGISTS' ASSOCIATION, at 8.—On Corbicula fluminalis, its associates and distribution in Britain: Alfred Bell.—On the Dip of the Chalk of Norfolk, and the Remains of Old Land Surfaces called the "Stone-bed:" Rev. John Gunn, M.A.

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