THURSDAY, OCTOBER 21, 1886

OUR GUNS

WHENEVER attempts are made to manage scientific matters by means of committees failure is sure to result. Some of our Continental friends, the French especially, are fond of working in pairs, and excellent results have been arrived at by such means, but the method does not appear suitable to the English intellect, hence all our great achievements in science have been attained by single individuals. As soon as a committee gets to work, darkness seems to fall over the intellects of its members, and not only are the most absurd blunders perpetrated, and errors of judgment committed, but they are persevered in long after outsiders have detected and exposed them. We need only mention the Longridge wire-gun and the Moncreiff carriage as instances of the defective judgment which kept back the introduction of these useful and original inventions for some thirty years. But the blindness of the Ordnance Committee, or of the Unknown Being who is responsible for our guns, is still more curious and distressing with reference to the strains which guns must be constructed to withstand. We look in vain for any information on this head from the recent reports of committees or from the lectures of their inspired representatives, while such information as we have reveals the fact that, at the time when our new breech-loaders were designed, the knowledge of pressures which the Unknown Designers had was absolutely erroneous, and that the errors were of so elementary a character that it requires no special knowledge of the subject to detect them. If the indicator-diagrams of a steam-engine, and a statement of the work performed by it, were laid before, at any rate, the two civil members of the Ordnance Committee, with a request that the pressures in the cylinder should be investigated with a view to ascertaining whether they were correct, these gentlemen would, at once, compare the indicated power with the work done, and if the former were less than the latter they would, without hesitation, declare that the pressures said to have prevailed in the cylinder were too low. Now, attached to the official drawing of the first 10-inch breech-loading gun was a pressure-curve purporting to represent one-fourth the bursting pressure when firing a projectile of 500 lbs. weight, and imparting to it a muzzle velocity of 2100 feet per second. The mean pressure, measured from this curve, is 8·8 tons per square inch, the travel of the shot in the bore is 22 feet, hence the work done by the powder would be 15,205 foot-tons. The muzzle energy of the shot is a little more, namely, 15,284 foot-tons. But besides the energy communicated to the shot, the 300 lbs. weight of powder gases have to be set in motion, the friction of the gas checks has to be overcome, rotation has to be imparted to the shot, the atmosphere has to be displaced, and the aggregate of this work can be shown to amount to at least one-third of that required to drive out the shot, a fact which the pressures recorded in the experiments made with the *Thunderer* gun clearly proved. Colonel Maitland, in his lecture on our new guns at the United Service Institution in June 1884, rightly pointed out that the area bounded by the pressure-curve represented the work done in the bore; how is it, then, that it never occurred to any one on the Ordnance Committee to compare the work done with the effect produced? Such a comparison would have shown 20,400 foot-tons of work done by an indicator-diagram measuring only 15,205 foot-tons! The check pointed out should have been applied as a matter of common prudence, because it is notorious that then, as now, our direct knowledge of the pressure of powder gases in the bores of guns was very limited.

We are aware that it has been explained that the pressure-curve we have been discussing does not represent powder-pressures, but pressures one-fourth of those which would burst the gun; but such an explanation does not mend matters, for it reduces the factor of safety of the gun—already assumed at the dangerously low limit of four—to three, which no one, surely, would contend to be sufficient!

We are obliged to revert to the question, Why has not an actual pressure-curve been made public, and why did not the *Collingwood* Committee commence their report by showing that the 12-inch 43-ton gun was designed of sufficient strength? The answer, we are afraid, is that our gun-builders do not know what pressures they have to contend against, that our guns are being made by rule of thumb; in fact, their proportions are slowly arrived at by the costly method of trial and error.

Again, Colonel Maitland, in his lecture, gives a diagram showing, graphically, the pressure resulting from firing quick-burning, medium, and slow-burning powders. We must assume, the curves being given for the purpose of comparison, that they represent the effects of the same weights of powder burned under exactly similar conditions; therefore the areas of the figures bounded by the curves, as Colonel Maitland tells us, represent the work done in the gun, and measuring the areas of each curve up to only 14 calibres' length of bore we find that the slow-burning powder does more than twice the work of the medium-burning, and two and a half times that of the quick-burning powder! Surely Colonel Maitland would not wish us to draw such conclusions; and yet they are necessarily deduced from a diagram which must have represented the views of the Ordnance Committee only two years ago, and after Capt. Noble had shown, in his admirable lecture on "The Heat-Action of Explosives," delivered at the Institution of Civil Engineers, that the potential energy of all powders was very nearly the same; a view recently indorsed by Sir W. Armstrong, who stated that rather more of the slowest-burning powder was required to produce a given ballistic effect. We venture to say that, had the questions in review been under the control of a single, competent, fully-responsible man, the anomalies which we have pointed out could never have arisen, the aid of practical mathematicians would have been invoked, and the warnings of Sir W. Armstrong and others would not have been disregarded.

The public, no doubt, is weary of the constant discussion of past blunders, and the repeated allusions to them would be unjustifiable were it not for the vital bearing which these have on the future, and a most valuable result will be obtained if our efforts, and those of other writers, should be the means of destroying our

absurd system of administration altogether, or at any rate of dispelling the fatal complacency in which the Ordnance Department wraps itself, and which found a voice when Colonel Maitland declared two years ago "that our ballistic knowledge has long been fuller and more complete than that of any of the Continental authorities"!

But it is proverbially easy to find fault, especially with Government departments, though by no means so easy to propose practical remedies for defects of administration which force themselves so irresistibly upon the nation as do the shortcomings of our naval and military management. Fortunately, however, no great originality is required on the part of the would-be reformer. He has only to observe how great private firms manage their business, and carry on operations quite as extensive and complicated as any of the branches of Her Majesty's service. What private firm could exist, secure the confidence of its customers, or the soundness of its work, if its head were appointed for five years, and selected, not because he had received special training in the business which he is about to manage, but had done good service in some other situation for which he had been trained; or, worse still, if the selection were made because the man selected was a good fellow and on the best of terms with all the members of the firm! Has any great firm ever started as a company? Has not every one of them owed its origin to the personal qualities of some one man, and those that have survived the death of their founder, have been carried on by men of distinguished ability selected usually by him. We do not speak of enterprises requiring so little originality as railway, gas, or water companies, but even in them the chairman rises by a species of natural selection to a position of prominence, the natural homage due to a master mind. Would any sane man propose, for a moment, that the chairmen of such companies should be changed every five years, and farther, that in order that they might suffer no loss they should exchange offices, that is, the railway chairman, at the expiration of his term, should become chairman of the gas or water company, and so on?

Yet this is precisely the way in which our dockyards and arsenals are managed. Officers, most of them most estimable and excellent gentlemen, who happen to be in favour with the superior powers, receive these desirable appointments, and often travel from one to another till they are obliged to retire from the service altogether. They would be more than human if they refused the offers made to them, and it is unreasonable for the public to cover them with abuse on account of shortcomings which are due to the system, and not to the individuals. We cannot, for a moment, admit that any of the committees are corrupt in the slightest degree, directly or indirectly, or that they have not done their best to carry out the work intrusted to them; neither are we disappointed with the results of our absurd organisation, any more than we should be with the misfits which would result if we insisted on our tailor becoming our bootmaker also.

Take the case of the Ordnance Committee. It is composed of officers who, including the President, are being continually changed, and it also numbers two apparently permanent civil members. Not one of these gentlemen has been brought up to the business of steel-making or gun manufacture, not one of them has made himself a name in the branch of manufacture and metallurgy which the Committee directs, not one of them would be competent to go abroad and start a steel-works and gun factory unaided by the contractors and subordinate experts about them—how can they be competent to deal either with the complicated theories or the practical details of gun manufacture? and when failure occurs, who is to blame?

Judging by Colonel Maitland's lecture and Sir F. Bramwell's expositions, the Committee, as a body, and as individuals, are not only satisfied but even complacent, for they find that other nations are in almost as bad a muddle as we are ourselves. It is perfectly obvious that there must be individual responsibility. The head of each department must be a permanent officer directly responsible for the design and execution of such things as the military or naval forces require, and these heads should be selected from the most able men to be found within or outside the services, men who have already achieved a reputation in the special departments for which they are required.

And there are precedents for this. The Post Office;—can anything exceed the admirable manner in which that branch of administration works, and keeps in the forefront of progress? It is needless to say that it is not worked by shifting committees. Or, take the steam department of the Admiralty. We never hear of serious complaints of the main engines or the countless subordinate machines of our war-ships; our Navy is ahead of all others in respect of adapting every useful invention, every scientific appliance; but then Mr. Wright is a permanent chief, and he is not hampered by a committee composed, shall we say, of carpenters appointed for short terms of office. And yet the changes wrought in Mr. Wright's department during his long term of office are more extensive in kind and much more varied in detail than anything the Ordnance Department have had to contend with. The steam-engine has been completely altered, surface condensation has been introduced, the steam-pressure has been increased eight-fold, compound and triple expansion has been introduced, the whole system of torpedo warfare has come into being with all its complicated appliances, the electric light has been adopted, and in addition the design and supervision of the Dockyard machinery has fallen to his share. The public never hears of Mr. Wright: had we not mentioned his name, most of our readers would have been ignorant as to who was the meritorious officer to whom we were referring; his very virtues have been the cause of his obscurity; his is not an heroic part, and he has never drawn public attention to himself by making a mess of anything.

And next, let us look abroad. We have no hesitation in stating that the most successful gun factory in the world are the Abouchoff Works near St. Petersburg. That establishment, since 1866, has been under the direct personal control of Admiral Kolokolzoff, and during that period the guns turned out have not varied either in design or material; they have been increased in length and constructed to produce higher muzzle energy; but it

is an absolute fact that the projectiles which fit the guns of 1866 can be fired from the guns of to-day, and *vice versâ*. None of the Abouchoff guns have ever burst or injured a single man! The Committee on the *Collingwood* accident ascribe the disaster in part to the unequal composition of the material. Admiral Kolokolzoff provides against the possibility of this by using nothing but crucible steel. His casting-house contains about 2000 crucibles; each holds a small charge of steel, the composition of which is determined with the utmost care and exactness. The consequence is that his material is absolutely uniform, and, in addition, he is the only man that has adopted Whitworth's method of fluid compression. He does not use crucible steel because he has no other means of casting: he has Bessemer converters and Siemens-Martin furnaces; but for the highest-class work he prefers the crucible metal, because of its necessary uniformity when prepared with proper care. Had we had a man of the Admiral's capacity permanently at the head of our Gun Factory, had we subsidised any important steel-works as liberally as the Elswick firm has been assisted, we could also, twenty years ago, have had ingots of 40 tons weight of crucible steel of any quality desired. The Abouchoff works began to make 12-inch guns about the same time as we did, but their gun of the same proportions as those of the *Collingwood* weighs 50½ tons against the 43 tons of our discredited weapon. Our amended guns will weigh the same as the Russian. How is this to be accounted for, if we be, as Colonel Maitland asserts, far ahead of our neighbours in the science of gunnery?

Let us now contrast the Russian record with the history of our own guns. Sir William Armstrong introduced what he, in his address to his shareholders, calls, with some pride, his own gun—our first breech-loader. It was a built-up gun, upon the principles advocated by Mr. Mallet in his work on artillery in 1856, and the breech mechanism was a close imitation of that of the guns on board the Chinese junk which was moored off Essex Street during the Exhibition of 1851. At that time the Broadwell ring, or, rather, gas-check, such as we know it applied to muzzle-loaders, had been used at Woolwich, but had probably been forgotten; at least it was not applied to the Armstrong breech mechanism, which failed from its avowed danger when applied to the larger calibres of guns. We then gave up breech-loading and reverted to muzzle-loading, and finally we have come back to breech-loading, and adopted steel some twenty-five years after the Russians had completely solved whatever difficulties there may have been in the process of using it. In muzzle-loaders we revert to the gas-check, and so we have at least three classes of projectiles in use instead of one only. How is it that we have got into all this confusion? The only possible answer is that it is caused by our absurd system of having no permanent responsible scientifically educated officer at the head of each department of the Arsenal. The newly appointed chief knows nothing of what his predecessor did or what his experiences had been, for experience cannot be readily communicated from one man to another; he is, in fact, not a chief, but, for more than half his time, the slave of his permanent subordinates.

HAINAN AND ITS PEOPLE

Ling-Nam, or Interior Views of Southern China, including Explorations in the hitherto untraversed Island of Hainan. By B. C. Henry, A.M. (London: S. W. Partridge and Co., 1886.)

PORTIONS of this book have already appeared from time to time in the two magazines in the English language published in China, the *China Review* and the *Chinese Recorder*, but they well deserved the more permanent book form, for the author, like many other missionaries, has travelled widely in parts of China which are rarely visited by Europeans. Mr. Henry, too, writes from a full mind; he has made the most of his great opportunities, and accordingly he has contributed here a very real and solid addition to our knowledge of the Middle Kingdom. In reading it we are constantly reminded of a work written a good many years ago by another missionary, which has now almost attained the dignity of a classic, viz. Dr. Williamson's "Journeys in North China"; both are of the same useful, substantial kind, and for a long time to come both will have to be referred to for information in regard to the respective districts with which they deal. Mr. Henry refers solely to Southern China, as the name *Ling-Nam* ("South of the Ridge") implies, and to the Kwangtung or Canton province. He describes various journeys through the central and northern parts of this large and populous province, along the principal streams. As we read o town after town with populations of 100,000 and over, we begin to understand how populous China is. But then, with the exception of the valley of the Yangtsze, the two great southern provinces of Kwangtung and Kwangsi are the most thickly peopled of the whole empire. Even those who have travelled in parts of the Canton province will be surprised to learn from Mr. Henry of the magnificent scenery of the north and north-west. The idea of the passing traveller in and around Canton and the neighbouring cities is that the whole province is a vast plain in a high state of cultivation; but in the upper courses of the tributaries of the West River Mr. Henry found scenes worthy of the wildest mountain regions. Here also, on the borders of Hunan, he came in contact with one of those tribes which are found like scattered fragments over the whole of China south of the Yangtsze—amongst, but not of, the Chinese, with their own communities living generally in fastnesses amongst the mountains, preserving in a great measure their ancient habits, and but slightly contaminated by the proximity of their Chinese conquerors. Their name is legion, and they are sure to furnish abundance of work for ethnologists in the future. In the present instance the people are called the Iu, and are described by Mr. Henry as lower in stature than the Chinese, with a similar complexion, although some are almost copper-coloured. They do not shave the head, but wear the hair coiled up behind, men and women having long hair. They wear immense silver earrings and necklets, while the hair is decorated with ornaments made of the pith of the wood-oil tree and cocks' feathers. Their territory is forbidden ground to the European, the Chinese taking care that the restriction is rigorously enforced. The meagre Chinese accounts of this people

add little to our knowledge of them ; but it appears that they have no written language, although a few understand Chinese. Their language is distinct from any Chinese dialect. Beyond these few details nothing is known of the Iu, and they and their country appear destined to remain a mystery for some years to come.

But beyond question the most interesting and valuable chapters in the book are those dealing with the island of Hainan. This has been hitherto in great measure a *terra incognita*. The late Mr. Swinhoe succeeded in going a few days' journey from the coast, and vessels occasionally touched at one of the ports. But it was not until a few years ago that its position was properly settled ; before that time it was twelve miles out on all the charts. Mr. Henry, with a Danish gentleman who had already made a circuit of Hainan on foot, travelled into the heart of the island, and making a long detour returned to the port of Hoihow on the north. He thus travelled through a considerable part of the mountainous region in the centre, which is the abode of the Lis, or aboriginal population, and had ample opportunity for studying their habits. The information given in this book about the island and its people is, as far as we know, the first detailed and definite account published in any European language. The whole northern half of the island he describes as a plain, level to a great extent, but mostly undulating, and broken in a few places by isolated hills and low ridges. The central and southern portions are mountainous, the highest elevation being reached in ranges called the Five-Finger and Li-Mother ranges, from which all the larger streams take their rise. The flora of the island, though but slightly investigated, is known to be of great variety and interest. Mr. Henry noticed about 100 species of plants which he recognised as well known, while he brought back 200 species which are now in process of determination. From what is now known, the flora seems more nearly allied to that of the islands of the south than to that of the adjacent mainland. The number and variety of Hainan birds is suprising. Mr. Swinhoe noted 172 species, 19 of which proved new to science, and were first described by him ; but as his journey was only of a few weeks' duration, and chiefly along the coast, it is probable that many new discoveries in ornithology will be made when the interior is better known. Of the mammals even less is known, and the variety of fish around the coast is endless. The meteorology, too, is noteworthy. Hainan is the home of the typhoon, and earthquakes are of frequent occurrence. In the latter case the axis of disturbance runs directly across the island from one side to the other. Of the people Mr. Henry is able to give us much more information. The Chinese immigrants have peopled the coast opposite the mainland, and all the low-lying lands up to the base of the hills, which latter are inhabited by the Lis. But between the two is a people speaking a Loi dialect, the origin of which is unknown. They are like the Chinese in many respects : they wear the same dress, live in the same kind of houses, eat the same food, and intermarry freely with them, but they hold to their peculiar dialect with remarkable persistence. There is a theory that these people are descendants of Miao-tsze, brought ages ago from the highlands of Southern China to act as mediators between the Chinese and the aborigines of Hainan. How far they resemble any tribe on the mainland remains to be determined, but they are wholly distinct in physique, language, and customs from any of the Li tribes. The ubiquitous Hakkas from Canton have also established themselves in Hainan, pursuing agriculture under the most forbidding circumstances, and converting the jungle into cultivated fields with their usual tenacity and success. But the main interest of the Hainan portion of the book centres around the Lis. Here, as everywhere else that they have come into contact with aborigines, the Chinese have adopted the simple classification of "tame" and "wild," "ripe" or "green," to distinguish those who have succumbed to Chinese influence and those who have not They wear the hair twisted into a knot on the top of their heads. The women are all tattooed with blue lines over the face. The process of tattooing is very simple. An incision is made with a sharp knife to the shape of the pattern given ; and, while fresh, ordinary Chinese ink is introduced, which gives a blue tinge, and in a few days the wound begins to heal. The Chinese say that the same pattern is preserved for generations in the same family, not the slightest variation being allowed, lest the husband's ancestors should not recognise the wife after death. In a Chinese account of the Lis, translated by Mr. Henry, it is said that their custom is not to cry when their parents die, but to swallow quantities of raw meat, which is their mode of expressing great grief,—a curious circumstance, which possibly may be accounted for by the statement made in the same account, that the Lis originally belonged to a race of birds and beasts, and that being derived from an egg they remained impervious to Chinese civilisation. However this may be, Mr. Henry found them a simple, kindly, hospitable people, who appeared to think nothing too much trouble when assisting the stranger. No idols, or other religious symbols, or indeed trace of a religion at all, was found amongst them, although the traveller looked carefully for them. A curious custom among them is for the young people to have authority in the house, and every question of food, lodging, or purchase of articles is referred to them. The father and mother appear to efface themselves inside the house. At meals the whole family is united. They greet a guest by extending the arms, placing the open hands with the finger-tips touching, or nearly so, and draw them inwards with an inviting motion. They bid farewell in a similarly graceful fashion, extending the open hands with the palms upwards, and slightly inclined outwards, in a movement as if handing one on his way. Their features are rather square, the nose not being so flat as that of the Chinese, and the eyes of a different type. No sign of graves was seen anywhere, and all inquiries failed to elicit any intelligible account of what they do with their dead. The substance of all that the travellers could learn was that they place the body without a coffin in any secluded spot, taking care to replace the earth, and cover it over so that it may not be recognised. They are free from many of the superstitious and idolatrous practices of the Chinese ; they have no ancestral worship, and no knowledge of geomancy. They seem to be divided into fifteen or sixteen tribes, which are known under different names, and differ more or less in dress, language, and customs, but all evidently belonging to one homogeneous race, bound together by common ties, and as a rule living on friendly

terms with each other. Mr. Henry thinks they are probably of Malay origin, but his argument, based on the names by which they call themselves, appears somewhat weak. It is more probable that we shall know nothing of the ethnology of the Lis until that of the Lolos, the Miaous, Ius, and many other tribes of Southern and South-Western China and Tonquin, has been studied. Whether the Lis have a common origin with one or all of these, or with the aborigines of Formosa, must for the present remain in the region of conjecture. But there can be no manner of doubt that, in the words of Mr. Henry, Hainan promises much of interest to the traveller and scientific investigator, in its striking natural features, in its imperfectly known flora and fauna, and in the questions that arise as to the race, religion, and probable destiny of its aboriginal people.

GIGLIOLI'S "AVIFAUNA ITALICA"

Avifauna Italica. Elenco delle specie di uccelli stationarie o di passaggio in Italia, colla loro sinonimia vulgare, e con notizie piu specialmente intorno alle migrazioni ed alla nidificazione. Compilato dal Dottore Enrico Hillyer Giglioli, &c. 8vo, pp. 626. (Firenze, 1886.)

A SHORT time ago (NATURE, June 24, p. 168) we noticed the new "Check-List" of North American birds issued by the American Ornithologists' Union, and took occasion to refer to the corresponding "List of British Birds" compiled by a Committee of the British Ornithologists' Union, and published by that Association in 1883. We have now before us a copy of a similar publication upon the birds of Italy, prepared, however, under somewhat different circumstances.

At the International Ornithological Congress held at Vienna in 1884, which was attended by delegates from nearly all the civilised nations of the world (with the strange exception of Great Britain !), Italy was worthily represented by Prof. E. H. Giglioli, of Florence, well known as one of the most learned and enterprising zoologists of that country, and for the excellent series of Italian vertebrates which he has collected together in the museum under his charge. In consequence of the recommendations contained in the report presented to the Italian Government on the results arrived at by the Congress, it was determined to constitute an "Ornithological Office" in Italy under the Ministry of Agriculture, and Prof. Giglioli was made Director of the new Department. In compliance with the resolution passed at the International Ornithological Congress, one of the new Director's first tasks was the compilation of a standard list of Italian birds, or "Avifauna Italica," as it is here shortly termed.

In preparing their various lists of native birds, the delegates at the Congress were invited to follow as a model the catalogue of Austro-Hungarian birds, lately issued by Messrs. v. Tchusi zu Schmidhoffer and v. Homeyer. But Prof. Giglioli could not altogether acquiesce in this recommendation, and, perhaps wisely, preferred to adopt the systematic classification already employed for his series of birds in the collection of Italian vertebrates at Florence already spoken of, which is in fact by far the most nearly complete collection of the kind existing in the Italian kingdom. Besides the correct scientific appellation of each bird, and what is considered as its standard Italian name, Prof. Giglioli has also taken great pains to give all the vernacular terms by which each species is known in the many and various Italian dialects. These are in some cases very numerous, as will be seen on reference to such species as *Lanius excubitor* and *Merops apiaster*, and, although of less interest to foreign naturalists, will make the list of greater value to the native student of Italian birds—whose assistance is specially required in ascertaining many yet unknown particulars concerning the range, times of migration, and mode of nesting of the various species.

As regards the limits of the Italian avifauna, it would seem that Prof. Giglioli is an "Irredentist" of the most extreme type. Not only does he include Corsica and Malta within the Italian zoological region, for which, no doubt, he has every show of reason, but also the Trentino, Istria, and Dalmatia. It is difficult to understand why the line should be drawn at Dalmatia, or why it should not also just as well include Montenegro, Epirus, Greece, and even Macedonia! This so-called "Italian Region" is divided by Prof. Giglioli into three provinces, namely, a Northern Continental, and a Southern Continental Province, separated from each other by the line of the Apennines, and an Insular Province, consisting of Sardinia, Sicily, and the Maltese Islands.

Not only has our author been very liberal in the extent of country assigned to the Italian Ornis, but, in our opinion, he has also somewhat unduly increased the number of species included in the avifauna by the admission of some of very doubtful authority. The occurrence of *Aquila nipalensis* within Italian limits, for example, does not seem to be supported by any certain evidence. The same may be said of *Caprimulgus asiaticus*, *Chelidon cashmiriensis* (!), *Cotile obsoleta*, *Dendrocygna javanica*, and at least half a dozen other species in Dr. Giglioli's list. It would seem, therefore, that the number of species (443) assigned to the "Avifauna Italica" in the present work may have to be slightly diminished, although, on the other hand, future researches will doubtless result in the discovery of many additions to the series of occasional visitants.

Strange to say, one of the most recent and noteworthy additions to the list of permanently resident Italian birds has been made by an English ornithologist. In 1883 Mr. J. Whitehead discovered in the pine-forests of Central Corsica, a nuthatch perfectly distinct from every other known European species, and for the nearest ally of which we must go to Asia Minor. This nuthatch has been named after its discoverer, *Sitta Whiteheadi*. It is quite possible, therefore, that not merely more stragglers from other parts of Europe, but even new endemic species, may still have to be added to the Italian List.

After finishing his general catalogue, Prof. Giglioli goes into a general discussion of the Italian avifauna, and gives the number and names of the various categories into which the 443 species assigned to it may be divided. The permanent residents are stated to be 207 in number, the summer visitants to be 69, and the winter visitants 36. Those of regular passage are only 9 in number; those of irregular passage, 8. Besides these, 28 are set down as

of irregular appearance, 80 as stragglers, and 6 as doubtful. Two "ornithological calendars," one giving the times of "migration" and the other those of "nidification," add considerably to the value of this useful work, which must not only of necessity be in the hands of every Italian ornithologist, but which every student of the European Ornis, or of any constituent parts, should have for reference. We trust that the good example thus set by England, America, and Italy will lead to the publication of other similar hand-books.

OUR BOOK SHELF

The Law of Storms, considered practically. By W. H. Rosser. Second Edition. (London: Norie and Wilson, 1886.)

WE welcome with much pleasure the second edition of this useful little work on storms practically considered. The first edition, briefly noticed by us at the time (vol. xiv. p. 504) appeared ten years ago. Since then the researches of meteorologists have materially advanced the science, notably in establishing on a firmer basis the law of the in-moving spiral circulation of the wind in cyclones, and defining with some exactness the limits of variation of the angle of inclination of the winds as they blow inwards toward the centre of storms. In this view especially the last part of the work has been recast, recent investigations being summarised with no little ability, and the results thereafter applied to navigation. The book, which is professedly a practical one, is specially and admirably adapted to give seamen the best available information in handling their ships in storms.

Ueber Manatherium delheidi, eine Sirene aus dem Oligocän Belgiens. Von Dr. Clemens Hartlaub. *Zool. Jahrb.*, vol. i. (1886).

DR. CLEMENS HARTLAUB'S excellent contributions to our knowledge of the recent Sirenians have lately been noticed in these columns (July 8, p. 214). We have now before us his essay on an extinct form of the same peculiar group of mammals. The luxuriance of fossil forms of the Oligocene of Belgium is well known to all zoologists. Upon materials gathered from the Superior Rupelian beds of Hoboken, near Antwerp, which have already produced remains of *Crassitherium* and *Halitherium*, Dr. Hartlaub founds a new genus of Sirenians, nearly allied to the living Manatee, which he proposes to call *Manatherium*. Its dentition, so far as it is at present known to us, does not materially differ from that of *Manatus*, of which, indeed, it may have been the immediate progenitor; and the necessity for its generic separation from its modern representative is perhaps not altogether evident. The species is named *Manatherium delheidi*, from M. E. Delheid, in whose cabinet of Belgian fossils the remains upon which it is based are contained. Fossil species of true *Manatus* have been described by Leidy and other authors in America, and M. Filhol has assigned some African remains to the same genus. But *Manatherium delheidi* is at present the only European form described as belonging to this exact type of the Sirenians.

LETTERS TO THE EDITOR

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

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Tangent Scale in a Galvanometer

ON account of the correspondence which has recently taken place in this and other journals regarding the use of the tangent scale in a galvanometer, when the plane of the coil makes an angle with the direction of the force in the magnetic field, the following extract from Sir William Thomson's patent, No. 4617 of 1883, and the accompanying remarks, may clear up some of the points that have been raised:—

"In using this instrument I sometimes cause the zero to be at one end of the scale, so that, when the potential is at the prescribed definite amount, the pointer is at the centre mark of the scale of tangents. The deflections are thus more easily observed, on account of the large size of the divisions."

This extract is quite explicit as to taking the zero at one end of the scale, and it is abundantly evident, from the text of the patent and from the illustrative drawings, that the scale referred to is a tangent scale. The essential feature in this use of the tangent scale is that the strength of the current is proportional to the difference between the tangents of the angle corresponding to zero and that corresponding to the deflection due to the current.

The total length of the scale, as shown in the patent already referred to, and used in this Laboratory for over two years, is 120°. Lately, however, the length of the scale has, with considerable advantage, been increased to 147°·8, thus giving twice the sensibility obtainable with the 120° scale.

As regards Prof. Carey Foster's letter to NATURE of October 7 (p. 546), a tangent galvanometer arranged to use the tangent scale in this manner is essentially adapted to measure currents which flow through its own coil in one direction only, but in these instruments, as designed by Sir William Thomson, the necessary accuracy is secured by the following procedure. The index (which has a range of about 95° on each side the middle point of the tangent scale) is caused to point to a mark exactly 90° from the middle point of the scale, and the relative positions of the coil and the scale are then adjusted, so that, when the index points to the 90° mark, the strongest current which can be safely sent through the coil produces no sensible deflection.

J. RENNIE

Physical Laboratory, the University, Glasgow, October 16

On the Connection between Chemical Constitution and Physiological Action

IN the address delivered by Dr. Brunton on this subject before the Section of Therapeutics and Pharmacology at the last meeting of the British Medical Association, a copy of which was published in NATURE, August 19, p. 375, he observes, in alluding to the adoption of more scientific methods in pharmacology:—"This may be said to have begun about twenty years ago, when the researches which my predecessor in this office, Dr. Fraser, made with Prof. Crum Brown upon the connection between physiological action and chemical constitution inaugurated a new era in pharmacology. . . . We might first date the beginning of this age from Blake's attempts to show that a connection exists between the forms in which the various bodies crystallise, and the mode in which they act on an animal body. . . . Nevertheless, I think we may fairly say that it was the experiments of Crum Brown and Fraser which fairly started pharmacology in the new direction in which it has since been steadily advancing." Now it can, I think, be shown that in these remarks Dr. Brunton has not only misunderstood the scope of my experiments, but that he has been led into error on account of his having no definite idea of the meaning of the term chemical constitution, which he has evidently confounded with that of chemical composition. The same confusion of these terms is not only apparent all through the address, but is also found in the paper on the subject by himself and Dr. Cash, published in the *Transactions* of the Royal Society, 1884.

The term chemical composition is well understood, but the meaning of the term chemical constitution is not so well defined. Perhaps the difference between the two terms may be pointed out in the shortest space by an example. If we take the salts of iron, for instance, we know that the salts of the protoxide have a chemical constitution analogous to the other members of the magnesian group with which they are isomorphous, and that this resemblance in constitution connotes not merely that they crystallise in analogous forms, as Dr. Brunton seems to imagine, but also that they form many analogous chemical compounds which resemble those of the other members of the same group more closely than the compounds of any other group. By the addition of oxygen to the protoxide, not only is its chemical composition changed from FeO to

Fe_2O_3, but at the same time a base is formed, the compounds of which are totally different from those of the ferrous oxide, but which resemble in their chemical properties the salts of alumina, Al_2O_3, with which they are isomorphous. Here there is evidently a change, not merely of composition, but of constitution; the addition of oxygen has not only altered the relative weight of the constituents, but has completely changed the structure of the molecule in a definite direction, and impressed on it a constitution analogous to that of the molecule, Al_2O_3, with which it is isomorphous. Now, when I had shown that this change in the constitution of the salts of iron was attended by a marked change in their physiological action, when I had proved that the physiological action of the ferrous salts was analogous to that of the salts of the other members of the magnesian group, which they resemble in chemical constitution, and that the physiological action of the ferric salts was analogous to that of the salts of alumina with which they are isomorphous, and when it was proved that an analogous connection existed between the chemical constitution and physiological action of the compounds of the elements of all the more important isomorphous groups, I think nothing but a complete misapprehension of the meaning of the terms chemical constitution and isomorphism could have led Dr. Brunton to allude to my researches as an "*attempt to show that a connection exists between the form in which various bodies crystallise and the mode in which they act on an animal body.*" The same error as regards the meaning of the term chemical constitution has led Dr. Brunton to fail to comprehend the bearing of the experiments of Crum Brown and Fraser on the question, on which, in fact, they throw no light, although evidently regarded by him as a beacon for subsequent observers. These gentlemen found that by the addition of an ethyl or methyl molecule to strychnia its physiological action was profoundly modified, and concluded that this was owing to the chemical constitution of the substance being changed. As they worked with a reagent, strychnine, of the chemical constitution of which we are still ignorant, it was impossible for them to know if the addition of an ethyl or methyl group had made any change in its chemical constitution. The probabilities are that no such change had taken place, as the new compounds were addition and not substitution compounds. It is not merely for asserting a claim to priority that I make this communication, although I think *suum cuique* a very good rule; but I wish to point out the causes which in my opinion are not only retarding the progress of physiology in this direction, but which are tending to throw it back to where it was before the publication of my earlier experiments nearly fifty years ago.

October 6 JAMES BLAKE

Relation of Coal-Dust to Explosions in Coal-Mines

IT is a stubborn and grievous fact that the loss of life by explosions in coal-mines has risen in the last decade, although the number of explosions has fallen. This points clearly to some essential defect in the remedies adopted. The remedies in use apply apparently to one class of explosions only, hence the decrease in the number of explosions. But, unhappily, there are many to which they do not apply, and those the worst; hence the larger number of lives lost. Some research, which has much engaged me of late, and which I hope soon to make public, has led to the conclusion that possibly the reason of this is about to be, or is even already, detected.

Many, well competent to judge, have thought that too much attention has been given to *gas*, and too little to *dust*. This is a growing conviction, both in Germany and in England, and of late years the dust has had considerable attention. A work, recently published (September 1886) by Messrs. W. N. and J. B. Atkinson (Government Inspectors of Mines), entitled "Explosions in Coal-Mines," strives, and I think fully succeeds in establishing that many of the most disastrous colliery explosions in the last six years have been practically "*dust explosions.*" My conclusion, from certain simple physical and chemical experiments, and from a most careful microscopic examination of coal-dust from various seams worked in this field, is that the Messrs. Atkinsons' view is right, and, moreover, that the attention hitherto given to coal-dust has not only been useless, but absolutely pernicious, since it has lulled into a state of false security.

I have been down several typical coal-pits in this district (the Durham field), such as Seaham, Murton, Silksworth, Pelton, &c., and in some of them I have seen the water-pipes along the main haulage roads supplied at convenient distances with stop-cocks, and have found the dust on such roads so damp as to be rendered harmless, if it had not been so already, but the fine dust which coats the upper faces of the roof-timbers was there untouched, lying often to the depth of half an inch. Now, the *bottom dust*, as we may call the former, I am prepared to prove is almost if not quite universally harmless; and the *upper dust*, as we may call the latter, I am equally prepared to prove is in the highest degree dangerous, and especially a certain portion of it, which I propose to call "*flocculent dust.*" Lastly, I claim to be able to establish that the main source of the really dangerous dust is that portion of the coal called variously "dant," "mother of coal," and "mineral charcoal." The upper, and especially the flocculent dust, possesses physical and chemical properties wanting, or existing in the most shadowy form, in the bottom dust; and the microscopical aspect emphasises these differences, as well as shows the relation of the former to what is very appropriately called "mineral charcoal."

It would pass beyond the limits of a letter to enter into particulars, but the observations and opinions of others may be hereby evoked, and this good work of saving life and property be materially furthered by your kindly admission of this letter to your pages. I will now only add that this ordinary upper dust and this flocculent dust removed, or rendered innocuous, it is my firm conviction that the number of explosions will rapidly fall, and also the loss of life be greatly reduced. This is the goal of my effort. Some practical men may indicate means, and perhaps I, who am a student, may be permitted to suggest that keeping the ventilating air-current saturated with aqueous vapour, rather than direct watering, would, if it be practicable, both lessen the amount of this dangerous dust, and also facilitate its removal. ARTHUR WATTS

Bede College, Durham, October 12

Volcanic Ash from New Zealand

A SAMPLE of the ash ejected during the recent eruption in New Zealand has just reached me through the kindness of Mr. W. Ferguson, Harbour Engineer, Wellington. It was collected sixty miles from the seat of the volcano.

The ash is of a gray colour, of a somewhat darker shade than that from Krakatão. The dark-coloured constituents of the New Zealand ash consist principally of black scoriaceous fragments and ferruginous particles of indefinite character; those of Krakatão consist mainly of magnetite and hypersthene, well defined. The following minerals are contained in the New Zealand ash:—

Plagioclase Feldspar, very fragmentary, limpid, showing polysynthetic striations in the polariscope, and sometimes medial twinning line. The few well-formed crystals observed recall the tabular forms from Krakatão (described in my paper, *Proc. Roy. Dublin Soc.*, vol. iv. p. 291). There is a notable absence of the cellular vesicular covering observed in the Krakatão feldspar, and so suggestive of the pulverisation of a ready-formed pumice.

Hornblende, in elongated prisms, sometimes fibrous longitudinally or striated; colour dark green, pleochroic green longitudinally to brown; extinction makes a small angle, less than 15°, with the prism axis; occurs occasionally included in the feldspars. It is scarce.

Biotite and a golden-coloured mica are common in well-formed crystals of hexagonal outline, remaining dark between crossed Nicols.

Iron Pyrites, free and in embedded grains; striated pale yellow octahedral forms. Scarce.

Magnetite, in lustrous black octahedral forms. Not abundant.

Sulphur, in small broken pale-yellow fragments; burns with the characteristic smell, held over a lamp. Scarce.

Glass, remaining dark between crossed Nicols; variously coloured and often containing crystallites arranged fluxionally. Common.

Of these minerals, mica, hornblende, and sulphur are, so far as my observations go, not present in the Krakatão ash. Comparing it with samples from Krakatão gathered at a comparable distance from the scene of eruption, the New Zealand ash suggests a more hastily formed material, the minerals in common being less perfectly developed in the New Zealand ash. I have not noticed as yet in this ash the hypersthene conspicuous in that of Krakatão. There are some organic remains, calcareous fragments of shells. J. JOLY

Physical Laboratory, Trinity College, Dublin, October 18

An Abnormal Starfish

A FEW weeks ago I dredged, off the north end of Arran, an interesting specimen of *Porania pulvillus*, Gray (= *Goniaster templetoni*, Forb.). It is rather more than 5 cm. in diameter, and one of the five short rays (that opposite to the madreporite), when viewed from the aboral surface, is seen to be distinctly bifurcated about 1 cm. from its termination. On examining the oral surface, it is found that the ambulacral groove of the abnormal ray divides into two branches at a distance of 2 cm. from the edge of the mouth. One of these branches runs along one of the forks of the ray to its extremity without further complication, but the other branch, belonging to the second fork, divides again 2 mm. from the first bifurcation, so as to form two tracts, which unite with one another 3 mm. further on, thus inclosing a small piece of the ordinary integument in an ambulacral area. Finally, this ambulacral area divides once more close to the tip of the ray. Consequently, there are three bifurcations of the ambulacral area in a space of not more than 1 cm. in length. As there are no signs of injury or disease on the specimen, the abnormal condition seems to have been caused by a tendency to dichotomous division like that seen in the rays of Crinoids and of the Astrophytidæ. W. A. HERDMAN

University College, Liverpool, October 9

Peculiar Growth of the Common Acorn-Shell

A PECULIAR mode of growth of the common acorn-shell (*Balanus*) is met with at Hastings. These crustaceans are known to attach themselves sometimes by a shelly basis to rocks, &c. In this instance they seem to have worked together to form a common shelly tube, as seen in the accompanying life-size figure; still overcrowded, they have also lengthened their outer valves, thus spreading themselves out like the umbels of certain plants, as

many as fifty individuals being sometimes borne on one of these tubes. The columns supporting the pier are completely covered with them up to high-water mark. Except a comparative few of a later generation which—as will be seen in the figure—have attached themselves to the tube, and are in the normal condition, they all appeared to be dead, but of this I am not certain.

FRANCIS P. PASCOE

1, Burlington Road, W., October 18

Lunar Rainbow—Halo round the Sun in Connection with the Storm of October 15 and 16

ON the evening of the 9th there was a good lunar rainbow between 7 and 8 p.m. I have not seen one for some years, although about twenty years ago in one winter I saw seven or nine, I forget exactly which.

On the 14th, while coming home between 3 and 4 p.m., I saw a remarkable halo round the sun. I had intended making a sketch of it, but when I arrived there was pressing business, and when I was disengaged it was gone.

The halo was nearly a complete circle, but somewhat pressed in at the sides. Inside, there was a dark mass with a hard defined edge, with the least trace of faint mock suns at the left and right hand lower edges of the circle; outside, the sky was remarkably clear, of a greenish-blue colour. The evening and up to midnight was very hot, which was suceeeded first by heavy rain, then wind that lasted for over forty-two hours; during this time there was considerable heat; afterwards for about six hours it was fine, to be succeeded by heavy rain, and cold; this afternoon (October 17) is fine, with half a gale blowing. I should have mentioned that after the halo the aneroid went down as low as 28·3.

Ramelton, co. Galway J. H. KINAHAN

Mimicry in Snakes

I BEG to remark with reference to Mr. W. Hammond Tooke's letter on mimicry in snakes (NATURE, October 7, p. 547) that I stated a case of mimicry in snakes in the year 1869 (see also *Proceedings* of the Zoological Society, 1870, p. 368), and that I recently published a short paper on Adeniophis, which again treats the case. A. B. MEYER

October 9

The Gale

IT may be worth mentioning as a curious coincidence that three of the most violent gales of recent times occurred on very nearly the same date of the year, namely:—

Sunday, October 14, 1877.
Saturday, October 14, 1881.
Friday, October 15, 1886.

The first of these was the most destructive in its effects as regards this district. W. F. DENNING

Bristol, October 16

Adam's Peak

WITH reference to the "Adam's Peak shadow" I may perhaps mention the following fact:—While at Saas Fee (Canton Valais, Switzerland) this summer, we noticed more than once that the shadows of the Dom and its neighbours stood out clearly defined in the atmosphere. They were manifestly thrown on the cloud and mist that were suspended in the air at the time. The phenomenon was in this case witnessed from below.

Cheltenham, October W. L.

THE MARINE BIOLOGICAL STATION OF BANYULS-SUR-MER

YESTERDAY I had the pleasure of visiting the "Laboratoire Arago," or Marine Biological Station of Banyuls, being the second institution of this sort founded by M. Lacaze-Duthiers in connection with the College of the Sorbonne. I found it in full working order, the session, which lasts here from October to June, having just commenced. The building is placed at the western point of the little bay on which the fishing-village of Banyuls is situated, just beyond the Établissement des Bains, and consists of three stories. The ground floor is one large *salle*, containing basins which are abundantly stocked with marine animals, and is open to the public for inspection as an "aquarium." The lighting of these basins appeared to me to be particularly good, and the collection contains many Mediterranean forms not to be seen in our northern latitudes. The first floor contains the working-rooms, library, and museum; the upper floor contains the apartments of the Director. In M. Lacaze-Duthier's absence the institution is under the charge of M. Henri Prouho, whose official title is "Préparateur au Laboratoire Arago."

The fauna of Banyuls is probably not nearly so rich as that of Naples, but the advantages to English students would be, the nearer access (twenty-six hours from Paris) and the much more healthy situation.

If I understand rightly, the subvention awarded to the "Laboratoire Arago" by the French Government considerably exceeds that proposed to be given by the Treasury to our new Biological Station at Plymouth.

P. L. SCLATER

Port Vendres, Pyrénées Orientales, October 15

KEW GARDENS

THE well-known scientific traveller, Dr. Schweinfurth, has recently paid us a visit in England. The *Berliner Tageblatt* of September 12 reports his impressions of our botanical institutions as given in a lecture delivered the previous day before the "Versammlung deutscher Naturforscher und Aerzte." We extract the account of the National Botanic Garden at Kew. Some trifling

inaccuracies have crept into the report, but we leave them as they stand. The impression produced by English scenery, vegetation, and gardening on unaccustomed eyes is difficult to realise by those to whom they are the common-places of every day.

Dr. Schweinfurth opened his discourse with the remark that England under the influence of a summer sun such as it had enjoyed this year deserved to be called the most beautiful country in the world. Indeed, the ordinarily serious and matter-of-fact man of science seemed to be filled with enthusiasm when relating his observations on botanical institutions in England. He assured them that although he had spent weeks in London he was only in a position to offer them a fragmentary report on the subject. It is true the amiable orator had provided himself with very considerable fragments.

He first of all gave a detailed description of the world-wide renowned Kew Gardens, which he compared to a botanical "Ministry for the Exterior," inasmuch as there the reports of all the embassies and agencies flow together. The development of this gigantic establishment presents similar phases to that of the Berlin Botanic Garden. Originally a kitchen garden for the Royal Court, it has during this century expanded to its present size of about 250 acres. Independently of its varied and enormous botanical treasures, Kew Gardens is one of the most beautiful examples imaginable of park-like arrangement. Everything luxuriates in the most glorious foliage; not a dead leaf nor a dry stalk was to be seen. Everywhere the most untiring and intelligent care was evident; and the manner in which the most delicate plants are brought to their fullest development must excite the universal admiration. The entire administration of this extensive establishment is as simple as it is worthy of imitation.

Kew Gardens contain a vast herbarium which is preserved in a simple light building with open galleries running all round, in which work may be done during the day, but no lights are permitted. Along the walls are placed the cabinets containing the dried plants, which are poisoned with a solution of corrosive sublimate. The arrangement of the species is geographical. A magnificent library and an extensive collection of drawings greatly supplement the usefulness of the herbarium.

The way in which the plants are stuck on sheets of paper throughout their whole surface was deprecated by Dr. Schweinfurth.

Further, Kew Gardens contain seventeen large plant-houses, among which he specially mentioned those devoted to orchids, succulents, and tropical plants, including the palm-house, a building of about the same length as the Berlin palm-house, though by no means so lofty. Of the most beautiful part of the Garden, the colossal rockery of Alpine plants impressed Dr. Schweinfurth most, as it was in its greatest floral richness at the time of his visit.

There are also three spacious museums, situated at some distance from each other, which is a disadvantage; though from the enormous number of visitors—sometimes as many as 80,000 in a day—the separation may have appeared necessary. One of the museums contains a collection of useful vegetable products in various stages of development and manufacture. Another building contains the picture gallery founded by Miss Marianne North, consisting of 800 botanical landscapes from all parts of the world. They mostly represent the general aspects of plants, and their purely scientific value is unequal; but the great care with which the fruit is always painted is worthy of all praise.

LEPIDOPTERA IN THE SIKKIM HIMALAYA

DARJEELING has long been celebrated among entomologists as one of the richest localities in the world for insects, and especially for Lepidoptera, which, owing to the fact of their meeting a ready sale among visitors to the station, are collected as a matter of business by twenty or thirty of the Lepcha and Bhotea inhabitants of Sikkim.

But though many of the superb insects found here are common in collections, little or nothing is known as to their distribution, habits, and time of appearance, as no resident naturalist has ever done much at collecting or observing their habits in person. The number of species is so great, many of them so rare or so uncertain in their appearance, and the difficulty of studying their habits so great, that there is ample room for many years' work in this direction, and the lists which have been published by Mr. De Niceville in several recent numbers of the *Journal of the Asiatic Society of Bengal*, together with the very numerous additions to the known species made by Mr. O. Möller, show what a rich harvest is still to be gathered by one who does not fear exposure to the tropical heat and risk of fever in the low hot valleys where most of them are taken.

Having spent several days recently in observing the butterflies of Sikkim, I may give some idea of their habits and haunts.

First, and by far the most numerous, are the butterflies belonging to the fauna of the Indo-Malay region, which inhabit the low damp valleys from the level of the plains up to about 3500 or 4000 feet. This region is extraordinarily rich in the genus Papilio, of which there are at least thirty species almost confined to it, though some of them on hot sunny days fly far up into higher elevations. Most of these species are many-brooded, and begin to appear in March, continuing till the end of the rains to fly in greater or less numbers. Some of them, however, are only single-brooded; almost all of these appear before the rains, from March to the end of May or June. In the hot valleys they fly at all times of the day up till 4 or 5 p.m., and are only to be procured in quantity and in good condition by those who know their habits, the flowering trees they frequent, the wet spots in the sandy banks of rivers, where they associate in great numbers to settle, and the most attractive baits by which to allure them within reach of the net. This is the sort of work which the Lepcha excels in. He likes the wandering free life in the jungles far better than steady work, and, filling his boxes in two or three days without much exertion by waiting in the favourite haunts of the butterflies, he earns a handsome wage by selling his booty at a pice apiece. He will not trouble himself to catch the small and inconspicuous Lycænidæ and Hesperidæ, unless specially instructed to do so; but, as a fact, these two families are the most numerous in species, if not in individuals, and would probably together amount to at least 200 species in Sikkim, almost all of which, as far as I can learn, are found in this zone of altitude.

Nymphalidæ also are very numerous and very varied, though more difficult to procure. The females of some of them, as well as of some Papilios, remain unknown, or are very rare, notwithstanding the abundance of the males. They do not fly much, or frequent the open sunny places, but remain settled high up on trees, or in dense jungle, where it is impossible to penetrate or to use a net. Many large and splendid moths of the family Agaristidæ are mostly day fliers, and innumerable Bombyces, Geometers, and Sphinges also frequent these hot valleys, and are bred or captured in various ways by the Lepchas, but seldom by Europeans. During the rains, when they are most abundant, the risk of fever at night is too great for much lamp work, and breeding is by the natives but little understood. The smaller moths, especially the Micro-lepidoptera, remain almost unknown, though some of the most showy sometimes find a place in the boxes of the Lepchas.

When we come to the zone of elevation between 3000 and 6000 feet, we come into a climate which produces the

grandest forest in Sikkim, and surely one of the grandest in the world. A mixture of tropical and temperate forms in highest perfection occurs, oaks, chestnuts, magnolias, laurels, and many other giant trees, laden with climbers, orchids, ferns, aroids, and other epiphytes, till the branches break with their weight, mixed with a number of beautiful shrubs and herbaceous plants. But this forest is almost everywhere, unless strictly protected by the forest department, or growing on slopes too steep for cultivation, destroyed by fire or axe, for the purpose of cropping with rice, millet, Indian corn, and potatoes, which are the principal crops of the natives; and owing to the great extension of cultivation, and the immigration of Nepalese into Sikkim and British Bhotan, a tract of really virgin forest between 3000 and 6000 feet is becoming quite a rarity.

Partly on account of this destruction of the native trees, which are replaced in abandoned cultivation by worthless weeds, such as artemisia, and by quick-growing soft-wooded trees of no value, the species of butterflies peculiar to this zone are much fewer in numbers, both of species and individuals, than lower down, and some of the finer and larger species of Adolea, Limenitis, and Athyona, which formerly were not rare in Sikkim collections, appear to be now very scarce or extinct in their old haunts. A little higher up, however, we find a forest of much the same character, though denser, darker, and the trees much more overgrown with moss. At 7000 and 8000 feet rhododendrons appear, and a dense undergrowth of hill-bamboo, called "maling," which forms the principal fodder for ponies in Darjeeling, in some places makes the forest quite impenetrable. Here the sun shines but rarely during the rainy season, and even in the cold weather mist is very prevalent. This forest is the home of some of the most superb insects in the world.

Let us walk up a few miles above Darjeeling into the great forest which covers Sinchul on a sunny morning early in June, and wait on one of the highest peaks, where a small bare space can be found. Flying over the tops of the trees with a rapid soaring flight we shall see that grand insect *Teinopalpus imperialis*, peculiar to these forests, and if lucky enough to attract him to the ground by a bait, or able to reach his resting-place, we may catch one or two in a morning. But his female so rarely flies from her leafy perch that in sixteen years I only know of three or four examples having been taken, and these one may say by accident in unexpected places. *Papilio Krishna* and *P. Minercus*, again, frequent the same forest; but of the former, though males are in places abundant, the female is hardly, if ever, taken. *Herda duma*, *Picris Horsfieldi*, *Neptes Zaida*, and other species, have the same peculiarity, that the females are hardly ever seen; and only long and patient waiting in spots where sunshine is of rare occurrence, will enable the most sharp-sighted collector to obtain them. Some beautiful, though sombre-coloured, Satyridæ, such as *Lophoessa goalpara*, *Yama*, and others, *Raphicera satricius*, *Lethe scanda*, *Dinarba* and *Sidonis*, are peculiar to these shady, damp forests, and flit along the roads when disturbed in dull weather as well as in sunshine; but however active the search, the number of species and of individuals seen in a day will be small compared to the results of a day in the tropical valleys. Higher up still, from 9000 to 12,000 feet, the outer ranges of Sikkim are very poor in diurnal species, though rich in Geometra, and Micro-Lepidoptera, as the climate is too damp and sunless in summer to encourage the appearance of species of Palæarctic genera, which are in places so abundant on the more sunny, grassy hills of the North-West Himalaya.

In the interior, however, where the climate is drier, and where Coniferæ and rhododendrons form the principal features of the forest from 8000 to 11,000 feet, there are a number of European genera and species which I have at present only procured through native collectors, but which I hope to see for myself before long in life. *Papilio Machaon*, *Colias Fieldii*, *Picris brassica*, *Vanessas*, *Argynnis Lathonia*, the lovely *A. gemmata*, are common in these higher, drier, and more flowery regions, whilst *Parnassius*, *Aneis*, *Melitæa*, and other Alpine genera are also found in certain places. The moths of the interior hills are too little known for me to say much about them, but there are great numbers of species of European aspect, and many novelties amongst them may be expected whenever the Tibetan frontier is crossed.

H. J. ELWES

SKETCH OF THE EARLY HISTORY AND SUBSEQUENT PROGRESS OF PALÆOBOTANY [1]

AMONG the many memoirs included in the Fifth Annual Report of the U.S. Geological Survey, just distributed, none evinces more laborious research than the sketch of palæobotany, and no part of this will prove more valuable, both from its exhaustive treatment and its wealth of references, than the section with the above title. The matter divides itself naturally into a history of the scientific, and of the pre-scientific period. To the latter of course belong the speculations of the early Greek philosophers, whose ideas were far more correct than those held fifteen or sixteen centuries later, for they at least recognised that petrifactions had once been living things, and that the mountains in which sea-shells were embedded had once been under the sea. These doctrines were it appears the popular belief of the Romans, and continued to be held until the spread of Christianity caused them to be rejected, and that long period of stagnation to set in, when all natural science was weighed down and subordinated to the religious cosmogony.

We do not find, however, any direct and unequivocal references to fossil plants or wood in either Greek or Latin writers, though such must have been far from uncommon objects in limestone districts, and the history of palæobotany cannot therefore be said to have commenced before the thirteenth century, when Albertus Magnus described most unmistakably the occurrence of petrified wood.[2] Little further mention, however, is made of any fossil vegetable organism until the latter half of the sixteenth century, when we find several writers describing and discussing the origin of petrified wood, which seems to have added fuel to a controversy that had already for centuries been raging concerning the genesis of petrifactions. Building upon Aristotle's doctrine of spontaneous generation, scholastic writers had come to affirm that it was equally possible for stones to grow of any required form as for living animals and plants. Avicenna in the tenth century had conjured up a *vis lapidifica*, and Albertus Magnus in the thirteenth century had imagined a *virtus formativa*. Bauhin dreamed of some subtle Spirit of the Universe, while Libavius opined that fossils grew, like living things, from germs or seeds. Balthasar Klein obtained a petrified stem, one side being stone, the other coal, an object which excited the liveliest curiosity. He sent the specimen to Matthiolus, who, after studying it, came to the conclusion that coal was a third and final step in the process of transmutation, and that just as wood turned into stone, so stone in turn became transformed into coal. Klein's own views about it seem, however, to have been more rational. The discovery in the mines of Joachimsthal of a petrified trunk with the bark on added to the interest already aroused, and kept alive the discussion.

In 1565, leaf-impressions incrusted in tufa were

[1] From the Fifth Report of the U.S. Geological Survey, by Lester F. Ward, condensed by J. S. Gardner.

[2] For all references the Fifth Report of the U.S. Geological Survey, p. 388 *et seq.*, must be consulted.

described by Kentmann, and in 1664 the existence of leaf-impressions in true rock was for the first time published by Major. In 1699, Lhywd, a Londoner, figured and described a number of ferns from the Coal-Measures, which can even now be recognised. These he was inclined to consider due to the *succus petrificus*, a petrifying juice whose action was controlled by the *vis lapidifica*, both petrifying forces having been invented by Kircher in 1655, when he propounded his theory of *seminaria de corpuscula salina* as the true faith regarding petrifactions. Sperling believed in a special stone-making spirit, and Camerarius (1712) held that in the beginning God had supplied the earth's interior with these varied forms, just as he had placed grass and herbage on its surface. Still others were content to regard fossils as mere freaks of Nature. Such-like ideas held the field, and only began to give way during the early years of the eighteenth century, for we find that, as late as 1733, infinitesimal particles were believed by a Dr. Arnold to have been brought together at the Creation to form dead outlines or images of all the living creatures upon or within the world. During all these dark ages, however, there were not wanting writers who held more rational views as to the nature of fossils, and even combated the supernatural explanations of the dominant schools. It was due to fossil vegetables, according to Brongniart, that these crude ideas came to be abandoned. All these theories were swept away by the "Flood theory," the first germ of which is apparently to be found in Luther's commentary on Genesis, where he expresses the belief that surviving indications of the Deluge would be found in the form of wood hardened into stone around the mines and smelting-mills. Several writers between Luther's time and the close of the sixteenth century held the same view, but the Flood theory was for a time drowned in the more fantastic speculations then in vogue, not to come to the surface again until another century had passed. In 1695 Woodward published a work on fossils, in which he maintained that all the solid parts of the earth's crust were loosened by the Flood and mingled promiscuously in its waters, and that at its close everything sank back to the surface according to its specific gravity, the remains of animals and plants assuming the positions in which they are found petrified. The chiefest expounder of this hypothesis, however, was Scheuchzer, whose great work on fossils, in 1709, laid the foundations of palæobotany, though he subsequently rendered himself even more notorious by describing a large fossil Salamander as *Homo diluvii testis*. His work, however, aroused so deep an interest that for many years collectors and writers were busy searching for and describing fresh evidences in support of the Diluvial theory. It had indeed for some time no serious rival, and remained all but universally accepted down to the second half of the eighteenth century, when dissentients first ventured to make themselves heard. The last two decades of the eighteenth century were destined to witness a collapse of the Diluvial theory as rapid as its rise in the first decade, though Hugh Miller even found supporters of it in our own time.

During the seventeenth century the occasional protests of the rational minority, among whom we find Steno, made few disciples; but during the eighteenth their arguments were felt with increasing force. The Deluge hypothesis, faulty as it was, was a great actual advance, for it at least recognised the real nature of the objects, and turned discussion towards the means through which fossils came to be embedded. Though several authors wrote in a truly scientific spirit during this century, it was Blumenbach who first taught with authority that the beings to whose former existence these fossil forms were due were not only antediluvian, but pre-Adamitic, and that, moreover, there had been a series of faunas and floras inhabiting the earth before the age of man. The change in opinion, however, had long been preparing, and prominent among the questions that led up to it were: Are these the remains of the same kind of plants that are now found growing upon the earth? and, When did the originals live that have been preserved by changing into stone? Only two generations since the answers would have been universally that they were plants that grew but a few thousand years ago, and that they either grew where found, or had been brought from other countries by some such agency as the Flood, or else had been destroyed by these agencies and become extinct. Scheuchzer regarded them as plants which could still be found living, citing a number of genera as examples. Among many others who embraced this view was Lehmann (1756), who laboured hard to prove that the impressions of *Annularia sphenophylloides* were flowers of *Aster montanus*, caught in full bloom, and petrified *in situ*. The exotic theory, as it may be called, first appears in a note of Leibnitz, 1706, on the occurrence of impressions of Indian plants in Germany; and in 1718 Antoine de Jussieu discussed the resemblances of the coal plants of St. Chaumont to ferns of the tropics. Parsons (1757) stated that the Sheppey fruits were absolutely exotic, and Dulac soon after compared the coal plants of St. Etienne to American species. These instances are only a few among many, for similar views became commonly held. Volkmann (1720) and others held what may be described as a degeneration theory, believing that antediluvian vegetation was of a higher order, and free from thorns, thistles, and other scourges, while comprising many fruit-bearing trees of which our modern ones are the degenerate representatives. The same authors held at the same time mixed views, thinking that many of the petrified plants might have become extinct during the Deluge or other physical changes, and it was probably this idea that led to the more critical investigation of the stratified rocks, and brought the question as to when the originals lived within the region of practical science.

THE RECENT EARTHQUAKES AND VOLCANIC ERUPTIONS

TERRIBLE as has been the tale of destruction to life and property during the last six years owing to the exceptional activity of the subterranean forces in nearly every part of the globe, we cannot avoid the reflection that scientific men in the future will feel that there have been at least some compensating advantages for these sad losses. Never before, perhaps, have greater opportunities been afforded to us for collecting the real facts, and for testing, verifying, or correcting hypotheses concerning these interesting phenomena; and never, certainly, have such organised efforts been made to deal adequately with the great opportunities which have been afforded to us.

After the earthquakes at Agram, a Commission appointed by the Hungarian Government was sent to examine the district, and the result was a Report of great value and interest, in which the exact details of the actual phenomena observed were carefully sifted from the mass of vague rumours and gross exaggerations with which they had become involved. Admirable monographs on the terrible earthquakes of Ischia in 1881 and 1883 have been prepared by Prof. Mercalli, of Monza, and by our own countryman, Dr. Johnston-Lavis. The tremendous catastrophe which occurred in the Sunda Straits three years ago has already given rise to a vast mass of literature bearing on the subject. Commissions, including very competent observers, were sent to the district by the Dutch and the French Governments, and the former of these has already completed and published its very valuable Report. We may be certain, too, that the more

recent events, in New Zealand and Charleston respectively, will not be allowed to sink into oblivion until every effort has been made to gather to a focus all the light which they are capable of affording to us on the great problems of vulcanology and seismology.

No one can have studied the reports of the late eruption of Tarawera in New Zealand without being impressed by the energy and enterprise exhibited by the local Press of the colony. The first mail after the outbreak brought us very full and detailed accounts collected by correspondents who, braving no inconsiderable risks, travelled over the scene of the catastrophe to collect information, and these accounts were amply illustrated by maps, sketches, and photographs. It must always be remembered, however, that the requirements of journalism and science are different, and to some extent antagonistic: the former demands, above all things, speed; the latter, accuracy. It is often only when the work of the newspaper correspondent is well-nigh forgotten that the scientific man finds himself in a position to deal with the vass mass of unsifted materials—good, bad, and indifferent—which is poured out before him in such wonderful profusion; to him relations of events can never be "stale" if they are capable of being authenticated and of supplying accurate data for the legitimate inductions of science.

In the case of the Tarawera eruption, as in that of Krakatâo, it must be always a subject of regret that the topographical and geological surveys of the scene of the outbreak which were made prior to the event appear to have been far from perfect. Tarawera is situated in the midst of a barren region, in the very heart of the native reserve, and it was moreover most jealously guarded from the intrusions of white men by the superstitious Maoris, who used it as the place for depositing their dead. Dr. Hector, the accomplished Director of the New Zealand Geological Survey, confesses that he had never been able to ascend the Tarawera Range, but that from an examination of its flanks he concluded that it was composed of highly acid (rhyolitic) lavas in *coulées* and dykes, and that large quantities of obsidian and pumice were also present. He was thus led to conclude that Von Hochstetter was right in mapping the mountain as belonging to his recent volcanic series. Mr. Percy Smith, the Assistant Surveyor-General of New Zealand, who like Dr. Hector was upon the spot within a few hours of the outbreak, had been more fortunate in obtaining some knowledge of the upper part of the mountain before the eruption. In the year 1874 he ascended the mountain three times, and found its summit to be destitute of any trace of a crater, but to consist of a table-land about three miles long by half a mile wide, divided into two portions by a saddle, and covered by angular fragments of rhyolite, apparently shivered by the action of frost.

There unfortunately still exists some doubt upon the question as to whether Tarawera has ever been in eruption during the period that New Zealand has been occupied by the Maoris. On the one hand, it has been asserted that no traditions of any previous outbreak are preserved among the natives; but, on the other hand, the names given to the parts of the mountain are said to indicate a knowledge on the part of those who first applied them of its volcanic character, and moreover the extreme sacredness attaching to the locality seems certainly to point to the conclusion that there had been something remarkable in its past history.

Certain it is, however, that, up to June 10 last, Tarawera was not by any means regarded as a spot upon which a volcanic outburst might be expected to break out. But after a series of violent earthquakes occurring on the midnight preceding that day, and lasting for about three-quarters of an hour, a great fissure opened, beginning with an orifice on its northern summit and gradually extending south-westwards to a distance of four miles during the next hour and a half; distinct ejections took place from at least seven vents along this line of fissure. The highly heated condition of the materials thrown from these vents, which set on fire trees at a great distance around the mountain, certainly points to the conclusion that molten lava was ejected from the volcano during this its earliest stage of eruption. But that this lava rapidly became consolidated and no longer incandescent on its surface appears to be clearly established by the observations of Dr. Hector, who, watching the steam cloud on two successive clear nights, was unable to detect any trace of a reflected glow upon it. After the first tremendous outburst, this eruption appears to have been almost entirely a hydrothermal one, and to have slowly but gradually declined in intensity.

Immediately after the completion of the first fissure, there opened a second one throwing out enormous volumes of steam. This second fissure, which eventually attained a length of nearly eight miles, running in a nearly north-and-south direction, was that which passed through the famous lake of Rotomahana. Its ejections seem to have been purely hydrothermal in character, and by the masses of ash and mud thrown out, the beautiful sinter terraces have been apparently converted into mud-volcanoes. There still remains some doubt as to whether the second fissure is not to be regarded as a branch of the first-formed one. The eruptions from a number of vents formed along this second fissure have also been gradually diminishing in intensity; but the quantity of steam and of more or less finely comminuted rock ejected from them has been enormous.

According to the latest accounts which have reached us from the district, the ash, which covers the whole country like a great mantle of snow, effectually prevents the completion of the necessary geological observations upon the scene of the eruption. Indeed, Dr. Hector, after a preliminary survey, felt that no useful detailed work could be done until the rains have removed this covering of loose dust and rendered the country more easily accessible. Mr. Percy Smith has, however, ascended Tarawera, and reports the existence of a great fissure four miles long and five hundred feet wide, of which there seems to have been no trace when he ascended the mountain on former occasions.

It is evident from this brief outline that a number of problems of the greatest interest await solution in connection with the recent display of volcanic energy in New Zealand. Never before, perhaps, have better opportunities been afforded of studying the phenomena attending the formation of the fissures along which volcanic ejections take place. It is remarkable, too, that, although the quantity of materials erupted was very great, there were few if any regular cones of the ordinary pattern built up along the fissures. There also remains much to be learnt concerning the actual nature of the materials ejected at different stages of the outburst, and the way in which they were distributed: all the materials at first thrown out still remain buried under the later ejectamenta.

Upon these and many other problems of the greatest importance we may rely on the geologists of New Zealand, both officials and amateurs, for obtaining all possible evidence during the next few months; and when their researches have been completed the New Zealand eruptions of 1886 can scarcely fail to prove among the most instructive which have ever come under the observation of vulcanologists.

That the terrible catastrophe at Charleston will be similarly utilised by the numerous and able geologists of the United States we cannot for a moment doubt. The telegram despatched by Major Powell during the recent meeting of the British Association at Birmingham shows how fully alive he was to the importance of carrying on systematic observations in the district; among his staff of excellent geologists constituting the United States Geological Survey he will experience no difficulty in

selecting observers admirably qualified for this investigation; nor need we fear that the United States Government will be wanting in their accustomed liberality in publishing the Reports on the subject when they are prepared. Nor will the unofficial geologists of the country and private associations be behindhand in contributing to the mass of information gradually accumulating upon the question of the nature and origin of the terrible event.

ON LION-BREEDING[1]

THE Gardens of the Royal Zoological Society of Ireland have become famous among zoological gardens for their breed of lions. While here and there among the zoological gardens of the world a lion cub is born, none save those of Dublin can boast of a period of lion-cub production of nearly thirty years' duration, or of the extraordinary success of the birth of 131 cubs. This being so, we are indebted to Mr. V. Ball for a history of the subject, which has been published in a recent part of the *Transactions* of the Royal Irish Academy. The subject is one of interest in several ways, and the following short abstract of the details will call our readers' attention to it.

In 1855 a pair of lions from Natal were purchased for these Gardens. The exact relationship of these appears to have been unknown, but their first litter was born in 1857. From 1857 to 1885 we find a total of 131 cubs born, of which twenty-one were either born dead or died shortly after birth, and 110 were reared, eighty-six of these latter being sold, greatly to the profit of the Society and to the advantage of very many of the zoological gardens of Europe, Asia, and America. These 131 cubs were the offspring of nine lionesses and four lions; of the latter, one, "Natal," was the father of forty-two cubs; and another, "Old Charley," who was a son of "Natal's," was the father of forty-six; while of the former, one, "Old Girl," who was born in the Gardens in 1859 as one of a litter of five, was the mother of no less than fifty-five cubs, of which forty-nine were reared. This prolific lioness died at the age of 16 years, apparently of old age.

The facts given by Mr. Ball in one of his very carefully compiled tables seem to indicate two periods of the year at which lionesses in a state of semi-domestication produce their young. While the absence of any well-authenticated information as to the period of the year in which lion cubs are born when in a state of nature is quite remarkable, yet Mr. Ball ventures the fairly safe surmise that considering the period necessary for the rearing and education of a cub to be at the least a year, for the cub is often learning to kill its prey when over a year old, it is most improbable that lionesses have more than one litter in a year when in a wild state; but he thinks it probable that the geographical surroundings of the parents may alter this period, and that it may be in the autumn season in the tropics, when the great heats and droughts of summer are over, and in the spring season in more temperate climes, where the summer warmth would be of service to the young offspring; and he very ingeniously speculates that the two periods of maximum production, as observed in the lionesses in the Dublin Gardens, may have been inherited from two corresponding periods, the result of climatal conditions in a wild state. Another remarkable phenomenon comes to light on comparing the curves of production, when modified into curves of conception, with the monthly curves of temperature for Dublin. In doing so, the maximum curve in the one case is found to closely approximate to the maximum curve of temperature, *i.e.* June and July; and the second maximum curve corresponds to the period of lowest temperature, *i.e.* December and January: but it will be remembered that then the animals are kept in well-heated houses, so that this period, as to temperature, may, though the temperature be artificial, be compared to the other, when it is natural.

The cubs when born are noted as distinctly spotted with dark brown on a ground colour which is rather light brown than fulvous; from about one to three months they are perhaps most distinctly defined; and, though along the back the spots are somewhat quadrangular in shape, there is no indication of actual bars or bands.

In reference to the sexes of the cubs, Mr. Ball is able from accurate information to record the sex of 130 of the cubs, and we find 74 were males and 56 females, giving a majority of 14 males in every 100 cubs. This is an interesting and novel addition to our knowledge of the natural history of the large Carnivores.

No lion or lioness lived in the Gardens for a longer period than 16 years, and it seems probable that 12 to 14 years is the average duration of lion life. The cases so often referred to of lions living to an age of 20 to 30, or the case of "Pompey," who died in the Tower in 1760 at the age of 70, stand on no scientific or even reliable evidence.

Under the heading of "The Cause of Success in Breeding," we find some valuable suggestions as to the keeping of these splendid Carnivores; but we searched in vain for the secret of success. Horse-flesh is evidently not dear in Dublin, as the annual cost of the food of an adult lion, being for the most part horse-flesh, only came to 15*l.* in 1885. A series of tables accompanies the memoir, and some illustrations of the cubs of the lioness "Queen," born April 1885, from drawings by Mr. Thomas.

[1] "Observations on Lion-Breeding in the Gardens of the Royal Zoological Society of Ireland," by V. Ball, M.A., F.R.S., Director of the Science and Art Museum, Dublin, and Hon. Sec. of the Royal Zoological Society of Ireland. *Transactions* of the Royal Irish Academy, vol. xxviii. Part 24, August 1886.

NOTES

AN article in NATURE for May 6 (p. 7) drew attention to the fact that this present year is the tercentenary of the introduction of the potato into England, and discussed some of the points of its history. Apart from the purely historic aspects of the question, "Whence did our potato first come?" it was shown that in connection with the suggestion of cross-breeding to strengthen against disease it is very important to know which is the species that for three hundred years we have been cultivating. With a view to drawing the attention of cultivators to the subject, it is proposed to hold a Tercentenary Potato Exhibition at the St. Stephen's Hall, Westminster, from Wednesday, December 1, to Saturday, December 4, and to appoint one of those days for a Conference, when some of the unsettled questions may be discussed. The Exhibition will consist of four sections:—(1) An historic and scientific collection, to include early works on botany, in which the potato is figured; maps showing the European knowledge of the New World three hundred year ago, and the proximity of potato-growing districts to the ports most frequented; early books on travel and voyages in which references to the potato occur; works and papers in which attempts to define the different species are made; illustrations of the species and varieties; contemporary references to the voyages of Hawkins, Drake, Grenville, and Raleigh. (2) Illustrations of potato disease, and works on the subject. (Sections 1 and 2 will be arranged under the advice of a committee of scientific gentlemen who have consented to give their co-operation.) (3) Methods for storing, preserving, and using partly diseased potatoes, &c. (4) A display of tubers of all the various varieties grown. (In this section gold, silver, and bronze medals will be awarded. Each exhibit must be accompanied by a statement of date of planting, locality, nature of soil, &c.)

Mr. John Whitehead, well known to ornithologists for his discovery of a new species of Nuthatch in Corsica, has been travelling in Borneo during the last two years, and has sent home a large collection of birds. Unfortunately the disturbed state of the country in the Brunei district has prevented Mr. Whitehead from accomplishing the chief object of his expedition, the ascent of Kina Balu, and he has therefore been obliged to restrict his labours to the neighbourhood of Labuan and the country round Sandakan. These districts have been well worked for years by Mr. Alfred Everett, Mr. Treacher, Mr. Pryer, and other naturalists, and Mr. Whitehead's collection, although very complete, did not contain anything new to science. He is now travelling in Java, and purposes to explore some of the mountain-ranges in the interior.

Mr. George Reid, a well-known contributor to the pages of Mr. Allan Hume's journal, *Stray Feathers*, has just finished a "Catalogue of the Birds in the Provincial Museum, N.W.P. and Oudh, Lucknow." Mr. Reid is the member of the Committee of Management in charge of the Natural History Department of the Lucknow Museum, and the value of the bird-collection depends upon the series which Mr. Reid has himself given to the Museum, his donation amounting to 1287 specimens out of a total of 2646. The Museum appears to possess a very complete collection of birds from the neighbourhood of Lucknow, and it is encouraging to see that Mr. Reid, in re-organising the natural history portion of the Museum under his charge, has recognised the first duties of a local institution, and has commenced by making a good collection of the birds of the province, of which Lucknow is the capital. Mr. Reid will be glad to entertain the idea of exchanges with other Museums.

The concluding part of the late John Gould's "Supplement" to his "Monograph of the Trochilidæ" will shortly be issued by Messrs. Sotheran. This work, which was left unfinished at Mr. Gould's death, has been completed by Mr. Bowdler Sharpe, who has also nearly finished the great work on the "Birds of New Guinea," which had not long been commenced by the author before he died.

Messrs. Taylor and Francis will shortly publish a work by Mr. T. Mellard Reade, F.G.S., entitled "The Origin of Mountain-Ranges." In addition to containing a systematic theory of mountain-building, with detailed experimental illustrations, the structure and geological history of the great mountain-masses of the globe will be discussed. The work will also contain many maps and sections of mountain-ranges, and a contoured map of the North Atlantic Ocean, together with numerous sketches of mountain-structure and scenery, from Nature, by the author.

Prof. R. H. Richards, of Springfield, Massachusetts, has invented an ingenious and effective application of the zoëtrope for the illustration of the relation between certain isomeric forms. The apparatus exhibits the gradual passing of a cube into an octahedron, a dodecahedron, &c. It can be used also for exhibiting the growth of hemihedral forms of crystals.

A project is on foot for tunnelling the "Great Divide." The Divide is the Rocky Mountains, and the point proposed to be tunnelled is under Gray's Peak, which rises no less than 14,441 feet above the level of the sea. At 4441 feet below the peak, by tunnelling from east to west for 25,000 feet direct, communication would be opened between the valleys on the Atlantic slope and those of the Pacific side. This would shorten the distance between Denver, in Colorado, and Salt Lake City, in Utah, and consequently the distance between the Missouri River, say at St. Louis, and San Francisco, nearly 300 miles; and there would be little more required in the way of ascending or descending or tunnelling mountains. Part of the work has already been accomplished. The country from the Missouri to the foot of the Rockies rises gradually in rolling prairie till an elevation is reached of 5200 feet above the sea-level. The Rockies themselves rise at various places to a height exceeding 11,000 feet. Of the twenty most famous passes, only seven are below 10,000 feet, while five are upwards of 12,000 feet, and one, the Argentine, is 13,000 feet. Of the seventy-three important towns in Colorado, only twelve are below 5000 feet, ten are over 10,000 feet, and one is 14,000. The point from which it is proposed to tunnel is 60 miles due west from Denver, and although one of the highest peaks, it is by far the narrowest in the great backbone of the American continent.

At a meeting on Tuesday of the Committee of the subscribers to the British School of Archæology at Athens, Prof. Jebb said the School had been erected and paid for, Mr. F. C. Penrose had been appointed Director, and a provisional income of 400*l.* a year for three years had been raised; but additional funds were required. Prof. C. T. Newton, in urging the importance of having a great School of Archæology, suggested that there should ultimately be raised a special fund for the payment of the travelling expenses of the students at Athens. On the motion of Prof. Jebb, a Managing Committee was appointed.

On Saturday last, after six in the evening, several shocks of earthquake were felt in Alsace and many other parts in the nearest Alpine valleys, in the Vosges, and in the Black Forest. At Strasburg there had not been any earthquake for almost 200 years. The direction of the movement was from north to south. Several of the shocks were rather severe.

A telegram from Halifax, October 14, states that a shock of earthquake lasting ten seconds had been felt at Sydney, Cape Breton Island, Canada.

The Rev. J. H. Abrahall writes from Combe Vicarage, Woodstock, that on September 30, while near Blenheim Park, walking westwards about 7 p.m., he was aware of a sudden splendour above him on his left. Turning towards it, he saw a meteor moving eastward. It pursued a level path beneath the Milky Way about a sixth of the distance from the zenith to the horizon. It was bigger than Jupiter, and of a yellow hue. A reddish flame curled, crest-like, backward from its top. Its course was slow, and it quenched the light of the stars it passed over. It soon vanished, leaving no luminous train.

We have already referred to two successive instalments of Mr. Taylor's papers on the aborigines of Formosa, which have appeared in the *China Review* of Hong Kong. The third and last is now before us. It first describes the Pepo-huans, who are really not aborigines at all, but who stand between the savages and the Chinese settlers, speaking the language of both. They are believed by themselves and the other tribes to be the result of mixed marriages between whites and Chinese, who have traded to the country or been wrecked on the coasts, and aboriginal women. They are a simple, harmless, peaceful people. The Diaramocks, who inhabit the mountain-ranges which form the north-western boundary of the Tipuns (already described), are a fierce and intractable race, addicted to cannibalism. Little is known about them, as they hold aloof from other tribes. They are supposed to be the true aboriginal inhabitants of Formosa. There is also said to be a tribe of red-haired savages, living amongst the central mountains, but no authentic information has been gained respecting them. The inhabitants of Formosa generally are described as inquisitive and intelligent. The Chinese have a proverb to the effect that when the savages take to wearing trousers there is no opening

left for a Chinaman. The custom of head-hunting which prevails in some districts is mainly intended to prove the valour of the young men. On the whole, Mr. Taylor has given us a large number of details, classified under various tribes, which were not known before.

IN the September number of the *Meteorologische Zeitschrift*, Prof. Hann gives the results of many years' observations on the temperatures of the various parts of the Vienna forest. The forest valleys have a considerably lower temperature than the open land outside. This difference is smallest in winter and greatest in summer. But there is no similar effect during the course of the day, for the afternoon difference is not the greatest. It is actually least in the warmer hours of the day, and greatest in the cooler part. In the early morning and evening the influence of the forest in lowering the temperature of the air is greatest.

THE last number (vol. lv. Part 2, No. 2, 1886) of the *Journal* of the Asiatic Society of Bengal has for its first paper a list of butterflies taken in Kumaon, a district in the middle portion of the Himalayas, lying between Garhwal and Nepaul, by Mr. Doherty, of Cincinnati, who spent several months towards the close of last year in the expedition. Mr. Doherty's failure in the higher regions bordering on Tibet leads him to advise entomologists that the three summer months are the only good ones for collecting, either on the desert plains of Tibet, or in the deep valleys of the Himalayas sheltered by the outer range from the violence of the monsoon rains. Dr. Barclay contributes two papers—one on a second species of Uredine affecting the Himalayan spruce-fir (*Abies Smithiana*, Forbes), the first being described in the first paper of the present volume ; the second paper by the same writer relates also to new species of Uredine parasitic in the deodar (*Cedrus deodara*, Loudon). Mr. Atkinson concludes his six papers on the Indian *Rhynchota*, which have been compiled in order "to provide those who may become interested in this order of insects with some guide to their classification and arrangement, and was at first devoted to the correction of our only English list, but this became so unsatisfactory that it was found better to revise the whole on the basis of Stål's numerous and elaborate essays." The number of species described under each family is: *Cicadidæ*, 115; *Cercopidæ*, 67; *Membracidæ*, 33; *Jassidæ*, 38; *Fulgoridæ*, 204. These figures, Mr. Atkinson adds, could probably be doubled in a few years, for the number of *Jassidæ* alone awaiting examination should add several hundred species to the Indian fauna. Dr. King adds three apparently new Primulas from the higher parts of the Eastern Himalayas to the *Primulaceæ* of Sir Joseph Hooker in his "Flora of British India." Finally M. de Nicéville has a paper "On the Life-History of Certain Calcutta Species of *Satyrinæ*, with special reference to the Seasonal Dimorphism alleged to occur in them."

ANOTHER consignment of German carp (*Cyprinus carpio*) is to be imported by the National Fish Culture Association to meet the growing demand for this species, which is superior to its congener of this country. The Association, through its secretary, Mr. Oldham Chambers, has urged upon those possessing disused waters to introduce the carp, both the mirror and leather species, therein. Although the German carp belongs to the same genus as the English, the former is being imported to improve the latter, which have deteriorated in flavour and condition owing to lack of cultivation. The fish will be committed to the charge of the Marquess of Exeter's pisciculturist, who has proceeded to Germany for the purpose of bringing them over, together with other species.

AN amusing incident occurred last week at the Colonial and Indian Exhibition Aquarium, where a remarkable raven from the Isle of Mull is now on view. On being fed it is the habit of this bird to hide the remnants of its repast in various parts of its habitat, and exhume them when prompted by hunger to renew the meal. One day a rat invaded the spot, and commenced to excavate for the hidden articles of consumption. Enraged at this proceeding, the raven fell upon the rodent, and gored it to death after a severe struggle on both sides.

MESSRS. WHITTAKER AND CO. will issue in the course of next week "On the Conversion of Heat into Work, a practical Hand-book on Heat Engines," by Mr. Wm. Anderson, M.I.C.E.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus* ♂) from India, presented by Mr. T. L. Brewer; a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mr. Walter C. Horsley; a Bonnet Monkey (*Macacus sinicus* ♂) from India, presented by Mrs. Samuel Lloyd; a Common Squirrel (*Sciurus vulgaris*), British, presented by Miss F. Westrup; two Grey Seals (*Halichœrus grypus*) from the Island of Canna, N.B., presented by Mr. R. Thom; a Varying Hare (*Lepus variabilis*) from Perthshire, presented by Mr. T. West Carnie; a Goshawk (*Astur palumbarius*) from France, presented by the Baron D'Epremesnil; a Golden Plover (*Charadrius pluvialis*), British, presented by Mr. G. Smith; ten Common Vipers (*Vipera berus*), British, presented by Mr. C. F. McNiven; two Black-footed Penguins (*Spheniscus demersus*) from South Africa, purchased.

OUR ASTRONOMICAL COLUMN

THE BINARY STAR τ CYGNI.—Mr. J. E. Gore (who has taken up this branch of astronomy with great vigour) has published in the *Astronomische Nachrichten*, No. 2749, elements of the orbit of τ Cygni. Using the measures of Dembowski, Burnham, Frisby, and Tarrant, he finds:—

P = 53·87 years	☊ = 83° 0′
T = 1863·99	λ = 205° 26′
e = 0·3475	*a* = 1″·19
γ = 44° 40′	μ = − 6°·68.

These elements represent the observations fairly well. It must be remembered, however, that the measures only extend over a period of ten years, and the orbit must therefore be considered, as Mr. Gore states, to be provisional only.

THE LICK OBSERVATORY.—We learn from *Science*, vol. viii. No. 190, that the following plan has been devised by Prof. Holden for the working of the great telescope:—"We mean to put the large telescope at the disposition of the world by inviting its most distinguished astronomers to visit us one at a time, and to give to them the use of the instrument during specific hours of the twenty-four. Each day there will be certain hours set apart when the Observatory staff will relinquish the use of the equatorial to distinguished specialists who will come from the United States and from Europe to solve or to attack some one of the many unsolved problems of astronomy. In this way we hope to make the gift of Mr. Lick one which is truly a gift to science, and not merely a gift to California and to its University."

COMET BARNARD (1886 *f*).—Dr. J. von Hepperger has published the following elements and ephemeris for the comet discovered by Mr. Barnard on October 4:—

T = 1886 December 24·3064 Berlin M.T.

$\pi - \Omega$ = 78° 56′ 20″
☊ = 140 17 55 } Mean Eq. 1886·0.
i = 93 33 52
log *q* = 9·91236

Error of middle place (*O* − *C*).

$d\lambda \cos\beta = -8 \qquad d\beta = -1.$

Ephemeris for Berlin Midnight

1886	R.A. h. m. s.	Decl. ° ′ ″	Log Δ	Log *r*	Brightness
Oct. 22	11 16 13	3 57′6 N.	0·2961	0·1434	1·86
26	11 27 15	4 21′1	0·2747	0·1296	2·21
30	11 39 16	5 53′2	0·2520	0·1093	2·66
Nov. 3	11 52 28	7 1′7 N.	0·2281	0·0916	3·22

The brightness on October 6 is taken as unity.

10 SAGITTÆ.—Mr. S. C. Chandler has discussed, in the *Astronomische Nachrichten*, Mr. Gore's observations of this star, together with some of his own, and some observations made for the Harvard and Oxford Photometric Catalogues. The result of his inquiry is to give M = 1885 December 4d. 9h. 36m. G.M.T. + 8d. 9h. 11·0m. (E − 391), the duration of increase being 3·00d., and of decrease 5·38d., and the magnitude at maximum being 5·6, and at minimum 6·4. Mr. Chandler considers it likely that the period will prove to be within two minutes of the truth. Mr. Espin's value, however, is 1h. 28m. shorter.

THE OBSERVATORY OF RIO DE JANEIRO.—M. Cruls, in a communication to the Paris Academy of Sciences, states that the long-talked-of transference of the Rio Observatory is about to be commenced. The site chosen lies nearly on the same parallel as the present Observatory, but two minutes farther to the west. The Brazilian Observatory possesses, from its proximity to the tropic, an advantage over all others, in that for forty days in the year the sun's zenith distance does not exceed 1°. M. Cruls anticipates that in the new edifice he will be able to undertake, with success, observations of terrestrial magnetism, and of atmospheric electricity, and he would wish to set up a delicate seismograph for recording slight movements of the soil. He trusts also that the Observatory will bear its share in the great photographic survey of the heavens proposed by Admiral Mouchez.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 OCTOBER 24-30

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on October 24

Sun rises, 6h. 41m.; souths, 11h. 44m. 16·6s.; sets, 16h. 47m.; decl. on meridian, 11° 50′ S.: Sidereal Time at Sunset, 18h. 59m.

Moon (New on October 27) rises, 2h. 37m.; souths, 9h. 19m.; sets, 15h. 48m.; decl. on meridian, 4° 45′ N.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury ...	8 22 ...	12 47 ...	17 12 ...	18 30 S.
Venus	5 41 ...	11 9 ...	16 37 ...	6 58 S.
Mars	10 44 ...	14 37 ...	18 30 ...	23 30 S.
Jupiter... ...	5 33 ...	11 3 ...	16 33 ...	6 37 S.
Saturn... ...	21 24* ...	5 26 ...	13 28 ...	21 18 N.

* Indicates that the rising is that of the preceding evening.

Oct. 30 ... h. 10 ... Mars in conjunction with and 6° 5′ south of the Moon.

Variable Stars

Star	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·2 ...	81 16 N. ...	Oct. 24,	4 51	*m*
			,, 28,	4 30	*m*
R Ceti	2 20·2 ...	0 42 S. ...	,, 29,		*M*
Algol	3 0·8 ...	40 31 N. ...	,, 24,	23 3	*m*
			,, 27,	19 52	*m*
λ Tauri	3 54·4 ...	12 10 N. ...	,, 25,	22 30	*m*
			,, 29,	21 22	*m*
U Ophiuchi... ...	17 10·8 ...	1 20 N. ...	,, 24,	1 19	*m*
		and at intervals of	20	8	
β Lyræ...	18 45·9 ...	33 14 N. ...	Oct. 30,	21 30	*m*
S Vulpeculæ ...	19 43·7 ...	27 0 N. ...	,, 28,		*M*
R Sagittæ	20 8·9 ...	16 23 N. ...	,, 29,		*m*
δ Cephei	22 24·9 ...	57 50 N. ...	,, 25,	2 30	*M*
			,, 28,	21 30	*m*

M signifies maximum; *m* minimum.

Meteor Showers

The present week offers fewer active radiants than the one just past. The following radiants are, however, represented:—Near β Canis Minoris, R.A. 105°, Decl. 12° N.; and from Cancer, R.A. 133°, Decl. 21° N. Both yield swift meteors, especially the latter. October 24 and 29 are fireball dates.

GEOGRAPHICAL NOTES

THE last volume of the *Izvestia* of the Caucasus Geographical Society (vol. viii. 2) contains a great variety of geographical information. General Stebnitzky contributes a most interesting paper on the figure of the earth, being a discussion of results obtained from pendulum-observations in connection with the opinions expressed by M. Faye. An excellent map of the province of Kubañ, on a scale of 13 miles to an inch, is accompanied by a sketch of the colonisation of the province, which already has a Russian population of more than one million inhabitants. M. Koshkul gives a short description of the "Naphtha Mountain," in the Transcaspian region. The telegraphic determination of the longitudes of Tiflis, Shemakha, and Baku acquires the more interest, as it allows of the determination of the general error (14″·3) of the Caucasian triangulation and the deviations from the vertical line, due to local causes at these three places. A list of points whose positition has been determined by the triangulation made in the Transcaspian region, as also in Khiva and Bukhara, is given by MM. Pervas and Gedeonoff, and will be most welcome to cartographers. Among the notes we notice the following:—On the Caucasians of Kubañ, due to M. Zagursky, whose researches on the languages of the Caucasus are always so great a help to ethnography; a list of the Caucasian population in Kubañ in 1883, from which we learn that from Kubañ alone no less than 13,600 Circassians have emigrated since 1871; M. Chantre's craniological measurements are summed up by M. Zagursky; and M. Lessar contributes a paper on the north-western frontier of Afghanistan. The "Appendix" shows where the chief attention of the Caucasus Geographical Society is now directed. They contain translations of a work dealing with Armenia (the "Toros Akhpar" guide through Armenia, by the Archbishop Garegin Srvandzyantz); of the Turkish "Salname" for the Erzeroum Vilayet; of notes on Syrian-Khaldeans, by a native from Hosrabad; and of Mr. Charles Wilson's lecture on Asia Minor, delivered before the London Geographical Society.

THE first fascicule of the full Reports of the Polar Meteorological Station at the mouth of the Lena has just been published. It is the first fascicule of the second part, and contains the meteorological observations made since September 1, 1882, to August 31, 1883, compiled by M. Eigner, and published under the supervision of Dr. R. Lenz; the second fascicule of the same volume will contain the meteorological observations in 1883-84; while the first volume is reserved to magnetical observations, and the third will be devoted to the non-obligatory observations, among which the auroræ will occupy a prominent place. The meteorological observations now published, comprise the pressure of air, the temperature, elasticity of vapours, relative moistness, force and duration of wind, nebulosity, snow and rain, as also the temperature on the surface of the soil and the snow, and at depths of 40, 80, and 160 cm., these last two missing for the months of July and August 1883, in consequence of an accident to a thermometer. All observations are given in full, that is, for every hour, as also the monthly averages. The daily range of all elements is also represented by curves, whose scale is exactly that accepted for the publication of the French observations at Cape Horn; the work is accompanied, moreover, by a map of the mouth of the Lena, and of the station itself, as also by a drawing representing the station amidst the tundra, on the banks of a branch of the Lena. A full description of the instruments and their corrections is given both in Russian and in German.

THE October number of the *Proceedings* of the Royal Geographical Society has for its leading paper one by Sir Francis de Winton, on the Congo Free State, the conditions of its administration by Europeans, and its probable future. In this latter respect Sir Francis de Winton is naturally inclined to look on the favourable side. Of more strictly geographical interest is the letter from Mr. Grenfell recounting his latest explorations in the missionary steamer *Peace*, of the tributaries of the Congo, between Leopoldville and Stanley Falls, with very detailed maps.

Petermann's Mitteilungen for October contains a long paper by M. Nikitin, the chief geologist of the Russian Geological Committee on Glaciers in Russia. His object is to lay down the limits of the traces of glacial action in that country. Lieut. von François's journeys in the southern Congo basin are the subject of the next paper; and, finally, there is a brief account

of the Cunos or Tulé Indians of Darien, from the reports of a missionary sent to labour among them to Bishop Thiel, of Costa Rica, who has communicated them to Herr Polakowsky.

THE current *Mittheilungen* (Band xxix. Nos. 7 and 8) of the Geographical Society of Vienna contains letters from Dr. Lenz and Herr Baumann, from the Congo, and part of an account by Dr. Holub of his present journeyings in South Africa. Of special interest are two papers on the Hauslab cartographical collection. One describes the general extent and contents of the collection, which is in three parts: (1) books; (2) engravings; (3) maps. The last contains about 4500 sheets, and is especially rich in old specimens of cartography. Two of these form the subject of a second paper: they are a globe, the author of which is unknown, but which probably dates from soon after Columbus; the other is a chart of the Mediterranean dated 1513.

THE FIFTY-NINTH MEETING OF GERMAN NATURALISTS AND PHYSICIANS, BERLIN, SEPTEMBER 18–27

[FROM OUR BERLIN CORRESPONDENT]

THE present has in every respect been the most important of these annual meetings. Even in the number of visitors it far exceeds any similar reunion since the foundation of the Society, as many as 2224 members, and 1931 associates, or 4155 altogether, having entered their names, while no less than 1496 ladies took part in the general proceedings and social gatherings. It may here be remarked that the constitution of the German Naturalists' Society differs essentially from that of the British Association, as it exists only so long as the meeting lasts, and consists of members—that is, of persons who have published treatises, other than dissertations for academical honours, on general scientific and medical subjects—and of ordinary associates. Two or three sittings are devoted to the formal proceedings, such especially as the choice of the following year's place of meeting, and of the two leaders, whose duty it is to summon the next assembly, and arrange the work on hand. The general sittings are occupied with matter of universal interest, and are attended in common by all members, associates, and ladies. The more strictly scientific work, however, is distributed amongst the several Sections, thirty on this occasion, each of which is presided over by a freshly elected chairman, and set apart for the discussion of papers by specialists. After the last general sitting, at which the annual meeting is officially dissolved, it ceases for the time being to exist. Enjoying no special source of income, and keeping no permanent records, it possesses in the officers appointed to arrange for the next gathering the only germ of a new and equally ephemeral existence. To this temporary organisation corresponds the manner in which its proceedings are issued. An official journal, published only while the gatherings are held, contains the proceedings of the general sittings *in extenso*, those of the various Sections in shorter or more detailed reports. It may here be mentioned that, at the suggestion of the administration, a Commission was on this occasion appointed for the purpose of reporting to next year's meeting any proposals for a modification of the statutes. Reference was made more especially to such a change as would confer on the German Naturalists' Society a more stable existence; in fact, an organisation somewhat similar to that of the British Association.

Of the 4155 members and associates present, Berlin was represented by 1444, other places by 2711 (including 429 foreigners), as under: Europe, 347; America, 54; Asia, 18; Africa, 6; Australia, 4. Most of the leading representatives of German science were present, although illness unfortunately prevented the attendance of Von Helmholtz, Kirchoff, and Wislicenus, the first and last of whom had undertaken to deal with some matters of general interest.

Under the presidency of the two administrators, Prof. Rudolf Virchow and Prof. A. W. Hofmann, the first sitting was held on Saturday, September 18, when an audience filling the spacious Circus Renz was addressed by Herr Virchow on the development of the Society from modest beginnings, and its present importance for the mutual interdependence of the various branches of the natural and therapeutic sciences. He dwelt on the progress made since the first meeting in Berlin, in 1828, under the presidency of Alexander von Humboldt, which had been attended by Oerstedt, Berzelius, Gauss, Weber, Johannes Müller, Mitscherlich, Rose, Magnus, Ehrenberg, but from which Goethe had absented himself. The importance of these illustrious *savants* for the development of the physico-chemical and biological sciences, and the continuity of their researches with the problems now under discussion, formed the conclusion of this highly instructive opening address. After receiving the felicitations of the representative of the Minister of Public Instruction, Von Gossler, of the Berlin Oberbürgermeister, and the Rector of the University, and after the meeting had made choice of Wiesbaden for next year's gathering under Prof. Fresenius and Dr. Pagenstecher, Dr. Werner Siemens discoursed on "The Scientific Character of the Age." The speaker dilated on the spread of the natural sciences through these periodical gatherings and through their introduction into the school-room, thus influencing the *technique* of the arts, which in their turn react powerfully on the social relations, so that, by his command of the forces of Nature, man is now enabled to produre the necessaries and the pleasures of life in greater abundance with less expenditure of time and labour. He is certainly not able to overcome all the evils inherent to the present period of transition; but our scientific age promises to discover all the remedies calculated to alleviate and cure the ills from which we now suffer.

At the second general sitting, held on September 22, Prof. Pohlmann, of Buffalo, conveyed the greetings of the American Association to the German Naturalists, together with a general invitation to the International Medical Congress to be held next year in Washington. Prof. Ferdinand Cohn, of Breslau, then spoke on "Vital Questions," dealing with the nature of life from the present scientific stand-point, in reference more especially to the simplest living beings, the lowest plants, whose vital functions he described in attractive language. He considered that we had already half solved the riddle of life, inasmuch as we had grasped its mechanism and the physical and chemical forces which set it in motion. But we have to face other phenomena and active forces, which must be clearly fathomed by the more fortunate efforts of future re earch, so that the full solution of the problem of life may perhaps be deferred to a remote period. The next speaker was Herr George Schweinfurth, from Cairo, who spoke on "Europe's Mission and Prospects in Central Africa," arguing energetically for the possibility and necessity of colonising that region. He described the wealth of this continent, both in natural resources and available labour, which by colonisation alone could be properly utilised in order not only to insure a happy and worthy future for the natives of Africa, but also to open a wide field of fruitful activity for the already crowded populations of Europe. He warmly combated the assumptions that its tropical climate closed the door of Africa to most Europeans, and that acclimatisation was impossible. Under certain precautionary measures, and when Western culture has reclaimed Africa by railways, draining, disafforestation, tillage, and stock-breeding, just as Europe itself has been reclaimed by the hand of man, then the white race will find itself as much at home in Africa as the Negro. After the transaction of some formal business, Prof. His, of Leipzig, addressed the meeting on "The Development of the Zoological Station at Naples, and on the Growing Urgency of a Scientific Central Establishment." From the information gained by repeated personal visits, he gave a vivid description of the Neapolitan Station, and concluded by indicating the chief objects of such a central institution as he considered should now be founded. Amongst these objects he mentioned the investigation of the anatomy of the brain, which could be best carried out in such a central station.

At the third general sitting, held on September 24, Dr. Ludwig Wolf, of Dresden, reported on his journey to Central Africa, describing his route from Leopoldville, on the Kassai, and its copious affluent, the Sankuru, through the domain of the Bakutu, the Bakuba, the Balula, and Lunda peoples. He gave an animated picture of his experiences on this journey, which he made as a member of the Wissmann Expedition. He was followed by Prof. Neumayer, of Hamburg, who urged the necessity of Antarctic exploration, dilating especially on its importance for geology and palæontology. From it he anticipated an answer to the question how, as he assumed, the South Pole had been a centre of dispersion for living organisms throughout the southern, as the North Pole is now generally supposed to have been for the northern hemisphere. He further dwelt upon the great value of terrestrial magnetic observations in high southern latitudes, since in the far north a whole chain of stations had recorded the extent of the fluctuations of the magnetic needle. Simultaneous observations in the north and south will alone enable us to arrive at definite conclusions on the nature of

terrestrial magnetism and its relations to the earth-currents, Polar lights, and solar energy. Prof. Bergmann, of Berlin, followed with some remarks on the relations of modern surgery to the treatment of internal ailments. After some formal proceedings, the third general sitting, and with it the fifty-ninth gathering of the German Naturalists and Physicians, were brought to a close.

In a brief report of this nature it would be impossible to do more than refer in the most summary way to the work done in the several Sections, of which twelve were devoted to scientific and eighteen to medical subjects. Altogether 522 topics were discussed, and 155 demonstrations carried out. Most of the proceedings will be published in special scientific journals, and here it will suffice to mention more especially the remarkable synthesis of coniine, the poisonous alkaloid of hemlock, effected with surprising success by Prof. Ladenburg. Thanks to this achievement, the artificial production of a vegetable alkaloid may now for the first time be regarded as successfully accomplished. In the physiological department the question of the localisation of the cerebral functions gave rise to an animated discussion, in which Profs. Hitzig, Munth, and Soltz took part. In the section devoted to the subject of scientific instruction, Prof. Haeckel pleaded strongly for a severer training in this branch of knowledge amongst young students. It may be mentioned in conclusion that, in connection with this meeting, an exhibition of scientific instruments, apparatus, and educational appliances was held in the apartments of the Academy of Arts and Sciences. There was a good show of instruments of precision, microscopes, electric, medical, and other appliances, which attracted a large number of visitors during the few days the exhibition lasted, from September 16 to 26.

THE HARVEIAN ORATION

DR. PAVY, F.R S., delivered the Harveian Oration at the Royal College of Physicians on Monday afternoon. After giving the directions marked out by the founder of the Oration—viz., to commemorate the benefactions that have fallen into the possession of the College and to search and study out the secrets of Nature by way of experiment—the orator alluded to the augmentation which the income from the endowment of the Croomian Lectureship has recently undergone, by which the amount available is raised from 10*l.* to 200*l.* per annum ; and to the sum (2000*l.*) bequeathed by the late Dr. Gavin Milroy. He next spoke of the course pursued by Harvey as set forth by Lord Bacon, in his "Novum Organum," or "true directions concerning the interpretation of Nature." Instead of giving himself up, as others had done before him, to arguing out conclusions from accepted axioms, Harvey struck out, Dr. Pavy continued, into the hitherto untrodden path of inquiry—that of induction—and sought knowledge by a direct appeal to Nature through the medium of observation and experiment. "It were disgraceful," he says, "with this most spacious and admirable realm of Nature before us, did we take the reports of others upon trust, and go on coining crude problems out of these, and on them hanging knotty and captious and petty disputations. Nature is herself to be addressed, the paths she shows us are to be boldly trodden." In the discovery of the circulation Harvey applied the principles of induction and argued upon them in a strictly logical way. He showed himself to be a good and careful observer, judged even by the standard set forth by John Stuart Mill on the process of observing. The experiments which Harvey conducted on the arteries and veins, to assist him in his inquiry, were founded upon a well-devised plan. Dr. Pavy next spoke of the new departure in physiology which Harvey's discovery established, of the opposition with which his views were received, and remarked that the high position in his profession he had attained did not suffice to secure his escape from the effect of the prejudice against innovation entertained by the multitude. Aubrey tells us he had "heard him say that after his book on the circulation of the blood came out he fell mightily in his practice ; 'twas believed by the vulgar that he was crack-brained, and all the physitians were against him." Harvey lived, however, to see his doctrine generally accepted. The orator next referred to one issue of research derived, he said, from the labours of the present day, which has already yielded much good and useful fruit and gives promise of yielding much more. "Belonging to the realm of living Nature there are," he continued, "small organisms, the existence of which we must have remained unconscious of in the absence of the aid of the microscope. These bodies are known by the name of bacteria or bacilli, and, while some difference of opinion has existed, it is generally thought that they are organisms belonging to the vegetable kingdom. There is nothing in their appearance to strike the observer that they possess any significance, and yet by recent research it has been found that they play a most important part as constituents of the living world." The experiments of Spallanzani, Schulze, and Swann, were next described by Dr. Pavy, the natural conclusion to be drawn from which, he said, "goes far towards absolutely establishing that the air contains the germs of living organisms, and that it is these that constitute the source of the microscopic organisms found to become developed in the presence of organic matter, which some have contended take rise spontaneously. This view is supported by the researches of the present day, and nothing that would bear the scrutiny of strict investigation has ever been adduced against it. It stands at the foundation of our modern notions regarding the *rôle* played by bacilli, and thus occupies a position of weighty importance with reference to the matter. The step from the action exerted by bacteria as agents exciting the decomposition of organic products to that which brings them before us as a source of disease is not a large one. In the one case they lead to change which would not otherwise occur, and in the other they disturb the order of changes naturally taking place and thus induce an abnormal state ; and although there is nothing in their morphological characters to show the reason, different trains of phenomena—in other words, different diseases—are occasioned by different kinds of bacilli. . . . Through the indefatigable researches of Pasteur and others the distinguishing form and life-history of certain of these organisms have been clearly made out. Placed under suitable conditions, it has been found that they can be reared or cultivated artificially, and one of the most marked and important characters belonging to them is the enormous extent of self-propagating power they possess. This accounts for the rapid spread that is observed to take place of an infectious disease, if allowed to progress without controlling measures being brought to bear upon it. We have to deal, then, with something that lives and grows by virtue of a power pertaining to itself. Permit this living growth—this parasite, in fact—to become dispersed and to enter the system of a living person, and presuming it has lodged upon a soil supplying suitable conditions for its development, it will thrive and multiply and give rise to a series of phenomena which the physician has no power to arrest. Once the bacillus is implanted and the disease established, all that the physician can do is to see that the patient has fair play—that he is kept under the most favourable conditions for battling successfully against his enemy. What is to be philosophically aimed at, however, is to check the spread—to bar the transmission of the parasite from one person to another, by attacking it outside the body ; and this, with the application of the proper measures of disinfection, can with facility be done, but naturally the facility of preventing extension stands in proportion to the degree of limitation at the time existing. The spark of fire is with the greatest ease extinguished, but let it kindle into flame, and in proportion as the flame spreads the difficulty becomes greater to get the conflagration under. This is one way in which the attack upon the bacillus may be made, and the ravages of disease restrained. Another way, by quite a different line of tactics, presents itself ; and the knowledge of this is due to the researches that have been recently conducted. The vulnerable point to which I am alluding lies not in connection with the bacillus itself, but with the condition of the medium upon which it may chance to fall. It has been found that the parasite requires virgin soil for its growth. This observation stands in harmony with the result of common experience as regards disposition to contract infectious disease. It has been from remote times generally known that a person who has passed through one attack of an infectious disorder is not liable to the same extent as before to become affected on exposure to contagion. An influence has been exerted giving rise to more or less protection being afforded against a recurrence of the disease. Now it happens that by certain means the bacillus may be brought into such a weakened state as only to occasion, when introduced into the system of an animal, an effect of a mild nature, not dangerous to life, instead of the ordinary form of disease ; but the effect produced, and this is the great point of practical importance, is as protective against a subsequent attack as the fully-developed disease. There are two methods by which attenuation in virulence of the disease-producing organism may be brought about—

by conducting their artificial cultivation in a particular way, and by transmission through the system of an animal differing in nature from that in which the disease naturally occurs. When the chain of discoveries reached the point of showing that bacilli could be reared outside the body in an artificial soil or cultivating medium, a great advance was made towards obtaining a full knowledge about them, as it placed the observer in a more favourable position for the successful prosecution of research by enabling him to vary and control his conditions in a manner that could not otherwise have been effected. Although much has been accomplished, it must be said much still remains to be done. In the case of a few bacilli the life-history has been pretty clearly made out. Cultivated in a certain way they retain their virulence, no matter through how many successions they pass. The last product in a series of successive cultivations is as virulent as the parent stock. By modifying the conditions under which the cultivation is carried on, the successive products of descent may be gradually weakened until they become harmless. Such being the case, any desired degree of attenuation may be obtained, and by inoculation with a virus brought down to the proper strength the non-fatal affection may be occasioned which gives immunity from subsequent liability to take the disease under exposure to contagion. The knowledge thus acquired has been already practically turned to account upon a large scale for checking the ravages of that exceedingly fatal disease among cattle known as anthrax, or splenic fever, and through the success attained much sacrifice of life has been averted. If this can be accomplished for one disease, and more than one can be mentioned, is there not ground for believing that means will be found for placing others of the class in the same position? Attempts are being made in this direction. All eyes throughout the civilised world are, indeed, at the present moment fixed upon the work of Pasteur in Paris with reference to hydrophobia. It would be a great achievement for this frightful disease to be brought under subjection, and certainly the results that have been obtained appear to give hopes that an approach to something of this kind has been arrived at. Looking at the nature of the disease, there is nothing inconsistent with its being dependent upon a bacillus, or microbe, as Pasteur calls it. On the contrary, owing its origin as it does, when occurring naturally, to inoculation with the poisoned secretion of an affected animal, and taking into view the facts that have been learnt in connection with its transmission by artificial inoculation, evidence points to such in reality being the case. If due to a bacillus, why may not this bacillus be open to attenuation in the same manner as that of anthrax? If thus open to attenuation, why not susceptible of producing a non-fatal form of affection? And if this condition has been produced and passed through, why should not protection be thereby given against the subsequent development of the disease as a result of the primary inoculation from the bite of the rabid animal? Such a train of reasoning is quite legitimate, and for the application of the principle of action to which it leads, there is this advantage on the side of hydrophobia, that from the prolonged period usually taken for incubation after the introduction of the poison in the ordinary way, time is given for the artificial inoculations by subcutaneous injection to produce their effect and to render the system refractory to the further development of disease. I have been an eye-witness of Pasteur's work. It is from the nerve centre, the seat from which the symptoms of the disease start, that he obtains his virus. Employed for inoculation in a fresh state it produces a fatal disease, and the disease has been transmitted successively on through a number of animals, with the result that the last affected animal yields as strong a virus as the first. Kept in a pure, dry air, attenuation advances, and after a certain time the nerve centre loses its disease-producing power. Used for inoculation at a given period of preservation it produces an effect which renders an animal resistant to the influence of inoculation with the virus in a fresh state, and Pasteur contends that it acts similarly when the virus has been introduced in the ordinary way. The treatment of persons bitten by rabid animals by inoculation with attenuated virus has now been on its trial a considerable time, and a large experience gained. Judgment, it must be stated, still stands in suspense; but it must also be said that the results obtained tell decidedly in favour of the view advanced. The other method by which it has been recently experimentally found that the virulence of bacilli can be weakened is by transmission through an animal of a different nature from that in which the disease naturally occurs. This, in reality, represents the principle at the foundation of the system of vaccination, discovered by Jenner at the close of the last century. It may now be regarded as an accepted conclusion that vaccine-lymph is the virus of small-pox modified by transmission through the cow. Jenner's discovery consisted in showing that the result of vaccination with the lymph of cow-pox affords as much protection against small-pox as an attack of small-pox itself. This was the fact he educed, but the knowledge possessed in his time did not permit of its being looked at in any further way than as a simple fact or truth of Nature. Viewed, however, with the light that has been thrown upon it by the researches of the present day, we see not only the fact, but also its explanation: we see that the principle of action of the procedure proposed by Jenner, which has conferred such incalculable benefit upon mankind, is based upon the attenuating effect upon the small-pox virus of the human species by transmission through another animal; and knowing this, the prospect is presented of its being rendered susceptible of application for the control of other diseases. Whether this should prove so or not, at all events advantage is gained by the knowledge acquired. Need I say anything more to exhort you, in accordance with the duty that has devolved upon me? Surely the acquirement of knowledge, giving us as it does greater power in the exercise of our calling, and thereby promoting the high and noble object of rendering our lives more useful to our fellow-creatures—surely this is a sufficient incentive, following the words of Harvey, 'to search and study out the secrets of Nature by way of experiment.'"

NOTE ON THE ASTRONOMICAL THEORY OF THE GREAT ICE AGE[1]

THE following calculation has convinced me that Mr. Croll's theory affords an adequate explanation of the Ice age. I compute the total quantity of heat received by each hemisphere of the earth during summer and winter respectively as follows:—

Let $2H/a^2$ be the quantity of sun-heat falling perpendicularly on an area equal to the section of the earth at the mean distance a from the sun in the unit of time.

Let δ be the sun's north declination. Then the share received by the northern hemisphere will be

$$\frac{H}{a^2}(1 + \sin \delta),$$

and by the southern

$$\frac{H}{a^2}(1 - \sin \delta).$$

At the distance r, and in the time dt, the heat received in the northern hemisphere will be

$$\frac{H}{r^2}(1 + \sin \delta) \cdot dt;$$

but we have

$$r^2 d\theta = h dt,$$

whence the expression becomes

$$\frac{H}{h}(1 + \sin \delta) \cdot d\theta;$$

but we have

$$\sin \delta = \sin \theta \cdot \sin \epsilon,$$

where ϵ is the obliquity.

The total heat received by the northern hemisphere from the vernal to the autumnal equinox is

$$\int_0^{\pi} \frac{H}{h}(1 + \sin \epsilon \sin \theta) \cdot d\theta = \frac{H}{h}(\pi + 2 \sin \epsilon).$$

We have thus the following theorem:—

Let $2E$ be the total sun-heat received in a year over the whole earth; then this is divided into shares as follows:—

$$\text{Northern hemisphere, summer, } E\frac{\pi + 2 \sin \epsilon}{2\pi},$$

$$\text{,, winter, } E\frac{\pi - 2 \sin \epsilon}{2\pi};$$

with identical expressions for the summer and winter in the southern hemisphere.

[1] Paper read at the Royal Irish Academy on May 24, 1886, by Sir Robert Stawell Ball, LL.D., F.R.S. Communicated by the Author.

If we make $\epsilon = 23° 27'$ we find that the heat received during the summer (equinox to equinox) of each hemisphere is ·627 E, while the heat during the winter of each hemisphere is ·373 E. More briefly still. If each hemisphere receives in the year a quantity of sun-heat represented by 365 units, then 229 of these are during summer, and 136 during winter. These figures are independent of the eccentricity of the earth's orbit.

The length of the summer is defined to be the interval when the sun's centre is above the equator. The length will of course vary with the eccentricity and with the position of the equinoxes on the orbit. We need only take the extreme case where the line of equinoxes is perpendicular to the major axis of the orbit. The maximum difference between the length of summer and of winter is thus

365 days × eccentricity.

I take the maximum eccentricity of the earth's orbit to be

0·0745,

this being the mean of the values by Leverrier, Lagrange, and Stockwell (see Croll, "Climate and Temp.," p. 531), and, therefore, the greatest difference between summer and winter will be about 33 days, *i.e.* one season is 199 days, and the other is 166 days.

The total quantity of heat received during the year on each hemisphere is practically independent of the eccentricity; but the mode in which that heat is received at the different seasons will vary, and thus give rise to the following extreme cases:—

GLACIAL

(Summer)	229	heat units spread over	166 days.
(Winter)	136	,, ,,	199 ,,

INTERGLACIAL

(Summer)	229	heat units spread over	199 days.
(Winter)	136	,, ,,	166 ,,

We hence deduce the following, where unity represents the mean daily heat for the whole year on one hemisphere:—

GLACIAL

Mean daily sun-heat in summer (short) ...	1·38
,, ,, winter (long) ...	·68

INTERGLACIAL

Mean daily sun-heat in summer (long) ...	1·16
,, ,, winter (short) ...	·81

PRESENT (NORTHERN HEMISPHERE)

Mean daily sun-heat in summer (186 days)	1·24
,, ,, winter (179 days)...	0·75

These figures exhibit a thermal force of great intensity. The unit represents all the mean daily heat received from the sun by which the earth is warmed up from the temperature of space. The heat unit in fact maintains a temperature perhaps 300°, or even more, above what the earth would have without that heat. Each tenth of a unit may thus roughly be said to correspond to a rise or fall of mean temperature of 30° or more. The long winter of 199 days, when the average heat is only two-thirds of a unit, leads to the accumulation of ice and snow, which form the Glacial epoch. The short winter of 166 days, where the temperature is ·06 of a unit above that of our present winter, presents the condition necessary for the mild interglacial epoch.

THE BRITISH ASSOCIATION

SECTION H—ANTHROPOLOGY

The Native Tribes of the Egyptian Súdan, by Sir Charles Wilson, K.C.B.—These may be divided into four distinct groups—the Hamitic, Semitic, Núba, and Negro; but the first three only were dealt with in this paper. The largest tribe in the Súdan is the Kabbabish. They extend from Dongola to the confines of Darfúr; they speak a pure Koranic Arabic, and have a tradition that they came from Tunis; they are possibly of Berber descent, but the Sheikhs are apparently of Arab origin. They are divided into two great branches and several minor clans. One clan, Kawahleh, appears to be of Arab origin.

The Celtic and Germanic Designs on Runic Crosses, by Prof. W. Boyd Dawkins.—The author said that although it is generally assumed by archæologists that the early Irish manuscripts, such as the illuminated Gospels of St. Cuthbert and St. Chad, are of pure Irish art, and that consequently the interlacing "rope-" or "basket-work" pattern is distinctly Irish and Celtic, such an assumption is not warranted by experience. A consideration of the distribution of the designs on ornaments and monuments in the British Isles and in France, Scandinavia, and Germany, lead to the conclusion that the art was probably derived from the centres of civilisation in South Europe, principally Greek and Etruscan, and it has clearly been proved by Chantre to have been introduced into France from Italy. The square interlacing pattern does not occur in France or the British Isles in association with any remains of a date anterior to the movement of the Germanic tribes against the Roman Empire, and as it is only found in regions into which the German tribes penetrated, it may be concluded that it is distinctly Germanic, and not Celtic, still less "pure Irish."

The Scientific Prevention of Consumption, by G. W. Hambleton.—There are two distinct objects to be accomplished in the prevention of consumption. On the one hand we have to secure an adequate amount of breathing capacity in proportion to the rest of the body, and on the other to prevent either compression of the chest or injury to the lungs. This can be done by adopting those measures that tend to the development of the breathing capacity, and suppressing or obviating those conditions that compress or injure the lungs. By adopting measures is meant placing men, women, and children under conditions of habitation, clothing, education, and urging upon them habits that tend individually and collectively to develop the lungs.

Dragon Sacrifices at the Vernal Equinox, by George St. Clair, F.G.S.—The object of this paper was to show that human sacrifice, which prevailed extensively in early times, was a custom connected especially with the vernal equinox, and that the offerings were made to appease a mythical dragon which made its demand at that time. The dragon of mythology was identified and defined, and it was shown in what sense he opened his jaws at the spring season of the year. Human sacrifice was practised more especially at the spring of the year, or (in other instances) in honour of deities who once presided over equinox constellations. Artemis and Cronus, to whom this homage was chiefly shown, were both connected with the zodiacal sign Scorpio, and, according to M. Ernest de Bunsen, Scorpio was the starting-point of the primitive calendar. If the festival of Saturn did not get displaced or misplaced through the precession movement, it was still a festival in honour of the god of the under-world, and that meant death and the grave. Tradition says that human sacrifices were abolished by Hercules. As Scorpio rises with Hercules, and ceases to be a dark sign, the mythology is consistent with itself.

Evidence of Pre-Glacial Man in North Wales, by Dr. Henry Hicks, F.R.S. — The author in this paper described the conditions under which a number of flint instruments were discovered during the researches carried on by Mr. E. B. Luxmore and himself in the Ffynnon Beuno and Cae Gwyn Caves, in the Vale of Clwydd, in the years 1884-86. Last year a grant was made by the British Association for the purpose of carrying on the explorations, chiefly with the object of obtaining further evidence as to the age of the deposits in the caverns. The results obtained this year are highly confirmatory of the views which he (Dr. Hicks) had previously held, and have a very important bearing on the antiquity of man in Britain. It was found that the main entrance to the Cae Gwyn Cave had been blocked up by a considerable thickness of Glacial beds, which must have been deposited subsequently to the occupation of the cave by the Pleistocene mammals. A shaft was dug through these beds in front of the entrance to a depth of over 20 feet, and in the bone-earth, which extended outwards under the Glacial beds on the south side of the entrance, a small well-worked flint flake was discovered. Its position being about 18 inches beneath the lowest bed of sand, it seemed to be clear that the contents of the cavern must have been washed out by marine action during the great submergence in mid-Glacial times, and then covered by marine sand and an upper covering of boulder-clay. He believed that the flint implements, lance-heads, and scrapers found in the caverns were also of the same age as this flint flake, and hence that they must have been the work of pre-Glacial man.

The Recent Exploration of Gop Cairn and Cave, by Prof. Boyd Dawkins.—This was a paper on the exploration of Gop Cairn and Cave, near Gop Hall, New Market, St. Asaph, now being carried on by Mr. Pochin, Mr. P. G. Pochin,

and the author. The cairn commonly known as "Queen Boadicea's Tomb" was composed of blocks of limestone, about 40 feet high, 300 feet long, and 200 feet broad. A shaft was sunk near the centre of the cairn, but the only remains discovered were a few refuse heap bones of hog, sheep or goat, ox or horse, too fragmentary to be accurately determined. They were, however, of the character found almost universally in Britain in the burial-places of the Neolithic and Bronze Ages. The cairn itself was similar in character to one near Mold, in the same district, in which a skeleton was discovered in 1832 lying at full length, clad in a golden corselet, and adorned with 300 amber beads. An urn full of ashes and other remains was also met with. While the cairn was being attacked, a cave was discovered 141 feet to the south-west, and there were found bones and teeth of various animals which belonged to the Pleistocene age, and similar to those discovered in the caves of the Vale of Clwydd. Above these was found a deposit containing fragments of charcoal and large quantities of broken bones of wild and domestic animals. Slabs of limestone burned on their upper surface were also found, and pointed out the position of the fireplace. The date of this upper deposit was fixed by several fragments of pottery, which was in its characteristics similar to that of the Bronze Age. Besides these, a large number of human bones were found, increasing in number as the explorers dug their way to a square sepulchral chamber, 4 feet 10 inches by 3 feet 10 inches. This chamber was packed with human skulls and bones of all ages in the greatest confusion, and evidently interred from time to time. Among the bones were found two jet ornaments, a beautifully polished flint flake, with edges carefully bevelled, and some fragments of rude pottery of the kind commonly found in sepulchral urns of the Bronze Age. The chamber and the deposits showed that caves had probably been used for habitation and sepulture in North Wales in the Bronze Age, as they had already proved to have been used in the Neolithic Age. The human remains threw great light on the ethnology of the district in the Bronze Age, and proved that in the Neolithic Age the population of that part of Wales was of the oval-headed Iberic type, so widely spread throughout Europe. All the skulls were of this type save one, which possessed all the characteristics usually found in a round-headed Celt of the Bronze Age, and the presence of this skull in a sepulchre of the Iberic people appears to mark the beginning of the fusion of the two races, which has been going on ever since, and by which the Iberic type is at the present time being slowly obliterated.

On Bowls' Barrow, near Heytesbury, in South Wilts, by W. Cunnington.—These researches, the writer stated, had been made at the east end of the barrow, where the original cist had been found empty, but with a skull near it. Several other skulls were also found in a more or less broken condition. Covering the floor of the barrow near where the skeletons were found was a black unctuous earth, which had been found to contain a large quantity of ammoniacal salts. Separated from the cist at the east end of the barrow several horns of oxen had been found, in addition to those that were found there some years ago. The skulls and other human remains which had been found were clearly primary burials, and were covered by large blocks of Sarsen stone, some of which weighed from 200 lb. to 300 lb.

The Crania and other Bones found in Bowls' Barrow, by Dr. J. G. Garson.—The author said that the skulls are of large size, and long and narrow in form. In general outline they present two distinct forms, namely, the elongated oval, and what is called the coffin-shaped. They all conform in every respect to the long barrow type, and are all those of adult males.

Papuans and Polynesians, by the Rev. George Brown.—The object of this paper was to show that the two races had a common origin. Mr. Brown said he had worked for many years among the purest types of Polynesians and of Papuans, and in reducing the languages to writing he became convinced that, from the point of view of language and from their manners and customs, some of the difficulties in assigning to the two races a common origin were not so insuperable as they appeared. He considered that the basis of the Polynesian race was Papuan with an Asiatic admixture. The idea that cannibalism existed because of the love of animal food and the inability to gratify this appetite in any other way was all nonsense: in ninety-nine cases out of a hundred it was only practised as a means of revenge. The author gave a description of the etiquette and general manners and customs of the two peoples, and, summing up his argument, said the points of similarity were so much more numerous and marked than the points of difference that as they inquired further they would find no insuperable difficulty in giving them one common origin.

What is an Aryan? by Sir George Campbell, K.C.S.I.—The great difficulty which we had in distinguishing the Aryan was that the Aryan race was seldom pure. Almost all the Aryans we met with were a very mixed race, but by their features and colour they were easily distinguished from the Turanian and Negro races. The difficulty in distinguishing between the Aryans and the Semites lay in their features, and if the rather high features, which we called Jewish, were the real types of the Semites, what were the types of the Aryans? There were two distinct branches of Aryans with which he had long been in contact—the dark branch found in India and Asia, and the fair branch, which included the whole of Europe and Asia Minor. Then in part of Western Asia, in the Hindu Kush, there was a whitey-brown variety of the race, which might be classed as the intermediates, and this he believed to have been the original habitat of the Aryan race. The question, of course, was what was the original Aryan—white, brown, or whitey-brown? and he was inclined to think that he was a whitey-brown, and that his primæval seats were in the higher recesses of the Hindu Kush, and that the branch which went into India had become darker by admixture with the aborigines, while those who went into Europe had become fairer or been completely blanched into whiteness by similar admixture with the fair races. As to features, he had come to the conclusion that the high prominent features which we were accustomed to speak of as distinctive of the Semite races were the real original features of the Aryan, and that the Jews had acquired them only by admixture with the Aryan races. The true type of Semite he believed was to be found in the Southern Arab.

On the Influence of the Canadian Climate on Europeans, by Prof. W. H. Hingston, M.D.—After describing the physical, geographical, and climatic characteristics of the country, the author proceeded to say that the heat of the summer in Canada was more easily endured than the moist humid summer weather often experienced in Europe. The skin was called into greater activity, and the heat of the summer weather acted very strongly on the liver, but if European residents adopted the indigenous customs of the country, lived moderately and temperately, and led active lives, their livers would give them no trouble. The cold weather in winter stimulated people to activity. The mortality in early life was large, because in no country in the world were there so many children, but the mortality in adult life was not large. With the exception of Malta, the Canadian stations used to be considered the healthiest posts of the British army, and there were really no diseases peculiar to the country, while many which prevailed in England and in Europe had no existence there.

The Life-History of a Savage, by the Rev. George Brown.—The author gave an account of the life-history of a native of New Britain, an island in the Polynesian group, about forty miles north-east of New Guinea. He commenced with the birth of the example child, and said that when a child was born to the Papuan people who occupied this land, a warm banana-leaf was wrapped round his body, and he was fed with the expressed juice of the cocoa-nut, and left ever afterwards to be "dressed in pure sunshine." He described the children's games of the people, and the initiation of the boy as he grew up into certain secret rites, and the ceremonies at the various feasts, especially on his marriage, and the feast when he was taught to curse his enemies. On the occasion of his marriage there was an interchange of goods and a distinct payment for the wife. Presents were also given by the women to the bride and by the men to the husband, and after a broom had been given to the former, and a spear to the latter, a stick was given to the man. The spear meant that the husband was to protect his wife, and the broom that with it the wife was to do her household work, and the stick was a symbol of his authority, or, in plain English, "Here's the stick with which to whack her if she does not." At the time of death the cries of the friends of the deceased were very piteous and touching. The dead person was cried to to come back, was expostulated with for having left his friends, was entreated to say how his friends had offended him, and so on, the mourners seeming to be speaking in the very presence of the spirit of the dead person. Many of the things which we should call good they also called good, but they had a definite

idea of a future state and also of punishment for one offender, the niggardly man. When an old man came near death he was placed upon a litter, and carried round to see the old scenes amid which he had passed his life—his canoe, the sea, and all the old familiar subjects, and then he was taken back to wait his time. After death he was placed in a sitting posture and taken into the public square, with his weapons by his side, and before him the people placed offerings of their valuable goods and money.

Notes on Photographs of Mummies of Ancient Egyptian Kings recently Unrolled, by Sir William Dawson, F.R.S.—The photographs representing the mummies of Seti I., Rameses II., and Rameses III. were communicated by Dr. Schweinfurth, of Cairo. They are of great interest as enabling us to see the actual features of these ancient Egyptian kings, and to compare them with their representations on the monuments and with modern Egypians. It appears that the features of Seti are scarcely of Egyptian type, as represented either by the monuments of the older dynasties or by the present Egyptians; though, as Dr. Schweinfurth shows in a drawing accompanying the photographs, a similar style of countenance still exists among the Copts. It also appears that the features of Rameses II. strongly resemble those of his father, and are very like those of some of his statues. Both Seti and Rameses have narrow and somewhat retreating foreheads, and strongly developed jaws, indicating men of action rather than of thought; and both were men of great stature and bodily vigour, and seem to have lived to advanced ages.

Prehistoric Man in Manitoba, by Mr. C. N. Bell, F.R.G.S. (Winnipeg, Canada).—The author announced the existence in the Canadian North-West of sepulchral mounds, and pointed out the hitherto unknown fact that there is a continuous line of mounds from the mound-centres of the Mississippi River, down the Red River, to Lake Winnipeg. Human remains, much decayed, were found in the mounds, all buried by being placed on the surface under heaps of earth in which patches of charcoal and ashes frequently occurred, though no remains of funeral feasts, as bones, &c., were met with. Indians, when first met with, buried weapons with their warriors, but none were found in these mounds, though implements and ornaments of shell, bone, and stone were common, as well as pottery, which latter was unknown to the Indians of North-West Canada on the arrival of white emigrants. One mound had a floor of burnt clay and boulders, similar to the sacrificial mounds and altars of Ohio. Ornaments were found made of sea-shells, which must have been carried 1200 miles from their native waters. These mounds, from Lake Winnipeg to the Gulf of Mexico, were of the same character, and very likely were made by one race, though the whites found great diversity of mortuary customs prevailing among the Indian tribes inhabiting that great tract of country.

Notes on a Tau Cross on the Badge of a Medicine-Man of the Queen Charlotte Isles, by R. G. Haliburton.—Mr. Haliburton said this badge was noteworthy, as Queen Charlotte Isles form one of the most isolated groups of the Northern Pacific. They lie off the west coast of British Columbia. This symbol was used by the Indians on large sheets of copper, to which they assigned a high value, and each of which they called a *Tau*. The connection of that name with the symbol is warld-wide. Our T is simply the tau symbol, and is called *tee* or *tau*. The medicine-men represent the tau sometimes on the forehead. The ancients used to mark the captives who were to be saved with a tau or cross; Ezekiel refers to this, and the word he uses for "the sign" to be marked on the foreheads of them that are to be saved really is the "tau" or "cross." No one has divined why the *scarab* was so sacred. He was led to a solution by seeing an exaggerated *tau cross* on the back of a scarab. On looking into the Egyptian name for the scarab he found it to be *tore*, and that the sutures on the beetle form a tau cross. But the same name is applied to the same beetle by our peasantry—*tor-beetle* or *dor-beetle*. Wilkinson represents a god with a scarab for a head, one of the names of which was *Tore*. The use of the prehistoric or pre-Christian cross is world-wide.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—This term begins under a new official *régime*. Prof. Jowett, Master of Balliol, retires from the Vice-Chancellorship, and Dr. Bellamy, the President of St. John's College, succeeds to his place. The Master of Balliol's four years of office have seen several important reforms in which he bore a prominent part. Among them we may mention the alteration in Honour Classical Moderations, the disestablishment of the Examination in the Rudiments of Faith and Religion, the establishment of a University course for medical students, and the abolition of Pass Classical Moderations in favour of Preliminary Examinations for students of law, natural science, and mathematics. The last reform, indeed, has not yet become law; but the necessary steps to complete the legislation are already taken, and the Statute will doubtless pass Convocation during the present term.

Scholarships in Natural Science are announced this term for competition at Balliol, Trinity, and Christ Church.

The following scheme of lectures in Natural Science is announced for the present term:—

Physics.—Prof. Clifton lectures on General Electricity, and Mr. Selby on Electrostatics treated Mathematically. Practical instruction in Physics is given in the Clarendon Laboratory by Prof. Clifton and Messrs. Walker and Selby.

At Christ Church, Mr. Baynes lectures on Fourier's Theorem. At Balliol, Mr. Dixon lectures on Elementary Light and Heat.

Chemistry.—Prof. Odling lectures at the Museum on the Benzoic Compounds. Mr. Fisher gives a course of Inorganic Chemistry, and Dr. Watts a course of Organic Chemistry. Practical instruction is given by the above, and by Messrs. Baker and Marsh.

At Christ Church, Mr. Vernon Harcourt gives a course of lectures on Inorganic Chemistry for the Preliminary Examination. Practical instruction is also given at the Christ Church and Balliol Laboratories.

Animal Morphology.—Prof. Westwood lectures on the Hexapod Arthropoda. Prof. Moseley lectures on Comparative Anatomy. Mr. Baldwin Spencer gives an elementary course on the same subject. Mr. Hatchett Jackson lectures on Comparative Embryology. Mr. Barclay Thompson lectures on the Osteology, Odontography, and Distribution of Mammals. Practical instruction is given by Prof. Moseley, Mr. Spencer, and Mr. Robertson.

Physiology.—Prof. Burdon-Sanderson lectures on Circulation, Respiration, and Bodily Motion. Mr. Dixey lectures on Histology; and Mr. Hatchett Jackson on Elementary Physiology. Practical classes are conducted by Messrs. Dixey and Gotch.

Human Anatomy.—Mr. A. Thomson lectures on the Central and Peripheral Nervous System, and Digestive System. He also gives demonstrations on Topographical Anatomy, and has a daily class for Dissection.

Medicine.—Dr. Darbishire gives demonstrations at the Radcliffe Infirmary, in Physical Diagnosis and Regional Anatomy, and Mr. Winkfield gives demonstrations in Surgical Diagnosis.

Botany.—Prof. Bayley Balfour lectures at the Botanic Garden on Vegetable Morphology and Physiology.

Mineralogy.—Prof. Story-Maskelyne lectures at the Museum on Minerals occurring in Lodes.

Geology.—Prof. Prestwich lectures at the Museum on the Principles of Geology.

Anthropology.—Dr. Tylor lectures on the Development of Culture, Sign Reading, &c.

Mr. A. L. Selby, B.A., Demonstrator of Physics in the Clarendon Laboratory, has been elected a Fellow of Merton College.

Mr. H. B. Dixon, M.A., of Trinity College, has been elected a Fellow of Balliol College.

SCIENTIFIC SERIALS

IN the *Journal of Botany* for August Mr. J. G. Baker concludes his notes on British Rubi, and Messrs. Roy and Bisset contribute the second and concluding part of their notes on Japanese Desmids (illustrated).—The number for September commences with an interesting and important paper by Mr. G. Massee, on the structure and functions of the subterranean parts of *Lathræa squamaria*, L. (also illustrated). He regards the plant as of saprophytic rather than parasitic habit, the disks or haustoria on which its parasitism depends being frequently entirely absent from old plants. In some instances, but not all, the roots are covered with the mycelium of a fungus similar to that described by Kamienski in the case of

Monotropa.—The instalment of Mr. J. G. Baker's synopsis of the Rhizocarpeæ is occupied by a monograph of the forty species of *Marsilea*.—The remaining articles in these and those in the October number are of less general interest, or are reprints or reports.

Rivista Scientifico-Industriale, September 15.—Experiments on the electric conductivity of vapours and gases, by Prof. Giovanni Luvini. The important experiments here described have been carried out for the purpose of exposing the commonly accepted fallacy that moist air and gases in general are good conductors. Having already argued against this view in his recent memoir on the origin of atmospheric electricity, the author now clearly shows by a series of carefully conducted experiments that such bodies as moist air, aqueous vapour, and other gases are under ordinary pressure absolute non-conductors. Under pressures varying from 16° to 100° C. none of the vapours tested by him betrayed the least conductivity, all acting as excellent insulators. He promises to resume the subject in his work on the Polar auroras, to which the present essay and the memoir on the origin of atmospheric electricity serve as introduction. The conclusions so far arrived at, combined with Faraday's memorable experiments on the causes of the electricity in Armstrong's hydro-electric machine, tend to show that gases and vapours are not even electrified by friction with themselves or with solid or fluid bodies. Henceforth physicists must reject, as erroneous, all such theories respecting the electricity of machines, of the air, or the clouds, as rest on the assumed conductivity of moist air or on the property of gases to be electrified by friction. It is pointed out that, were the saturated atmosphere and clouds really good conductors, such a phenomenon as lightning would be simply impossible, or at all events extremely rare.—Separation of nickel from cobalt, by Pietro Gucci. For the new method here proposed and described it is claimed that it is both easier and much more expeditious than that of Fischer and Stromeyer, also that it determines the presence of the smallest particle of nickel in any quantity of cobalt.—New hygrometric formula and tables, by Prof. Paolo Cantoni.

SOCIETIES AND ACADEMIES

LONDON

Entomological Society, October 6.—Robert McLachlan, F.R.S., President, in the chair.—Mr. W. Bartlett Calvert, of Santiago, Chili, was elected a Fellow.—Mr. McLachlan exhibited a number of seeds of a Mexican species of *Euphorbiaceæ*, popularly known as "jumping seeds," recently received by him from the Royal Horticultural Society. He stated that these seeds were known to be infested with the larvæ of a species of *Tortricidæ*, allied to the apple *Tortrix*. They were first noticed by Prof. Westwood at a meeting of the Society held on June 7, 1858, and the moths bred therefrom were described by him as *Carpocapsa saltitans*. These seeds have since, from time to time, been referred to both in the United Kingdom and America.—Mr. Roland Trimen exhibited and read notes on some singular seed-like objects found in the nests of *Termites*, and also in those of true ants, in South Africa. They were apparently of the same species as those from the West Indies, described in 1833 by the Rev. L. Guilding as *Margarodes formicarius*, which was usually referred to the *Coccidæ*. They were of various shades from yellowish pearly to golden and copper colour, and were strung together by the natives like beads, and used by them as necklaces.—Mr. W. F. Kirby exhibited, on behalf of Mr. John Thorpe, of Middleton, a long series of buff and melanic varieties of *Amphidasis betularia*, and read notes on them communicated by Mr. Thorpe.—Mr. Kirby also exhibited, on behalf of Mr. Nunney, a dark variety of *Argynnis aglaia* from Caithness, and a tawny-coloured variety of *Vanessa urticæ* from Bournemouth.—M. Alfred Wailly exhibited a fine series of Saturnias and other Bombyces, mostly bred by him, from South Africa; also specimens of *Dirphia tarquinia*, *Attacus orizaba*, *Platysamia cecropia*, *P. ceanothi*, *Callosamia angulifera*, and *C. promethæa*, from Central America. M. Wailly stated that several of the large South African *Saturnidæ* formed no cocoons, the larvæ entering the earth to undergo the change to the pupal state. Mr. Trimen said he was able to confirm this statement.—The Rev. W. W. Fowler exhibited a number of minute *Acari* which had been doing injury to fruit trees near Lincoln.—Mr. Poulton gave an account of the experiments recently made by him with the larvæ of several species of the genus *Vanessa*, for the purpose of ascertaining the relations of pupal colour to that of the surface on which the larval skin was thrown off, which had formed the subject of a paper lately read by him before the British Association. He also exhibited the frame constructed by him for the purpose of these experiments.—Mr. Slater exhibited a specimen of *Prionus coriarius* found in Devonshire on fennel, and a specimen of *Calandra palmarum* from Pembroke Dock.—Mr. Enock exhibited *Mymar pulchellus*, and a specimen of *Atypus piceus* recently taken on Hampstead Heath.—Mr. Elisha exhibited a series of *Gelechia hippophaëlla*, bred from larvæ collected at Deal on *Hippophaë rhamnoides*.—Mr. Billups exhibited *Echthrus lancifer*, a species of *Ichneumonidæ* new to Britain, taken at Walmer on August 15 last. He remarked that Brischke had bred members of this genus from *Sesia sphediformis*, *S. formicæformis*, and *Leucania obsoleta*; but that in this country the genus was little known, only one species being mentioned in Marshall's list of *Ichneumonidæ*.—Mr. E. A. Butler exhibited living specimens of *Chilacis typhæ*, received from the Rev. E. N. Bloomfield, of Guestling, Hastings; and a pair of *Harpalus discoideus*, obtained in August last, near Chilworth, Surrey.—Mr. A. J. Rose exhibited specimens of a mountain form of *Lycæna virgaurea*, recently collected by him in Norway.—Mr. Champion exhibited *Teratocoris antennatus* and *Drymus pilicornis*, taken near Sheerness.—Mr. W. White exhibited a specimen of *Chelonia caja* with abnormal antennæ, and read notes on the subject.—Mr. Elisha read a paper on the life-history of *Geometra smaragdaria*.—Mr. C. O. Waterhouse communicated a paper on the tea-bugs of India and Java.

SYDNEY

Linnean Society of New South Wales, Aug. 25.—Prof. W. J. Stephens, M.A., F.G.S., President, in the chair.—The following papers were read:—Note on *Eucalyptus leucoxylon* (F. v. M.), by W. Woolls, Ph.D., F.L.S. In the "Flora Australiensis," vol. iii., two Eucalypts previously regarded as distinct species (*E. leucoxylon*, F. v. M., and *E. sideroxylon*, A. Cunn.) were united under the former name. Dr. Woolls has long thought that this step was a mistake, and in his paper he gives reasons based upon the examination of specimens of both forms, in favour of their specific distinctness, and of the restoration of Cunningham's name to the red-flowering iron-bark of New South Wales, the other name being restricted to the white gum of Victoria and South Australia.—Contributions towards a knowledge of the Coleoptera of Australia, No. III., by A. Sidney Olliff, F.E.S. This paper contains notices of several new species of *Nascio*—a genus of Buprestidæ—of which two are named *L. munda* and *N. mu'tesima*. Additional localities for some previously known species are also given, *N. carissima* being recorded from Sydney.—List of the Orchideæ of the Mudgee District, by Alex. G. Hamilton. In this paper, which is a contribution towards a knowledge of the geographical distribution of plants in New South Wales, fifty-seven species of orchids are enumerated as occurring in the Mudgee District; and particulars are given concerning their habitats and the months during which they flower. In addition a comparison of the orchids of this district with those of the county of Cumberland and of the other Australian colonies is also given.—On an undescribed species of *Chilodactylus* from Port Jackson, by E. P. Ramsay, LL.D., F.R.S.E., and J. Douglas Ogilby. Under the name of *Chilodactylus polyacanthus*, a new species of Morwong is described, and its affinity to *C. carponemus*, Cuv. and Val., is discussed.—Dr. Ramsay exhibited a number of very rare birds from Derby, North-West Australia, recently collected in that district by Mr. Cairns. He particularly drew attention to the following:—*Poephila acuticauda*, *Poephila mirabilis*, *Donacicola pectoralis*, *Emblema picta*, *Estrelda annulosa*, *Estrelda ruficauda*, *Pœcilodryas cerviniventris*, *Smicrornis flavescens*, *Pardalotus rubricatus*, *Pardalotus uropygialis*, *Malurus coronatus*, *Malurus cruentatus*, *Cacatua gymnopis*, *Climacteris melanura*, *Geophaps albiventris*, *Astur cruentus*, *Trichoglossus rubritorquatus*.—Mr. Macleay exhibited the following new or rare reptiles and fishes collected by Mr. W. W. Froggatt in the vicinity of Cairns, Queensland:—Snakes: *Tropidonotus picturatus*, Schlegel, *Dipsas boydii*, Macleay, *Hoplocephalus assimilis*, Macleay, *Hoplocephalus nigrostriatus*, Krefft, *Nardoa crassa*, Macleay, and *Dendrophis bilorealis*, Macleay. Lizards: *Varanus ocellatus*, Gray, *Varanus*, sp. ?, *Hinulia*, n. sp., four species of Geckotidæ unknown, one with tail of remarkable width, and several other unknown lizards. Fishes: *Dules Haswellii*, Macleay, *Aristeus rufescens*, Macleay,

Serranus lanceolatus, Bleek, a species new to Australia, and a species of *Eleotris*, probably undescribed, remarkable for its minute scales. Collected from the same district were a number of frogs, among which Mr. Fletcher pointed out examples of *Hyla dolichopsis*, *H. cærulea*, *H. lesueurii*, *H. peronii*, *H. nasuta*, *H. gracilenta*, *Limnodynastes ornatus*, and two other species not determined.

PARIS

Academy of Sciences, October 11.—M. Jurien de la Gravière, President, in the chair.—On a principle in rational mechanics, and on a demonstration used by Daniel Bernoulli in 1757, by M. de Jonquières. The reference is to the author's recently-explained theory of the hydro-extractor, the fundamental principle of which he now finds was already known to Bernoulli, at least so far as concerns the action of the pendulum. His demonstration, analogous to that of M. de Jonquières, is contained in his memoir entitled, "Principes hydrostatiques et méchaniques, &c.," which obtained the prize of the Royal Academy of Sciences.—On the persistence of the instinctive functions and voluntary movements in bony fishes after extraction of the cerebral lobes, by M. Vulpian. In supplement to his previous paper on this subject, the author mentions the case of a carp operated upon on March 18, 1886, and which survived till September 29. During this period it acted in almost every respect like any ordinary fish, noticing and avoiding obstacles, seizing and swallowing its food, rejecting non-alimentary substances, and so on. With the exception of smell, it evidently retained all its senses and instinctive and intellectual faculties. This experiment fully confirms the results already determined by the researches of M. Is. Steiner, and shows that in fishes instinct and will survive the extraction of the cerebral lobes, which in reptiles, birds, and mammals are the seat of those faculties.—Experimental researches on the nature of *rigor mortis*, by M. Brown-Séquard. The object of these studies is to show that the rigidity ensuing after death is due neither altogether nor even to any great extent to the coagulation of the albuminous substances of the muscles, as still maintained by most physiologists on the authority of Brücke, Kuhne, and Wundt.—On the temperature of the bed of oceanic basins compared with that of the continents at the same depth, by M. Faye. In connection with the reference made to this subject in the opening address of the President of the British Association at Birmingham, the author takes the opportunity of generalising the law already established by him respecting the more rapid and deeper cooling of the earth's crust under the seas than under the continents. Not only is this law applicable to the Polar seas, whose lowest depths have a temperature very near zero, but also to those which do not freely communicate with the Poles. In these waters also the temperature decreases with the depth, the difference between them and the continents at the same depths being, within about 15°, as great as for the oceans.—Purification of yttria, by M. Lecoq de Boisbaudran. In the process of purification here described the earth A, differing little from that of M. Clève, yielded a beautiful phosphorescence of a pink auroral tint, due not to the yttria itself, as supposed by Mr. Crookes, but to the presence of a minute trace of bismuth derived either from the primary substance or from the reagents.—Fluorescence of the compounds of bismuth subjected to electric effluvium *in vacuo*, by M. Lecoq de Boisbaudran. In this paper the author sums up his observations on the pink fluorescence referred to in his previous communication. He remarks incidentally that during these studies he detected traces of bismuth in numerous chemical products, several of which were supposed to be quite pure.—Summary of the meteorological observations made during the year 1885 at four stations in the Upper Rhine and Vosges districts, by M. Hirn. The observations here tabulated give the highest and lowest temperatures from month to month at Colmar, Thann, Schlucht, and Munster, the actinometric readings taken at the Colmar Observatory, the atmospheric pressure, rainfall, and other meteorological data at these stations.—On the transformation of surfaces, and on a class of differential equations, by M. E. Picard.—The reciprocal relations of the great forces of Nature, by M. Emile Schwœrer. The author's remarks are in reference to his French translation of M. A. Klein's remarkable analysis of MM. Hirn and Clausius's recent memoirs contributed to *Gaea*.—Saturation of normal arsenic acid with lime-water and with the water of strontian, by M. Ch. Blarez.—Contribution to the study of the alkaloids, by M. Oechsner de Coninck. Two very sensitive reagents are described, which are easily produced, and which are likely to prove very serviceable in the diagnosis of the various alkaloids and of the different bases treated by the author.—On the genus *Entione*, Kossmann, by MM. A. Giard and J. Bonnier. In the *Porcellana longicornis* of Concarneau the authors have discovered an *Entoniscus* closely allied to those met by Fritz Müller in the Porcellanæ of the Brazilian seaboard. The study of this species, here named *Entoniscus mülleri*, justifies the division of the genus proposed by Kossmann. The term *Ent'oniscus* being reserved for the two species of parasites of the Porcellanæ, the *Entoniscus* of the crabs would then constitute the genus *Entione*.—Diseased grapes in the vineyards of La Vendée, by M. Prillieux. The vineyards of this district have this year been attacked by a species of mildew here fully described.—On some garnet-bearing rocks of Puy-de-Dôme, by M. Ferdinand Gonnard. It is shown that, contrary to the received opinion, the important group of garnets, whether as a mineralogical accident, or as an essential constituent element of the different grenatites, is largely represented in the primitive or plutonic formations of Puy-de-Dôme.—On the phosphated deposits of Beauval (Somme), by M. Stanislas Meunier. From a careful study of the phosphate of lime recently discovered at Beauval, the author infers that the phosphated chalk of Picardy belongs to an older geological epoch than that of Belgium.

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