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THE MARQUIS OF SALISBURY ON SCIENTIFIC EDUCATION

THE scientific world is much indebted to the Marquis of Salisbury for the clear and powerful speech on the value of scientific education which he delivered in Manchester on Friday last. It is a satisfactory sign of the times when a statesman of his position and intellectual standing acknowledges the claims of science to a place in the higher education of the country equal to that of the older studies. Whilst adverting to the great strides which had been made respecting the elementary education of the country, Lord Salisbury does not forget that "the true key to the education of the lower classes is a love of knowledge on the part of the classes that are above them;" and he goes on to point out that in the district in which he was speaking, the secondary, and especially adult education, was well provided for. He passed a well-deserved encomium on the Owens College. Although the general instruction of the adult population by means of evening classes does not form the primary work of a College such as Owens, yet, placed as it is in the midst of a dense and busy population, it has found that there is much good work to be done in this direction.

In this service there can be no rivalry between Owens College and other institutions of a similar character; each has its own sphere, and, indeed, the truth is that if in large cities evening classes are to be of essential service, they must not be confined to one institution. For not only must the focus of instruction be near the men who are wearied with a hard day's work, but a different style of tuition naturally grows up in the various centres; one may, by natural selection, adopt one branch, and another another. Such a course is indeed the healthy development of a living organism which suits its growth to the conditions of its environment; and whilst it strengthens itself by so doing, it affords at the same time grateful sustenance and solace to those dwelling under its shadow. One of the great problems of the age, upon the successful solution of which much of our social and material prosperity depends, is indicated by the Marquis when he tells us that the truths of science should permeate the whole mass of the people. Evening classes such as we have referred to form one of the modes by which this may be accomplished. Another means of awakening the scientific interest of the people is by a widespread series of thoroughly trustworthy popular science lectures. Manchester has for some years taken a prominent position in this latter respect, and has been followed in this direction by the Gilchrist Trustees, who have established similar courses in the metropolis; whilst Liverpool, Glasgow, and other towns have recently determined to follow the same lead. The main object of such lectures is to interest more than to instruct, and we require, besides them, the general establishment of regular classes in which the subjects are thoroughly taught. Such classes are indeed established throughout the length and breadth of the country, thanks to the operations of the South Kensington Staff; and it is difficult to over-estimate the value of the scientific haul which year by year this network thrown from the metropolis gathers up. From the satisfactory and rapid growth of this system of science teaching, the time must necessarily arrive when the central agency should not be confined to the metropolis alone, but should be supplemented by local centres, each of which would probably be more conversant with the special wants of its district than the metropolitan institution could possibly be.

Good as all such evening and adult science instruction may be, its prosperity must depend on the existence and healthy growth of a higher class of teaching, such as that afforded by the various universities and colleges throughout the country. It is their problem to teach the teachers, and it is in the carrying out of this great task that Governmental assistance is imperatively required. By this assistance, however, we do not mean that institutions are to be at once artificially created; such a thing is just as impossible as to bring a full-grown man into the world at once, without his passing through all the stages of childhood. Each higher school will naturally select, if properly fostered, its own special direction of development, and it is absurd to suggest any operation by which such a natural growth should be cut down, like a Dutch garden, in order to improve its form.

Lord Salisbury did not touch upon the endowment of research, but it is obviously more important to endow the manufacture of unremunerative knowledge than to endow teaching which is more or less remunerative.

SOUTH AMERICAN TRAVEL

Travels in South America, from the Pacific Ocean to the Atlantic Ocean. By Paul Marcoy. Illustrated by 525 engravings and ten maps. Two vols. (London: Blackie and Son, 1875.)

The Amazon and Madeira Rivers: Sketches and Descriptions from the Note-book of an Explorer. By Franz Keller, Engineer. With sixty-eight illustrations on wood. (London: Chapman and Hall, 1874.)

Two Years in Peru, with Exploration of its Antiquities. By T. J. Hutchinson, M.A.I. With map and numerous illustrations. Two vols. (London: Sampson Low, 1873.)

WE notice these three works together, because to a considerable extent the first-mentioned embraces the ground gone over by the other two. Like Mr. Hutchinson, M. Marcoy devotes considerable space to the prehistoric antiquities and native populations of Peru, and, like Mr. Keller, the French traveller has much to say on the hydrography of the Amazon, on its fauna and flora, and on some of the numerous tribes that people the region contained within its vast basin. Of the three writers, M. Marcoy alone can be called a professional traveller,—at least, he appears as such in the present narrative; while Messrs. Keller and Hutchinson only took advantage of their vocation calling them to South America, to investigate what interested them in the particular regions which they visited. It is very gratifying to find men who do not profess to devote their lives to the advancement of scientific knowledge, so willing and competent as this engineer and this consul are to add to its sum. The number of such unprofessional—if we may so call them—advancers of scientific knowledge has in recent years been gradually increasing; and we hope that with improved systems of education, both in Europe and in America, systems in which a training in science will have a prominent place, such scientific volunteers will become more and more numerous. Considering the large number of Englishmen alone who occupy positions in our own colonies and other foreign countries, in the midst of districts of which we have very little accurate knowledge, what a rich harvest might be expected if only one half of them had the scientific training to be obtained at a German *Realschule!*

The dates of publication of the three works at the head of this article are somewhat misleading; the order in time of the respective travels is indicated by the sequence of the titles.

M. Marcoy's narrative is in some respects a puzzling one. It may be said, so far as his own journey is concerned, that there is not a single date in the whole book. Whether this be the author's fault, or that of the publishers of this translation of his work, we do not know; but we deem it rather a serious one if the work is put forth as the genuine narrative of a traveller who wishes to be regarded as a trustworthy observer and recorder of phenomena, many of which may alter in the course of a very few years. M. Marcoy's observations as to the condition of the prehistoric remains of Peru, of the condition of the peoples, both dominant and native, with whom he came in contact, of the state of rivers, of the fauna and even of the flora, will be deprived of no small amount of their value there is any doubt as to the date at which they were made. From internal evidence we conclude that the journey from Islay to Para was made during the twelve months following July either of 1847 or 1848; and we learn from St. Martin's recently published "History of Geography" that M. Marcoy was in the country about that time. But the work is thoroughly French from beginning to end, from the theatrical *pose* and costume of the author's portrait in the frontispiece to the final "Vale." We certainly believe that M. Marcoy made the journey across the South American continent about the year 1848, and that the work before us contains a narrative of what he heard and saw; but the author evidently studies effect so much, both in his illustrations and his style of writing, that one is apt to have a feeling that not unfrequently strict accuracy has been sacrificed, and that the author has given way to the very French failing of a love of exaggeration. This, we think, is particularly seen in the author's account of the French scientific expedition, in the company of which he performed part of his journey. His portrait of the "Count de la Blanche-Epine," as he calls the leader of the expedition, is evidently a caricature, and we fear the same may be said of several other portraits in the book; and whenever he refers to the Count—and he does so *ad nauseam*—it is invariably with so much bitterness, that one is apt to think the Count had snubbed the somewhat Bohemian but evidently sensitive traveller.

FIG. 1.—Bark Canoe of Wild Indians (Aráras and Caripunas).—Keller.

But that the narrative has been revised within the last few years, is evident from several passages. He refers to occurrences which took place in 1866; and while sailing down the Amazon he discusses the value of observations which must have been made years after his journey. Throughout the work the personal narrative is frequently so mixed up with information obtained by the author either at other times—for he was many years in South America—or at second hand, that it is often difficult to know where to draw the line; and thus one who is simply in search of a trustworthy narrative of observed facts is apt sometimes to feel insecure.

Moreover, we find from M. St. Martin's work, that "Marcoy" is really a pseudonym, the author's real name being Saint-Cricq. Why a veracious traveller should write under a pseudonym it is difficult to see; fancy Wallace, or Bates, or Livingstone, or Baker, or Payer, or Meyer doing so. Did "Paul Marcoy" fear the vengeance of the "Count de la Blanche-Epine?" That M. Marcoy intends his narrative to be taken *au sérieux* is evident throughout, from his elaborate and really valuable dissertations on the antiquities and original populations of Peru, their sources and migrations, followed up by similar dissertations on the various groups of tribes he passed through, his minute and careful geographical descriptions, especially in connection with the Amazonian river-system, and the many details he gives concerning the fauna and flora of the extensive region which he traversed. We hope the publishers in the next edition will at least, if they can, give the exact date of M. Marcoy's journey; let them be assured that, instead of detracting from, it will add to the value of the work, even though with regard to Peru and the Amazon there have been later explorers.

Notwithstanding these blemishes, the work must be regarded as, on the whole, a trustworthy narrative, containing a great deal of valuable information, especially on

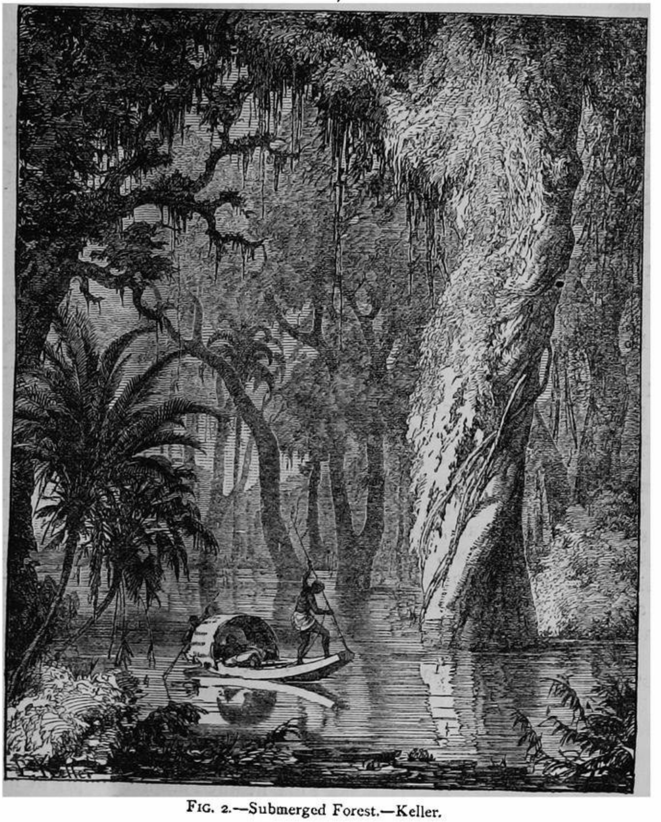


FIG. 2.—Submerged Forest.—Keller.

the tribes with which the traveller came in contact on the river Ucayali and its tributaries, and on the natural history of the regions he travelled through.

M. Marcoy's point of departure was the port of Islay, nearly under the 17th degree of south latitude. He tells us that his journey was undertaken as the result of a wager with the captain of an English vessel, that he would reach Para, in Brazil, by crossing the continent, as soon as the captain would sail to the same place round Cape Horn. As might be expected, he lost his wager. Still, considering, or because of, his simple equipment, and taking into consideration the frequent long stays he made at various places on his route, his journey, performed in a year and fourteen days, must be regarded as a wonderful feat. At the same time he managed to see a great deal that is worth recording. He went by Arequipa, the north end of Lake Titicaca, Acopia, Cuzco, to Echarati, on the Rio Quillabamba Sta. Ana, as he calls the river marked Urubamba in most maps, even in that of Barrera (1871) prefixed to Mr. Hutchinson's work. M. Marcoy is extremely particular about the courses and names of his rivers, and, as we have said frequently enters into long dissertations on the subject, giving minute details with much confidence. He is particularly confident as to the courses and names of the numerous rivers that unite to form the Ucayali. Near

Echarati, he embarked in a canoe on the Quillabamba or Urubamba, and sailing down this river and its continuation, the Ucayali, reached Nauta, opposite the mouth of the latter, on the Amazon; getting a boat at Nauta, Marcoy sailed down the Amazon to Barra, at the mouth of the Rio Negro, completing his journey from that point to Para in a sloop.

The first part of his journey after leaving Islay is dreary enough, over desert pampas and barren mountain regions, and the weary iteration of the trivial incidents in each day's journey becomes in the end positively tedious. In connection with Cuzco, the author gives considerable details concerning Peruvian antiquities, some of the remains of which he appears to have carefully and minutely studied, and of which he gives some valuable illustrations—sculpture, statuary, fortifications, pottery; and lastly, what professes to be a series of the thirteen Incas and their wives from Manco Capac downwards, who reigned over Peru from the foundation of Cuzco to the Spanish Conquest. They are beautifully executed, but we fear their historical value won't count for much. M. Marcoy has a very complete theory as to the peopling of America by the ancestors of the native races who at present inhabit America. He recognises two different types as including nearly all the peoples both of North and South America—the Mongolo-American type and the Irano-Aryan type, of which the former, the colonising or swarming element, as he calls it, is by far the more numerous. Both races, he seems to believe, entered America from Asia at a very remote period, probably by Behring Strait, which at the time of the migration he appears to think was bridged over by an isthmus. He endeavours to connect the Irano-Aryan type at least with the ancient civilisation of India and Egypt, with modifications and additions acquired by the migrants from the various peoples with whom they came into contact in their progress north-eastwards through Asia. The Quichuas, Aymaras, Antis, and Chontaquiros, tribes of Peru, he connects with this civilising element, as he calls it, to which he apparently attributes most of the wonderful monuments that now remain. That there are two distinct types among the native inhabitants of Peru the latest and most trustworthy researches seem to prove, as also that there has been more than one immigration from Asia, but that right across the Pacific, and not by Behring Strait; but that the Incas were the authors of the wonderful works of which so many remains still exist, seems in the highest degree doubtful. We fear the theories of M. Marcoy on this point will be considered rather wild by the scientific investigator, who we daresay will prefer the sober hypotheses of Mr. Hutchinson, based as they are on a broad basis of facts. But more of this when we come to the work of the latter.

M. Marcoy gives many interesting details concerning the social life of the various cities and towns of Peru through which he passed on his way to Echarati. The picture presented is on the whole a sad one, and we should hope that since he made his journey there has been a great reformation, and that since railways and steamers have brought the people more into contact with the busy world of Europe and North America, industry, morality, and education have attained a higher platform.

The real interest of M. Marcoy's journey begins when he launches on the river Quillabamba, probably the most tortuous river in the world, and so studded with rapids that navigation, except in canoes, is utterly impracticable. M. Marcoy gives much scattered information, helped considerably by the artistic illustrations, of the vegetation on the banks of this and the other rivers down which he passed. The traveller was nothing if not an artist; and the work before us, in the eyes of most readers, will derive half its value from the beautifully executed and graphic illustrations, which enable one to realise the scenes through which the author passed, better than any amount of description. So his sketches of the native Indians give one a good idea of the different types met with along his route. Most of these, we should think, are portraits, and some allowance, no doubt, must be made for the author's tendency to artistic exaggeration. Some of these portraits, as well as some of the sketches illustrating the social life and habits of the natives, we recognise as having been used (without acknowledgment) in a recent popular work on anthropology. This suggests the idea that the publication, so far as scientific purposes are concerned, is rather late; we should think it likely that whatever the work contains of value bearing on the ethnology, geography, and natural history of the Amazonian region, has already found its place in those sciences through the French edition.

Although the author enumerates many tribes to be met with on the Ucayali and its tributary rivers, the members of these tribes at the time he visited were very few, and the region through which he passed on his way to the Amazon appeared to be but thinly inhabited, notwithstanding the abundance of food, both vegetable and animal. Indeed, the native races of South America, like those of North America, seem to be dying out before the advance of the white man, though not so rapidly, for the simple reason that the spread of the white man over the southern continent is much more slow, and the whites themselves seem to be nearly as lazy as the Indians. Perhaps the fostering care of the Jesuit missionaries may also have helped somewhat in preventing the rapid extinction of the Indian tribes. These missionaries have been at work more or less ever since the Spanish conquest of Peru, and the "converts" may be counted by thousands, though M. Marcoy thinks, and he is not singular in the opinion, that the missionaries have succeeded only in producing a degraded type of Indian, differing from his heathen brother simply in having lost his independent spirit. M. Marcoy appears to be thoroughly acquainted with the history of the Jesuit missions in Peru, and one of the most pleasant episodes in his work is the account of his long stay at a mission station on the Sarayacu, a tributary of the Ucayali.

The tribes whom the author names as inhabiting the banks of the Ucayali and Quillabamba are the Quichuas, the Antis, the Chontaquiros, the Conibos, the Sipibos, and the Schetibos. Of these, only the first three, along with the Aymaras, and two or three tribes scattered through the valleys of Bolivia, does he recognise as representing his "Irano-Aryan" race. Most of the other tribes he believes represents his Mongol or Tatar race, the colonising element; while the Carib, Tupi Guarani, and other races, are in his opinion only various genera derived from the above-named mother families. We doubt whether this sweeping and easy way of grouping the American native races will stand the test of rigid ethnologic investigation; we suspect it will require much wider data than M. Marcoy had at his command to settle the question satisfactorily. The facts he gives, however, concerning the various tribes with which he came in contact, appear to us to be of considerable value. His descriptions of the peoples, the manners and customs, *physique*, traditions, movements, religious beliefs, vocabularies, &c., are all contributions to science, which the discriminating ethnologist will no doubt know how to make use of.

With regard to what must be considered as the proper source of the Amazon, M. Marcoy agrees so far with Mr. Squier, one of the latest writers on the subject, or rather with Dr. Santiago Tavara, of the Peruvian Hydrographic Commission, that it is not the Marañon. Dr. Tavara decided that as the Ucayali has greater volume and length than the Marañon, the former must be regarded as the Rio Madre del Amazonas. M. Marcoy had long before this concluded that as the Apurimac, a principal tributary of the Ucayali, is seventy-five miles longer than the Quillabamba or Urubamba, the upper part of the Ucayali, the former ought to be regarded as the real source of the Amazon. Several attempts have in recent years been made to discover if any of the many upper tributaries on the right bank of the Amazon could be made available for navigation by steamers, but, so far as we have learnt, with disappointing results, so that it is doubtful if any of these immense tributaries can ever be used as pathways for commerce.

During his slow progress down the Amazon, M. Marcoy frequently halted on its banks, visiting the mission stations, the half-civilised settlements of Brazilians and half-breeds, and the villages of the Indians. He also explored the mouths of some of the rivers flowing into the Amazon, and some of those curious natural canals which unite the main stream with many of its tributaries a considerable distance above the latter's *embouchure*. It is well known that the waters of some of the Amazonian tributaries, as the Rio Negro, are of a very dark colour, resembling coffee. We do not know that this has yet been satisfactorily accounted for; it can hardly, it would seem, be owing to the nature of the ground over which the rivers flow, as this is of very diverse kinds. M. Marcoy declares that when this water is looked at through a transparent vessel, it is perfectly limpid and colourless; only in cases where the current was slow or imperceptible, it had a brown tint. Animals of all kinds abound in and around these curious waters.

M. Marcoy made a careful exploration of the delta of the Purus, a large tributary on the right bank of the Amazon, by which he ascertained that the river has only one *embouchure*, the other openings being really only natural canals. M. Marcoy's knowledge of the hydrography of the south side of the Amazon seems to be clear and accurate, and is certainly extensive, and his frequent dissertations on the subject are worthy the attention of geographers, if they have not already gained it. One of the most valuable features of his work is the set of splendid maps which are prefixed, showing in minute detail the topography of his route.

We must leave M. Marcoy to find his way to Para, and accompany Mr. Keller in his journey up the Madeira. While we certainly think that in regard to the points to which we have referred the value of M. Marcoy's work is capable of being enhanced, still on the whole it must be regarded as deserving to occupy an honourable place among works of travel. It is essentially a popular work, and we hope it may have an extensive sale and many readers, as it contains a vast amount of really valuable information concerning the geography, topography, natural history, and ethnology of Peru and the Upper Amazon. Messrs. Blackie have done well in publishing an English translation, which has been remarkably well done by Mr. Rich.

(*To be continued.*)

MOGGRIDGE'S "HARVESTING ANTS AND TRAP-DOOR SPIDERS"

Supplement to Harvesting Ants and Trap-door Spiders. By J. Traherne Moggridge, F.L.S., F.Z.S. With specific descriptions of the Spiders, by the Rev. O. Pickard-Cambridge. (Reeve and Co., 1874.)

MR. MOGGRIDGE'S original work was reviewed in NATURE, vol. vii. p. 337, and we have already a mass of additional matter, paged continuously so as to form one volume when bound up with the first part. Only twenty pages are here devoted to the ants, yet we find several observations of great interest to the philosophic entomologist. Thus, the actions of lizards and tiger-beetles in attacking the ants were closely observed. The lizards only eat the winged males and females, but show great fear of the workers, always keeping out of their way; and the workers protect the winged ants by surrounding and swarming over them, so that the lizards can only occasionally dash at an outlying straggler. The Tiger-Beetle (*Cicindela*) devours the workers, but only attacks them with great precaution, keeping out of the way of the main body and seizing stragglers by a bite just behind the neck. If it fails to seize them in this exact spot it leaves go again, evidently knowing that if the ant's jaws once close on any part of its legs or antennæ they will never leave go, even after death. These observations apply to the two species of South European Harvesting Ants, *Atta structor* and *A. barbara*, and they furnish a clue to the use and purport of the large bodies of workers, which act as guards to the males and females. They also explain the use of the spines, hooks, and bristles with which so many of the weaker forms of ants are armed, as well as the occurrence of a proportion of soldiers—large-headed workers whose only function is to attack and drive away certain specially dangerous enemies. Some of these large-headed workers are essentially a huge pair of jaws with just enough body to carry them about, and whose sole object in life is to fasten on some special enemy and sacrifice themselves for the good of the community. The most important problem remaining for solution in connection with these harvesting ants is, how they contrive to keep the seeds in their granaries from germinating. Mr. Moggridge has proved that formic acid or its vapour has no influence, that the presence of the ants is necessary to prevent germination, but that their presence alone does not prevent it. Is it not probable that the whole secret consists in the ants continually using for food those seeds which begin to germinate, and that there always remain many seeds whose germination is delayed?

The remainder of the volume is devoted to Trap-door Spiders, many new species of which have been discovered, and much curious information obtained as to their habits. The spiders and their nests are illustrated by figures which are models of accuracy, and far surpass in delicacy and finish those of the first volume, good as those were. There are some interesting remarks about the British Nest-making Spider (*Atypus sulzeri*), which has very rarely been observed, but which, now attention is called to the subject, will no doubt be found to occur plentifully in the South of England. The new double-tubed and double-doored nest now first described is the perfection of insect architecture; and being constructed by a single insect is far more indicative of intelligence, mechanical skill, and reasoning power, than the habitations of ants or bees.

This volume is a striking example of the way in which the most confirmed invalids may employ and enjoy themselves; of the marvellous interest that attaches to the minute observation of the habits of many of the lower animals; and of the vast field for discovery that is still open to observers. It will long remain a standard work on the subject of which it treats, as well as a worthy memento of the enthusiastic and amiable naturalist whose early departure from among us will be so widely deplored.

A. R. W.

THE UNIONIDÆ

Observations on the genus Unio, together with descriptions of new species in the family Unionidæ. By Isaac Lea, LL.D. (Philadelphia, 4to.)

ALTHOUGH no date of publication is given, the last paper contained in this volume appears to have been read on the 3rd of February, 1874. It is a goodly volume of seventy-four pages, and twenty-two beautiful plates.

The number of this volume (xiii.) shows the extent to which the octogenarian, but still indefatigable author, Dr. Lea, has prosecuted his favourite study. He tells us in the Introduction: "In my twelfth volume I mentioned the number of North American species (Unionidæ) then known to be 772. By adding sixty to these, we have the number 832 species." And he remarks that "these do not by any means constitute the whole number of existing species; many of the smaller streams falling into our large rivers have not been explored, and these when well searched will unquestionably produce new forms of this numerous and interesting family."

Now it seems to us that the little word "forms" thus innocently used must disarm every conchologist of that weapon of criticism (species-making) with which Dr. Lea has been so often and so mercilessly assailed on this side of the Atlantic. Substitute "form" for "species," and what is there to prevent the European Unionidæ attaining a more respectable position as regards number than they do at present? In Great Britain we can show only five species, besides sixteen named and well-marked varieties. In Germany, according to Kreglinger, there are fifteen species (including some of our varieties), and twenty-nine named varieties. The number could be increased almost *ad infinitum* by reckoning every distinct form from each river, stream, lake, canal, and pond in which the Unionidæ are found; and we should lose one test of specific difference, which consists of ignoring all variation of shape caused by habitat, and which induces us to believe that undoubted species are those that live together without any intermingling or gradation. But whether all the North American Unionidæ are called "species," or "varieties," or "forms," Natural History and Conchology in particular are under a great obligation to Dr. Lea for his admirable works. One, perhaps not the least, merit is his symmetrical method of description, the characters of every species being given in the same relative order, so that they can be readily compared and the differences between the several species more easily ascertained. This is certainly important in his case; because some of the figures on the same plates bear a rather suspicious resemblance, *e.g.* those of *Unio globatus* and *subglobatus*, *U. tuscumbiensis* and *radiosus*, *U. crudus* and *pattinoides*, *U. yadkinensis* and *conasaugaensis*, *U. amplus* and *insolidus*, *U. rostellum* and *exacutus*, besides *U. subparallelus* and *basalis*. The above-named species are compared by the author, not with each other, but with different species.

Another reflection occurs to us on the perusal of this work; and that is as to the division of labour. A universal naturalist is now an extinct animal; and the region of biology becomes every day more and more subdivided into separate fields of investigation. Thus, in the Mollusca Mr. Davidson restricts himself to the Brachiopoda, Dr. Lea to the Unionidæ, and Dr. L. Pfeiffer to the Pulmonobranchia. Every other department of zoology, as well as of botany, has its own votaries for different orders and even families; and it is in this way that knowledge is at present advanced, not by some great Coryphæus, but by many less-gifted persons who have the opportunities and inclination

"To labour and effect one thing specially."

OUR BOOK SHELF

La Vie; Physiologie Humaine, appliquée à l'hygiene et à la Médecine. Par le Dr. Gustave le Bon. (Paris: J. Rothschild, 1874.)

MOST authors compose their works first, leaving the preface until the last thing, in order that they may appreciate the full influence of their detailed study when making the generalisations with which they feel bound to start their volume. We have no reason to think that the author of the work under notice is any exception to this rule. In the nine hundred or so pages of his book he explains in a clear and very intelligible manner many of the most important facts and theories of the science of physiology; in some parts introducing improved methods of illustration, in others not quite recognising the most recent advances which have been made, even by his own countrymen. Particular stress is laid, throughout the work, on the bearing of the points discussed on everyday life, on hygiene, and on pathology; in all of which the author, from his experience in the routine of practice and the recent Franco-German war, in which he was engaged in active ambulance service, is able to speak with authority. There are two other points in which the work is slightly different from most text-books of the subject, one being that a short account is given of the history of most of the physiological discoveries of importance, which is generally neglected in works of similar character, notwithstanding the additional interest which is thereby introduced. The other point is, that an account is given of the anatomical construction of the organs whose functions are to be studied, by which means those who have not, as medical students, gained the necessary amount of knowledge of anatomy to make clear their fundamental notions, can read on and understand without reference to other works.

In the preface Dr. Le Bon enters into a short account of the aims and objects of the study of physiology. He remarks that "it is with profound wisdom that the philosophy of the ancients epitomised what ought to be known by man, in the maxim, printed in golden letters on the doors of their temples, *Know thyself*." We cannot, however, in any way agree with this physical distortion of the proverb, and think that the endeavour to place physiology on such a footing will never lead to successful results. The subject is not taught in schools, and it is true that the youth during several years of his life has, instead, been a student of the past, in company with the heroes of Greece and Rome. "The time has arrived for him to make use of his knowledge. He enters the business of life. He has to instruct the masses, lead the multitude; yet, of the nature of men, of their instincts, of their passions, he is absolutely ignorant." Notwithstanding all this, we must differ from our author in assuming that a thorough knowledge of the human organisation is indispensable, or even useful, in supplying the deficiency indicated; and there are many, we think, who will agree with us. No better proof that such is the case can be adduced than the medical profession itself. Its members are all more or less acquainted with the most important physiological facts and theories; supplemented, which is much to the point, with a thorough anatomical knowledge. Nevertheless, it is not to the medical profession that we are accustomed to look for moral philosophers, politicians, or novelists, but rather for thorough scientific workers, and an overwhelming percentage of nonentities, as far as the world at large is concerned. Statistics as to the average length of life amongst medical men would hardly show any advantage in their favour, and as patients they are notably unmanageable. As an education, physiology is therefore, no doubt, as good as any other science, but its further value is a delusion and a snare. It has been our object, on several occasions, to ascertain the amount of information as to the mechanism of the organ and of the piano possessed by some of the most accomplished musicians, and in nearly every case we have found that they are perfectly ignorant of acoustics and the mechanical construction of the machinery they are employing. And yet is not *Know thy instrument* at first sight as applicable to the musician as *Know thyself* to humanity at large? How few of us could pick to pieces and reconstruct a clock or watch, and yet how many of us have never missed a train in our lives!

These remarks are not made in disparagement of physiology, but in opposition to the misleading argument adopted by several others as well as the author of the work before us, to the injury of science itself in the estimation of the public at large, because of the false expectations it raises.

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.*]

Fossil Remains of the Fallow Deer found in Malta

REFERRING to Dr. Jeitteles' monograph on the Distribution of the Fallow Deer, translated by Mr. Sclater (NATURE, vol. xi., p. 71), it may be interesting to record that fossil exuviæ referable to *Cervus dama* were discovered in Malta within the last few years. From inquiries I learn that they were found in a rock fissure impacted amongst the red soil which usually fills all the numerous rock rents of the island, where also fossil elephants' remains have been met with. The exuviæ in question were sent to the late Mr. W. Flower, F.G.S., and subsequently examined by Mr. Busk, Mr. Boyd Dawkins, and myself. They contain fragments of long bones and several entire feet bones and teeth, referable to small-sized adult individuals of the Fallow Deer. There is, besides, the molar of *Equus* and a canine referable to *Canis*, from the same situation.

The mineralogical aspects of the specimens are similar to those of the Quaternary fossil fauna of the island, but this is, as far as I can discern, the first instance of fossil remains of *Cervus* and *Equus* having been discovered in Malta or Gozo. Canine teeth of the same dimensions as the above, and referable to *Canis*, were found by Admiral Spratt and myself in conjunction with teeth and bones of *Hippopotamus pentlandi*, from the Malak Cavern of Malta.

Royal College of Science,
Dublin, Jan. 21

A. LEITH ADAMS

Electric Conductivity of Nerves

IN a recent number of NATURE (vol. x. p. 519) the reviewer of "The Protoplasmic Theory of Life" states broadly that few physiologists will agree with the statement in the book that the nerves are not better fitted for the conduction of electric currents than the other moist tissues, and that they possess no demonstrable apparatus for insulation of these currents. There must be some misunderstanding here, for I have adduced proofs from Dubois-Reymond, Ranke, Fick, and others, and I believe all physiologists of note concur in the view as represented by me. The reviewer has apparently overlooked the circumstance that one of the principal points in the chapter was the distinction of the conveyance by nerves of the *stimulus* caused by electricity, and the mere conduction of an electric current, for he says "there is not the least doubt that it is through the nerve-fibres that electric stimulation will most readily and most powerfully affect muscular fibres at a distance." No one, I imagine, does doubt this, but it is not at all the same thing as saying that the nerve is the best medium for affecting the muscle owing to its superior power of conducting electricity, for it may also mean that the nerve is susceptible to the stimulus of electricity. This is, indeed, sufficiently shown by the fact that a mechanical stimulation of the nerve will have a similar effect, while we do not attribute to the nerve any superior power of conducting mechanical force. Permit me to refer to the additional light thrown on the question in the recently published work of Prof. Vulpian ("Leçons sur d'Appareil Vaso-moteur," 1875). It had been asserted by Legros and Onimus, that on passing a galvanic current through a nerve containing vaso-motor filaments, the ascending current caused contraction, while the descending ones produced dilatation of the capillary arteries. The experiments of Vulpian and Carville yielded results not in accordance with this statement, and both currents were found to cause contraction. Vulpian explains this discrepancy by pointing out that Legros and Onimus assumed to act on particular nerves by sending the current through the skin and subjacent parts. "Not only," says Vulpian, "are we not authorised to believe that we act on these nerves by this mode, but, in addition, it is evident that we determine excitation of all the tissues comprehended in the current, the skin among others, and that that excitation may provoke reflex vascular dilatations which complicate the results" (p. 114). To perform the experiment properly, it is necessary to secure isolation artificially by cutting the channels of reflex vaso-motor action. Again, if you electrify the sciatic nerve in a dog which has been curarised, no contraction of the voluntary muscles to which it is distributed takes place. And in paralysis of the radial nerve in man from cold, the power of volition over the muscles supplied by it is lost, while the sensory and vaso-motor filaments bound up in the same nerve retain their functional activity. In those cases the power of conducting electricity is not impaired, nor is it indeed in the dead body even; but here, as expressed by Vulpian, "the musculo-motor filaments have lost their normal aptitude to cause the muscular bundles to pass from the state of repose to the state of activity" (p. 122). What that "normal aptitude" consists in is still a question, but it is certainly not the power of conducting electricity, although a knowledge of the latter is of great importance in judging of Dr. Beale's theory of muscular contraction.

Dr. Beale, as is well known, still holds to the opinion that the nerve-force is electricity, and that the nerves have not only the power of conducting electricity but of evolving it as a vital act on stimulation from the little masses of protoplasm, bioplasm, or living matter with which the nerve-cords are studded. Although there are many objections to this theory, still the badly-conducting power of the nerves for electricity does not appear an insuperable one when we think of the nerve-force merely as a stimulus, for the quantity of a stimulus necessary to rouse up vital action bears an infinitesimally small proportion to the result. But when the same force is assumed to be the efficient cause of muscular contraction, the question assumes a very different aspect. In Dr. Beale's theory the muscular fibre proper is held not to contain protoplasm, and to be incapable of living action or of evolving force, the contraction being produced by inductive electric action on the sarcous particles, which causes them to change their position and thus approximate the ends of the muscular fibre. The source of the electricity is said to be the protoplasm masses contained in the muscles, in continuous contact with the motor nerves, and it is conveyed to the muscular fibres by loops of fine nerve-fibres crossing them in various directions. In this theory, even supposing insulation to be complete, it is obvious that the conducting power of the nerve-fibre becomes of supreme importance, because not the stimulus only, but the whole force of muscular motion, must be conveyed by it. Now, the nerve-cords do conduct electricity certainly, but so many million times worse than metallic wires, that the loss of energy by transformation into heat must be enormous. Such a loss is inconsistent with the economy of nature and with the actual facts; therefore, unless the nerve-force is a specific force different from surface-electricity, galvanism, and magnetism, though analogous to them, and probably easily convertible into electricity, Dr. Beale's theory cannot be upheld. I have not yet seen any reply by Dr. Beale to this objection. JOHN DRYSDALE

Liverpool

Kirkes' Physiology

IN a letter headed "Kirkes' Physiology," in NATURE of last week, signed "W. Percy Ashe," your correspondent would not appear to be practically acquainted with the semi-lunar valves at the base of the great vessels emerging from the heart, for his arguments, although perfectly correct in themselves, and based on well-known physical laws, do not, I submit, apply in the instance he quotes, for the simple reason that the conditions necessary for their application do not exist.

Let us consider briefly the shape of the sinuses of Valsalva during the diastole of the ventricles of the heart. For our purpose we shall be sufficiently correct in describing them as three inverted, empty, and slightly truncated pyramids; one surface, the outer one, of each, is formed by the arterial coat, whilst the other two surfaces, constituting the semi-lunar valve, are in apposition with the corresponding surfaces of the other two valves. Now, the pressure over the whole surface of the sinus may be divided into four pressures, one sustained by each of the three sides, and one by the bottom.

The three sides sustain an equal pressure, but the two inner ones constituting the valve are by far the weakest, and the pressure on each of these is really supported by an equal pressure on the corresponding surfaces of the other two valves, and consequently may be considered as *nil;* whilst the pressure on the third side is resisted by its own strength, and it is formed, as I have said, by the wall of the artery, which is particularly strong at this point.

The remaining pressure is sustained by the bottom or truncated apex of the pyramidal pouch. This pressure is greater in proportion to its extent of surface than the other pressures—the column of fluid being higher—and this surface directly rests on and is *partially embedded* in the structure of the ventricle, which must thus undoubtedly support it.

Therefore the idea that "the reflux is most efficiently sustained by the muscular substance of the ventricle," which is the main part of Mr. Savory's theory, is most directly confirmed by the actual construction of the valves, and which your correspondent may see for himself by making a vertical section through the aortic valves in a sheep's heart.

As at the time of the greatest pressure on the valves the ventricles are dilating, it follows that they cannot reduce the area of the valves at that time, as your correspondent in his last remarks would seem to imagine, nor in fact can they ever do so.

4, Granville Place, Blackheath E. PRIDEAUX

The Rhinoceros in New Guinea

LIEUT. SIDNEY SMITH, late of H.M.S. *Basilisk*, reports that while engaged in surveying on the north coast of Papua, between Huon Bay and Cape Basilisk, being on shore with a party cutting firewood, he observed in the forest the "droppings" (excrement) of a rhinoceros in more than one place, the bushes in the neighbourhood being also broken and trampled as if by a large animal. The presence of so large an animal belonging to the Asiatic fauna in Papua is an important fact.

Skins of a very fine species of Bird of Paradise, having plumes of a brilliant red in place of the yellow plumes of the common species (*P. apoda*), were obtained from the natives further to the eastward. ALFRED O. WALKER

Chester, Jan. 21

[We should be inclined to doubt very seriously the occurrence of any rhinoceros in New Guinea. At any rate, the *important fact*, as our correspondent terms it, cannot be considered as established.

The red-plumed Paradise Bird of the south of New Guinea has been named by Mr. Sclater, *Paradisea raggiana* (P. Z. S., 1873, p. 559), from skins sent home by Mr. D'Albertis.—ED.]

Thomson's "Malacca"

IN your review (NATURE, vol. xi. p. 207) of Mr. J. Thomson's very interesting work on the "Straits of Malacca, Indo-China, and China," you have justly acknowledged that the author "makes no pretension to have travelled in the interests of science, but only to be a photographer and an observer of the ways of men;" and as his excellent book will no doubt have a wide circulation, it may perhaps not be an unthankful office to correct two statements with reference to the natural history of Penang, which I had some opportunity of studying during a sojourn there of some eighteen months.

Our author, describing the noise made by the insects on Penang Hill, says: "One beetle in particular, known to the natives as the 'trumpeter,' busies himself all day long in producing a booming noise with his wings." Had Mr. Thomson succeeded in observing one of these insects whilst "booming," which he states he was unable to do, I think he would have found the musician to have been no beetle at all, but one of the Cicadidæ, and the sound not produced by the wings, but, as is generally known, internally, by the vibration of a membrane set into action by a special muscle. These insects are abundant at Penang, one species, *Dundubia imperatoria*, being particularly large, and which, with several other species, were taken by myself when there. It is nothing unusual for these insects to be wrongly described by natives, as we are told by Mr. Gervase F. Mathew, R.N. (in the *Entomologist's Monthly Magazine*), that in Tobago *Cicada gigas* makes a noise like the whistle of a locomotive; and he was told by the natives that the sound was that of the "tree-locust." At Surinam it is said *Cicada tibicen* is called the "harper," on account of its giving forth a sound like that of a harp.

Mr. Thomson also tells us (p. 35), when describing planter life in Province Wellesley, that the planters, when driving home at night from one estate to another, have the possibility of an encounter with an orang-outan, a rhinoceros, or a tiger. The orang, however, is not found there at all, and I know of no instance of an attack by a rhinoceros. In fact, that animal is so scarce that during my whole stay there the only report of one which I heard was that the animal's dung had been seen in the jungle. Tigers are still anything but scarce, but during my many nightly rides whilst living on the sugar plantations I am happy to say I never heard or saw one, nor was our roll-call ever diminished by that animal. The tiger there is a midnight prowler, but confines himself more to pigs, goats, and dogs. The wild animals are gradually being beaten back by the cultivation of the land, and the same may be said of even the insects. No doubt they abound in the centre of the peninsula, and there also, no doubt, may be found the Negrito stock, of which our author has given us a good photograph as found at Johore.

The illustrations of this very interesting book are excellent, and photography seems to be doing for anthropology what spectrum analysis is still achieving for astronomy.

Streatham Cottage, West Dulwich W. L. DISTANT

Bees and Flowers

MY children noticed with much interest, last autumn, the curious manner that the bees attacked the flowers of the *Antir-*

rhinum majus, making a hole at the bottom of the corolla of the flower near the stalk, and so getting at the honey from the outside. It was too late in the season to be able to observe it much, or often, but we are pleased to find others have seen it too.

In Sir John Lubbock's lecture at the London Institution he said some "humble-bees sucked the honey of the French bean and scarlet-runner in the legitimate manner, while other bees cut a hole in the tube, and so reached it surreptitiously."

This flower I speak of is one with the corolla much more marked than those the lecturer quoted. Next season we will hope to watch it again, and see if it only happens late in the year, for the injured blossoms seemed to wither very soon after the incision was made.

MARY J. PLARR

Tunbridge, Jan. 9

Iron Pyrites.—Curious Phenomenon

SOME iron pyrites exhibited in a particular case in the Maidstone Museum have crumbled into a coarse, finely-divided mass. The specimens have been exhibited for about two months, and the decomposition has been effected in that time. Some other specimens recently removed from another case are becoming soft.

Could any of your readers account for this, and has such a thing ever been observed before?

FREDERIC CASE

Maidstone, Jan. 19

OUR ASTRONOMICAL COLUMN

ANTARES AS A DOUBLE STAR.—The small bluish companion of Antares was detected by Mitchel at the Observatory of Cincinnati in July 1845. Measures taken by him in the summer of 1846 are published in No. 4 of his *Sidereal Messenger*. They gave the distance 2″·52, the companion preceding on the parallel, at the epoch 1846·59, and Mitchel thought this distance was half a second greater than at the time he discovered the small star. He mentions that on the 13th of August, 1846, he saw the star distinctly at 5.30 P.M., "the sun shining, unobstructed by clouds or mist." Early in the year 1848, Antares was repeatedly measured by Bond with the great refractor of Harvard College, and by Dawes in this country. Their mean result, weighted according to the number of nights, is—

1848·24 : Position ... 273°·71. Distance ... 3″·574.

The proper motion of the large star, though small, is still sufficiently sensible. Leverrier (*Annales*, tome ii.) assigns for the secular motion, − 0s·059 in Right Ascension, and − 3″·36 in Declination. If the above angle and distance are brought up to the present time with these values, we find on the assumption of merely optical proximity of the companion—

1875·25 : Position ... 288°·8. Distance ... 3″·54.

We would suggest that the star should be carefully re-measured, now that it is drawing away from the sun's place in the morning sky, to decide on the optical or physical connection of the components. Dawes' last measures in 1864 certainly rather favour the latter view, but they were made on a single night, and the object is one of difficult observation. It will be seen that on the assumption of optical duplicity, the distance is just now very nearly stationary, but the change of angle during the last twenty-five years amounts to 15 degrees, and will be easily confirmed or otherwise.

THE "TEMPORARY STARS" OF TYCHO BRAHE AND KEPLER.—The position of the famous star of 1572 in the constellation Cassiopea, with which Tycho's name is usually associated, has been determined with all the precision that his observations admit of, by Prof. Argelander, of Bonn. His place, reducing to the commencement of the present year, is in

Right Ascension	... ...	0h. 17m. 52s·6
North Declination	... ...	63° 27′ 18″.

Near to this position is a star of about the eleventh magnitude, which, by micrometrical comparison with two of its neighbours meridionally fixed, is found to have for the same epoch,

Right Ascension	... ...	0h. 17m. 52s·1.
North Declination	... ...	63° 26′ 24″

It is, therefore, distant less than one minute of arc from the most reliable position of Tycho's star that can now be assigned. On this account alone it would be worthy of attention, but we are able to state, further, that during the last four years this small star has exhibited slight fluctuations of brightness at irregular intervals, which increases the probability of its identity with the star of 1572. It may also be noted that in August 1874 there was a decided ruddiness in its light.

Kepler's observations of the star which suddenly assumed such extraordinary brilliancy in the constellation Ophiuchus in the autumn of 1604, are contained in his work "De Stellâ novâ in pede Serpentarii," but the best position we possess is doubtless that deduced by Prof. Schönfeld of Manheim, from the observations of David Fabricius. For the commencement of the present year we have

Right Ascension	... ...	17h. 23m. 8s.·9
South Declination	... ...	21° 22′ 16″.

This position is probably liable to greater error than in the case of Tycho's star.

The nearest object at the present time is a star of the twelfth magnitude (or rather fainter), following the above place 6s·5 and 2½′ south of it, which has not sensibly varied during the last few years, but it is a suspicious circumstance that Chacornac has entered upon his chart No. 52, a tenth magnitude about 8s. preceding Schönfeld's place, and nearly on the parallel of declination, which is not now visible, or was not last summer. The neighbourhood requires to be closely watched. The observer may set the circles of his equatoreal for Oeltzen 16872, R.A. 17h. 23m. 34s., N.P.D. 111° 23′. The observations for Chacornac's chart were made between the 31st of May and 12th of August, 1861.

THE ZODIACAL LIGHT.—On the evening of Sunday last, the 24th inst., a surprisingly bright display of this as yet problematical phenomenon was exhibited. There was a repetition on the following evening, but in a less favourable sky. The light had the usual yellowish or pale lemon tinge of the more notable exhibitions in these latitudes. The axis of the light appeared to pass λ Piscium, and the vaguely-defined apex was situate somewhere about 19 Arietis, but it was not possible to locate it with anything like precision. The light was broad and of a deeper, perhaps, ruddy tint near the horizon. The display to which we have adverted, excelled in brightness any that has been witnessed in the neighbourhood of London for many years. It appears very probable that opportunities for favourable application of the spectroscope may be afforded in the dark evenings of the present and following months.

PLANETARY THEORIES *

THE theory of Neptune, which I have the honour of presenting to-day to the Academy, completes the *ensemble* of the fundamental theories of the planetary system, of which the first dates back to September 16, 1839, thirty-five years ago.

The numerous developments added year after year are all mentioned in the organ of the Academy. Some of them figure only by their titles, and as they are scattered through a great number of volumes, the Academy will no doubt permit me, at the moment when I have arrived at

* "New Theory of the Motion of the Planet Neptune; with Remarks on the *ensemble* of the Theories of the eight principal Planets, Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune" A paper read before the French Academy of Sciences by M. Leverrier, December 21, 1874.

the end of this long discussion, to present a precise but succinct *résumé* of them.

In 1849, after I had already been engaged for ten years in the work, and the better able to estimate the difficulties, I presented its essential conditions in terms in which I have no alteration to make.

None of the tables, let us say, intended to represent the movements of the planets, accord rigorously with the observations. The most precise, those of the Earth and Mercury, are not so accurate as could be wished. I do not speak of those irregular discrepancies which the uncertainty inseparable from every physical measurement necessarily introduces between observation and calculation, but rather of those systematic errors whose variation follows a determined law, the real existence and regularity of which are prominent in the *ensemble* of the work of the different observatories, and for which theory alone can be blamed. These inaccuracies ought to engage our earnest attention; no doubt they are inconsiderable, but, on the other hand, they are everywhere present, and their smallness does not authorise us to neglect them.

It would assuredly not be very serious in itself that our astronomical tables should make an error of half a second in the time of the passage of a star on the meridian, if the importance of this error did not lie in its degree of certainty rather than in its magnitude. Every discrepancy betrays an unknown cause, and may become the source of a discovery. If these errors should increase considerably with the time, we may, it is true, await their complete development in order to read with greater certainty, in their onward progress, the cause which produces them; but, first, we should thus leave to posterity the task of perfecting science and the advantage of discovering new truths. Moreover, certain extraneous influences may manifest themselves by effects always slightly sensible; and if we neglect these effects, the cause on which they depend will remain for ever unknown.

The theory of the motion of a planet rests upon the hypothesis that each planet is subject only to the actions of the sun and of the other planets, and, moreover, that these actions are exercised conformably to the principles of universal gravitation.

But the consequences of the Newtonian law have not been, in many respects, deduced with sufficient rigour; and, on this account, we are not in a condition to decide if the disagreements evident between observation and calculation are due solely to analytical errors, or rather if they are partly due to the imperfection of our knowledge of celestial physics.

It will be necessary, then, to take up again the mechanical theories of the motions of the planets, and to rigidly examine them to their most remote consequences, before we are able to effect a decisive comparison with observations. This is what has been done.

Let us rapidly state that the general developments have been the subject of five memoirs, presented and published in 1840, 1843, 1849, and 1855.

The formulæ relative to secular irregularities have been treated particularly in the memoirs of 1840 and 1841.

The same subject has been handled, in a more general and more complete manner, in the paper communicated to the Academy on Nov. 11, 1872, concerning the four great planets, Jupiter, Saturn, Uranus, and Neptune.

The theory of Mercury, presented in 1843, since completely revised, was only definitely completed in 1859.

The theory of Venus was given in 1861.

That of the Sun (the Earth) in 1853 and 1858.

That of Mars in 1861.

The theory of Jupiter in 1872 and 1873.

That of Saturn in 1872 and 1873.

The theory of Uranus, given in 1846, and connected with the discovery of Neptune, was the subject of a new work presented on Nov. 15 last.

Finally, the last theory, that of Neptune, is offered by us to the Academy to-day.

The theories of Jupiter, Saturn, Uranus, and Neptune have the peculiarity that they are developed in functions of indeterminates, so that their use may be prolonged during an unlimited time.

The theories once established, it will be necessary to compare them with the long and valuable series of meridian observations devised by Rœmer, instituted for the first time at Greenwich, in September 1750, by the famous observer Bradley, and continued since then to our own days in the great observatories. But as the positions of the moving stars are connected with the fixed stars, it is evident that it will be necessary also to be assured of the relations of the stars among themselves, with respect to the equinox and the ecliptic. This necessity is particularly imposed in respect to right ascensions, on which specially depends a knowledge of the motions of the planets. The work was effected in the memoir of April 5, 1854, for the series of observations of Bradley. This was a delicate subject, for it necessitated the revision of the labours of Bessel, given in his work entitled "Fundamenta Astronomiæ." We have had to propose various corrections in the positions of the fundamental stars, and the verification of the accuracy of these corrections was put to the test (*au concours*) in Germany. The result confirmed all our determinations. Consequently they have served us in establishing with certainty the positions of the stars of comparison during the 120 years of observations which we have had to consider.

The comparison of the motions of Mercury with the theory given by us in 1843 did not present from the first a satisfactory result. The transits of Mercury across the Sun furnish data of very great precision, but which it was not possible completely to satisfy.

This first result fills us with uneasiness, it is known. May not some error in the theory have escaped our notice? New researches, in which everything was tested in various ways, only tend to convince us that the theory was accurate, but that it did not agree with the observations. Years passed, and it was only in 1859 that we managed to discover the cause of the established anomalies. We discovered that they are all connected with a very simple law, and that it is sufficient to increase the motion of the perihelion by 30½ seconds per century to reduce everything to order.

The displacement of the perihelion acquires thus in the planetary theories an exceptional importance. It is the surest indication, when it must be increased, of the existence of a cosmical matter yet unknown, and circulating like other bodies around the Sun. It matters not whether this matter may be agglomerated into a single mass, or disseminated in a multitude of meteorites independent of each other. Provided that its parts all circulate in the same direction, these effects combine to impress upon the perihelion a direct motion.

The consequence is clear. There exists in the neighbourhood of Mercury, between the planet and the Sun, without doubt, a matter, a material hitherto unknown. Does it consist of one or more small planets, or of meteorites, or even of cosmical dust? The theory does not pronounce on this point. On many occasions, trustworthy observers have declared that they observed signs of the passage of a small planet across the Sun; but nothing definite has been reached on this subject.

We should not, however, doubt the accuracy of the conclusion. We shall see, in fact, the same analysis applied to the discussion of the observations of Mars lead to an analogous result, and this result found fully verified.

Bessel has said of the theory of the sun that it has not made the progress we should have expected from the great number and the value of the observations. This estimate has for long troubled our mind, too trustful of this supposed accuracy of the observations. After having revised and discussed anew the observations of the Sun, made since the time of Bradley at Greenwich, at Paris, at Königsberg, to the number of 9,000, we have been forced to quite a different conclusion, viz., that the observations of the Sun are far from what they ought to be, on account of the systematic errors which affect them, and that there is no discordance between theory and observation which may not be attributed to errors in the latter.

In spite of all, the discussion of the observations of the Sun led us hence to an important result connected with the great question which agitates, at this moment, the scientific world; a result which surprised ourselves, so much had the determination of the parallax of the Sun, deduced by the director of the Berlin Observatory from the Transits of Venus in 1761 and 1769, inspired a false confidence. I arrived at the conclusion that the parallax of the Sun, estimated then at 8·57″, ought to be increased by the 25th part of its value.

Soon after, the comparison of the theory of Venus with the observations led to the same result, the necessity of increasing by $\frac{1}{25}$ the parallax of the Sun.

Finally, the theory of Mars led, in its turn, to a conclusion not less precise. It was proved that we could not account for the *ensemble* of the observations of Mars without increasing the movement of the perihelion by about one-eighth. This was the reproduction of the same fact as in the case of Mercury, and the conclusion to be drawn from it was the same, viz., that the planet Mars must be subject to the action of a quantity of matter till then neglected, and that it must be estimated at the eighth part of the mass of the Earth.

But then two hypotheses were possible, as we explained at the *séance* of June 3, 1861: either that the matter till then left out of the count resided in the belt of the small planets as a whole, or that it must be added to the Earth itself. In the latter case, and as a consequence, the parallax of the Sun must be increased by the 24th part of its received value, that is to say, that we would be led to the same result already deduced from the theories of the Sun and of Venus.

Meantime M. Fizeau has given a method for determining the speed of light, by a physical experiment, on the surface of the earth; and from this measurement, combined with the quantity of the aberration of the stars, we know that we can deduce the parallax of the Sun.

Foucault, on his part, had devised a plan of solving the same question by another method, and he was engaged in realising the experiment. I pressed him strongly to carry it into execution. We know that in the *séance* of Sept. 22, 1862, Foucault announced that he had fixed the rate of light at 298,000 kilometres per second; hence, by adopting the quantity of aberration determined by Struve, 8·86″ resulted for the parallax of the Sun, a number corresponding to an increase of 1-30th of the received value.

M. Cornu, in the important paper read by him at the last sitting, resolved definitively the question by the employment of the method of M. Fizeau. He was good enough to refer to the determination which I presented to the Academy at the sitting of July 22, 1872, based on the celebrated and very exact observation of the occultation of the star ψ^2 Aquarii by the planet Mars, an occultation observed in 1672 by the three great astronomers, Richer, Picard, and Rœmer.

Moreover, we shall combine materials obtained from various points of view on this delicate question, and will further increase by discussion the great interest which will be presented by the materials collected with so much devotion by the various expeditions destined to the observation of the present Transit of Venus. For this reason, and because the method which results from the occultation of ψ^2 Aquarii is present under a form precise and striking, we shall shortly ask permission from the Academy to deposit the work in its hands, after having given it the necessary developments.

Jupiter and Saturn have given rise to a theoretic work the extent of which has been considerable, on account of the very great mutual perturbations of the two planets. The comparison of the theory of Jupiter with the observations has presented, after the proper modifications of the elements, a complete harmony. The tables of Jupiter have also been adopted by the editor of the *Nautical Almanac* to serve for the preparation of that important work. I owe to our *confrère* Mr. Hind, superintendent of the *Nautical Almanac*, the satisfaction of thus seeing adopted by the astronomical world the various tables of Mercury, the Sun, Venus, Mars, and Jupiter, so far as they have appeared.

The tables of Saturn are now constructed, and their comparison with the observations is almost finished.

The theories of Uranus and of Neptune being also completed, it only remains further to effect their comparison with the observations.

The profound knowledge which my excellent colleague M. Gaillot, chief of the Bureau des Calculs, and member of the Council of the Observatory, has of these matters, and the devotion with which he has assured the laborious construction and comparison of the tables of Jupiter and Saturn, are to me a sure guarantee that the final work will be, whatever happens, carried out to the end.

RUSSIAN FORESTS

VEGETATION in the fossil or recent state forms the main source of the wealth and prosperity of most nations, either directly or indirectly: directly, in the case of the vast subterranean deposits of the remains of former plant-life in Britain, as also in the broad expanses of land covered with timber-trees in Russia. According to recent statistics* the extent of the forests of Russia in Europe is about 442,897,500 acres, or forty per cent. of the whole area. The forests are very unequally distributed, and internal communication is still very imperfect in many parts of the empire; hence much of this wealth is at present unavailable. Every year, however, the facilities for transport are increased, and there is a corresponding augmentation in the amount realised. Nearly sixty-five per cent. of the forest land is situate in the four governments of the North—Archangel, Vologda, Olonetz, and Perm; this equals sixty-five acres to each inhabitant. The governments of the South are relatively poor in timber, and in some parts almost treeless; but since 1842 the forest administration has been engaged in remedying this defect by planting largely. Between 1866 and 1870 upwards of 20,000 acres were planted, exclusive of the action of private owners. The principal trees are the Scotch pine, spruce fir, larch, birch, lime, aspen, and oak. To these may be added for the governments of the South, though relatively playing an unimportant part in commerce, the elm, ash, beech, hornbeam, maple, various poplars and willows, &c. The value of the forest products exported in 1871 amounted to 16,026,553 roubles, of which more than one-third came to this country. But the internal consumption gives a better idea of the immense wealth of these forests. It is only possible to give an approximate estimate of the value, which Mr. Werekha states must be at the very least 265,450,000 roubles per annum. In Russia, wood is still either the only or the principal fuel used. The railways consume wood for fuel to the annual value of 7,200,000 roubles. Wooden drinking-vessels, platters and spoons, take the place of pottery and metal in many districts, except in the houses of the rich. Mr. Werekha estimates that forty million wooden spoons are made every year; but Mr. Weschniakoff, in his account of the domestic industries of Russia, puts the figure at thirty millions.

* "Notice sur les Forêts et leurs Produits," etc. Par P. N. Werekha.

But the most destructive industry, so far as the forests are concerned, is the manufacture of bast mats, bark boots (*lapti*), cordage, and other articles prepared from the liber or inner bark of the lime, birch, and willow, chiefly of the former tree. It is computed that 100,000,000 pairs of *lapti* are made annually, each pair requiring the bark of four young trees; thus 400,000,000 trees are cut down every year for shoes! Lime-trees from five to ten years of age, and half-grown birch, are employed for this purpose. Such reckless waste is much to be regretted; and Mr. Werekha observes that the pines are tapped for their resin and bled to death in from ten to fifteen years, in the same way as the Landes of Gascony were denuded of their pine-forests during the last century.

The previously almost useless aspen, either for fuel or building, has attained to considerable importance within the last few years as a material for paper-making. There are already ten manufactories actively engaged in the preparation of this paper in Russia, and two in Finland; and as vast reserves of this tree have accumulated in the forests, it is expected to prove a source of great riches for many years to come. Timber, of course, is the most valuable article exported, though resinous products and bast mats bring in a large sum. The Scotch pine, spruce fir, birch (for coach-building), and the oak, are the principal and almost the only timbers exported. Speaking of the giant oaks of Russia, Mr. Werekha becomes almost sentimental, for they form the strength of British and French shipbuilders, and occasionally revisit their native country in a form by no means flattering to national pride, as the Russians are still very small shipbuilders.

THE INDIA MUSEUM*

THE India Museum, at present located at Whitehall, has long been known for its extensive and valuable collections of Indian products, a collection too valuable, indeed, not to have been made more available, both for scientific and commercial purposes, than it has been. The removal, however, of the specimens to the galleries at South Kensington will bring them within the reach of ordinary mortals who have neither bodily strength nor inclination to make a pilgrimage to the topmost floor of one of the highest buildings in London.

The importance and value of these collections has to some extent been shown in the several reports which have from time to time been issued from the Foreign Office. Dr. Forbes Watson, as Reporter on the Products of India, has done much service in this respect, and Dr. M. C. Cooke, who has drawn up the present report, is no novice amongst Indian gums and resins, having gained an extensive experience from his long official connection with the Museum.

There are, no doubt, many products of the Indian forests that ought to be included in European commerce, but, from the want of a proper knowledge of their uses, have never established themselves in the market. Individually, we have often deplored the prevailing prejudice amongst commercial men in favour of old and well-known commodities, amounting sometimes even to the absolute rejection of new products, without giving such products a fair trial. Dr. Forbes Watson, in an introductory note to the report under consideration, in reference to this, says it should "be remembered that gums or resins sent over for valuation in the London market are necessarily subject to comparison and competition with the very best qualities of the same substances which come into any of the European markets, and that careful collection is not a too frequent characteristic of Indian products." Dr. Watson further points out that it is of very great importance to the existing and future trade of India that samples should be sent home in sufficient quantity for report, since this is the only means by which they can be brought under the notice of competent authorities. For this purpose it is suggested that in the case of gums, resins, &c., quantities of from 20 lbs. to 25 lbs. would be sufficient for distribution amongst brokers and traders, as well as for analysis and experiments. The necessity, also, of obtaining accurate information on the botanical source of the plant yielding any particular product is strongly urged. The value of accurate specimens gathered at the time of collecting the article itself, whether it be gum, resin, wood, or fibre, must be apparent to everyone, and is strongly advocated in the article "Botany" in the "Admiralty Manual." In all cases such specimens should consist of leaves, flowers, and, where possible, fruits also, securely labelled and numbered, so that no mistake may occur.

This report of Dr. Cooke's is valuable, as it brings together nearly all that has been written on the gums and resinous products of India. The botanical synonymy of each species, with references, is first given; next, a short botanical description; then its habitat, native names, history, description, and uses; and finally, in the case of the most important products, references to the works where the subject has been treated of. Dr. Cooke has brought his report down to the most recent period, for we find under the genus Garcinia, of which the species are described as yielding gum, a description of *G. Griffithii*, with the following note:—"Anderson says of this plant that there is in Maingay's herbarium a plant very like it in habit, but described by him as having a circumsciss anther, which is cultivated in Singapore as the true gamboge of Siam. There still appears to be some doubt as to the source of Siam gamboge, which Dr. Hooker seems disposed to attribute to this tree." The fact is, that in the most recent revision of the order, *Garcinia Griffithii* of Anderson has been considered identical with *G. morella*, var. *pedicellata*, to which Siam gamboge has been referred by Hanbury, and which Dr. Hooker thinks has sufficiently distinctive characters to raise it to the rank of a species under the name of *G. Hanburyi*. Again, Dr. Cooke refers to the very recent work of Flückiger and Hanbury, in which Siam gamboge is attributed to *G. morella*, var. *pedicellata*, as stated above. Indeed, throughout the report there are frequent references to the "Pharmacographia," but we are not a little surprised that Stewart and Brandis's "Forest Flora" is not quoted. Thus, for instance, at p. 24 of the report, the Marking Nut, *Semecarpus anacardium*, is dismissed with very few lines; while in the "Forest Flora" is an excellent description of the tree; of the wood, which "is full of an acrid juice which causes swelling and irritation, so that the timber cutters object to fell it unless it has been ringed for some time;" and of the fruit and the black varnish, which is prepared from the pericarp, and which is used mixed with lime-water for marking cotton. Small consignments of these fruits occasionally arrive in this country, and not long since a quantity of a very fine kind came into the hands of a London house.

J. R. J.

* Report by Dr. M. C. Cooke, on the Gums, Resins, Oleo-resins, and resinous products in the India Museum, or produced in India. Prepared under the direction of the Reporter on the Products of India. 1874.

UMBELLULA, OR CLUSTER POLYP

ABOUT six months since (vol. x. p. 142) we referred to a letter from Prof. Wyville Thomson, in which he mentions having brought up from a depth of nearly 1,500 feet, between Prince Edward's Island and the Crozets (Kerguelen's Land), specimens of an Umbellula. When the *Challenger* was between the coasts of Portugal and Madeira, several specimens of another species of the same rare genus, but from a depth of about 2,000 feet, were also dredged up. The history of these curious Cluster Polyps is interesting. Some hundred and twenty years ago, and some one and twenty years before M. Kerguelen discovered the land now bearing his name, Capt. Adriaanz, the master of the whaling-ship *Britannia*, being then in lat. 79° N., and about eighty miles from Greenland, on pulling up his sounding line, found two specimens of a large plant-like polyp clinging to it; the length of the stem of the larger specimen was six feet, and he noted that the expanded flower-like polyp which was at one end of the stem was of a fine bright yellow colour. Struck by their size and beauty, and the strangeness of such creatures living at a depth in the sea of more than 220 fathoms, he brought them home to his friend Mr. Dunze, of Bremen, who had been a pupil of the illustrious Haller. Mr. Dunze gave the smaller specimen to Christlob Mylius, a Professor of Botany at Leipzig, and the larger to Peter Collinson, F.R.S.; this latter gentleman gave it to John Ellis, of zoophyte fame, to describe, which he did in the Philosophical Transactions for 1752, accompanying his description with a plate. What became of this specimen is unknown. Mylius's one found its way into a collection in Göttingen, and was not to be found there by Pallas in 1766. No specimens being found for thus more than a century, an air of uncertainty hung round this Cluster Polyp, and its portrait, so often copied in our text-books, seemed to be all one was likely to know about it. It was, therefore, with the greatest delight that the writer of these lines, in the summer of 1872, saw two specimens of Umbellula in the Swedish Museum of Natural History at Stockholm; one rare object after another had been shown to him by Prof. Lovén; but the Umbellula, though the last, was not the least of the treasures accumulated therein by this esteemed professor, who stated that Mr. J. Lindahl had dredged them up during the expedition of H.S.M. *Ingegerd* and *Gladan* to the Greenland Seas in 1871. Within the last few days we have received from Stockholm a quarto memoir, "Om Pennatulid-slägtet Umbellula af Josua Lindahl," with three plates. This memoir was read before the Royal Swedish Academy in February 1874, and describes the two specimens as two species, under the names of *U. miniacea* and *U. pallida*. Prof. Kolliker has also described one of the species found during the *Challenger* expedition as *U. Thomsoni*, making four species of the genus now described. It is marvellous what changes have taken place in our knowledge of the Natural Sciences in the interval between the description of Ellis's species and those so excellently described and figured in the memoir before us. The other genus Grinillum of the family Umbellulinæ, found about 1858 in a depth of 2,700 fathoms in the Banka Sea, will, we trust, be re-discovered by Prof. Wyville Thomson. It is only known by a fragment of the stem in the Leyden Museum, the crown of polyps having fallen overboard as Capt. Siedenburg, after whom the species is called, was pulling in the line to which it clung.

E. P. W.

SCIENCE IN THE ARGENTINE REPUBLIC*

THE Bulletin of the National Academy of Exact Sciences of Cordova, of which the three first numbers have lately reached this country, gives us an interesting account of a new endeavour of the well-known naturalist, Dr. Burmeister, to introduce scientific studies into his adopted country. In 1868 Dr. Burmeister presented a memorandum to Dr. Sarmiento, lately President of the Argentine Republic, upon the expediency of adding a Faculty of Mathematical and Physical Sciences to the National University of San Carlos in Cordova. In response to this appeal authority was given to Dr. Burmeister by the Minister of Public Instruction to import eight professors from Germany to establish the Faculty; and Dr. Burmeister himself was appointed Special Commissioner for the purpose, and eventually Director of this branch of the University. For a long time, Dr. Burmeister tells us, his exertions to obtain a staff of professors from his old colleagues in Halle were unsuccessful. The novelty of the idea and the distance of Buenos Ayres rather stood in the way of his offers being accepted. At length, in 1870, two of the vacant posts were filled by the arrival of Dr. Max Siewert to occupy the chair of Chemistry, and of Dr. P. G. Lorrentz to fill that of Botany. In the following year the assistance of Dr. G. H. Weyenbergh, of Haarlem, was obtained for the chair of Zoology, and that of Dr. Sellack for the professorship of Medicine. Not until 1873 was the staff finally completed by the appointment of Dr. Vogler to the professorship of Mathematics. In the same year, as we understand from Dr. Burmeister's report, the plans for the construction of the new buildings necessary for the University were finally approved of by the National Congress, and the works are now in process of execution.

From notices which subsequently appear in the *Bulletin* we fear that Dr. Burmeister has met with some difficulties in controlling his staff of professors. This can be hardly wondered at when the novelty of the plan is considered, and the difficulty of getting eight persons, strangers to each other, to work together to establish a new institution in a far distant country, where a foreign tongue is spoken. We have little doubt, however, that under Dr. Burmeister's supervision all will ultimately right itself, and that the Academy of Exact Sciences of Cordova will become an institution highly creditable to the enlightened rulers of the Argentine Republic, who have established the National Observatory under the direction of the distinguished astronomer Dr. Gould in the same city.

That some progress has already been made in the cultivation of the natural sciences in Cordova is apparent by several papers contributed to the first three numbers of the *Bulletin*, amongst which are essays "On the Land and Fresh-water Molluscs," by Dr. Doëring; "On certain genera of Microlepidoptera," by Dr. Berg; "On the Vegetation of the province of Tucuman," by Dr. Hieronymus; and "On the Salinas of Buenos Ayres," by Dr. Schickendautz.

* Boletin de la Academia Nacional di Ciencias Exactas existentente en la Universidad de Cordova. Entregas 1, 2, and 3. Buenos Aires, 1874.

NOTES

AT the suggestion of the Council of the Royal Geographical Society, a manual will be prepared for the use of the Arctic Expedition, consisting of reprints of papers in the transactions of learned societies which would not otherwise be accessible, and other materials; the object being to furnish an exact view of the state of existing knowledge of Greenland and the surrounding seas. The geographical and ethnological portions will be undertaken by the Arctic Committee of the Geographical Society. The other sections will be edited by Mr. Rupert Jones, under the supervision of a Committee of the Royal Society. The appointments of the lieutenants and other officers to the Arctic Expedition were made this week. The Royal Society has recommended the appointment of a botanist and a zoologist for the consideration of the Admiralty, but they have not yet been officially selected. Good progress is being made in the strengthening of the ships at Portsmouth, which have been ordered to be ready for sea by the middle of May. The statement, in some of our contemporaries, that Capt. E. Hobart Seymour is to be second in command of the Expedition, is incorrect.

MANY sorts and conditions of men will regret as a personal loss the death of the Rev. Charles Kingsley, which took place on Saturday last. We regret his loss as that of a man who had a warm love for science, and who by his writings and example has done much to foster a love for it among others. He was an honour to his country and his cloth, and it would be a good thing for the latter in many ways if its members could be persuaded to follow his example, and, like him, take a hearty interest in every healthy form of human activity. Few men have been more loved than Charles Kingsley, and the wide influence of his example and teaching has been undoubtedly for good.

THE death is announced of M. d'Omalius d'Halloy, the well-known veteran Belgian geologist, as having taken place on the 15th inst., at the age of ninety-two years. M. d'Halloy was born at Liége on February 16, 1783. He was a member of the Royal Academy of Brussels, of which he was president in 1850, Corresponding Member of the French Academy of Science, and Member of the Geological Society of Paris. He was author of a large number of scientific works; among others, "Eléments de Géologie" (1831), "Introduction à la Géologie" (1833), "Précis élémentaire de Géologie" (1843), "Abrégé de Géologie" (1853), besides numerous memoirs in the *Journal des Mines*, the *Journal de Physique*, the *Annales des Mines*, the *Mémoires* of the French Geological Society, and the *Bulletin* of the Belgian Academy.

WITH regard to the Transit of Venus, the following telegram, dated Aden, Jan. 21, has been received:—"Ingress and egress well observed from three stations in Rodrigues; nine Janssen plates; fifty-eight sun-pictures. Observers, Neate, Hoggan, Wharton."

A GENTLEMAN whose name is unknown has made a gift of 10,000*l*. for the promotion of university education among the working classes of Nottingham.

AT the recent meeting of Convocation of the University of London, a resolution was unanimously carried, "That in the opinion of Convocation it is desirable that a special examination be instituted in this University in the subjects which relate to public health." It was stated that there is every probability of the Senate giving force to the resolution by the establishment of an examination of the character indicated.

A COURSE of six lectures on scientific subjects, in the Town Hall, Stratford, was commenced on Monday by Mr. J. Norman Lockyer, F.R.S., whose subject was the "General Principles of Spectrum Analysis. The hall, we believe, was crowded with an attentive and intelligent audience, largely composed, apparently, of people belonging to the working classes. Mr. Lockyer lectures on the same subject next Monday, and on the two succeeding Mondays Dr. Martin Duncan, F.R.S., lectures on "Mountain-making" and on "Coral Islands." On Mondays, March 1 and 8, Dr. Carpenter, F.R.S., will lecture on "Deep-sea Researches." The lectures are given in connection with the Gilchrist Educational Trust.

THE Council of the Royal Horticultural Society have recently instituted a series of fortnightly lectures on Wednesday evenings, at eight o'clock, intended especially for those Fellows and their friends whose engagements prevent their attendance at the Wednesday afternoon meetings, and for the instruction of their gardeners. The first lecture of the series was delivered by Prof. Dyer, on the Growth of Ferns from Spores, which was followed by one last evening by Mr. A. W. Bennett, on the Fertilisation of Flowers by means of Insects.

FEW papers of greater interest to botanical students have recently issued from the press than Mr. Bentham's treatise on the recent progress of systematic botany, read at the Belfast meeting of the British Association, and which, but for untoward circumstances, would have formed the address to the Linnean Society at the Anniversary Meeting in May last. Commencing with a review of the history of systematic botany from the time of Linnæus, and of the gradual introduction of the natural system, he then considers the principal works in this branch of science recently published, or now in progress, under the following heads:—(1) *Ordines Plantarum*, or general expositions of the orders and sub-orders constituting the vegetable kingdom; (2) *Genera Plantarum*, or systematic descriptions of all the genera constituting the vegetable kingdom; (3) *Species Plantarum*, or systematic enumeration and descriptions of all known species; (4) Monographs of orders and genera; (5) Floras, or histories of the plants of particular countries or districts; and (6) Specific descriptions, detailed or miscellaneous. The practical advice of this veteran systematist to compilers of works of this description should be carefully studied by all botanical writers.

A NEW French weekly scientific periodical has issued its first number under the patronage of a Standing Committee of the French Geographical Society. It is edited by M. Herz, one of the staff of the *Journal Officiel*. It is called the *Explorateur*, and is published for the purpose of promoting the cause of geographical exploration among the French. One of its first objects is to send trustworthy travellers into the Sahara, where M. Dourneau-Dupré and others were murdered a few months ago. The *Explorateur* is opening, at present, a private subscription on behalf of M. Largeau, who is desirous of trying his chances in the same region. Some native pioneers have been also sent out, and are expected shortly to transmit valuable intelligence from the central Sahara.

A PARCEL of dried plants has recently been received at Kew from the Samoan Islands, sent by the Rev. Mr. Powell. Some novelties may be expected from this region, as it is still very little explored.

PROF. DYER'S article on the Tree Aloes of South Africa, recently published in this journal, having elicited numerous inquiries respecting this curious genus, it may be interesting to some of our readers to know that several fine species are in flower at the present time in the Succulent House at Kew.

TREE FERNS are nearly all of elegant and pleasing habit, and one deserving these epithets in a high degree is *Cyathea insignis*, a native of Jamaica and other West Indian islands. A magnificent specimen of this species recently attracted admiration in the tropical conservatory at Kew. It has fronds upwards of twelve feet in length, the stipes or stalks of which are densely clothed with long glossy scales.

ABOUT fifty new genera were added to the flora of Australia during the year ending with the appearance of Baron Mueller's last report, many of them of great interest in phytogeography. The following are a few of the more interesting:—Corynocarpus, Carmichælia, Ilex, Lagerstrœmia, Agrimonia, Embothrium (§ Oreocallis), Ulmus (§ Microptelea), Moræa, Areca, and Wolffia.

PASSING through the greenhouse containing the collection of succulent plants at Kew the other day, a correspondent was much struck with the flowers of a plant he had previously taken to be an ivy. The resemblance in foliage and habit is indeed so strong that a botanist might easily mistake it for a species of that genus, unless, of course, it was minutely examined. It is a native of South Africa, and is referred to the familiar genus Senecio, *S. macroglossus* being its name. The yellow flower-heads are large and showy, the ray-florets being few and broad. A figure of it, we are informed, will shortly be published in the *Botanical Magazine*. This plant has been introduced into St. Helena, where it bears the name of Ground Ivy, as may be learned from the label attached to a specimen in the Kew Herbarium, sent from thence by Mr. Melliss. Several other South African species of the same genus present equally interesting peculiarities.

BOXWOOD, the wood of *Buxus sempervirens*, which is almost exclusively used for the best kinds of wood-engraving, has been for some years becoming more and more scarce. Wood of the largest diameter is the produce of the forests of the countries bordering on the Black Sea. Large quantities are produced in the neighbourhood of Poti, from which port the wood is shipped direct to England. The supply, however, from this port is, we learn, becoming fast exhausted; and it is said, unless the forests of Abkhassia are opened to the trade, it must soon cease altogether. The quantity exported from Poti during the year 1873 amounted to 2,897 tons, of the value of 20,621*l.*; besides this, from 5,000 to 7,000 tons of the finest quality annually pass through Constantinople, being brought from Southern Russia and from some of the Turkish ports of the Black Sea for shipment, chiefly to Liverpool. An inferior and smaller kind of wood supplied from the neighbourhood of Samsoon is also shipped at Constantinople to the extent of about 1,500 tons annually. With regard to the boxwood forests of Turkey, the British Consul at Constantinople reports that they are nearly exhausted and that very little really good wood can now be obtained from them; in Russia, however, where some little Government care has been bestowed upon forestry, a considerable quantity of choice wood still exists; but even there it can only be obtained at an ever-increasing cost, as the forests near the sea have been denuded of their best trees. The trade is now entirely in English hands, although formerly Greek merchants exclusively exported the wood. In the province of Trebizonde the wood is generally of an inferior quality; nevertheless, from 25,000 to 30,000 cwts. are annually shipped, chiefly to the United Kingdom.

THE trade between Portugal and Great Britain is very largely composed of fruits of the Citrus tribe: the value of the exports from Portugal have, however, of late been considerably augmented, and will be more so in a few years, by the large number of pine-apples shipped to England. During the last two or three years the cultivation of this fruit in the Azores for export purposes has been largely developed. Bananas, also, have occupied much attention, and have been exported in such quantities, and realised such remunerative prices, that a large and flourishing trade may be expected. With these products already established and yielding satisfactory returns, it would scarcely be supposed that landowners would devote their attention to other and untried crops; yet we learn that the *Phormium tenax*, or New Zealand flax plant, has been introduced into some parts of the Azores, where its growth has proved highly satisfactory: and as it is proved that it will flourish in places where nothing else will grow, it may, in course of time, become an article of export.

THE distillation and manufacture of attar of rose is a large and important branch of industry in Adrianople. In the northern parts of the country, we are told in an official document, the produce of 1873 exceeded by 35 per cent. that of the previous year, the quantity distilled being some 121,875 ounces, valued at about 90,000*l.* It is chiefly exported from Philipopoli to England, France, Germany, and Austria; and recently merchants in the United States and Germany have opened correspondence with firms in Adrianople, with the view of establishing agencies to further extend this branch of commerce.

A VALUABLE and interesting report reaches us from New Zealand, on the "Durability of New Zealand Timbers." It has been drawn up by Mr. T. Kirk, F.L.S., and is by far the best account of the woods of that colony that we are acquainted with. New Zealand has exhibited her timbers at several of the international exhibitions; and though many of them have been remarkable both for size and beauty, they have never rivalled those of our Australian colonies, owing to want of care in seasoning, preparing, and naming the specimens. In some practical hints on seasoning timber, Mr. Kirk rightly says that no plan is so effective as keeping it in well-ventilated sheds, protected from the rain. He points out errors in felling and using timber, which all practical foresters and builders are acquainted with, but which are unfortunately of too frequent occurrence in many countries, namely, felling trees during the growing season, using timber immediately after felling, coating green or unseasoned wood with paint, &c. In the list of useful woods given, which number thirty-eight distinct trees, the Kauri (*Dammara australis*), Totara (*Podocarpus totara*), and the Red Pine, or Rimu (*Dacrydium cupressinum*) have a first place. The first-named is the finest tree in New Zealand, growing to a height of 120 to 160 feet; its wood, also, is the most valuable, being used before all others for masts, spars, and other shipbuilding purposes. The wood is frequently very beautifully mottled, and would be much valued by cabinet-makers in this country, were it an article of import; but New Zealand woods reach us only occasionally. The Kauri is largely used in New Zealand for railway sleepers. As an instance of its durability, Mr. Kirk says that near Papakura, an ancient Kauri forest has been buried at some remote period; in some places the logs still show above the surface. Much of the timber has been dug up in perfectly sound condition, and used for sleepers on the Auckland and Waikato Railway. Kauri timber is also exported to some extent from New Zealand to Australia, Tasmania, and Mauritius; and during the past three years the quantity so exported has more than doubled. Considering the limited area to which the tree is confined, it is to be hoped that some system of conservancy will preserve the trees.

THE Senatus of Edinburgh University has received a favourable reply from the Treasury as to an endowment for the proposed Chair of Education. Dr. Bell's trustees offered an endowment of 4,000*l.*, and the Senatus asked Government to grant a similar sum to complete the endowment. It is also stated that the arrangements for the establishment of the Chair of Education in the University of St. Andrew's are in such a state of forwardness that it is expected they will be completed forthwith, and that a Professor, with a suitable endowment, will be ready to enter on his duties by the beginning of next winter session.

THE Council of the Society of Arts have decided to offer the Society's Fothergill Gold Medal for an effective means of extinguishing fire on board ship, and they have directed the Secretary to enter into communication with leading shipowners, with the view of enlisting their aid in this important matter.

AN underground railway was inaugurated between Pera and Galata a few days since.

THE meeting at Paris of the International Conference on the Metrical System has been postponed till March 1.

ON the morning of January 22 an earthquake was felt at Ravenna, in Central Italy. The exact hour is not stated. It would be curious to ascertain whether it was connected with the rapid elevation of barometric pressure of 17 millimetres in a few hours, which was observed at the Paris Observatory and in many other places in France at the same time.

AT a recent meeting of the Academy of Natural Sciences of Philadelphia, Prof. Leidy—from a study of some fresh specimens sent him by Prof. Hayden, and obtained about one hundred miles east of Greeley, Colorado—declared his conviction that the colossal genus *Brontotherium* of Marsh is synonymous with *Symborodon* and *Miobasileus* of Cope; and that all these must give place to *Titanotherium* of Leidy, of which there are probably not more than two species.

MR. S. W. GARMAN describes, in the Proceedings of the Boston Society of Natural History, a new American species of serpent from Florida, under the name of *Helicops alleni*.

MR. WILCOX communicates to the Academy of Natural Sciences of Philadelphia the account of an unusual mode of burial which was formerly practised among the Indians of North Carolina. He states that in numerous instances burial-places have been discovered where the bodies had been laid with the face up and covered with a coating of plastic clay about an inch thick. A pile of wood was then placed on top and fired, consuming the body and baking the clay, which retained the impression of the body. This was then lightly covered with earth.

INTERESTING additions to our knowledge of the fauna of the Mammoth Cave have recently been made by Mr. F. W. Putnam, of Salem, U.S., who, as a special assistant on the Kentucky State Geological Survey, of which Prof. N. S. Shaler is the director, had great facilities extended by the proprietors of the cave, and he made a most thorough examination of its fauna, especially in relation to the aquatic animals. Mr. Putnam passed ten days in the cave, and by various contrivances succeeded in obtaining large collections. He was particularly fortunate in catching five specimens of a fish of which only one small individual had heretofore been known, and that was obtained several years ago from a well in Lebanon, Tennessee. This fish, which Mr. Putnam had previously described from the Lebanon specimen under the name of *Chologaster agassizii*, is very different in its habits from the blind fishes of the cave and other subterranean streams, and is of a dark colour. It lives principally on the bottom, and is exceedingly quick in its motions. It belongs to the same family as the two species of blind fishes found in the cave. He also obtained five specimens of four species of fishes that were in every respect identical with those of the Green River, showing that the river fish do at times enter the dark waters of the cave, and when once there apparently thrive as well as the regular inhabitants. A large number of the white blind fishes were also procured from the Mammoth Cave and from other subterranean streams. In one stream the blind fishes were found in such a position as to show that they could go into daylight if they chose, while the fact of finding the *Chologaster* in the waters of the Mammoth Cave, where all is utter darkness, shows that animals with eyes flourish there, and is another proof that colour is not dependent on light. Mr. Putnam found the same array of facts in regard to the crayfish of the cave, one species being white and blind, while another species had large black eyes, and was of various shades of a brown colour. A number of living specimens of all the above-mentioned inhabitants of the waters of the cave were successfully brought to Massachusetts after having been kept in daylight for several weeks, proving that all the blind cave animals *do not* die on being exposed to light, as has been stated.

WE have received the *Annuaire* of the Belgian Academy for 1875. It contains the usual useful information concerning the organisation and work of the Society, the prizes it awards, list of members, &c. The principal memoir is that of Quetelet, mentioned in NATURE, vol. xi. p. 217, with a portrait; there are also memoirs, with portraits, of two other deceased members, Charles Poelman, the comparative anatomist, and H. L. F. Partoes, the architect.

THE additions to the Zoological Society's Gardens during the past week include an Australian Cassowary (*Casuarius australis*), new to the collection, from Australia, presented by the Marquis of Normanby; a Banded Cotinga (*Cotinga cincta*) and a Naked-throated Bell-Bird (*Chasmorhynchus nudicollis*), from Bahia, purchased; a King Vulture (*Gyparchus papa*) from Buenos Ayres, presented by Mr. M. Billinghurst; a Bonnet Monkey (*Macacus radiatus*) and a Macaque Monkey (*M. cynomolgus*), presented by Mr. H. Lumsden, a Rhesus Monkey (*M. erythreus*), presented by Mr. W. de Winton, and a Bonnet Monkey, presented by Miss M. Hailes, all from India; a Black-tailed Antelope (*Nanotragus nigricaudatus*) from West Africa, purchased.

ON THE MUSCULAR MECHANICAL WORK DONE BEFORE EXHAUSTION

MUSCULAR exertion may be either dynamical or statical. Dynamical work is generally intermittent, while statical work is generally continuous in its action. The dynamical work done by any muscle before exhaustion is easily measured in kilogrammetres. Assuming the force exerted by any muscle to be w, and if n be the number of times the force is exerted through the distance h, until exhaustion sets in, then the total work, W, done before exhaustion, is

$$W = w\,h\,n \qquad (1).$$

If, however, a weight, w, be supported on the horizontally outstretched arm, then by the above formula the amount of work is zero, although the arm soon tires out. In his "Principles of Animal Mechanics" pp. 24—44, London, 1873, Mr. Haughton has attempted to estimate the statical work thus done by the muscles of the arm. Let w = the weight, a = weight of arm, α = distance from centre of glenoid cavity to centre of weight, and t = time in seconds before exhaustion. The muscles exert a force capable of sustaining the weight of the loaded arm at its centre of gravity. Let θ be a small arc, through which the arm moves uniformly with an unknown angular velocity w in the time t. Then, if x is the distance from the centre of the glenoid cavity to the centre of gravity of the loaded arm, we have—

$$\text{Total work} = (w + a)\,x\,\theta$$

But since

$$(w + a)\,x = \alpha\left(w + \frac{a}{2}\right),$$

and

$$\theta = w\,t, \qquad \text{we shall have—}$$

$$\text{Total work} = w\,\alpha\left(w + \frac{a}{2}\right)t \qquad (2).$$

The values of (a) and (α) are easily obtained by direct measurement and weight. This formula (2) is, however, no better than (1), for when θ is zero, w is also zero, and the work would be nothing. Mr. Haughton has, however, used this formula, assuming ω = 1, which value he has deduced from experiments made by myself (Prin. of Animal Mech., pp. 475—7), and published in the *School Laboratory*, 1871, vol. i. p. 108.* The experiments were conducted as follows:—

A weight w = 7·00 kilos. was lifted from a vertical to a horizontal with the shoulder, in a varying time t. At the instant the weight reached the horizontal, the muscles were relaxed, and the weight allowed to drop, being caught on a cushion attached to the leg. The intervals of work and rest, t, were in all cases equal. (I intend to repeat these experiments, making the interval of rest constant). Mr. Haughton has repeated my experiments, and has deduced the formula—

$$n = \frac{A\,t}{1 + \left(\frac{2\,\omega}{\pi}\right)^2 t^2} \qquad (3).$$

where n is the number of lifts before exhaustion. The observations for my right arm are given below.

TABLE I.

t	n (obs.)	n (calc.)	d per cent.	e per cent.
1·164	15·8	22·2	− 41	1·9
1·50	22·8	22·8	0	2·1
2·00	18·5	21·7	− 17	1·0
3·00	17·3	18·2	− 5	1·7
4·00	15·3	15·5	− 1	1·9
4·50	15·0	13·8	+ 8	1·3
5·00	14·3	12·6	+ 12	2·8
6·00	12·8	9·4	+ 27	3·1

The values of the constants in (3) as obtained by Mr. Haughton are, A = 30·4 and $\frac{2\,\omega}{\pi}$ = 0·666. Substituting these values, and the proper values of t in (3), and we have n (calc). Column d is the difference in per cent. of n (obs.) Each value of n obs. is a mean of four determinations. The probable error of this mean in per cent. of n (obs.) is given in column e. The experi-

* These experiments were merely published as a preliminary, in order that I might pursue the investigation at my leisure.

ments of Prof. Haughton are more nearly represented by (3), but that they are in themselves more accurate, is, as will be seen, a matter of doubt. One of the deductions which Prof. Haughton makes from (3) is the determination of his so-called "angular velocity," $w = 0{\cdot}666\,\frac{\pi}{2} = 1{\cdot}0472$.* The mean value of w as determined from several observations is 1·00. Hence (2) becomes—

$$\text{Total work} = a\left(w + \frac{a}{2}\right)t. \qquad (4).$$

Besides the difficulties already noticed, the conclusion arrived at in (4) is open to several fatal objections, a few of which I will detail.

1. In his reduction resulting in (3), Prof. Haughton assumes the truth of the following law (Prin. An. Mech., p. 442):—"When the same muscle (or group of muscles) is kept in constant action until fatigue sets in, the total work done, multiplied by the rate of work, is constant." By "rate of work" is meant the work per second. But in these experiments the muscles were not "kept in constant action," and even during the interval of work the action of the muscle constantly varies. The "rate of work" is therefore also entirely indefinite.

2. The method of experiment used by me, and which seems to have been followed by Prof. Haughton, I have found entirely unreliable, as will be hereafter shown.

3. Putting $\beta = \left(\frac{2\omega}{\pi}\right)^2$ in (3) and it may be reduced to the form—

$$\frac{n}{t} = A - \beta n t \qquad (3').$$

Anyone who will take the trouble to calculate and co-ordinate the values $\frac{n}{t}$ and $n\,t$ from Prof. Haughton's observations, pp. 468, 474, will see that these co-ordinated values form a curve, instead of a straight line. This is much more plainly marked in an unpublished series now in my possession. These latter experiments were made with an apparatus and method to be described in the next paper. They are more accurate than those before published, but not as accurate as can be obtained. It is certain, however, that the value of w in (3) is not constant. Assuming it to be constant, however, and its value in the series referred to, lies between 0·30 and 0·50. This illustrates very forcibly the futility of attempting theoretical reductions on the basis of assumed "laws," until we have first made sure of our facts.

Another series of mine which was also reduced by Prof. Haughton consisted in raising a varying weight, w, through the length of the arm in a time $t = 1{\cdot}164$ sec. The experiments were otherwise conducted as before described. Mr. Haughton makes use of the above-quoted law in this reduction, and finds the relation to be—

$$\left(w + \frac{a}{2}\right)n = \frac{A'}{\left(w' + \frac{a}{2}\right)} \qquad (5).$$

For my right arm the constants are $A' = 1000$ and $a = 2{\cdot}0$. The comparison of n (calc.) and n (obs.) is satisfactory, and for want of space it is omitted. Solving (5) for n and making $w = 7{\cdot}0$, and making $t = 1{\cdot}164$ in (3), and the values of n are evidently identical, or—

$$Z\,\frac{A'}{(7{\cdot}0 + 1)^2} = \frac{A\,1{\cdot}164}{1 + \left(\frac{2\omega}{\pi}\right)^2 (1{\cdot}164)^2}$$

where Z should equal unity. Solving for Z and introducing the values of the constants, and we find $Z = 1{\cdot}41$. Although this discrepancy was pointed out to him, Prof. Haughton has transferred unreduced, from the observations leading to (5), the first value of n ($t = 1{\cdot}164$) in Table I. It is to be regretted that Prof. Haughton did not leave unpublished the last 43 pages of his interesting and valuable work.

FRANK E. NIPHER.

(*To be continued.*)

* A few of these decimals might be dropped without impairing the accuracy of the result.

SCIENTIFIC SERIALS

THE current number of the *Journal of Anatomy and Physiology* commences with a suggestive description, by Dr. J. F. Goodhart, of three cases of malformation of the spinal column associated with lateral curvature, which lead him to the conclusion that cases of asymmetry of the two sides of the spinal column are due to original malformation of the bodies of the implicated vertebræ in the direction of a bi-lobed or double nucleus, and the subsequent unequal growth of the two halves.—Prof. Struthers has also a lengthy article on variations of the vertebræ and ribs in man, which will be read with interest in connection with that of Dr. Goodhart, and by all comparative anatomists, several very instructive abnormalities being described.—This paper is followed by one from the pen of Dean Byrne, on the development of the powers of thought in vertebrate animals in connection with the development of their brain; in which the author, by a comparison of the cerebral capacities of the different families of Mammalia with those of comparative anatomical structure and embryonic development, endeavours to prove that the functions of the anterior lobes of the brain belong to the act of thinking single objects of sense, those of the middle lobes to the act of thinking such objects with a sense of succession of them and as part of that succession, and those of the posterior lobes to the act of thinking a co-existence or succession of them as a case of a general principle.—Prof. M. Watson continues his contributions to the anatomy of the Indian elephant, describing the muscles and blood-vessels of the face and head. The same author also, with a drawing, describes a remarkable case of pharyngeal diverticulum, which opened on the free margin of the posterior pillar of the fauces, occupied the anterior triangle of the neck, and had a duct-like communication with its orifice, running between the internal and external carotids.—Dr. Arthur Ransome records the position of the heart's impulse in different postures of the body, from chest-rule measurements made by Mr. W. A. Patchett.—Baron A. de Watteville describes the cerebral and spinal nerves of *Rana esculenta*, from a series of dissections recently made.—Prof. Turner gives an account of the occurrence of *Phoca greenlandica* as a British species, from a specimen captured in Morecambe Bay and identified by Mr. T. Gough.—Mr. J. C. Ewart records notes on the minute structure of the retina and vitreous humour.—Mr. J. C. Galton also has a note on the Epitrochleo-anconeus or Anconeus Sextus (Gruber) as a supplement to Prof. Gruber's paper, giving drawings of it in *Tamandua tetradactyla*, *Cholopus didactylus*, *Phascolomys wombata*, and *Echidna setosa*.—The remaining short papers are by Mr. J. Reoch, on urinary pigments; by Dr. J. J. Charter, on abnormalities of the arteries of the upper extremity; by Mr. J. Harker, on a four-toed fœtus without head or upper limbs; and by Dr. J. Cantlie and Mr. Bellamy, on the absence of the quadriceps-femoris muscle, and on the presence of a sixth lumbar vertebra, the first rib being rudimentary.

THE *Scottish Naturalist* for January maintains the prestige of this interesting quarterly, now entered on its fifth year and third volume. It commences with an article of a more popular character than most:—"Illustrations of Animal Reason," by Dr. Lauder Lindsay, the authenticity of the anecdotes being vouched for by the writer. Among the botanical notes, the most interesting is that of the discovery in Aberdeenshire by Mr. Sadler, during an excursion of the "Scottish Alpine Club," of two plants new to Britain, *Carex frigida* and *Salix Sadleri*, the latter now described for the first time, and probably a hybrid between *S. reticulata* and *S. lapponum* or *lanata*. We have further instalments of "The Lepidoptera of Scotland," by Dr. Buchanan White, and "The Coleoptera of Scotland," by Dr. Sharp.

Poggendorff's Annalen der Physik und Chemie, 1874, No. 11.—The first paper is by W. Müller, of Perleberg, on the reduction of metallic oxides by hydrogen, and the application of this process for the quantitative determination of metals. The value of this method of quantitative determination depends on the fact that hydrogen reduces different metallic oxides at different temperatures. The results of Müller's experiments show that the quantities of several metallic oxides may be determined in this way, when the mixtures are heated in hydrogen, and care is taken with regard to regulation of temperature. The method proved successful for copper and zinc, copper and silver, copper and bismuth, copper and cadmium, copper and lead, copper and tin, copper and iron; also for copper, iron, and zinc, and pretty well for copper, cadmium, and zinc; but it was unsuccessful in the case of silver and iron, silver and lead, arsenic and antimony. The apparatus is simple enough, but the experiments take a very long time, and will not be of much general practical use.—The next paper records some thermo-electric studies by E. Budde.—Dr. Kurd

Lasswitz, of Breslau, contributes an article on the decay of the "kinetic atomic theory" in the seventeenth century.—Another communication is by Dr. H. Streintz, of Vienna, on torsion-oscillations of wires. It is followed by a paper on resistance in galvanic conductors, by H. Herwig. This paper was accidentally delayed, and should have been published before another one on the same subject, which appeared in Part 1874, No. 9, of these Annals.—The next paper, on fluorescence, by O. Lubarsch, is highly interesting. The author gives an account of elaborate investigations he made on the subject, with special reference to spectrum analysis; his general results seem to show (1) that for each fluorescent substance there are only certain rays of light causing fluorescence; (2) that the colour of the fluorescent light depends on the rays of incidence, and follows Stokes's law; and (3) that the most refrangible fluorescent rays, produced by sunlight, correspond to that place in the spectrum where the liquid shows its maximum of absorption, providing its fluorescence proves a simple one, when examined by prismatic analysis of the linear spectrum. In all three points Mr. Lubarsch differs from Pierre and Lommel, who investigated the subject before him.—On the expansion of mercury after Mr. Regnault's experiments, is a valuable communication from Mr. A. Wüllner.—The remaining papers are: On the influence of the temperature of air on the index of refraction, by M. V. von Lang; and on the oblique passage of rays through lenses with reference to a peculiarity of the crystalline lens, by L. Herman.—Besides these, there is a short note by H. Schneebeli, on Hipp's machine for determining the laws of motion.

Der Naturforscher (Nos. 49-52, Dec. 1874.)—Among the papers in this number we note the following:—On currents and temperatures in the Atlantic Ocean; observations made on board the German corvette *Gazelle*, by the commander Herr von Schleinitz, on a voyage to the Kerguelen Islands.—On carnivorous plants; researches made by Prof. Ferd. Cohn, of Breslau, with European species.—Note on the discovery of a new asteroid, 139, on Oct. 13, 1874, by Mr. J. Palisa, at Pola. It appeared of the 11th magnitude, under R.A. 2h. 7m. 19·39s.; Decl. +7° 29′ 50·7″—On the native iron of Ovifak, Greenland; discussing the question whether this native iron is of meteoric or terrestrial origin.—On the influence of temperature upon the respiration of plants; researches made by Herren von Wolkoff and Mayer at Heidelberg, showing that the influence is not nearly so great as is generally accepted.—On the formation of urea in the animal organism, by Herr von Knieriem.—On attraction and repulsion by heat and light, by A. Bergner; account of experiments made, which led to different results than those obtained by Mr. Crookes.—On the decrease of intensity in the light of Jupiter's satellites when passing over the planet's disc. This was explained by S. Alexander as resulting from interference and absorption of the rays of light; H. J. Klein now gives a much simpler explanation.—On the inorganic cell and the phenomena of growth in the inorganic world, by M. Traube; giving a purely physical explanation for the origin and growth of the cell.—Besides many smaller notes of scientific interest, the last number contains a detailed account of the sledge journeys made by Oberlieutnant Jul. Payer while in polar regions with the Austrian Polar Expedition.

SOCIETIES AND ACADEMIES

London

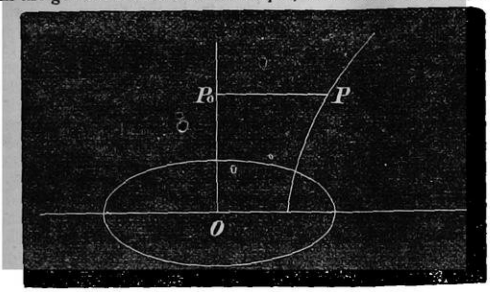
Royal Society, Jan. 21.—"On the Origin and Mechanism of Production of the Prismatic (or columnar) Structure of Basalt," by Robert Mallet, C.E., F.R.S., &c.

In this paper the author shows that all the salient phenomena of prismatic basalt as observed in nature can be accounted for as results of contraction by cooling in a homogeneous body possessing the properties of basalt, and that the theories hitherto advanced and repeated in text-books of the production of basaltic prisms are alike untenable and unnecessary. If a large level and tabular mass of homogeneous basalt cool slowly by loss of heat from one or more of its surfaces, the contraction of the mass while plastic will be met by internal movements of its particles; but when the temperature has fallen to a certain point of rigidity reached at between 900° and 600° F., splitting up commences, and that surface will begin to divide itself into similar geometric figures of equal area, which on mechanical principles must be hexagons, the diameter of which is shown to depend upon the relation that subsists between the coefficients of extensibility of the material and of its contraction by cooling down to the splitting temperature. These hexagons are the first formed ends of the future prisms, which split deeper into the mass as cooling down to the splitting temperature reaches deeper into it. When the prisms have split down to a certain distance, further cooling proceeds, not only from the ends of the prisms, which formed the surface of original cooling, but from the sides of the prisms. Now, as each prism is coldest at the end, and hottest where in the act of splitting, and is also hotter along the axis than at the exterior of each prism, so, by contraction, differential strains are produced in each prism, both parallel to the axis and transverse to it, which result in cross fractures at intervals along the length of the prism, the distances between which the author has assigned. Transverse fracture round the prism must commence in the outer *couche* in a plane normal to the resultant of the contractile strains longitudinal to and transverse to the axis of the prism; the fracture commences, therefore, oblique to the prismatic axis. This obliquity diminishes as the transverse contractile force diminishes, as the circumferential *couche* of cooling reaches nearer to the axis of the prism; the result is that the transverse fracture when completed is lenticular or cup-shaped, the convex surface always pointing in the same direction in which the cooling is progressing within the mass.

If the mass cool from the top surface only, the convex surfaces of the cup-shaped joints will all point downwards; if cooled from the bottom only, they will point upwards; and if from both surfaces, the convexity of the joints will be found pointing both upwards and downwards in the mass. As the splitting always takes place normal to the surface of cooling, so, if that surface be level and cool, uniformly, the prisms must be vertical and straight; also, if the cooling surface be a vertical or inclined one, the direction of the prisms will be normal thereto. If, however, the mass cool from its upper or lower surface, but of much greater thickness in one direction than in the opposite one, the prisms formed will not be straight, but have their axes curved, because the successive couches reaching the splitting temperature successively within the mass, and normal to which the splitting takes place, are themselves curved planes. These are a few of the principal points of this paper, which the author believes renders, for the first time, a complete and consistent account of all the phenomena observed in prismatic basalt. A considerable number of these phenomena were referred to and explained by the author. At the conclusion of his paper the author submits to rigid examination the notions which from 1804, the period of Mr. Gregory Watts's paper (Phil. Trans.), to the present time, have continued to occupy the text-books of geologists, and he points out how entirely these fail to account for the phenomena.

Linnean Society, Jan. 21.—Dr. G. J. Allman, F.R.S., president, in the chair.—Dr. Hollis read a paper on the pathology of oak-galls. Oak-galls may be divided into two classes, the unilocular or one-celled, which include the woody marbled oak-galls, the ligneous galls of Réaumur, and the currant leaf-galls; and the multilocular or many-celled, including the spongy oak-apple and the oak-spangles of the leaves. The author went with some detail into the structure and history of development of each of these kinds, taking a few examples of each. With the exception of the oak-spangles, all the different kinds appear to be formed during the growth of the leaf. The pathological differs from the healthy development in the more rapid growth of its cellular elements and in the larger size they attain; this is gained at the expense of the differentiation of the matrix of the bud. The author traced the origin of the different layers of the gall itself to the different layers of the leaf from which it is produced. A discussion followed, in which the President, Mr. Murray, Mr. Howard, Prof. Dyer, and others took part.—The following papers were then read:—Reports of the *Challenger* Expedition; On the Lichens, chiefly of Tristan d'Acunha, by the Rev. Dr. Stirton.—On the Lichen Flora of New Zealand and Chatham Island, by the Rev. Dr. Stirton.

Mathematical Society, Jan. 14.—Prof. H. J. S. Smith, F.R.S., president, in the chair.—Mr. J. W. L. Glaisher gave an abstract of a paper by Prof. Cayley, on the potentials of ellipses and circles. The potential of an ellipse of uniform density (in regard to a point not in the plane of the ellipse) was found by a process similar to that made use of in Gauss' memoir, "Determinatio attractionis quam exerceret Planeta," &c. (1818); the final result resembled in a remarkable manner the formula for the potential of an ellipsoid. The author then deduces a remarkable result relating to the particular case where the attracted point *P* is in the focal hyperbola of the ellipse, viz.: if we consider the semi-axis minor as constant, but the semi-axis major (and therefore also the focal hyperbola) as variable; and take the point *P*, always in the focal hyperbola, at a constant altitude above the plane of the ellipse; then the potential remains constant. The potential of the circle is of course included in the general formula for the ellipse, but there are some special



investigations which are developed in detail in the paper.—Mr. Glaisher then proceeded to give a sketch of a second paper by Prof. Cayley, on the attraction of an ellipsoidal shell. The shell in question is the indefinitely thin shell of uniform density included between two similar and similarly situated ellipsoidal surfaces. It was known for a long time that the attraction of such a shell on an internal point was equal to zero; and in 1833 Poisson showed analytically that the attraction on an external point was in the direction of the normal to the confocal ellipsoid through the attracted point, or (what is the same thing) in the direction of the axis of the circumscribed cone having the attracted point for its vertex. In 1834 Steiner gave a very elegant geometrical demonstration of Poisson's theorem, but did not attempt to complete the solution so as to obtain the attraction of the shell. This was done two years ago by Prof. J. C. Adams, F.R.S., who gave the solution at a lecture given in Cambridge. The result (which in the present paper is worked out in a different way) comes out with great simplicity, and we obtain, *without any process of integration*, for the attraction of the shell a finite expression which coincides with known formulæ, and which leads very easily to the known formulæ for the attraction of a solid ellipsoid.—Mr. J. Hammond read a paper on the solution of linear differential equations in series. He first takes the general equation and expands y in a series of determinants, the n arbitrary constants being the first n differential coefficients of y when x is put equal to zero, the particular integral being also expanded in a series of determinants. He then gives expansions of the same form for $\frac{\psi(x)}{\phi(x)}$ and $\frac{1}{\phi(x)}$ and a value of the mth differential coefficient of $\frac{\psi(x)}{\phi(x)}$ in the form of a determinant of $m + 1$ rows. And lastly, he considers two particular cases of the expansion of y in series from its differential equation.—Major J. R. Campbell exhibited two "Mechanical Calculators." The instrument is little more than a development of the circular slide scale in which two principles are engaged in one arrangement: (1) that of the common slide scale; (2) that of the scale invented by the late Dr. Roget (see article "Slide Scale," by De Morgan, in the "Penny Cyclopædia.) The designer described the construction and application of the instrument, and having been thanked by the chairman for his communication, presented both instruments (which were constructed with extreme neatness of penmanship) to the Society. Major Campbell also presented his description of the instrument to the Society, containing notes on its manufacture, tables of logarithms, and log-logarithms employed in the construction.—Mr. J. J. Sylvester, F.R.S., made a brief communication on the representation of any unicursal curve and its nodes in terms of the parametric coefficients, and on Roberts' and Hart's cases of unicursal 3-bar motion. M. Camille Jordan spoke on the subject of Mr. Sylvester's communication

Zoological Society, Jan. 19.—Mr. Robert Hudson, F.R.S., vice-president, in the chair.—The Secretary called attention to a letter received from a correspondent in Ternate, Moluccas, in which it was stated that the writer had living examples of four species of Paradise Birds in his possession, namely, of *Paradisea papuana*, *Seleucides alba*, *Diphyllodes speciosa*, and *Ptilorhis magnifica*.—A communication was read from Mr. J. Brazier, of Sydney, N.S.W., giving descriptions of ten new species of Australian shells, from the collection of Mr. A. Coxen, of Brisbane, Queensland.—Mr. A. G. Butler read descriptions of four new species of butterflies of the genus *Protogonius*, belonging to the collection of Mr. H. Druce.—A communication was read from Messrs. P. L. Sclater and O. Salvin, giving descriptions of three new species of South American birds. These were proposed to be called *Microcerculus squamulatus*, *Automolus striaticeps*, and *Tigrisoma salmoni*.—Prof. Newton, F.R.S., gave an account of a MS., in the French Archives de la Marine, which contained some additional evidence as to the original fauna o Rodriguez, and called special attention to the unknown writer's account of the terrestrial birds of that island, amongst which were mentioned the "Solitaire," the *Erythromachus leguati* o A. Milne Edwards, and other now extinct forms.—A commu nication was read from Dr. A. B. Meyer, director of the Roya Natural History Museum, Dresden, containing the description of a new Bird of Paradise, skins of which had been sent to him by Mr. van Musschenbroek, the Dutch Resident at Ternate, and which it was proposed to call *Diphyllodes Gulielmi* III. The habitat of this new bird is stated to be the inner mountains of Eastern Waigiou.—A communication was read from Major H. H. Godwin-Austen, containing supplementary notes on a former paper on the species of *Helicidæ*, of the sub-genus *Plectopylis*.

Meteorological Society, Jan. 20.—Dr. R. J. Mann, president, in the chair.—After the Report of the Council had been read by the Secretary and adopted, the President delivered his address, in which he dwelt in detail upon the various important and useful measures that had been carried out by the Society during the past year, and in doing so alluded to the action of the Maritime Conference in forwarding uniform and consentaneous operations on the part of meteorologists; the establishment of a uniform system of record, by the combined action of the Society and the Meteorological Office of the Government, which has been adopted by the Army Medical Department; and the starting of a considerable series of authorised and carefully inspected observatories, which have been planned upon a geographical base, so as to give a comprehensive grasp of the meteorology of England, and so as to enable returns to be periodically made which will present at a glance the leading features of climate and season. The value of these stations, it was pointed out, had been very materially increased by a system of concerted action which had been agreed upon between the Meteorological Society and the Meteorological Office of the Government, and which it was intended to extend as the best and most available situations for other observatories could be determined upon. The President next spoke of the large addition that had been made to the usefulness of the Society by the acquisition to its ranks of a considerable number of the most distinguished meteorologists of foreign lands; of the importance of a scientific alliance with the Public Officers of Health, who are now so closely connected with meteorological investigations; of the influence of exceptional seasons upon the health of the community; of investigations in progress with the climate, and especially the winter climate, of London, now of daily importance to some three millions and a half; of systematic observations of the influence of seasons upon animals and plants; of the formation by the Society of a library of standard meteorological works; and of the introduction of close study of the physical condition and aspects of the sun in connection with changes of weather and vicissitudes of season, a subject which is now getting to be of surpassing interest on account of the brilliant discoveries and marvellous deductions that have recently been made in this noble branch of scientific research. The following gentlemen were elected Officers and Council for the ensuing year:—President, Robert James Mann, M.D., F.R.A.S. Vice-Presidents: Charles Brooke, M.A., F.R.S., F.R.C.S., Henry Storks Eaton, M.A., Rogers Field, B.A., Assoc. Inst. C.E., Capt. Henry Toynbee, F.R.A.S. Treasurer, Henry Perigal, F.R.A.S. Trustees: Sir Antonio Brady, F.G.S., Stephen William Silver, F.R.G.S. Secretaries: George James Symons, John W. Tripe, M.D. Foreign Secretary, Robert H. Scott, M.A., F.R.S. Council: Percy Bicknell, Charles O. F. Cator, M.A., Cornelius Benjamin Fox, M.D., Frederic Gaster, William John Harris, M.R.C.S., James Park Harrison, M.A., John Knox Laughton, M.A., F.R.A.S., Robert J. Lecky F.R.A.S., William Carpenter Nash, Rev. Stephen J. Perry, M.A., F.R.S., William Sowerby, E. O. Wildman Whitehouse, F.R.A.S., Assoc. Inst. C.E.

Physical Society, Jan. 16.—Prof. Gladstone, F.R.S., in the chair.—A paper was read on the electrolysis of certain metallic chlorides, by the President and Mr. Alfred Tribe. If metallic copper be immersed in solution of cupric chloride, insoluble cuprous chloride is formed upon it. The authors found that if a strip of platinum be connected with one of copper and the two immersed, the insoluble cuprous salt was also deposited upon the platinum. Attributing this result to the electrolysis of the cupric salt by a feeble current, they tried the effect of a zinc-platinum cell excited by common water and with two platinum electrodes in the cupric chloride. Cuprous chloride appeared at the negative electrode and chlorine at the positive. An ordinary Grove's cell also gave cuprous chloride for the first two or three minutes, but afterwards metallic copper. A zinc and a platinum plate were joined and immersed in the cupric chloride; cuprous chloride was deposited upon the platinum, the edges being also incrusted with metallic copper. With magnesium in place of the zinc, a larger proportion of copper was obtained. Mercuric and ferric chlorides being analogous to those of copper, induced the authors to experiment with them also. Precisely analogous results were obtained, mercurous and ferrous chlorides appearing at the negative electrode.—A communication was made by Prof. Guthrie on "Salt Solutions and attached Water." Continuing the direction of research previously indicated, and the results of which were communicated to the Society in November last, the author described the following facts:—Contrary to the generally received opinion, the minimum temperature attainable by mixing ice with a salt is very independent of the ratio of the two and of their temperature, and of the state of division of the ice. The temperature of a mixture of ice and a salt is as constant and precise as the melting-point of ice. The nine salts resulting from the union of potassium, sodium, and ammonium, on the one hand, and chlorine, bromine, and iodine on the other, were examined in reference to their cryohydrates, the temperatures of the formation of which range from -28 to -11. For the same halogen, sodium salts assume less water than ammonium, and ammonium less than potassium. For the same metal, iodine salts assume less water than bromine, and bromine salts less than chlorine. The result of the examination of thirty-five salts establishes the identity of the temperature at which the cryohydrate is formed with the temperature got by mixing the salt with ice. Only two apparent exceptions to this identity have been as yet observed. The temperature at which a cryohydrate is formed is, with similar salts, lower, according as it assumes a less molecular ratio of water. There appear to be no exceptions to the rule that the lower the temperature got by mixing the salt with ice, the lower the molecular ratio of water. The temperature of incipient solidification of spirits of wine of different strengths was also examined. It was found that from spirits containing more water than the four hydrate, pure ice was separated, and that the temperature gradually sank to $-34°$ C., when the ratio of the four hydrate was reached. Thence the temperature remained constant, and the whole solidified into a hard mass. When a spirit richer than this cryohydrate is cooled, the cryohydrate separates, and a stronger and stronger spirit is left, which ultimately defies the source of cold (solid carbonic acid) to solidify it. Prof. A. Dupré's experiments regarding the maximum temperature produced on diluting alcohol are thus singularly confirmed. For this experimenter showed that this very four molecule ratio produced the greatest heat in its formation. Ethylic ether, which dissolves water and is dissolved by it, seems to form a definite cryohydrate. Water saturated with ether solidifies at $-2°$ C. without separation of ether. The icy mass when ignited burns with a colourless flame, the heat of which just suffices to melt the ice.

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Academy of Sciences, Jan. 18.—M. M. Fremy in the chair.—The following papers were read:—On the saline matter which the sugar-beet takes up from the soil and from manure, by M. E. Peligot; experiments which the author made with ten specimens of beet, all treated differently with regard to soil and manures, and tables of results obtained when analysing their ashes.—On the temperatures under turf or naked ground during the late frost, by MM. Becquerel and E. Becquerel.—A note by M. de Lesseps, on a project of communication between France and England, by means of a submarine tunnel, with an extract of a detailed account of this project as presented to the French National Assembly. M. Dupuy de Lôme then spoke against this project, and expressed himself in favour of a channel railway ferry.—On the *régime* of the principal rivers in the north, centre, and south of France, by M. Belgrand.—A note on M. Gosselin's paper of the last meeting (see NATURE, vol. xi. p. 240) with regard to unmovable dressings of wounds, by M. Ollier. Baron Larrey then made some further remarks on the subject.—On the first method of Jacobi for the integration of equations with partial derivatives of the first order, by M. G. Darboux.—On a system of tangential co-ordinates, by M. Casey.—On the deposits of flint implements near Précy-sur-Oise, and the presence of great pachydermata in the diluvium of the same locality, by M. E. Robert.—A note by M. de Lontin, on his ameliorations of dynamo-electric machines.—A note by M. Bonneil, on an aëronautical apparatus.—A note by M. E. Duchemin, on a new compass that can be used on the surface of liquids, and gives the time by the sun.—A note by M. C. Beuchot, on the application of steam for canal and river navigation.—On the causes of wear and tear and explosions of steam-boilers, by M. F. Garrigou.—MM. Blandin, Baruzzi, Mosca, and Guillaumont, sent some communications on Phylloxera.—The Minister for Foreign Affairs transmitted to the Academy some documents received from the French Consul at Mauritius, on the results obtained by Lord Lindsay in the observation of the transit of Venus. The French Consul at Honolulu sent some details on the same subject with regard to observations made by English expeditions at Honolulu, Hawaï, and Kanai.—A letter from the Minister for Agriculture and Commerce, drawing the attention of the Academy to the steps that ought to be taken to prevent the invasion into France of the fly *Doryphora*, which attacks the potato plantations in the United States.—On the notion of general systems of algebraic or transcendent surfaces, deduced from that of *implexes* of surfaces, by M. G. Fouret.—On the stellar system, 61 Cygni, stars physically related, the relative motion of which is not an orbit but rectilinear, by M. Flammarion.—Account of the discovery of asteroid (141), at the Paris Observatory, by M. P. Henry.—On the ammonia in the atmosphere, by M. A. Schloesing.—Researches by M. Müntz, on the respiratory functions of fungi.—On the decomposition of Fehling's liquor, and the admixture of glucose in the presence of sugar, by MM. P. Champion and H. Pellet.—On the pulsations of the heart, by M. Marey.—On the carrying along of air by a steam or air jet, by M. F. de Romilly.—On the phenomena of mineral and organic localisation with animals, and their biological importance, by M. E. Heckel.—On the development of Pteropoda, by M. H. Fol.—The neutralisation of the acidity of chloral hydrate by carbonate of soda retards the coagulation, while it preserves the physiological properties, by M. Oré.—Researches on the silicified plants of Autun and Saint-Etienne, by M. B. Renault, with special reference to the genus Botryopteris.—On the influence of forests upon rivers and the hygrometric state of the atmosphere, by M. L. Fautrat.—On the breaking of vessels by the freezing of water, by M. A. Barthélemy.—During the meeting the Secretary announced the sad loss the Academy had sustained through the death of M. d'Omalius d'Halloy, of Brussels, correspondent of the Academy's Mineralogical Section. M. C. St. Claire-Deville then spoke a few words in memory of the deceased.

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