THURSDAY, DECEMBER 20, 1888.

THE "ENCYCLOPÆDIA BRITANNICA."

The Encyclopædia Britannica. Vol. XXIV. (Edinburgh: Adam and Charles Black, 1888.)

THE assertion attributed by the undergraduate to the Master of his College, "What I know not is not knowledge," might be made in sober earnest on behalf of the authors of the ninth edition of the "Encyclopædia Britannica" in their corporate capacity. Their task has been to compile a compendious summary of all that is best worth knowing; to set up a landmark which should indicate the point to which we have now attained, which should distinguish between the uncertain and the sure, between hypothesis and fact.

To affirm that they have in all respects succeeded would be to assume an omniscience from which even the boldest critic might shrink, but it is doing them bare justice to say that it is generally held by those most competent to judge that their work is worthy of themselves. Art and science, history and literature, everything from the cedar on Lebanon to the hyssop on the wall, are included, and article after article bears in the initials at its end the hall-mark which stamps it as a work of the highest authority.

The "Encyclopædia," therefore, is not a mere compilation. Many of the scientific articles, though avoiding the mistake of giving undue prominence to opinions specially associated with the authors' names, are evidently the product of minds capable of looking forward as well as around. They are not content with producing the stock evidence in favour of generally-accepted theories; they know their weak as well as their strong points. They tell the reader not only what has been done, but something of what there is yet to do.

As examples, and in choosing them we confine ourselves to writers who, though they shared in the work, have unhappily, and to the great loss of science, not lived to see its completion, we may refer first to Prof. Clerk Maxwell's contributions on molecular physics. His article on "Atom" has become famous. Under the head of "Capillary Attraction," he gave (in spite of a few slips which have been pointed out by Sir William Thomson) a fuller and more suggestive discussion of the theory of capillarity than is to be found in any other English treatise. Turning to other subjects, no higher authority on the microscope could have been found than the late Dr. Carpenter. The article on "Terrestrial Magnetism," by Prof. Balfour Stewart, is a masterly synopsis both of the present state of knowledge on this subject, and of the directions in which inquiry should be prosecuted.

It is not, however, our intention either to attempt to give a general outline of the scientific articles or to criticize those in the concluding volume. At the moment when the task is just completed, we would rather congratulate the editor, authors, and publishers, on a work in which they may fairly take an honest pride. The examples we have cited will suffice to prove to our readers that anyone who has access to a good public library may now find in the "Encyclopædia Britannica" a review of what is known on almost every scientific subject, together with references which are sufficient to direct him if he wishes to pursue it further for himself.

Of course we do not mean to assert that articles in the earlier volumes—some fourteen years old—are always up to date now. But in spite of this drawback it is no slight advantage to have a succinct account of the state of knowledge at a definite and not very distant epoch. No doubt, editor and publishers have gained much valuable experience during the progress of the work, and perhaps they will be able to pigeon-hole a scheme by which the tenth edition will be more rapidly issued. We live quickly now, and though fourteen years was at one time considered a not unreasonable probation for an expectant swain, it seems long to a modern subscriber who is looking for the colophon.

Now that the end has come, the work may be regarded by Englishmen—or rather, if our Scotch friends insist on regarding that word as excluding them, by Britons—with just pride. Its completion was celebrated, in accordance with our national custom, by a dinner, of which we give some account elsewhere. In the course of an admirable speech, which he then delivered, Mr. Adam Black referred to the circulation of the ninth, as compared with that of the eighth, edition. It appears that while five thousand copies of the eighth edition were sold, the circulation of the ninth has been ten times as great. No doubt this is due in part to the demand for the work in the United States, but we may also assume that there has been a largely increased demand in England. The fact deserves to be specially recorded as a very striking sign of the times. It affords remarkable proof that during the lifetime of a generation there has been a steady growth not only of general intelligence, but of an enlightened desire to seek for information on all important subjects at the best and most trustworthy sources.

In these days of specialism, it is well that those engaged in different pursuits should, in one task at all events, meet on common ground. In educational matters they are too often opponents, struggling for the prominence of their particular subjects, offering rival inducements to the ablest scholars. Round the table in Christ's College, last week, these differences disappeared. The old learning and the new shared a triumph together. Every man who could tell, better than they, something of real interest to his fellows was recognized as having a claim on their attention.

In the company of encyclopædists, however, though due attention is given to each, the amount due is measured with the most scrupulous care. If sometimes we despair of the future when we read the endless babble of the platform, we may take courage from the study of pages in which the description of fact and the expression of thought are reduced to their utmost concentration. There is still hope for a race which, though it is producing "Hansard," has produced also the ninth edition of the "Encyclopædia Britannica."

Memories of some of those who have been left by the way cast over such a meeting a sobering but not necessarily a saddening influence. The "Encyclopædia" is itself a proof that we are growing in knowledge which can be put to good account to make the lives of succeeding generations less toilsome and more elevated than they

would otherwise have been. Lives which have been spent in the effort to secure this knowledge have not been lived in vain. To aid in securing that the tenth edition of the "Encyclopædia Britannica" shall mark an advance in our mastery over Nature comparable with that which is chronicled in the ninth there are still those among us who "would even dare to die."

MEDIÆVAL RESEARCHES FROM EASTERN ASIATIC SOURCES.

Mediæval Researches from Eastern Asiatic Sources. Fragments towards the Knowledge of the Geography and History of Central and Western Asia from the Thirteenth to the Seventeenth Century. By E. Bretschneider, M.D. (London: Trübner and Co., 1888.)

FOR some years past, owing mainly to the labours of Colonel Yule, European students have been made acquainted with the travels of European explorers of the Middle Ages in Central Asia and China. In "Cathay and the Way Thither," published in 1866 by the Hakluyt Society, and especially in his monumental edition of 1875 of the travels of Marco Polo, Colonel Yule laid before the world a record of practically all that had been done by mediæval travellers from Europe in these regions. Dr. Bretschneider's work is of the same nature, inasmuch as it deals with explorations of the same period in the same regions, but with this exception—his travellers are Chinese and start from China, Colonel Yule's are European and start from Europe. The former goes to Chinese literature as his storehouse, the latter to European literature. Each is complementary to the other; and, indeed, Dr. Bretschneider acknowledges that it was Colonel Yule's works that led him to study and collect the materials supplied by Chinese literature regarding the mediæval history and geography of Central Asia. He found that such quotations from the works of Chinese travellers as had made their way to Europe were not always carefully or faithfully translated; and as his position of physician to the Russian Legation at Pekin gave him peculiar opportunities of study, and placed at his disposal the valuable and rare library of Chinese works collected over a long series of years, at the expense of the Russian Government, by the Russian Ecclesiastical Mission, he determined to investigate the subject at first hand for himself. The result was the publication, in the pages of the Transactions of the North China Branch of the Royal Asiatic Society between 1874 and 1876, of a series of papers dealing with Chinese knowledge of Central Asia, and Chinese travellers there from about 1200 to 1600. Three of these papers are collected in the volumes before us, and form, as it were, the backbone of the work, viz. "Notes on Chinese Mediæval Travellers to the West"; "Notices of the Mediæval Geography and History of Central and Western Asia"; and "Chinese Intercourse with the Countries of Central and Western Asia during the Fifteenth Century." The new edition is brought up to date by references to the results of recent researches and investigations of Russian and other travellers, and especially to the vast increase in our knowledge of these regions produced by the rapid extension of Russian territory in the direction of India and China.

Dr. Bretschneider tells us that Chinese literature contains very considerable accounts of the geography of Asia at different times, and of the nations which formerly inhabited that part of the ancient world. These are mostly to be found in the histories of the various dynasties which have successively ruled China. At the end of each of the twenty-four dynastic histories, a section is devoted to the foreign countries and nations which came in contact with the Chinese Empire. These were probably collected by Chinese envoys, or compiled from the reports of envoys or merchants coming from those countries. Another category is drawn up in the form of narratives of journeys undertaken by Chinese. They never travelled, it seems, for pleasure, or to enlarge their sphere of knowledge. We owe all their narratives of travel either to military expeditions, or official missions, or pilgrimages to places famed for their sanctity. The number of these reports is not inconsiderable; but the difficulty of searching them out is great, as they do not, as a rule, exist as separate publications, but lie concealed amongst collections of reprints; and many of them have been wholly lost, their existence at one time being known only from ancient catalogues, or quotations in books which have survived. The difficulties of elucidation also are very great, for even when translated they require a vast number of explanations. This will be understood when we mention that, besides prefaces, introductions, explanations in the text, &c., there are 1188 footnotes, some of them running over several pages, in these two volumes, containing altogether rather less than 700 pages.

The first paper, entitled "Notes on Chinese Mediæval Travellers to the West," is confined to the thirteenth century, "the period of the development and the zenith of the power of the Mongols in Asia," and the earliest journey recorded in it is the itinerary of Chinghiz Khan's army from Mongolia through Central Asia to Persia in 1219. This is followed by the record of the journey of an envoy of the Emperor of North China, sent in 1220 to Persia, and as far as the Hindu-Kush Mountains, to meet Chinghiz Khan. The third journey recorded is that of a monk, who travelled, by order of the great conqueror, from China to Samarkand. He left Shantung, in the extreme east of China in 1220, went by way of Pekin, crossed the eastern part of Mongolia, probably passed near the modern Uliassutai, traversed the Chinese Altai Mountains, near the present Urumtsi, and along the northern slope of the Thian-Shan Range to Lake Sairam, whence he descended into Ili, went through Tashkend, crossed the Syr-Daria into Samarkand, and thence went southwards to Balkh, and on to Cabul. He returned by the same route, except that he made a shorter cut across the Mongolian desert; and arrived at Pekin in 1224. Such a journey performed either way to-day would probably make the traveller the geographical hero of the year, and it is recorded that, when he entered Pekin on his return, "venerable old men, men and women, assembled from all sides, and accompanied the master (the traveller) with fragrant flowers, and bowing before him obstructed the road." The fourth traveller started from Mongolia, and going by Samarkand, went westward to the Elburz Range, and the country where the Mulahi or Assassins lived; and the fifth was a Mongol officer who wandered about Central Asia between 1260 and 1262. The records of these various journeys are full of the most

interesting details about the countries and people visited, told sometimes in a very quaint and amusing manner. The task of following their routes and identifying the places is appalling; but Dr. Bretschneider goes through it all, balancing theories, and comparing modern descriptions of the same places, with untiring patience and ever-ready learning.

The second paper is entitled "Notices of the Mediæval Geography and History of Central and Western Asia," drawn from Chinese and Mongol writings, and compared with the observations of Western authors in the Middle Ages. These also refer to the period of the Mongol supremacy in Asia, and are mainly drawn from records of warlike expeditions of the Mongols to the West in the first forty years of the thirteenth century. These are preceded by bibliographical notices of the Chinese, Mongol, Arabic, and other books used, an historical and ethnographical sketch of the Khitan, Karakhitai, and Uigur peoples, and, more interesting still, a discussion on the information of the Chinese at the same period about the Mohammedans.

The second volume opens with a curious specimen of mediæval cartography, a rude Mongol-Chinese map published in the first half of the fourteenth century; and about 140 pages of the volume are occupied with identifications of the places mentioned on the map. The last paper contains an account, also from Chinese sources, of their intercourse with the countries of Central and Western Asia during the fifteenth and sixteenth centuries. In this we are given the description by Chinese writers of over fifty tribes and peoples of the West, including Portuguese, Spaniards, and Dutch, as far as they were known at that period in China. A most interesting sketch of the early Jesuit missionaries in China is found under the head Italy, in which the struggles of the Jesuits to retain permission to reside at Pekin, the intrigues against them, and their success because of their scientific attainments, are all described. From this record it appears that in the sixteenth and beginning of the seventeenth century a considerable number of Jesuit fathers resided at Pekin, some of them holding office about the Emperor's Court, and that all died in China after a long residence. Ricci himself, the senior and predecessor of them all, lived in China twenty-eight years, Longobardi fifty-seven years, Emmanuel Diaz forty-nine years, and so on.

We cannot conscientiously say that the book is one for the general reader: its long notes, Chinese names in italics, and other outward and visible signs of learning will warn off all light-minded persons. But to the student of the geography and ethnology of Asia it is an indispensable aid, for it contains almost all that is at the disposal of those unacquainted with the Chinese language, of the observations and experience of Chinese travellers in Central Asia between the thirteenth and sixteenth centuries. We say "almost," because, since Dr. Bretschneider's papers were first published, Dr. Hirth has worked the same mine in his "China and the Roman Orient," published a few years ago, and the discussions which have arisen amongst Chinese scholars in consequence of this book have added much to our knowledge of Chinese literature relating to Central and Western Asia.

THE ORIGIN OF FLORAL STRUCTURES.

The Origin of Floral Structures. By the Rev. George Henslow, M.A., F.L.S. (London: Kegan Paul and Co., 1888.)

PROFESSOR HENSLOW'S book on the origin of floral structures tends to supply a want in botanical literature. It has the merit of being the first popular work which deals extensively with the morphology and development of the flower, and introduces to the English reader the work of Payer, Van Tieghem, and Baillon, besides further popularizing the exquisite researches of Darwin and Müller concerning the process of fertilization of plants.

The early chapters, which deal with the anatomy of the flower, though containing little original matter, present a good general view of floral anatomy and structure. The position of the various floral organs upon their axis having been deduced from the similar position and arrangement of leaves upon a vegetative shoot, we shortly come to the first of the author's main points, viz. the possibility of elucidating floral structures by an examination of the relative positions of the vascular bundles, or, as the author prefers to call them, "foliar cords." This idea is by no means new, and we venture to think that the author has not done sufficient justice to extant literature. It is, moreover a great pity, that the new expression cord has been substituted for the well-known vascular bundle, since there appears little or no need for it. In our opinion far too much stress is laid upon the position and distribution of the vascular bundles, as if the vascular bundles in every case determined the number and position of the various members of the flower and were not rather subservient to them, as certainly appears to be the case in many irregular flowers. In the discussion on the relative positions of the stamens and so-called petals of the Ranunculaceæ, Prof. Henslow has apparently not seen that Prantl has lately shown the so-called petals to be staminodes.

The second part of the work deals with the forms of flowers, and all the varied phenomena associated with fertilization. Prof. Henslow lays particular stress upon the theory that the shape of the flower as a whole, and also that of the various floral appendages, are definitely associated with, and bear relation to, the particular insects which fertilize them, and the further elaboration of this exceedingly probable hypothesis is the second main point to which he pays especial regard.

Nectaries—floral and extra-floral—he considers to have been brought into existence, equally with the rest of the floral appendages, through insect agency. Starting with a review of the cases of irritability and response to stimulus which so often occur in plant life, he further points out how frequently pathological growths, such as galls and the like, are formed by the irritation set up by insects, and argues that it is exceedingly probable that in the case of nectaries the perpetual irritation of particular localities by insects in search of the sweet juices which are present in the floral tissues, may have induced the formation of a definite glandular outgrowth, secreting nectar. This hypothesis is certainly ingenious, and even at the present time is not altogether without support. In the present state of the science it would, however, be premature to accept it without further and strong proof. Prof.

Henslow has no reference to Beccari's remarks which appeared in 1884 in the second volume of "Malesia" under the head of "Piante ospitatrice." In the preface to the descriptions of his exceedingly beautiful and well-known myrmecophilous plants, Beccari puts forward the very view taken by Prof. Henslow, both with regard to floral and extra-floral nectaries, so that Prof. Henslow has no need "to venture to go further" (*i.e.* than Beccari), and attribute the large honey-pits at the base of the leaf-stalk of *Acacia sphærocephala*—see p. 157—to the mechanical irritation of ants.

The book closes with some remarks on the origin of species and the origin of flowers. There is evidence that the author has not thoroughly acquainted himself with some of the literature to which he refers, and in certain instances important references are omitted altogether.

THE CORAL REEFS OF THE PENINSULA OF SINAI.

Die Korallenriffe der Sinaihalbinsel, geologische und biologische Beobachtungen. Von Johannes Walther, Dr. Phil., und Privat-docent an der Universität Jena. Des xix. Bandes der *Abhandlungen der Mathematisch-physischen Classe der Königl. Sächsischen Gesellschaft der Wissenschaften.* (Leipzig: bei S. Hirzel, 1888.)

MUCH has been written and said of late on the origin of coral reefs; yet the best authorities, when they have not theories of their own to uphold, are agreed in thinking that the matter is far from being finally settled. For this reason a thorough examination of all coral districts is much needed, and every work which adds to the general stock of knowledge on the subject deserves attention. The present memoir deals with the geology of the peninsula of Sinai, and the dependence of the coral reefs in the Gulfs of Suez and Akabah on the characters of the rocks forming the shores. Herr Walther has undertaken difficult and disagreeable, if not dangerous, journeys in the course of his research, and in point of thoroughness his observations leave little to be desired. Believing that a solution of the question in any given area can only be obtained by carefully studying the relations of the reefs to their basis, he has thoroughly examined the geological character of the western mountains of the peninsula, and gives in the first part of the book a full account of all that he observed. The results of his geological survey are most conveniently studied in the plate giving a series of sections through the peninsula. These show that south of Uâdi Firan there are two parallel lines of granite mountains, running north-west and south-east, and between them lies a basin filled in with sedimentary rocks. As far south as Gebêl Nakûs the granite forms the shore, and the author points out that in this region there is no fringing reef and no coral of any kind. Further south, where the sedimentary rocks form the sea-cliff, the fringing reef makes its appearance, sending out offsets from the shore from place to place, which form barrier reefs and even atolls. The shores of the Gulf of Akabah are granitic, and are devoid of coral reefs. Commenting on this, the author explains that the granite is rapidly weathered out, and that its surface thus constantly undergoing destruction does not afford a sufficiently firm basis for coral growth.

The coral reefs are divided into living reefs, sub-fossil reefs, and ancient reefs. The first are the fringing and barrier reefs or atolls actually being formed beneath the sea-level; the second are upheaved reefs, lying just above the sea-level, and consisting of coral heads cemented together; the third are infrequent, and consist of masses of dolomitic limestone, the structure of which betrays its coral origin, lying 230 metres above the sea. The thicknesses of these reefs were accurately determined, and were found to be, for the ancient reef, 15–17 metres; for the sub-fossil reef, 3–5 metres; and for the fringing reef, 3 metres. These facts are by far the most important part of the author's work; they prove that considerable changes of level have taken place since the coral reefs were first formed, and that these changes have been in the direction of elevation. Thus another instance is added to the many now accumulating of barrier reefs and atolls being formed in an area of elevation. The slight thickness of the reefs also deserves attention. At the end of the book the author speaks of a reflux of the sea having occurred rather than an upheaval of the land. As he does not explain what he means by a reflux of the sea, his statements are rather puzzling. Does he hold the view that considerable changes of sea-level have occurred as consequences of glaciation at either pole? In any case, the phenomenon which he seeks to account for by an alternating level of the sea, viz. the existence of a dead reef below the sea-level and beneath the living fringing-reef at Râs Muhámmed, requires for its explanation nothing more than a period of subsidence following on a period of elevation; and several of the geological facts seem to point to a recent though slight subsidence at the southern end of the peninsula.

The author adds nothing to our knowledge of the biological conditions and the composition of coral reefs. His accounts of the living coral and its mode of growth, of the filling up of the interstices of dead coral blocks with detritus, and the formation of oolitic granules, are familiar to all visitors to coral lands, and have been fully described by previous authors. Although an unnecessary amount of space is devoted to the description of these well-known phenomena, the whole work demands the attention of geologists and of students of coral formations. The numerous plates and woodcuts render the text light and easily comprehensible, and the map showing the condition of the coral reefs at different geological periods is of especial interest. G. C. B.

OUR BOOK SHELF.

The Book of the Lantern. By T. C. Hepworth, F.C.S. (London: Wyman and Sons, 1888).

THE lantern has of late years become such an important aid to almost every branch of education, even in theological and political matters, that no apology is needed for the publication of a thoroughly practical treatise on everything connected with it. As a former lecturer at the Royal Polytechnic Institution, and present lecturer at the Birkbeck, Mr. Hepworth has gained the practical experience the benefits of which he now places at the disposal of others.

After brief reference to the history of the lantern, the optical arrangements are considered, and these are

followed by instructions for the preparation and storage of oxygen, which is now so commonly employed in conjunction with hydrogen, or ordinary gas, for illuminating purposes. The preparation of slides of every description, micro-photography, and the process of making lantern enlargements, are all fully considered. One chapter is also devoted to the description of a few simple scientific experiments, which can be easily performed whilst projected on the screen. Finally, a few valuable hints are given to aspiring lecturers or entertainers who wish to avail themselves of the powers of the lantern.

The necessary references to firms which supply particular appliances have been made without any partiality. The addresses of such firms might have been given with advantage.

The book is full of practical hints from beginning to end. It is very readable, and we can confidently recommend it to all who are concerned with lantern matters in any shape or form.

Chemical Problems. By J. P. Grabfield, Ph.D., and P. S. Burns, B.S. (Boston: D. C. Heath and Co., 1888).

THE systematic part of this book occupies the first forty-six pages, the remaining forty pages containing reprints of examination papers. The first part contains general information as to chemical calculations and such matters, with some problems worked out which are likely to be of service to the elementary student; but there are a few points that appear open to improvement. The word reaction is used in its ordinary sense, and also to indicate an equation without the figures that indicate the numbers of the several molecules; to adopt the words of the authors, an equation is a balanced reaction. This appears to be a needless perversion of the meaning of a useful word. The student is told to "balance the reaction" "by repeated trials" of numbers, a method that is certainly very common, but entirely unscientific and unnecessary—in short, a method of cramming, and not a method of teaching. At p. 12 we read, without qualification, "that the weights of all gases are to each other as their molecular weights": it would be very inconvenient to the commercial maker of gases if the weights of his productions were so restricted. At p. 5 the word weight is used in yet another sense: "If we divide the *weight* of any element in the molecule, multiplied by 100, by the per cent. of that element, we will have the molecular weight." This looseness of language would, we fear, be confusing to most students and to many teachers. The volume will be chiefly useful to those who are preparing for the examinations indicated in the second part.

LETTERS TO THE EDITOR.

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

The Recent Eruption at Vulcano.

IN a letter recently received here from Mr. Narlian at Lipari, that gentleman mentions some interesting facts relating to the recent eruption of Vulcano. Amongst others, he says that some weeks since some fishermen crossing between Sicily and Vulcano "found themselves in a boiling sea, the water bubbling up," "pieces of pumice coming up through the water." It appears also that the cable between Capo Milazzo and Lipari has been broken at about the same place, which is marked by "large rocks." He then says he has been unable to examine any of the pieces of pumice said to have come from the bottom of the sea.

Whether we have evidence here of a submarine eruption or of a fumarole it is difficult to decide, but further information we must hope will be forthcoming. It is possible that it is simply a submarine fumarole or spring, similar to the Sorgente Le Caldaje, which is met with in the sea at a point forming a triangle with the islets of Lisca Bianca and Bottaro between Lipari and Stromboli.

The following is the latest information in regard to the eruption of Vulcano (the letter is dated Lipari, December 12):—

"Some weeks since, the crater itself showed signs of diminishing activity. The eruptions are often at intervals of hours from each other, and never of such violence. Some days ago, a gentleman, Mr. Salino, says he had gone to the top of the mountain and seen the interior. This gentleman assured me that two-thirds of the old crater is filled up (he had visited the place eighteen years ago!); there was an opening of about 100 metres in diameter in the north-east side of the crater. No lava was seen."

From this it appears that the eruption is diminishing; that probably this filling up of the crater is due to the construction of a cone of eruption, or that it is being choked by the materials ejected from the new opening in the north-east side. Of course without examining the locality one can only conjecture what has really taken place. H. J. JOHNSTON-LAVIS.

Naples, December 15.

Natural Selection and the Origin of Species.

FOR the third time Mr. Thiselton Dyer announces that his judgment is opposed to the theory of physiological selection. But this is not the point that I am debating. I am not discussing the merits of my theory, or endeavouring to influence the opinion of a critic who, after having shown that he had not read my answer to the criticisms which he triumphantly reproduced as never having been answered, now tells us that he has "devoted a good deal of time to the study of" my "views." From the first I have restricted myself to meeting his specific allegations. Still restricting myself to the same ground, I find that there are but two points in his last letter which it is necessary for me to consider.

First, touching the inutility of some, as distinguished from the alleged utility of all, specific characters, Mr. Thiselton Dyer expresses impatience with me for putting what he regards as a "strained interpretation" on Mr. Darwin's writings.[1] Now, of all things in the world, this is exactly what I should most wish to avoid. But, rightly or wrongly, I am profoundly convinced that such strained interpretation as there is, here lies on the other side. Over and over again—and more and more emphatically the later the editions of his works—Mr. Darwin insists that he does not regard natural selection as the only agent which has been concerned in the origination of species, and therefore concludes—to quote only one additional passage from among many to the same effect: "No doubt the definite action of changed conditions, and the various causes of modification, lately specified, have all produced an effect, probably a great effect, independently of any advantage thus gained" ("Origin," p. 160). Moreover, towards the close of the last edition, he complains most bitterly of "steady misrepresentation" with regard to this very point (p. 421)—a complaint all the more forcible from its presenting the only note of bitterness that is to be met with through the whole range of his writings. Now, since his death, this "steady misrepresentation" has continued, until the post-Darwinian school have come to designate by the term "pure Darwinism" the very doctrine which he here so vehemently repudiates.

This doctrine of utility as universal was very clearly enunciated in his own life-time by Mr. Wallace, as "a necessary deduction from the theory of natural selection" ("Contributions," &c., p. 47), but, as just remarked, he expressly renounced it in his section headed "Utilitarian Doctrine, how far true." Therefore I say that, quite apart from all questions of biological theory, or merely as a matter of historical fact, any charge of "strained interpretation" must here lie at the door of those who seek to attribute to Mr. Darwin the opinions which have always been held by Mr. Wallace, and which have now been adopted by the school of Prof Weismann. Moreover, not only is there no sense or reason in speaking of the passages in

[1] He says: "What, however, I view with less patience than his unsustained generalizations, is his persistent attempt to place them on the shoulders of the Darwinian theory." Elsewhere, however, the crown and front of his charge is that I have sought to shrivel up the Darwinian theory to very small dimensions—nay, that I have roundly denied it altogether, if my words have any meaning. How these contradictory criticisms are to be reconciled I must leave their author to explain.

question as "admissions wrung from a hostile witness," or as due to Mr. Darwin "admitting the possibility of explanations to which he really, however, did not attach much importance;" but by thus endeavouring to belittle his judgment on these points, the post-Darwinians are merely showing the weakness of their own. These passages are due to Mr. Darwin having clearly perceived that the doctrine of Mr. Wallace was neither sound in logic nor true in fact. Not sound in logic, because it does not follow as a "necessary deduction from the theory of natural selection," that all specific characters must be adaptive—it being sufficient for the theory if only some such characters are adaptive in each case, as Mr. Huxley has recently shown; not true in fact, because any number of cases (such as those given by Mr. Mivart) can be quoted to the contrary. Therefore, as I said two years ago in the *Nineteenth Century*, those who seek to encumber the theory with this illogical deduction are merely giving occasion to the enemy; it is a gratuitous dogma, standing like the feet of clay in a figure of iron.[1]

But to pass on to the second point. In my last letter I challenged Mr. Dyer to justify his statements that I had roundly denied the agency of natural selection as "the mechanical means by which evolution has been brought about," and that the theory of physiological selection "shrivels up the part played by natural selection to very small dimensions." In answer, he quotes a passage from my paper, and agrees with me that what it says is substantially the same as what the *Times* said. But he still fails to see that this is totally different from what he himself said. In other words, unlike the *Times*, he does not perceive the validity of my distinction between natural selection as a theory of species and as a theory of adaptations. Physiological selection, he thinks, shrivels up natural selection, because, if a true principle in Nature, it must play an important part in the origination of species, and, in whatever measure it does this, it must in a corresponding measure detract from the importance of natural selection. Having at last got him to show that this is his way of regarding the matter, I must first of all repeat that natural selection, besides being a theory of the origin of species, is also something very much more: it is a theory of the cumulative development of adaptations, wherever these occur. In fact, it is, as I have before said, *primarily* a theory of adaptations in all cases, and only becomes *incidentally* a theory of species in those cases where the adaptations happen to be of merely specific value. It is now perfectly evident that Mr. Dyer fails to perceive this distinction; hence his misunderstanding of my views, and hence also the present correspondence. He regards the "origin of species" as synonymous with, and therefore as covering the whole field of, "organic evolution": therefore he accuses me of roundly denying natural selection as "the mechanical means by which that evolution has been brought about," on the ground that I have suggested a supplementary theory of the origin of species. Such being manifestly the impression under which he has read my paper, it is no wonder that in the process he has been, as he says, "completely befogged." I will now endeavour to clarify the matter by explaining at length what I had supposed the readers of my paper would have recognized for themselves.

It is quite true that the evolution of adaptations depends upon the evolution of species, the serial succession of which, in any given line of descent, is the necessary means (through the struggle for existence) to the gradual development of adaptations in that line. But it is of no consequence how many "indifferent" characters these successive species display, provided that they also display, in ever-improving degrees, the particular adaptive characters which are in course of evolution. A bird's wing, for example, is an adaptive structure which cannot be evolved as a merely specific character; it requires to be slowly built up through the lives of an enormous number of successive species, which ramify into genera, families, &c., as the process goes on. Now, throughout this process it is a matter of no consequence how many *other* features of a *non-adaptive* kind arise among all these innumerable species: it is enough, as regards the evolution of a wing, that at each stage of the process *some* of the species should present slight improvements on their predecessors in respect of this adaptive structure. Physiological selection, sexual selection, geographical isolation, "changed conditions" as to climate, &c., or any other "factor," may all the while have been originating any number of *species*, without reference to their wings, though, at the same time, natural selection was continuously promoting the development of wings in *genera*, *families*, and *orders*. In short, species are like leaves, successive and transient crops of which are necessary to the gradual building up of adaptations, while these, like the woody and permanent branches, grow continuously in importance and efficiency through all the tree of life. Now, it is the office of natural selection to see to the growth of these permanent branches: physiological selection has to do only with the deciduous leaves. Hence, although natural selection has likewise an immensely large share in the origination of species (*i.e.* has to do with all species which are distinguished by adaptive characters *peculiar to themselves*), this, in my view, is really much the least important part of its work. Not as discovering *an* agent in the differentiation of species, but as revealing *the* agent in the genesis of adaptations, do I regard Mr. Darwin's theory as the greatest generalization in the history of science. If this view of the matter betrays on my part, as Mr. Dyer says, a fundamental misunderstanding of that theory, I shall be greatly obliged to him for showing me wherein the misunderstanding consists. In the event of his doing so, I will cheerfully renounce the inquiry on which I am engaged, for then, no doubt, my theory would be found in opposition to—and not, as I suppose, in co-operation with—the theory of natural selection. On the other hand, should he fail to meet this request, I shall have "reluctantly to arrive at the conclusion" that the "fundamental misunderstanding" in this matter, like the "strained interpretation" previously considered, lies the other way.

It will now, I trust, be sufficiently evident why I differ *toto cælo* from Mr. Dyer where he concludes that the theory of physiological selection shrivels up the theory of natural selection. In point of fact, the former theory stands to the latter in precisely the same relation as does the theory of sexual selection. In both these supplementary theories, it is the origin of species that is concerned, and so concerned with reference to characters that are non-adaptive. The cases being thus precisely parallel, I should like to know whether my present critic regards one of Mr. Darwin's own theories as shrivelling up the other.[1] Assuredly, Mr. Darwin himself did not think so, because he clearly perceived that the "origin of species" constituted but a small part of the whole field of "organic evolution." It is true that he entitled his work "The Origin of Species by means of Natural Selection," and therefore in my paper I was careful to point out that, "if it appeared somewhat presumptuous to have insinuated that Mr. Darwin's great work on the 'origin of species' has been mis-named," there were passages in the work itself which fully justified me in my definition of his theory. My critic now quotes this explanation as justifying his statement that I intended to deny the agency of natural selection altogether! I do not quite know how to meet an opponent who resorts to such strange devices; but I may at any rate assure him that in my opinion no more appropriate title could have been chosen by Mr. Darwin for his great work than the one which he did choose; and if I spoke of that work as having been mis-named, I thought I had made it clear enough that I was "strictly speaking," or speaking to a point of logical definition. Moreover, at the time when the work in question appeared, the problem as to the origin of species was, as its author says, "the mystery of mysteries." But

[1] In connection with this point I have to express regret for a verbal error which Mr. Dyer has already pointed out in my last letter. But, from what he says of Prof. Nägeli's essay, it appears to me that he cannot have read it. At any rate, it is in no way confined to "the inutility of family characters," and in considering it Mr. Darwin supplies more than two pages of instances to illustrate his argument therewith, ending with the general conclusion:—"We thus see that with plants many morphological changes may be attributed to the laws of growth, and the interaction of parts, independently of natural selection." To ignore all such passages, or to regard them as admissions," is assuredly—once more to quote my critic's words against himself—"entirely to misapprehend their significance, or the spirit in which they were made"

[1] In this connection it is interesting to note that Mr. Wallace has always been the principal opponent of the theory of sexual selection, as he now is of the theory of physiological selection. Moreover, the reason of his opposition in both cases is that he thinks such subordinate theories of the origin of species must fail to find a *locus standi* in the presence of the greater theory of natural selection: the latter, in his view, must necessarily "shrivel up" the former. Now, his arguments against sexual selection are incomparably stronger than those which he has advanced against physiological selection (compare "Tropical Nature," pp. 192–211, with the *Fortnightly Review* for September 1886, and the *Nineteenth Century* for January 1887); yet they failed to influence the judgment of Mr. Darwin, whose very last words to science—read a few hours before his death to a meeting of the Zoological Society—were: "I may perhaps be here permitted to say that, after having carefully weighed, to the best of my ability, the various arguments which have been advanced against the principle of sexual selection, I remain firmly convinced of its truth."

now that we have all come to recognize species as nothing more than pronounced varieties, it appears to me a curiously interesting example of the "survival" of traditional modes of thought, that so many systematists still continue to regard the value of Mr. Darwin's theory to consist in what is really its least important function. The result has been clearly displayed in the present correspondence :—

> There's such divinity doth hedge a species,
> That science can but peep to what it would.

London, December 8. GEORGE J. ROMANES.

Engineers *versus* "Professors and College Men."

PROF. TAIT in his recent letter says that the only meaning the expression $\frac{Mv^2}{2g}$ conveys to his mind is the product of a mass by a length. But how does he measure his mass and his length? Is the mass to be measured in pounds or kilogrammes, or to be measured in units of g pounds or g kilogrammes? And is the unit of length the foot, or the metre or centimetre? so that g is variously 32, 9·81, or 981.

These are the points which are slurred over by "Professors and College men," but are of fundamental importance to practical engineers, who dare not trust to a formula till they have verified it numerically.

Let me conclude by giving Prof. Tait a question, selected from College text-books :—

"What is the meaning of $\frac{Mv^2}{2g}$ when the unit of area is one-tenth of an acre, the numerical value of g is 2, and the unit of weight is the weight of unit volume of the standard substance (the substance of which the specific gravity is unity)?"

I think he would be amused by the variety of answers he would receive, although the answers might individually be all correct.

December 17. A. G. GREENHILL.

Mr. Dodgson on Parallels.

MR. DODGSON has written to me thanking me heartily for my "interesting and helpful review" of his "New Theory of Parallels." He admits his slip in the corollary on p. 11, and supposes, as I had myself thought, he took ADC to be the triangle required instead of ABF. "But there is *one* criticism of yours which, if true, would vitiate the whole treatise. May I ask you to reconsider the point, and, should you see reason so to do, to notify to the readers of NATURE that you withdraw it? You say that, in Props. viii., xi., I tacitly assume that the 'amounts' of triangles are either *all* greater than two right angles, or else *all* less. . . . Such an assumption would indeed be monstrous." I willingly accede to Mr. Dodgson's request, as the following form of his argument, supplied in his letter to me, does away with my difficulty. "Either (α) there is a triangle whose 'amount' = two right angles, or (β) there is none. If (β) be true, then either ($\beta 1$) *all* triangles have *greater* 'amounts,' or ($\beta 2$) *all* have *less* amounts, or ($\beta 3$) some have *greater* amounts and all others *less*. Now ($\beta 1$) is proved impossible, in Prop. viii. ; ($\beta 2$) is proved impossible in Prop. xi. ; ($\beta 3$) may easily be proved impossible, by means of Prop. vii. Hence (β) is impossible. Hence (α) is true." It will be well, if, in a future edition, the missing link of ($\beta 3$) be supplied. One other point puzzles Mr. Dodgson. It is my remark on Prop. vi. : "How are the figures to be constructed if $n>2$?" Mr. Dodgson says : "It surely does not need pointing out that the operation of bisecting an angle may be repeated *ad libitum*." Certainly not. But what I meant was the effect of the e bisections upon the resultant chords. The figures to the proposition are incorrectly drawn : in the one figure BD, DC, and in the other BE, ED, DF, FC are *not drawn* greater than the radius, and my point was not the bisections but the enlargement of the figure : thus if $n = 3$, we should have eight triangles, vertices at the centre A, with the sum of their angles greater than 480°. My apology for thus trespassing upon valuable space is my desire to meet Mr. Dodgson's natural wish, and by pointing out what I thought were faults in his "interesting" *brochure* to enable him to make it more perfect in after editions. R. TUCKER.

University College School.

The *Porcupine* Echinoidea.

THE researches lately published by the Drs. Sarasin upon the anatomy of the Echinothuridæ, render a careful reconsideration of the types of Asthenosoma collected by the late Sir Wyville Thomson, during the voyage of H.M.S *Porcupine*, absolutely necessary in my opinion. The species were described in the Philosophical Transactions for 1874. I shall be much obliged if information can be sent me regarding the whereabouts of the specimens which were figured by Wild, *i.e.* the type-specimens of *Calveria* (*Asthenosoma*) *hystrix*, Wy. Th. ; *C.* (*Asthenosoma*) *fenestrata*, Wy. Th. ; and *Phormosoma placenta*, Wy. Th.

P. MARTIN DUNCAN.

Angry Birds.

IN reference to the notice of a fierce pheasant mentioned by Mr. Maw in the number of NATURE for December 13, I would refer him to my "Observations in Natural History" (p. 172), in which I have spoken of a daring cock pheasant, which I saw myself, while walking in the grounds of a friend in Cambridgeshire. This bird was in the habit of attacking any persons that approached near the spot where he was. Some woodcutters at work on the grounds had to protect their legs with strong leather gaiters. L. BLOMEFIELD.

Bath, December 18.

Two years ago, whilst walking across a fallow field here, I heard a fluttering of wings, and received a violent blow on the back of the neck from a partridge : before I could recover myself she struck the back of my head and knocked my hat off. Although I had a heavy stick, I could not drive off the bird, who, made a loud noise, and now attacked me in front. As I walked rapidly off, the bird followed and struck at me many times, attacking my head and shoulders with the greatest determination and violence. W. G. SMITH.

Dunstable.

PRESENTATION OF A PORTRAIT OF PROFESSOR A. W. WILLIAMSON, F.R.S., TO UNIVERSITY COLLEGE.

ON Wednesday (the 12th inst.) a portrait of Prof. A.W. Williamson, late Professor of Chemistry to University College, London, was presented to the College by Sir Henry E. Roscoe, M.P., F.R.S., on behalf of the committee of subscribers. The portrait is painted in oil by the Hon. John Collier. The presentation took place in one of the lecture-rooms, the chair being taken by the President of the College (Mr. John Erichsen, F.R.S.) ; and amongst those present were Sir F. A. Abel, Prof. Bonney, Prof. H. Morley, Dr. J. H. Gladstone, Prof. George Carey Foster, Dr. Atkinson, Prof. Ramsay, Prof. Thorpe, Prof. Marks, Prof. Russell Reynolds, and other Professors, and a large number of the past and present students of the College.

Dr. W. J. Russell, on behalf of the Committee, for whom he had acted as Treasurer, said that judging from the subscription list there was a large number of the former colleagues of Prof. Williamson who had subscribed to this portrait ; and it would no doubt be very pleasant to him to know that members of all the Chemical Societies in England had liberally subscribed towards the portrait ; and further, that many of the subscribers had not satisfied themselves by sending formal contributions, but had written to him (Dr. Russell) expressing their great esteem and regard for Dr. Williamson. The subscriptions did not come only from various parts of Great Britain, but from France, Germany, Switzerland, Italy, Russia, and even so far afield as the United States, Jamaica, India, and Japan. He thought this was all that it was necessary for him to say in order to indicate the high value which the subscribers attached to the great scientific attainments and labours of Dr. Williamson, whose intimate friends and old pupils, those who knew him best, now came forward to pay him this mark of their esteem and regard.

Sir Henry Roscoe, M.P., said :—I consider it, sir, a privilege that, as an old pupil and an attached friend of Dr. Williamson, I should have been chosen, on this occasion, to present his portrait—which I think you will

all consider as a life-like one—by Collier, to the College in which he laboured so faithfully and so successfully for nearly forty years. The first appointment of Dr. Williamson dates, as you, sir, are aware, from the year 1848, when, following Fownes, he was, as Professor of Practical Chemistry, placed in charge of the first teaching scientific laboratory established in England, and in a few years afterwards, on the resignation of Graham, he assumed the responsibilities of the two Chairs of Chemistry. A favourite pupil of Liebig's, Williamson had at Giessen imbibed the scientific spirit of that great master, and had, at the early age of nineteen, published his first original investigation. Afterwards carrying on his studies in Paris, and becoming intimate with Laurent and Gerhardt, he brought to London the best traditions of the French as well as of the German schools of chemistry, uniting in his person the attributes of both. Entering upon his duties in this College with the enthusiasm for his science characteristic of his nature, was it to be wondered at that he should have imparted to the young men who were fortunate enough to come under his influence some sparks of that fire which burnt so brightly in his own breast? I well remember the vivid interest, the keen appreciation, with which all those who studied in the Birkbeck Laboratory at that now distant time followed step by step the unfolding of his views on etherification, and on the constitution of salts, which may be truly said to have laid the foundations of modern organic chemistry. All those of his pupils who then made up their minds to devote their lives to chemistry, whether in the walks of the pure science or in those of its applications, must willingly own that much of the success which they may have met with in after years is due to his teaching and example; and admit that in the receptive period of a man's life the influence exerted upon them by a teacher whose years were not far removed from their own, of high aims and of ardent temperament, could not fail to be inspiring. This is not the occasion to inquire into the position which Williamson holds as one of the great chemists of our time and country. Rather is it our object now to express the feelings of gratitude and, if I may be allowed to say so, of affection, which we, who have been his pupils and are his friends, as well as those of us who can only claim the latter but perhaps no less intimate relationship, entertain towards him; to assure him that we look back upon the times spent in the laboratory with him as some of the pleasantest as well as some of the most fruitful of our lives. And both pupils and friends here join to show their appreciation of his labours and of his character, and to acknowledge the debt which they and their science owe to him. This portrait, sir, of our friend and master, finds a fitting resting-place within the walls of the College in which his working years were spent. It will remain as a memorial of a teacher, an investigator, and a colleague, whose main interest was to uphold and increase the renown of University College as a centre of intellectual progress, and of one whose character, both as a man and as a chemist, future generations, like our own, will delight to honour. It is now my pleasing duty to unveil the portrait, and to ask you, sir, as the President of this College, to accept it on behalf of the subscribers.

The portrait was then exposed to view.

The President said:—In the name of and on behalf of the Council and members of this College, I accept with gratitude this admirable likeness of our dear colleague and friend, Dr. Williamson. Sir Henry Roscoe has truly said that this is not the place to dilate on Dr. Williamson's great scientific merits, and the great claims which he has as a scientific man to any honour that could be bestowed upon him. I shall not venture on this subject, but I may say this: that looking at Dr. Williamson's career, as I can do, for the last forty years (thirty years of which he has been connected with this College), there never was a man more loyal to this institution, and more devoted to its best interests, than Dr. Williamson. The business of a Professor here is not only to teach, but to take part in the management of the College, which, as you know, devolves individually and collectively upon them. It is in the meetings of the Council and the Senate that the devotion of the Professors to the interests of the College is shown quite as much as in the teaching of classes. The College could not be worked without the business aptitude of the professorial staff; and in this duty of management none showed more zeal, loyalty, and devotion, during thirty years, than Dr. Williamson. We as a governing body must feel deeply indebted to him for the interest which he has shown in the welfare of this institution. But I should not be doing my duty if I were not to couple with his name that of his wife. Mrs. Williamson was as devoted as her husband, and did very much to raise the character of the School. She showed the greatest interest and enthusiasm in all the work which as a woman she was able to perform, and to bring about harmony within the walls of this institution. Mrs. Williamson worked side by side with her husband with unwearied devotion in, as I have already said, the best interests of University College. Ladies and gentlemen, I can only add in my own name, and in the name of this institution, the hope that Dr. Williamson and Mrs. Williamson will be followed with all health and happiness in their comparative retirement from further active work.

Sir Frederick Abel said:—Allow me to move a vote of thanks to the President of the College for his kindness in being the mouthpiece of many old friends in expressing as he has done the high respect and great affection entertained for Dr. Williamson by all his old colleagues. I desire to add that it is a great pleasure to me to be able to assist at this ceremony; and I, for one, am highly gratified at the life-like portrait presented to the College and accepted by you, sir, as President, on its behalf.

Dr. T. Anderson seconded the vote of thanks proposed by Sir Frederick Abel.

The President briefly acknowledged the compliment which had been paid him.

Dr. Williamson (who was received with cheers) said:—"I believe, sir, that the reward which upon the whole is most satisfactory (and which perhaps I may call the highest) which can be given to the man who has endeavoured to do his duty, is the expression of approbation from men of high authority on the subject-matter on which he has worked. The compliments which have been paid to me to-day have been enhanced greatly by some words which Sir Henry Roscoe let fall, and which could not have come with greater weight from anyone than from my old friend. It is to me a proud feeling—one which gives me great satisfaction—that in the decline of my life, and the end of my career, I should, from such a man—a man of such high character and position—have received so cordial and friendly an expression of approbation and personal esteem. I must ask leave, sir, to thank the Council, and you as their head, for the honour which you have done me in allowing my portrait to be placed within these walls; for although I have been associated with other colleagues, and have performed duties of other kinds, there is no place that I have felt it so great an honour to be connected with as University College. Here I have been associated with many men who have made noble self-sacrificing efforts in the best interests of this institution. I look back with pride on my connection with my colleagues of this College, though I have often bitterly regretted that my intercourse with the students has not been more personal. Sometimes a man comes up to me, shakes me by the hand, and calls me by my name, and I am obliged, to my shame, to confess that I do not know his name, which I am obliged to ask, and then I find he was an old student who knew me perfectly, remembered my lecturing in a long dark room, in which I was visible

to him, though he was not visible to me. I have often very much regretted that I have not been brought into closer relations with this large body of earnest men and students. Still, among those whom I have known I have found many esteemed friends. I do not think it desirable for me to make further remarks, beyond expressing to Mr. Collier my appreciation of his success in making what is not an ugly portrait out of such an ugly face as mine.

The proceedings then terminated.

In the evening Dr. Williamson was entertained at dinner at the Freemasons' Tavern by a goodly number of his friends and old pupils. Sir Henry Roscoe presided. After the toast of the Queen had been given and duly honoured, Mr. Carteighe, one of the honorary secretaries, announced that a considerable number of letters from subscribers had been received, expressing their regret at not being able to be present. The one from Prof. Michael Foster, F.R.S., referred humorously to Dr. Williamson as the "Ether Meister."

Sir Henry Roscoe, in proposing the toast of the evening, "Our Guest" (Dr. Williamson), alluded in kindly and affectionate terms to his early association with him, to his enthusiasm as a teacher, and to the respect in which he was held by men of science all over the world.

Dr. Williamson, in replying, expressed the gratification which their hospitality and kindness had afforded him, and referred with pride and satisfaction to the great honour which had been conferred upon him in the presentation of his portrait to University College. In conclusion, he invited any of his old pupils, present and absent, when in the neighourhood of Hindhead to call and see him in his "nest."

Mr. Norman Lockyer, F.R.S., proposed "University College and its President," and Mr. J. Eric Erichsen, F.R.S., the President, replied.

Prof. W. H. Flower, F.R.S., submitted "The Professors of University College." Prof. Henry Morley responded for the Arts Faculty, and Prof. G. C. Foster for that of Science.

Prof. Ramsay, F.R.S., proposed "The Chairman," and Sir Henry Roscoe, M.P., responded.

Prof. T. E. Thorpe, F.R.S., proposed "The Committee of the Williamson Testimonial," to which Mr. Michael Carteighe, President of the Pharmaceutical Society, and Dr. H. Forster Morley, the honorary secretaries, replied.

THE MORPHOLOGY OF BIRDS.[1]

II.

THE second part of vol. ii. is taxonomic and systematic. The author criticizes and tests the taxonomic value of the numerous characters of all the organic systems; each paragraph forms therefore a condensed *résumé* of our present knowledge of the various organs, with especial reference to those parts which proved to be of more than ordinary taxonomic importance. The question if an organ is of taxonomic value at all does not depend upon the presence or absence of the organ itself, but upon what it is like. Hence the weakness of those systems which have been based upon positive and negative characters only; even Garrod failed, since he took for his guidance not quality, but merely quantity. Those organic characters are preferable which exhibit a certain amount of differentiation, but which at the same time do not vary much within the limits of smaller groups of birds. Through combination of a considerable number of such characters, to be taken from organs between which there can be but little correlation, we have the best chance of arriving at a sound system. But of such characters there are, unfortunately, few.

However, on pp. 1580–91, Fuerbringer has selected forty-eight characters, not all, of course, of equal value, and has arranged them in tabular form, together with the ninety families into which he divides the birds. Especial attention may be drawn to the second column, which contains the first known occurrence of fossil members of each of the families. This column, together with the remarks on pp. 1107–10, and the discussions under the heading of each family in the special systematic part of the book, contains the only complete and critical essay on fossil birds that has yet been published.

But it is impossible to give here anything besides occasional hints about the vast amount of thought which the author has bestowed upon nearly all the organic systems, always on the look out for characters which might perhaps prove constant enough to act as guides amongst the chaos of the natural affinities of birds, always awake where great adaptiveness or convergence of forms might easily lead us astray.

Bill and feet proved to be of comparatively little value, in spite of their historical significance; the same applies to the oil-gland; whilst pterylosis is never to be neglected, especially that of the embryo.

Oology.—The size of the eggs depends upon the terrestrial, aquatic, or aërial life of the birds. Those which make their nests in high trees lay, as a rule, smaller eggs, and are "altrices"; whilst those which lay the eggs on the ground, and are "precoces," have more and larger eggs. Thickness of the shell, or the weight of the egg, often depends upon the smaller or greater liability of the eggs to external injury. The colour of the eggs stands, like that of the female bird, in correlation with the configuration of the nest, and affords good characters for classification. The best character, however, is formed by the finer structure or texture of the shell, since this remains unchanged in the species, and can also successfully be used for the recognition of wider relationship.

Skeletal System.—The importance of relative measurements has induced the author to look for a unit applicable to all birds. This he finds ingeniously in the average length of the dorsal vertebræ, because of the constancy of these parts. The numerous tables, which contain (pp. 794–800) an enormous number of measurements, have shown, however, that their taxonomic value is but very limited. The total number of vertebræ is inconstant even in the individual, and varies in larger groups to such an extent (Limicolæ 43–50, Anseres 50–63) that it can hardly be used in determining the systematic position of a given bird. Better results are yielded by the numbers of the cervical, thoracic, and sacral vertebræ alone, and their proportionate quantity, cf. Table xxii. pp. 778–79.

In the configuration of the sternum, the anterior margin, with its spine, is the most noteworthy point.

Of greater value is the configuration of the maxillo-palatine apparatus, as was first pointed out by Nitzsch, J. Mueller, and especially by Cornay in 1847. Huxley's classification, based upon these characters, in 1867, marked an epoch in the systematics of birds; but it is artificial, not natural, as the numerous exceptions and intermediate stages show, which have been discovered by later anatomists. The basipterygoid processes likewise afford gradual differences only. The whole maxillo-palatine apparatus is far too adaptive to permit of its use as a safe guide in classification.

The hyoid bones afford a rather good generic, and occasionally even a family character.

The size of the coraco-scapular angle depends in inversed ratio upon the development of the shoulder-muscles. This, with the various dimensions of the scapula, the processes and foramina of the coracoid, &c., receive special attention in the tabular lists, pp. 738–57,

[1] "Untersuchungen zur Morphologie und Systematik der Voegel, zugleich ein Beitrag zur Anatomie der Stuetz- und Bewegungsorgane." Von Max Fuerbringer, Professor der Anatomie, und Direktor des anatomischen Institutes und des Museum Vrolik der Universitaet zu Amsterdam. Mit 30 Tafeln. (Amsterdam: T. van Holkema, 1888.) Continued from p. 152.

and in the text of the osteological part of the book. Table xxxvii. contains the length of the humerus in units of dorsal vertebræ.

Pp. 1042–47 form a condensed essay on the pelvis. The difficulties of homologizing its constituent parts with those of other Vertebrata are pointed out, but they are not solved. The pelvis, as a whole, has never been tested sufficiently as to its taxonomic value, and the adaptability of the limbs, both anterior and posterior, warns us not to lay too much stress upon these parts either.

Pp. 1053–66.—Fuerbringer points out which muscles are of systematic importance, also how far and in which groups of birds he found them to be so.

The results yielded by the most extensive examination of the brachial plexus (pp. 232–80, Plates 8–10) are morphological only, but of no taxonomic value.

In his treatment of the sense-organs, the digestive, vascular, excretory, and reproductive systems, he gives only a more or less cursory review of the work of other anatomists. The organs of voice and respiration receive more attention. The author distinguishes between (1) syrinx trachealis, possessed by the Passeres tracheophonæ, and in a less finished degree by certain Pelargi; (2) s. tracheobronchialis (Psittaci, Passeres, Pseudoscines = Menura and Atrichia); (3) s. bronchialis, many Cuculidæ, Caprimulgidæ, Strigidæ, &c.

Concerning the ontogenetic development of birds, Fuerbringer has been struck with the extraordinary resemblance which the embryos of certain families exhibit to each other before the divergence of the final formation of beak and feet has been fixed. Thus, Laridæ and Limicolæ, Pici and Passeres, Striges and Caprimulgidæ, indicate in these stages close relationship.

Remarkable, although rather short (pp. 1107–19) are the chapters on palæontological development and on geographical distribution. The hypothetical division of the world into Arcto- and Neogæa is not favoured, whilst Lemuria is justly re-established. Explanations of the present distribution of the Ratitæ, Spheniscidæ, Rasores, Passeres, and other principal orders are attempted, and if not always successfully solved, are at least partly cleared up by the allusion to fossil intermediate forms.

The cradle of the Passeres is very old, of Cretaceous age, and existed probably in the Oriental region; the Eurylæmidæ still exist as the last and least modified descendants of the primæval Passeres. Thence they spread all over the globe. About the beginning of the Miocene age one stock branched off, likewise in the Oriental region, as the Oscine type, the numbers of which conquered the world, with the exception of the Neotropical region, which they reached last, and found already fully occupied by their older but highly developed relatives the Oligomyodi and Tracheophones.

The outcome of all this work is a most elaborate systematic arrangement of birds, recent and extinct. This occupies pp. 1136–1591.

Family after family is discussed as to its characters, affinities, distribution, first fossil occurrence, and the position it held in the opinion of previous ornithologists and anatomists.

Fuerbringer's system of birds is almost entirely new, less striking in the arrangement of the families and the placement of odd or solitary genera than in the disposal of the whole host of birds into a few large orders. Such a grouping together has been a long-felt desideratum, because the close adherence to the principle "*Divide et impera*" has led to a splitting up of the birds into an ever-increasing number of groups, whilst their combination into greater phyla was in danger of being lost sight of.

This want of generalization made us hail the terms Schizo-, Desmo-, Ægitho-gnathæ; but they were hardly established as household words amongst ornithologists before Schizorhinæ and Holorhinæ, Homalogonatæ and Anomalogonatæ, went through their short-lived existence, and in their turn gave way to other principles of classification by Garrod and Forbes, which will easily be detected in the system now before us. The class Aves is divided into two sub-classes, eight orders, twenty-four sub-orders, forty-five gentes, and ninety families. The orders, especially the four into which the Carinatæ are divided, represent such centres or phyla as we have been longing for, and around them are arranged other, mostly aberrant or much specialized, groups as "intermediary sub-orders." The orders end each in *-ornithes*, the sub-orders throughout in- *formes* (see table on next page).

This system of birds is graphically illustrated by two side views of an elaborate "ancestral tree," on Plates 27*c*, 28, and by three more plates which represent three horizontal sections through this ideal tree. The author justly insists upon the necessity of constructing such ancestral pedigrees in the three dimensions, and he has himself taken care to indicate isomorphism, *e.g.* Gypogeranus and Cariama, Procellariidæ and Steganopodes, by the convergence of the branches.

It is, of course, beyond the scope of this review to enter into many of Fuerbringer's ideas on the affinities of all the families of birds. Only those of general interest can here be dealt with.

The old group of the *Odontornithes* has properly been discarded; their constituent members have been distributed amongst the other birds. Probably all birds possessed teeth during the Cretaceous epoch.

Archæopteryx belongs to the primitive Carinate flying birds or Proto-Ptenornithes. It cannot be decided whether it is a direct ancestor of living Carinate birds; but there are no valid reasons why it should be looked upon as an intercalary type between reptiles and birds.

We learn more about the Ratitæ. They are Deuter-Aptenornithes, *i.e.* they are descendants of Ptenornithes, but have lost their power of flight. The differences between the various forms which are generally recognized under the name of Ratitæ are so great, that these birds cannot collectively be opposed to the Carinatæ. Struthio, Rhea, and Dromæus Casuarius are each representatives of separate orders. Fuerbringer approaches the views of Sir Richard Owen, who more than twenty years ago suggested that the various Ratite birds are the descendants of several groups of the Carinatæ, but that they have become modified in similar directions: their Ratite characters are cases of analogy, and do not indicate near relationship. The separation from the common Carinate stock took place very early, certainly as early as the Cretaceous epoch. The root of the Struthiornithes perhaps contains fibres of the later Pelargornithes, whilst the Rheornithes and Hippalectryornithes have also some traces in common with the primitive or dawning Charadriornithes and Alectorornithes. Lastly, the New Zealand Ratitæ, Apteryx, and Dinornis resemble the Carinatæ in so many features that they form only the sub-order Apterygiformes of the order Alectorornithes. The affinities of Apteryx with the Crypturi and Fulicariæ are even greater than those with the other Ratitæ.

For Carinatæ the synonym Acrocoracoideæ has been invented, but the author does not see his way to accepting them as a separate sub-class, since he had to break up the Ratitæ.

The most primitive forms amongst the Ornithuræ are the American Cretaceous Ichthyornis and Apatornis. They differ from recent Carinate birds in degree only, viz. by their tormodont teeth and amphicœlous vertebræ. They stand nearest to the Laridæ, with touches of the Procellariidæ and Ciconiiformes.

Hesperornis has most probably lost the keel of its sternum, and in correlation with this loss has also acquired platy-

CLASSIS AVES.

I.—Subclassis Saururæ.

Order.	Sub-order.	Gens.
ARCHORNITHES	Archæopterygiformes	Archæopteryges.

II.—Subclassis Ornithuræ.

STRUTHIORNITHES	Struthioniformes	Struthiones.
RHEORNITHES	Rheiformes	Rheæ.
HIPPALECTRYORNITHES ...	Casuariiformes	Casuarii = Dromæus + Casuarius + Dromornis.
Intermed.	S.O. Æpyornithiformes	Æpyornithes.
Intermed.	S.O. Palamedeiformes	Palamedeæ.
PELARGORNITHES	Anseriformes	Gastornithes. Anseres s. Lamellirostres.
	Podicipitiformes	Enaliornithes. Hesperornithes. Colymbo-Podicipites.
	Ciconiiformes	Phœnicopteri. Pelargo-Herodii. Accipitres. Steganopodes.
Intermed.	S.O. Procellariiformes	Procellariæ s. Tubinares.
Intermed.	S.O. Aptenodytiformes	Aptenodytes s. Impennes.
Intermed.	S.O. Ichthyornithiformes	Ichthyornithes.
CHARADRIORNITHES	Charadriiformes	Laro-Limicolæ. Parræ. Otides.
Intermed.	S.O. Gruiformes	Eurypygæ, incl. Rhinochetus, Aptornis. Grues = Grus + Psophia + Cariama.
Intermed.	S.O. Ralliformes	Fulicariæ = Heliornis + Rallidæ. Hemipodii = Mesites + Hemipodiidæ.
ALECTORORNITHES	Apterygiformes	Apteryges = Apteryx + Dinornis.
	Crypturiformes	Crypturi.
	Galliformes	Galli = Gallidæ + Opisthocomidæ.
Intermed.	S.O. Columbiformes	Pterocletes. Columbæ.
Intermed.	S.O. Psittaciformes	Psittaci.
CORACORNITHES	Coccygiformes	Coccyges = Musophagidæ + Cuculidæ.
		Intermed. G. Galbulæ, incl. Bucconidæ?
	Pico-Passeriformes	Pico-Passeres. { Pici. Passeres.
		Makrochires.
		Colii.
		Intermed. G. Trogones.
	Halcyoniformes	Halcyones. Bucerotes, incl. Upupa. Meropes.
		Intermed. G. Todi.
	Coraciiformes	Coraciæ. Caprimulgi. Striges.

coracoidal features; it would therefore have to be grouped with the Ratitæ if we wanted to degrade this expression to a collective term for cases of converging analogies or isomorphism, and thus deprive it of any phylogenetic meaning. The characters which mark Hesperornis as an Aptenornith are secondarily acquired, whilst all the rest of the skeletal characters indicate its close affinity with the European Enaliornis, and amongst recent birds with the Colymbidæ and Podicipedidæ. This relationship receives its final expression by the establishment of the order Podicipitiformes.

These Podicipitiformes, with the Anseriformes and with the Ciconiiformes, are combined in one big order, *Pelargornithes*. In proportion as the first two of these orders appear circumscribed and natural the Ciconiiformes appear heterogeneous They are made to contain the Phœnicopteri, Pelargo-Herodii, Steganopodes, and the Accipitres or diurnal birds of prey. The close affinity of the Phœnicopteri with the Pelargi is beyond doubt, and so is that of the Storks and Herons, and that of the latter with the Steganopodes. But how the Accipitres should be related to the other three or four gentes seems less clear. However, we must not forget that already Garrod had arrived at similar conclusions. Fuerbringer holds that the Cathartidæ are a very old and now declining Raptorial family, and that they have many structural points in common with the Ciconiidæ, whilst the Gypofalconidæ exhibit genetic relations with the Steganopodes (Fregata) and with the Ardeidæ. Gypogeranus had formerly (Miocene of France) a much wider distribution than now, and it is the last remnant of a group which branched off from the common Accipitrine Stork before the division into Cathartidæ and Gypofalconidæ took place.

Steganopodes are known to have existed in the earliest Eocene period, and are now on the decline; lowest amongst them stand now the Phætontidæ, highest the Fregatidæ. Their rather striking affinities with the Accipitres have already been mentioned, perhaps they are as distantly connected with the Pelargo-Herodii.

Pelargo-Herodii.—Plataleidæ form the lowest type, and afford some points of connection with the Limicolæ; Ardeidæ, the highest and most flourishing family, exhibit various characters by which we might trace their pedigree towards the roots of Colymbus, Haliæus, Falco, and others. This diversity of connections indicates either

that the Pelargo-Herodii are an extremely old group, which has preserved features common to all the other Pelargornithes, or that the division into the various much specialized gentes took place rather recently. Fossil material seems to favour the latter view, and this circumstance probably explains why the Ciconiæ have more in common with the Cathartidæ, whilst the Ardeæ approach the Steganopodes and Falconidæ. Why the Flamingoes should be elevated to the rank of a gens does not appear clear, considering their close genetic connection with the Pelargi, especially through the Miocene Palælodus.

Anseriformes.—Probably an old and small pre-Miocene group, which has marked its broader development more recently. The Eocene Gastornis seems to have been a gigantic type, which had lost its power of flight, like the diluvial Cnemiornis of New Zealand. Amongst recent Lamellirostres, Mergus is the lowest, Cygnus the highest type; they are distantly related to the Podicipitiformes.

Palamedeiformes show many connective points with the Anseres, Steganopodes, and Pelargo-Herodii, but their reception into the Pelargornithes is rendered impossible by various fundamental and primitive peculiarities. Through their intestines and pterylosis they somewhat resemble Rhea. Whether we place them nearer to the Anseres than to the Pelargi and Steganopodes depends upon the taxonomic value which we happen to attribute to their skeletal, muscular, intestinal, or external features.

The Antarctic *Aptenodytiformes*, s. Spheniscidæ, are a very old family, because the genus Palæeudyptes shows that they had become specialized into diving and swimming birds with total loss of the power of flight in the Eocene period, or probably even earlier. Fuerbringer calls the Penguins Trit-Aptenornithes, indicating that they, like the Great Auk, the Dodo, Ocydromus, and others, have lost their power of flight later than the Ratitæ. A sharp line between Deutero- and Trit-Aptenornithes cannot, however, be drawn, since Cnemiornis, Gastornis, &c., are intermediate forms, just as Stringops is now on the way to become Aptenornithic.

Many of the characters of the Penguins generally considered as primitive are partly "pseudo-primitive," *i.e.* phylogenetically reduced and ontogenetically retarded; *e.g.* the structure and distribution of the feathers, the finlike anterior extremities, the broad scapula, and, according to Fuerbringer, even the metatarsus. The resemblances with Podiceps and Colymbus are superficial only, but he cannot tell to which of recent birds the Penguins approach nearest. All that the author contends against is the removal of the Penguins into a sub-class, equivalent to the rest of the Carinatæ. On Plate 29*a* they are represented as a lonely group.

The *Procellariiformes*, or Tubinares, have likewise the rank of a sub-order, intermediate between Steganopodes, Ichthyornis, Spheniscidæ, and Charadriiformes. They are certainly a very old and now isolated group.

The large order of the CHARADRIORNITHES has split into aquatic and gralline types. The Alcidæ are closely allied to the Laridæ, and are probably the most recent of those birds which have assumed a pre-eminently aquatic and diving life, with correlated reduction of the wings. They are restricted to the periarctic zones of the northern hemisphere, whilst their relatives, the Gulls, enjoy a cosmopolitan range. There can be but little doubt that the oldest *Charadriiformes* were gralline, so that the Otides, with Œdicnemus, Parra, and the Thinocoridæ, stand nearer the common stock than the more specialized aquatic members.

The *Gruiformes* are connected with the Charadriiformes by Eurypyga, with the Ralliformes by Aramus. They seem to have reached their culminating period in the Miocene age. Dicholophus is the most highly-specialized form, and has assumed peculiar Raptorial characters isomorphic with those of Gypogeranus, which is a true bird of prey.

The *Ralliformes* flourished as early as the Eocene period. The Fulicariæ, consisting of the Rallidæ and Heliornis, are more nearly related to the Hemipodii than to the Crypturi. The sub-order of the Ralliformes takes, therefore, a position intermediate between Gruiformes, Crypturiformes, and Apterygiformes.

The latter two sub-orders, together with the Galliformes, constitute the order ALECTORORNITHES.

The relationship of the Crypturi with the Apteryges is real, and bridges over the gulf between Carinate and Ratite birds, especially through cranial and pelvic structures.

The *Galliformes* proper consist of three families: Megapodii, of Austro-Malayan distribution; Neotropical Cracidæ; and universal Gallidæ. The two former exhibit so many important differences in their soft parts that, in spite of their numerous skeletal resemblances, they cannot be opposed to the rest of the Fowls as Peristeropodes. Closely allied to the Galli is Opisthocomus, an old type now dying out; the last solitary species has reached a high degree of one-sided specialization, which elevates this bird above its nearest allies to the level of low arboreal birds.

Columbiformes stand between Charadriiformes and Peristeropodes, perhaps nearer the former through the Pterocletes, which are undoubtedly the more primitive group, whilst Columbæ, beginning with the Miocene only, are still on the ascending scale, and are birds of the future. Didus and Pezophaps are degenerate Columbæ, not necessarily very old forms.

Psittaciformes.—The affinities of the Parrots have puzzled Fuerbringer as much as other ornithologists. He places them as an intermediate sub-order, like the Columbiformes, between the Alectorornithes and Coracornithes. Our knowledge of fossil Parrots is very defective. They existed in the Lower Miocene of France, typically developed; now they are a large, numerous group of birds, with more than intertropical range, and with no living members through which they approach other groups.

The last great order is that of the CORACORNITHES.

The *Cuculiformes* = Musophagidæ and Cuculidæ, are connected with the ancestral Limicolæ and Galli; however, their roots meet so distantly, certainly not later than the earliest Eocene period, that these birds have gone along parallel lines of development since those remote times, and that the Cuculiformes cannot be classed with either Galliformes or Charadriiformes. Their original centre was probably the Oriental region, whence they spread chiefly in Western directions.

The *Coraciiformes* are relatively least removed from the Charadriiformes. The Coraciæ represent the lowest group of arboreal birds, and are related to the Caprimulgi, more remotely to the Owls, Trogons, and Bee-eaters. The Caprimulgi include necessarily the Podargidæ and Steatornithidæ, whilst their apparent similarity with the Cypseli rests chiefly upon secondary analogies. The same applies to the Striges with reference to the Accipitres. Owls have so many important points in common with the Coraciæ (Leptosomus), and especially with the Podargidæ, that they have to be looked upon as Raptorial Coraciiformes or "Podargoharpages."

Halcyoniformes.—The Halcyones, Meropes, and Bucerotes—the latter of course including Upupa—form a pre-eminently palæogæic group of syndactylous birds. The Todi, including the Motmots, connect them with the previous and with the next following sub-order. The same applies to the Trogons.

Pico-Passeriformes.—This large sub-order contains the Pico-Passeres, Makrochires, and the Colii. The Colii have frequently been classed with or near the Musophagidæ, Fuerbringer thinks owing to superficial analogies only. They are now a very lonely little group in the Ethiopian region, without any known history, or without

satisfactory indications of their pedigree, their affinities with the Cypseli being perhaps the least far-fetched.

The *Makrochires* = Cypselidæ + Trochilidæ, prove to be far more closely related to the Passeres than to the Caprimulgi. The old group of the "Cypselomorphæ" had therefore to be broken up.

Pico-Passeres.—Very intimate relationship connects the Indicatoridæ, Capitonidæ, Rhamphastidæ, and the Picidæ to one group—*Pici*. Primitive Pici existed in the Eocene age; many threads bind them to the Galbulæ and to the Halcyones, still more to the Pseudoscines.

Passeres.—They represent the highest types which the avian stock has as yet developed. In spite of their enormous number of genera and species, which surpasses that of all the rest of the birds, they agree so closely with each other in all their principal and primary characters that the Passeres proper are morphologically only of the value of one family. This uniformity has naturally always rendered their further classification very difficult.

Fuerbringer divides them as follows, in close conformity with the views held by most English ornithologists.

I. Family *Pseudoscines* = Atrichia + Menura.—They are types which are now dying out, and which differ from all other Passeres through those characters which they have in common with the Pici.

II. Family *Passeridæ*, with four sub-families.

(1) Desmodactyli = Eurylæmidæ.—They differ fundamentally from the Coraciæ, and are the last remnants of the oldest Passerine forms.

(2) *Oligomyodi.*—Their wide distribution—*e.g.* Pitta in the Oriental and Ethiopian regions, Xenicus in New Zealand, the overwhelming majority in the Neotropical region—sufficiently indicates the extreme age of the Oligomyodi, and sufficiently accounts for the great diversity in the development of the syrinx, podotheca, and femoral artery, &c., which makes these birds appear a rather heterogeneous group.

(3) *Tracheophones.*—The tracheophonous syrinx, and the entirely Neotropical distribution of the Conopophaginæ, Pteroptochinæ, Formicariinæ, Furnariinæ, and Dendrocolaptinæ, suggest a monophyletic origin of these birds from lower American Oligomyodi.

(4) *Oscines* s. *Acromyodi.*—This family forms what may be called the topmost branches of the avian tree, with the Corvinæ as its culmination. It is characterized by the diacromyodean syrinx, and by the bilaminate covering of the tarsus. The latter feature occurs, however, also in the tracheophonous genus Heterocnemis, and is absent in the Alaudinæ.

Regarding the development of these four sub-families of the Passeridæ, the reader may be referred to a previous page (p. 178) of this summary.

Most probably all birds are the descendants of one reptilian form, though of which we do not know. The first lizard-like birds were small, and very likely terrestrial. They diverged into climbers on rocks and trees, and into inhabitants of swampy regions. The latter stock gave rise to swimming birds. The first birds were not vegetable feeders, as is generally supposed, but lived on insects and other small Invertebrata.

Lastly, there arises the question: What are the reasons for the natural extinction of large birds? Not predestination or catastrophes.

High differentiation, possible only through the one-sided development of certain organic systems and correlated regressive metamorphosis of the others, has, in the older groups of birds, frequently led to increased size of the body. This size, although securing a predominant position to the birds for the time being, inevitably implies the turning-point in the height of their development Large or highly specialized animals will be least able to adapt themselves to further changes of their never-stationary, ever-changing surroundings, because, through their very one-sidedness, the retrograded as well as the most specialized organs have rendered the whole organism more fixed than is the case with lower or less differentiated and therefore still plastic contemporaries. Amongst the younger groups of birds such a large size as is common amongst old and isolated types has not yet been reached, and probably will always be avoided. Small, but equally developed, will be the birds of the future.

So far so good. But with all this praise, are there no faults in Prof. Fuerbringer's work? Certainly, there are some. Its greatest fault may be indicated and at the same time explained in one sentence. If the author had been able to devote another year's labour to his "Epoche machenden Untersuchungen," he probably would have written a smaller book. H. GADOW.

MUSINGS ON A MEADOW.

TO the general observer nothing in the way of vegetation would appear to present so few aspects, so limited a scope to the imagination and the associative faculties, as an expanse of herbage; and yet, perhaps, nothing that bountiful Nature has provided for the use and service of men so teems with the variety of associations that it presents to each different mind.

The farmer, whether he be the farmer of England, the wandering Bedouin, or the ranch-man of the New World, looks at the broad pastures and far-stretching plains, but not to admire the mingled masses of gorgeous colours, not to speculate upon the battle that may have been fought upon this spot or the scenes that have happened there in former times, not to separate the numerous varieties of grasses into their many botanical genera and species, but to calculate how many sheep he can feed to the acre upon it, whether there is enough of white clover to fatten his camels upon, or whether his horses will have a sufficiency of suitable food to graze upon. The wide wild waste of endless lines of pale yellow, red, and gray, conveys no pleasure, but merely the indication of a good soil; and the buttercups and daisies he sees in the pasture meadows of England, hallowed by songs and memories, are to his economic eye positively offensive; knowing, as he does, that the older these buttercups grow, the more distasteful they become to stock, but never stopping to discover that it is because they become more acrid. To him it would seem a species of legerdemain if a botanist were to say to him, pointing to a buttercup, "Dig that up, and you will find a tuber at the root," and were then to select another, apparently similar in appearance to the former, and were to tell him that it had no tuber at the root; for from his eyes are completely hidden those minute differences so easily seen by the specialist between *Ranunculus bulbosus* and *Ranunculus acris*.

The botanist, on the other hand, as his eye rests on the same spreading plains of green, is utterly regardless of the feeding value of the plants that he sees before him. As he wanders from country to country, his eager eye detects the diminution or increase of particular species in different latitudes and altitudes, searching out the truths of Nature, or watching with a view to the confirmation of some pet theory. His mind ranges over the different prairies, plains, and meadows of the world. Again the battle of plant life is waging for him. His delight is unbounded. Every plant has its own history, so evident to him, so abstruse to the mere superficial observer; and, involuntarily, associations crowd upon his mind, of some musty tome perchance, or some ancient and not very accurate plate, or some amusing anecdote. For example, the cactus in the plains of Arizona or Texas reminds him of the many times he has seen this genus portrayed in pictures of the Holy Land at the time of the Founder of Christianity, and how, even in books pretending to be learned, he has met with it in the description of the plants of Syria of 2000 years ago, although, as a matter of sober history, this

plant was only introduced into the Eastern Hemisphere after the discovery of America, in which continent the cactus is indigenous. Even if he be colour-blind, and the petals of the blazing poppy show to him the same tone as its sober sepals, yet he is still able to admire the beauty of form, which conveys to him the history of the development of the plant from its seed, and he would still be in the position to give a discourse interesting to the uninitiated though intelligent observer ; and at the end of an hour's conversation, in common with others, he would be compelled to exclaim that there was still much in the life of the plant of which he was utterly ignorant—so limitless are the subtle workings of Nature !

But what does the artist care for either of these views ? He cares not for the fattening of stock. He feasts with rapture on the different grays, greens, yellows, blues, and reds, that are spread out before him, and on the delicate tints and shadows cast by every passing cloud. He cares not to know of the buttercups and daisies that grow there ; it would even distress him to tell him that the yellow-greens are groups of fescues, and the blue-greens patches of cock's-foot and fox-tail. What is that to him ? He was wondering what colour in his box would reproduce those delicate tones. He does not seek to know how much corn to the acre that meadow would grow if ploughed up, nor how much it might once have grown. To him it is merely one endless feast of colour.

Perchance more sordid ideas of another kind may occur to him. Apprehensions as to the hanging of his picture may dispel his rapture in Nature's handiwork, and his mind may be occupied with a fear lest the red ground of his neighbour's picture will kill his own more delicate tones. Pounds, shillings, and pence, the cares of a wife and family, are apt to destroy for a time the beauties of Nature.

How happy is the man who sketches and sketches only to reproduce for himself these works of Nature ; whether they be the meadows of England, dotted with short-horns and Hampshire Downs, and bounded by the rook-sheltering elm ; or the plain of Megiddo ; or the boundless prairie of Manitoba.

How differently again would the antiquary survey the self-same scene ! His mind would revert to the people who trod these plains in days of yore. Their history, manners, customs, dress, and social habits, would open out to him a wide field of speculation. On this very pasture contending armies may once have trod, and the ebbing life-blood of patriotic heroes once have flowed. His eyes may be resting on a Bannockburn, or a Worcester, or a spot where the Carthaginians of old strove against the might of Rome, and were worsted in the fight. Here the chariots of the Egyptians may have rolled, or the devoted Aztecs have struggled hopelessly against their Spanish conquerors.

The contemplation of the plains produces in him yet another train of thought. He conjures up an historical novel or poem, but finds he has merely repeated the ideas he has read before : he casts them aside and starts afresh ; and still he envies the artist the ever-changing phases, and the botanist the unsearchable workings, of Nature. To him there are limits fixed and defined : his speculations are restricted to the period of man's existence on this globe, but for the painter and botanist the range and variety of subject are illimitable.

Thus the pasture and the prairie grow up and die away, containing, like most things in this world, their quota of good and bad. Some weeds go unregarded ; the pernicious effects of others become so prominent that they are recognized at once and hated accordingly, like the grass *Cenchrus tribuloides*, which bears a prickly fruit that winds itself into the wool of the sheep, and renders the rearing of sheep where it exists impossible ; while other plants, such as clover, and the blue grass, arrest the attention of even the careless agriculturist by their manifest merits.

Now, to all, these herb-clothed portions of the earth offer themselves in various phases according as the mind is prepared to receive them ; and happy is he who can so adjust his mind, and concentrate his thoughts upon the phase required ; though so devious are the paths of Nature that he will often travel far, and then, as a man traversing a labyrinth, be checked by some such knotty question as : "How does a plant obtain its nitrogen ?" and he will have to return to the post from which he started. And such are the difficulties which have deterred those who have written on the formation of pastures from going further on their course. They have rested content with a description of the peculiarities of each plant.

But to him who tries, both as botanist and agriculturist, to fathom the mysteries inseparable from a meadow, whether in the New or the Old World, difficulties present themselves "not in single spies but in battalions." Nature alone supplies enough subjects for the closest study and investigation : depth of soil, worms, showers, dews, periods of drought, periods of wet, grubs, birds,—each and all arrest the mind, and claim due consideration. And when to these are added difficulties of man's own providing, necessary though they be, the solution seems to become a hopeless problem. Now no longer is the battle of plants waged merely with the weather and their other natural antagonists, as they may be fitly called ; no longer is the struggle modified into the simple solution of the survival of the fittest ; for the farmer produces new enemies to pasture in the shape of stock and the scythe, for cattle select the plants they like best and leave the worst to seed, and the ruthless scythe exposes the delicate stem to the heat of the sun.

An opportune shower has preserved a field from the pernicious effect of soft oat grass (*Bromus mollis*), by thus rendering it palatable to stock, and so preventing its seeding, while the want of rain has caused a meadow, almost contiguous, to be impregnated with this obnoxious weed.

The struggle of plant life is always waging in a pasture, and unless the issue of the battle is directed by animals or men, the most vigorous get the upper hand.

Nature, with her customary and marvellous counterbalancing characteristics, has foreseen this possibility and provided against it, for in a wet season stoloniferous grasses (whose travelling shoots have then the power of sending innumerable roots into the ground, each to become a parent plant) cover the ground to such an extent that the superficial observer is tempted to declare that the meadow which he views is entirely composed of creeping grasses. On the other hand, in a dry season, deep-rooted plants such as tall fescue (*Festuca elatior*) gain the mastery and apparently oust their opponents. The vigorous grasses characterized by an underground growth, such as fox-tail (*Alopecurus pratensis*), and which are amply provided for by Nature in respect of hardihood when growing, are scanty seed-bearers ; and even when they do perfect their seeds, so small is the store of food contained in them, compared with their immediate neighbours, that a large percentage of them germinate only to wither away. Rye-grass and the smaller dog's-tail (*Cynosurus cristatus*), deprived of other means of reproducing their species and fostering them, bear seeds that are eminently qualified to reproduce themselves.

Let him, therefore, who essays to unravel the mysteries of our green meadows remember to cultivate to the acutest degree the faculty of ocular observation, for

> "Segnius irritant animos demissa per aurem
> Quam quæ sunt oculis subjecta fidelibus, et quæ
> Ipse sibi tradit spectator."

Let him also learn to employ and utilize the intelligence of others ; and above all let him not be surprised if, after much patient study and investigation, his heart sinks

within him, appalled before the host of difficulties; as when, for example, the shadow of a passing cloud on a sunny day reveals to him the individuality of the 400 plants in each square foot of pasture, which have before escaped his attention, and the thought flashes across his bewildered mind of the 400 parts played by each plant, and the 400 times 400 causes that effect them. Almost hopelessly he perceives that the knowledge which he is in search of, and which he fancied he had in his hand, has eluded his grasp like a fire-fly, and left only a flash behind; and for a moment his mind is enveloped in darkness, overpowered by the infinity of Nature. The searcher after truth, however, recovers, recognizes his difficulties, recalls the object of his pursuit, returns to it with renewed energy, and, with unbiassed mind, records his observations day by day.

ALPINE HAZE.

THAT no letter has appeared on the common occurrence of this phenomenon in the British Isles is one of a thousand tokens of the small amount of interest in atmospheric phenomena taken by the public in this country. In bright days when the atmosphere at the earth's surface is nearly calm and moderately dry, the sky being nearly devoid of clouds, horizontal layers of buff-coloured haze may be frequently seen near the horizon in almost every locality in the British Isles where the air is free from the smoke of our large towns. I do not happen to have seen it nor have I heard of its occurrence on the west coasts of Scotland or of Norway. I have frequently noticed it when out of sight of land. It would be interesting to know whether it is seen at a distance of 400 or 500 miles from the nearest shore. At St. Aubin's, Jersey, at an elevation at which the French coast near St. Malo is rarely visible, a stria of this haze is often the accompaniment of mirage, the inverted image of the white-tipped rocks appearing to hang from the layer of haze, and the mirage disappearing with a change of the observer's elevation, but the line of haze remaining visible. The mirage was, when first seen, mistaken for a few minutes by some members of my family for a series of water-spouts.

I have long ago given the specific name of *nebula arida*, "dust-haze," to the phenomenon dealt with in this letter; and I still think that the English title "dust-haze" is preferable to "earth-haze," or any equivalent of the former to any of the latter in foreign languages, the latter term being too general, and capable of including the haze or mist produced by the presence of water particles. The word "dust" does not exclude organic matter, although ordinary dust-haze consists in most cases, as I think, of inorganic particles. On the other hand, any name which appears to localize the phenomenon is scarcely admissible. Dust-haze may be somewhat easily distinguished from ordinary mist or water-haze by its colour appearing of a reddish-buff tint in reflected light; and unless in complete shade from direct light, rarely becoming neutral; whereas mist usually appears gray, neutral, or bluish in reflected light, and yellow, orange, or red in transmitted. Patches—or, as they appear at a distance, bands—of dust-haze often become beds of the under surface of *cumuli*, to the formation of which clouds they then seem to bear a causal relation. As frequently in our islands, the haze is replaced during the night by stratiform clouds at its own level. In these cases there can be, I think, little doubt that the solid particles cause the precipitation of vapour. This fact somewhat militates against M. Antoine d'Abbadie's theory that the haze is really dry air, a supposition which for other reasons I regard as untenable.

Seen near the sun at sunset, bands of dust-haze are mistaken by many observers for threads of *cirrus* (what I term *cirro-filum*), and moreover the two phenomena are not uncommonly seen at the same time. As observations at sunset are useful in forecasting weather, the observers should take care to remember that lines of *cirrus* are always more illuminated in transmitted light than any species either of haze or of stratus cloud; secondly, that the *cirrus* threads appear slightly arched when viewed across the line of sight, and radiating when more coincident with it; and lastly, that a slight curl here or there very often betrays the existence of the lofty ice-cloud. I have frequently given rough sketches of these latter sunsets to observers, and these have borne a singular likeness to Antoine d'Abbadie's sketch of the dust-haze itself (NATURE, November 22, p. 79). But I do not understand this sketch, or in what sense it represents two *horizontal* bands.

In conclusion, I may perhaps be permitted to refer to two phenomena slightly related to the subject of this letter. The first is smoke. This is much more "accumulated" or less amorphous than water-dust, although its optical characteristics resemble somewhat closely those of water-dust. On the other hand, it is much more amorphous than dust-haze; and even the line left in the atmosphere by a steamer on the sea horizon on a calm day will scarcely be mistaken for dust-haze. Smoke when at a considerable elevation undoubtedly produces *cumuli* under favourable conditions. A string of ill-defined *cumuli* may be seen in the smoke of a burning forest or heath when carried a long way from land by a wind from the shore. This condensation is probably principally caused by the presence of solid particles, as in the case of dust-haze, but it may be borne in mind that a large quantity of vapour is carried up with smoke.

Lastly, the keen eye will soon learn to distinguish a peculiar haze often noticeable in England, especially over the wheat-producing districts, in fair calm weather in the month of September. This haze is also visible in some, and probably in many, parts of continental Europe. It is caused by flying Aphides, ten or more of which may be often captured in a cubic yard of air at about 10 feet from the earth's surface. In reflected light the haze has a tint of tender ultra-marine ash.

W. CLEMENT LEY.

Lutterworth, December 8.

NOTES.

MR. RALPH COPELAND, Ph. Doc., F.R.A.S. has been appointed Astronomer Royal for Scotland, and Professor of Practical Astronomy in the University of Edinburgh, in the room of Prof. Piazzi Smyth, resigned. Prof. Copeland has proved himself to be among the most skilful of modern observers.

M. DITTE has been elected to succeed the late Prof. Debray at the Sorbonne.

THE Paris Municipal Council will shortly be asked to grant the funds required by Prof. Giard to provide a laboratory and to secure the necessary assistants.

WE refer elsewhere to-day to the dinner given on Tuesday, the 11th inst., at Christ's College, Cambridge, to celebrate the completion of the ninth edition of the "Encyclopædia Britannica." The chair was of course occupied by Dr. Robertson Smith, the editor. Among the scientific contributors present were Sir Frederick Abel, Dr. Affleck, Sir Nathaniel Barnaby, Dr. Buchan, Prof. Cayley, Prof. Darwin, Mr. F. Darwin, Prof. Dittmar, Prof. Michael Foster, Dr. A. Geikie, of the Geological Survey, Dr. Glaisher, Sir F. Goldsmid, Prof. Cleland, Prof. Marshall Ward, Dr. Creighton, Prof. Greenhill, Dr. Günther, Sir Charles Hartley, Baron von Hugel, Prof. Keane,

Mr. Keltie, Prof. Ray Lankester, Mr. Norman Lockyer, Prof. MacAlister, Col. Maurice, Captain Moriarty, Dr. John Murray, of the *Challenger* Commission, Prof. Newton, Prof. Roberts-Austen, Prof. Vines, General Walker. At the close of the banquet the Chairman read letters which had been received from scholars and men of science at home and abroad. In asking the company to pledge each other in good fellowship in the loving cup, he said he could not deny himself the pleasure of saying with how much cordiality and heartfelt gratitude he and his fellow-editor, Mr. J. S. Black, and the publishers greeted the contributors, who, by their hearty assistance and their constant readiness to do far more than one had a right to expect from contributors, had made it possible for them to carry to its completion a work the difficulties of which could not be appreciated other than by those who had to edit it. Having explained the difficulty of recognizing in one toast more than a thousand English and foreign scholars, of whom not more than one-tenth were present, Dr. Robertson Smith said he would follow the example of the title-page of the "Encyclopædia Britannica" and propose three toasts—Literature, Science, and Art. In submitting the first of these toasts, he referred to the great judgment and skill of his predecessor, Prof. Spencer Baynes. Dr. Garnett responded for Literature, Dr. A. Geikie for Science, and M. Yriarte for Art. Prof. Michael Foster, amid cheers, gave "The Health of the Editor." With regard to the first editor, they would all agree with him that the qualities which Prof. Baynes had for carrying on this great work were in a certain way unexampled. His great knowledge of men and things and the fascinating way in which he made one contribute an article were beyond compare. Concerning the present editor he would prefer to fall back upon the letter received from Prof. Huxley, in which he said:—"The influence for good of the spirit of sound criticism which permeates all the theological articles cannot be over-estimated; and in all other respects, so far as I can judge, the work is wonderfully well carried out." The toast was drunk with musical honours. Dr. Robertson Smith said it was hardly possible for him to thank them sufficiently for the way in which they had drunk his health. He would repeat how very much he had felt the constant kindness and support of all his contributors, without which a work of the kind was impossible. He feared that the editor must sometimes be more or less exacting in such cases. It certainly pained him more to be so than, according to his experience, it pained the contributor to meet the wishes that he expressed. Although all good English work had been due to the spirit of accommodation and of friendly help that pervaded our national life, from his own experience he did not think that any monument of English work had shown more of this good quality, which characterized literary men of every nationality, than had the "Encyclopædia Britannica." Prof. Newton proposed "The Publishers," and Mr. Adam W. Black responded. Mr. Sutherland Black gave "The Health of the Provost and Fellows of Christ's College," and with the reply of Dr. Peile the proceedings closed.

THE year 1889 being the fiftieth anniversary of the Royal Botanic Society, it is proposed that the occasion shall be celebrated by a special *fête*. An announcement on the subject will be made in due course.

PROF. JUDD informs us that he has communicated to the Geological Society a paper on the Tertiary volcanoes of the Highlands, dealing with some of the questions referred to in the article on this subject which appeared in NATURE two weeks ago.

ABOUT four years ago King Oscar of Sweden and Norway offered a prize, consisting of a gold medal valued at 1000 francs, and 2500 kr. (£140) in money, for any one great discovery within the sphere of higher mathematical analysis. The prize is to be awarded on His Majesty's sixtieth birthday, on January 21, 1889. Twelve papers have been sent in, seven of which are in French, four in German, and one in Italian.

VESUVIUS has lately been very active. It has been rapidly throwing up a new cone of eruption about 30 to 40 yards to the south-west of the original one, and the fissure across the crater plane towards the west-south-west is increasing in size and is richer in acid emanations. It is possible, therefore, that an eruption may take place soon on that side of the cone, since the vent tends to shift along the fissure pointing in that direction.

A SEVERE earthquake occurred in the Drant Valley on December 3 at 1.40 a.m. The shocks were from east to west, and were accompanied by subterranean noises.

IN addition to Prof. Milne's paper on the effects of earthquakes on the lower animals, to which we have already referred in these columns, the last number (vol. xii.) of the Transactions of the Seismological Society of Japan contains several other papers of interest, some of which, however, were noticed at the time they were read before the Society. Amongst other papers by Prof. Milne are: modern forms of pendulum seismometers; the Gray-Milne seismograph and other instruments in the Seismological Laboratory at the Imperial College of Engineering, Tokio; and on certain seismic phenomena demanding solution. A few of these latter are: sound-phenomena at the extremities of earthquakes; in soft ground the large horizontal motions are preceded by a series of vertical surface ripples; near to an origin the amplitude of normal motion is greater than the amplitude of transverse motion, but as the disturbance radiates they rapidly approximate to each other. Mr. W. G. Aston writes on earthquakes in Corea, giving a list of earthquakes prepared from the standard histories of that country, the "Tongkuk thong-kam" and the "Kuk-cho pong-kam," and showing that there were not more than twenty-seven earthquakes in all in that country in 1800 years. We observe also that the issue in Japanese of the Transactions of the Society is proceeding apace, and has now reached the fifth volume. This particular volume contains translations into Japanese of the following papers: earthquake effects, emotional and moral, by Prof. Milne; a model showing the motion of an earthquake particle during an earthquake, by S. Sekiya; earthquake frequency, by Dr. C. G. Knott.

ACCORDING to a private letter written by a resident at Godthaab, and sent to Denmark by the steamer *Fox*, Nansen encountered nothing but land covered with ice and snow in the interior of Greenland. The members of the Expedition, the writer says, were often able to "sail" along the smooth snowy surface on the *ski*. *Apropos* of the return of the Expedition, the first vessel leaving for Greenland next spring is the steamer *Hvielbjörnen*, belonging to the Greenland Company of Commerce. It departs late in March, so that the Expedition is due in Copenhagen at the end of May. A national subscription is now being raised in Norway to defray the cost of the Expedition, estimated at about £1000, part of this sum only having been as yet contributed. Some sort of national recognition of Dr. Nansen's achievements is also contemplated.

ON November 27, about 9 p.m., a brilliant meteor was seen at Christiansand, in Norway. It went from east to west in the southern sky, emitting a bright white light, finally bursting without any report.

FOGS of great density have prevailed recently in London, and have frequently spread over almost the whole of Great Britain and France. "It will probably not have escaped notice by those residing in the suburbs," says the *Times*, "that on many occasions lately, while the fog has lasted, moisture has poured down from the leafless branches of the trees as though they had

been exposed to a fall of rain, and the various hygrometers have shown the air to be completely saturated with moisture. Under such circumstances the fogs in London are always less injurious to life than those of a drier nature, and it will be observed that we have had no reports this year of cattle being suffocated at the Cattle Show by London fog, as they were a few years ago. What the difference may be between the two conditions would be an interesting subject for inquiry. On both occasions the fogs were anticyclonic, and it cannot be said that the number of fires in London has decreased during the past ten years."

THE Report on the Administration of the Meteorological Department of the Government of India in 1887-88, which has just been published, is divided into two parts. The first deals with the more important administrative questions that have arisen during the year; the second describes the actual working of the Department, and the condition of the observatories; it contains also extracts from the reports of the inspection of the stations. These reports show that in many cases the paid observers take but little interest in their work. Mr. Eliot has introduced various changes, among the chief of which are: (1) the discontinuance of solar and terrestrial radiation observations, except at a few selected stations, on the ground that these observations are open to various objections, and that the instruments are unsuited for exact measurement,—two instruments, apparently identical in construction, frequently giving different readings under the same circumstances; (2) the tabulation of all observations in a form admitting of easy reference, and of the calculation of daily averages,—at present, although the monthly means have been obtained, the average conditions of each day or week are not yet known; (3) the extension and improvement of the methods of collecting rainfall statistics. Rainfall is registered at all the meteorological stations, but each province has established its own method of taking the observations, the result being an utter want of uniformity in the hours of measurement, the times varying from sunrise to midnight. An observatory has been opened at Bagdad; and the question of the establishment of one at Perim, at the entrance of the Red Sea, is under consideration, at the suggestion of the English Meteorological Council.

ON November 1, a bird very rare in Europe was shot in the Island of Möen, in Denmark, viz. a specimen of the "isabel-coloured runner" (*Cursorius isabellinus*). The home of this bird is the Desert of Sahara. Only one or two specimens have hitherto been seen in Europe.

WE notice in the *Izvestia* of the East Siberian branch of the Russian Geographical Society, a very interesting paper by M. Khangaloff, on the customs of the Buriates some three or four centuries ago, when they did not yet carry on agriculture, and lived only by hunting and cattle-breeding. The author's attention has been devoted chiefly to the *zegheteaba*, *i.e.* the periodical hunting by whole tribes gathering together from places as distant from one another as Verkholensk, Tunea, and Transbaikalia. Several hundreds, and sometimes thousands, of men gathered for these communal huntings, which lasted for forty days, and the author gives interesting details as to the customs in use on such occasions. They are still maintained, although only few tribes come together, and in order to keep up the old associations, fines have been imposed on those who do not assist at the huntings. Several "gentes" take part in the communal huntings, and must send one man out of each ten men of each "gens." The poor are freed from the obligation. The cleverness of the Buriates in killing wolves with their arrows, while riding at full speed, is really astonishing. The best archers kill a wolf at a distance of 100 yards.

THE Superintendent of the Anting Missionary Hospital, in a report on that institution, says that the Chinese believe that various animals, principally the hedgehog, weasel, fox, snake, and rat, take up their abode in man and control his fortunes. The reason given by the Chinese for the selection of these animals is that they have discovered the secret of long life possessing which every other good thing is certain to follow. One patient insists that a man inside him holds interminable conversations with him. A strong cathartic removes this delusion for a few days, but the intruder is certain to return at the end of that time. With regard to the insane in China, they have a pitiable lot there. A plea of insanity is of no avail in a trial for murder, and the culprit is decapitated just as if he were sane. Usually, however, insanity takes a very harmless shape: holding conversations with imaginary persons is the commonest form; refusing to eat or drink, and insisting on sitting continually in one place, are also common.

A REPORT from Hirschberg states that while a reservoir was being made a subterranean river was lately discovered in the Riesengebirge. It is 2 metres below the surface of the earth. The river is said to be, at one spot, 150 metres broad.

PROF. KIKUCHI has published the geometry for Japanese students upon which, as we stated some few months since, he has been engaged. The English equivalent of the title-page is, "A Text-book of Elementary Geometry, vol. i., Plane Geometry, Books i., ii., iii. (corresponding to the Books i., ii., iii., of the Association Geometry)." The work is brought out by the Educational Department of Japan.

PROF. MATTHIAS DUVAL, of the Paris Medical Faculty, has just published a quarto atlas of embryology. It contains forty double plates, with over five hundred figures, concerning the embryological evolution of the chick.

A NEW alkaloid has been isolated from the poisonous plant *Fritillaria imperialis*, a member of the order Liliaceæ, by Dr. Fragner, of Prague. All parts of this plant, and particularly the bulbs, have long been known to be violently poisonous; the action of the poisonous principle being very similar to that contained in the *Scilla maritima*, which is so much used in medicine. In order to investigate the nature of this noxious substance, a large number of the crushed bulbs were triturated with lime, and the mixture evaporated to complete dryness upon a water-bath. The residue was then repeatedly treated with hot chloroform, and the solution so obtained agitated with water acidified with tartaric acid. On the addition of sodium carbonate to the concentrated solution, the alkaloid itself was obtained in the form of a voluminous yellow precipitate. After removal of the mother-liquor as completely as possible by means of the filter-pump, the substance was dissolved in hot alcohol. From this solution in alcohol the alkaloid crystallized in short needles, which, after several recrystallizations were obtained perfectly colourless. The crystals are very sparingly soluble in water, but readily in ether, chloroform, and alcohol, imparting to these liquids an extremely bitter taste. They melt at 254° C., and furnish, on analysis, numbers pointing to the formula $C_{35}H_{60}NO_4$. Dr. Fragner, in consideration of its source, has endowed the new alkaloid with the name "imperialine." On allowing a solution of imperialine in alcohol saturated with hydrochloric acid gas to stand for a short time, large translucent crystals of the hydrochloride, $C_{35}H_{60}NO_4HCl$, separate out; this salt is very soluble in alcohol or water, and these solutions also possess the bitter taste. On the addition of ether to a mixture of platinum or gold chloride and the alcoholic solution of the hydrochloride, a yellow oil is obtained which eventually becomes semi-solid. If this pasty substance be dissolved in hot dilute hydrochloric acid and allowed to stand, the platinum or gold salt is obtained, the former in orange and the latter in yellow-coloured crystals. The platinum salt, on analysis, was found to possess the composition $2C_{35}H_{60}NO_4HCl + PtCl_4$, and the gold salt gave numbers agreeing with the formula $C_{35}H_{60}NO_4HCl + AuCl_3$.

Thus the new alkaloid has been thoroughly investigated, and its composition determined with tolerable certainty. It is a significant sign of the progress of the times that these poisonous principles of the vegetable kingdom are being gradually isolated, and their nature determined. Of the wonderful processes by which they are built up within the vegetable cells, we are as yet almost completely in the dark, and can only hope for light and knowledge from the persevering attempts of chemists to understand their constitution and to synthesize them.

THE additions to the Zoological Society's Gardens during the past week include a Hawk-Owl (*Surnia funerea*) from Russian Finland, presented by Lord Lilford, F.Z.S.; a Nankeen Kestrel (*Tinnunculus cenchroides*) from Australia, presented by Mr. A. J. Wilkins; eight Wild Geese (*Anser cinereus*), a White-fronted Goose (*Anser albifrons*), a Herring Gull (*Larus argentatus*), British, presented by Mr. E. S. Cameron; two Galeated Pentonyces (*Pelomedusa galeata*), six Robben Island Snakes (*Coronella phocarum*) from South Africa, presented by the Rev. G. H. R. Fisk, C.M.Z.S.; three Black Tortoises (*Testudo carbonaria*) from South Brazil, presented by Mr. Leonard Cooper; five Moorish Geckos (*Tarentola mauritanica*) from the South of France, presented by Mr. J. C. Warburg; an Australian Cassowary (*Casuarius australis*) from Queensland, three Barbary Turtle Doves (*Turtur risorius*) from North Africa, a White Stork (*Ciconia alba*), European, deposited.

OUR ASTRONOMICAL COLUMN.

THE UNITED STATES NAVAL OBSERVATORY.—Captain R. L. Phythian, the Superintendent of the Naval Observatory, Washington, has just published his Report for the year ending June 30, 1888. The great 26 inch equatorial, which is in the charge of Prof. Asaph Hall, is in good order, and has been in constant use for micrometric measurement of the satellites of Saturn and Mars, and the regular list of double stars. The surfaces of both Saturn and Mars were constantly and carefully examined, and drawings made from time to time. In the case of the latter planet, the "canals" of Prof. Schiaparelli, though specially looked for, both during and after the opposition, could not be made out. The reduction and discussion of these observations are well advanced, in particular the computations with respect to the theory of Hyperion, which are now nearly ready for a complete discussion. The transit circle was dismounted and cleaned after April 4, 1888, and remounted in July, but notwithstanding this interruption 1970 observations were obtained with it from October 1, 1887, to October 14, 1888. The reductions are, however, in a backward state, the computing staff being too weak in number. The results for 1883 have been printed, and those for 1884 are in the press. The programme for future work includes the observation of the stars of the zones S. Decl. 14°–18° for the Astronomische Gesellschaft. The 9·6-inch equatorial has been chiefly used in the continued revision of Yarnall's Catalogue, and the observation of minor planets, comets, and of occultations.

The appendices to the Report contain the results of chronometer trials, and of the examination of sextants, binoculars, and other instruments, chiefly for naval use; the report of the Transit of Venus Commission, and that of Lieut. Winterhalter on his visit to Europe, in which he strongly urges the desirability of the Naval Observatory being empowered to join in the scheme of the Paris Astrophysical Congress of 1887 for charting the heavens by means of photography.

THE TOTAL SOLAR ECLIPSE OF JANUARY 1, 1889.—As the track of this eclipse passes through California, San Francisco, lying but a few miles south of the shadow line, it is probable that it will be watched by a number of persons who might make useful observations, and would gladly do so, if suitably directed. With a view of securing the services of such volunteers, and of employing them to the best advantage, Prof. Holden has published a little pamphlet containing "suggestions for observers." The two principal points on which he lays stress are the determination of the exact limits of the shadow, by noting the duration of totality at places just within it, and the photographing of the corona. The pamphlet is not in the least intended for trained astronomers, but will probably prove very useful for the purpose for which it has been written. No English astronomers are going out to observe the eclipse, but, should the weather prove favourable, it will be well watched by American observers, for a strong party from Mount Hamilton itself are to occupy a station immediately on the central line, and Mr. Chas. Burckhalter, of Chabot Observatory, has organized a party of twenty amateur photographers for the purpose of obtaining pictures of the corona. Messrs. George and Thomas Davidson also, sons of Prof. Davidson, of the U.S. Coast Survey, will photograph the corona at the elevated station of Winnemucca, whilst five observers from the Harvard College Observatory, under the direction of Mr. W. H. Pickering, are to take up a very full programme of photographic, photometric, and spectroscopic observations. Mr. C. H. Rockwell, also, of Tarrytown, N.Y., who was one of the Caroline Island party in 1883, will observe the eclipse.

COMETS FAYE AND BARNARD, OCTOBER 30.—The following ephemerides for Berlin midnight are in continuation of those given in NATURE for 1888 November 29 (p. 114):—

	Comet 1888 *d* (Faye).		Comet 1888 *f* (Barnard, Oct. 30).	
1888.	R.A.	Decl.	R.A.	Decl.
	h. m. s	° ′	h. m. s.	° ′
Dec. 21 ...	8 53 ...	0 28·8 N.	10 26 53 ...	2 0·2 S.
23 ...	8 7 39 ...	0 22·7	10 26 53 ...	1 10·0 S.
25 ...	8 6 20 ..	0 17·8	10 26 45 ...	0 18·0 S.
27 ...	8 4 54 ...	0 14·1	10 25 26 ...	0 35·7 N.
29 ...	8 3 25 ...	0 11·6	10 26 0 ...	1 31·1 N.
31 ...	8 1 53 ...	0 10·3 N.	10 25 24 ..	2 28·6 N.

The brightness of both comets remains practically unchanged from their brightness on December 19.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 DECEMBER 23–29.

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

At Greenwich on December 23

Sun rises, 8h. 7m.; souths, 11h. 59m. 36·1s.; sets, 15h. 53m.; right asc. on meridian, 18h. 9·4m.; decl. 23° 26′ S. Sidereal Time at Sunset, 22h. 3m.

Moon (at Last Quarter December 26, 6h.) rises, 19h. 59m.*; souths 3h. 43m.; sets, 11h. 14m.; right asc. on meridian, 9h. 51·1m.; decl. 16° 6′ N.

Planet.	Rises.	Souths.	Sets.	Right asc. and declination on meridian.
	h. m.	h. m.	h. m.	h. m. ° ′
Mercury..	8 3 ...	11 46 ...	15 29 ...	17 56·0 ... 24 46 S.
Venus.....	10 30 ...	14 52 ...	19 13 ...	21 2·0 ... 18 58 S.
Mars	10 34 ...	15 8 ...	19 42 ...	21 18·3 ... 16 57 S.
Jupiter....	7 13 ...	11 10 ...	15 7 ...	17 19·3 ... 22 44 S.
Saturn....	19 55*...	3 22 ...	10 49 ...	9 30·6 ... 15 50 N.
Uranus ...	1 47 ...	7 11 ...	12 35 ...	13 20·3 ... 7 48 S.
Neptune..	13 59 ...	21 42 ..	5 25*...	3 53·2 ... 18 30 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Dec. h.
28 ... 19 ... Mercury in superior conjunction with the Sun.

Variable Stars.

Star.	R.A. h. m.	Decl. °			h. m.	
U Cephei	0 52·4 ...	81	16 N. ...	Dec. 24,	22 23	*m*
				,, 29,	22 3	*m*
Algol	3 0·9 ...	40	31 N. ...	,, 27,	4 46	*m*
R Canis Majoris ...	7 14·5 ...	16	12 S. ...	,, 25,	17 0	*m*
			and at intervals of		27 16	
S Cancri	8 37·6 ..	19	26 N. ...	Dec. 25,	21 29	*m*
δ Libræ	14 55·0 ...	8	4 S. ...	,, 25.	6 54	*m*
R Ophiuchi	17 1·3 ...	15	57 S. ...	,, 27,		*M*
T Vulpeculæ ...	20 46·7 ...	27	50 N. ...	,, 23,	3 0	*m*
Y Cygni	20 47·6 ...	34	14 N. ...	,, 23,	17 40	*m*
			and at intervals of		36 0	
R Vulpeculæ ...	20 59·4 ...	23	23 N. ...	Dec. 29,		*M*
T Capricorni ...	21 15·8 ...	15	38 S. ...	,, 29,		*M*
δ Cephei	22 25·0 ...	57	51 N. ...	,, 25,	17 0	*m*

M signifies maximum; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
Near ι Ursæ Majoris ...	130° ...	49° N.	
,, κ Draconis	193 ...	68 N. ...	Swift; streaks.

THE BRITISH ASSOCIATION AND LOCAL SCIENTIFIC SOCIETIES.

THE fourth Annual Conference of Delegates of Corresponding Societies was held during the Bath meeting of the Association, thirty-eight local Societies having nominated representatives. The following is an abstract of the Report which has recently been issued by the Corresponding Societies Committee:—

At the first meeting the chair was taken by Dr. John Evans, Treasurer R.S., the Corresponding Societies Committee being represented by General Pitt-Rivers, Sir Douglas Galton, Prof. Boyd Dawkins, Prof. T. G. Bonney, Mr. W. Whitaker, Mr. G. J. Symons, Mr. W. Topley, Dr. Garson, Mr. J. Hopkinson, Mr. W. White, and Prof. R. Meldola, Secretary.

The delegates were invited to make any statements respecting the work done by the Committees appointed last year, or in connection with other subjects referred to in the Report which had been presented to the General Committee.

A discussion took place with reference to the working of the Ancient Monuments Act, in which the Deemster Gill, Prof. Boyd Dawkins, Dr. Evans, General Pitt-Rivers, Sir John Lubbock, and many of the delegates took part. The issue of greatest importance, so far as concerns the local Societies, is that these bodies should take upon themselves the responsibility of protecting, as far as possible, the ancient remains in their own districts.

Earth Tremors Committee.—Prof. Lebour reported that the Committee was about to apply for reappointment, with the object of, in the first place, prosecuting inquiries as to the best form of instruments, and the best conditions with respect to locality, foundation, &c., for fixing up such instruments. Several Societies and individuals had expressed their willingness to co-operate as soon as these conditions had been determined, and the Birmingham Philosophical Society had made a grant towards the expenses of these preliminary trials.

Prof. Lebour stated also that the North of England Institute of Mining and Mechanical Engineers had recently appointed a Committee, armed with a substantial grant, to make a series of experiments on so-called "flameless explosives." This Committee was now at work, and would gladly receive assistance in any way from kindred Societies. The same Institute had joined with the Mining Institutes of South Wales and Scotland in forming another Committee to conduct a series of experiments on fan-ventilation. He thought that these were examples of the kind of co-operation which the Conference of Delegates of Corresponding Societies was likely to bring about.

At the second meeting of the Conference, the chair was first taken by the Secretary, Prof. R. Meldola, and afterwards by the Vice-Chairman, Mr. W. Whitaker, the Committee being further represented by Mr. J. Hopkinson and Mr. W. White, and towards the close of the meeting by Dr. Evans, who had been detained at the Committee of Recommendations.

The Chairman, in opening the proceedings, said that it would be best to adopt their usual plan, and consider the suggestions and recommendations from the different Sections in their proper sequence.

Section A.

Temperature Variation in Lakes, Rivers, and Estuaries.—Dr. Mill said that he wished to point out some of the results that had been obtained by the Committee appointed to make the investigations in conjunction with the local Societies represented in the Association. He had a diagram which showed the work done more precisely than he could explain in a short time. The Committee had twenty observers working at various rivers; most of these rivers were in Scotland, only one or two being in England, while no observations had been started in Ireland. Their investigations showed that while in some rivers, particularly the Aray, the temperature was increased by rainfall, in others this condition was reversed, the temperature being found to suddenly fall during rain. He wished to impress upon the delegates the advisability of extending their observations throughout Scotland and England, and also of extending them to Ireland. Prof. Fitzgerald, the President of Section A, who was a member of the Committee, took a great interest in the subject, and had expressed an opinion that Mr. Symons's rain-gauge observers might make personal observations. Dr. Mill advised all observers to use the thermometer which he exhibited, and which he said was durable and cheap. He trusted that delegates on returning home would lay the subject before their Societies, give them some idea of the work of the Committee, and induce them to co-operate and make observations in their respective localities. Circulars, he added, would be sent to the Societies and to Mr. Symons's rain-gauge observers, and it was hoped that this would bring the question well before them. It would give local Societies an opportunity of doing what they professed to do, and he was perfectly certain they were anxious to promote real scientific work. The observations could be made with very little training, and the investigations of conscientious observers would lead to interesting results, as they would be considered by the Committee in connection with the temperature and rainfall of the districts in which they were made.

In reply to questions by Mr. Cushing and the Rev. E. P. Knubley, Dr. Mill said that the thermometer readings were taken at a depth of 6 inches below the surface of the water, and that the fullest particulars would be supplied by the Committee to any Society wishing to take part in the observations.

Section C.

Prof. Lebour, who had been nominated as the representative of the Committee of this Section, said that the Committees on (1) Sea-coast Erosion, (2) Underground Waters, (3) Erratic Blocks, and (4) Earth Tremors, the working of which had been explained to the delegates on former occasions, had been recommended for reappointment.

Geological Photography.—Prof. Lebour further informed the delegates that, in consequence of a paper read before Section C by Mr. O. W. Jeffs on local geological photographs, it was proposed by the Committee of the Section that a Committee should be appointed to collect and register such photographs. The proposal at present was so indefinite that there was no chance of the Committee of Recommendations dealing with it this year, but they gave the suggestion their cordial sympathy, and it was formally passed on to the meeting of delegates. It was hoped that delegates of Corresponding Societies, by discussing the matter among themselves, would have it so organized and ready to place before the Committee of the Section next year, and ultimately before the Committee of Recommendations, in such a form that a Committee of the Association might be appointed, with a small grant, to work the scheme satisfactorily. It was thought by the Committee of the Section that too many restrictions as to the uniformity of the photographs should not be enforced in the early stages of the scheme. The simple collection and registration of photographs was all that was at present aimed at.

The following suggestions with reference to this subject were forwarded by the Committee of the Section to the Secretary of the Conference:—

"(1) That a Committee be formed, having representatives for each county, charged with the arrangement of a local photographic survey for geological purposes in each district.

"(2) The Committee will gather together—

"(*a*) Names of Societies and individuals who have already assisted in this object, or who are willing to do so;

"(*b*) Copies of geological photographs already taken;

"(*c*) List of localities, sections of rocks, boulders, and other features desirable to be photographed;

and will arrange with local Societies for the work to be done as may be convenient or possible.

"(3) Each photograph to be accompanied by the following particulars:—

"(*a*) Name and position of locality or section;[1]

"(*b*) Details of features shown (with illustrative diagram or sketch whenever necessary for such explanation);

"(*c*) Scale of height and length, or figure introduced to indicate size in Nature;

"(*d*) Name of photographer and Society under whose direction the view is taken;

"(*e*) Date when photographed.

"(4) Size of photograph recommended: 12 × 10 inches (whole plate), but this is not compulsory.

"(5) Original negative to be the property of the Society or individual under whose direction it is taken, and who shall also fix a price at which copies may be sold.

"(6) One copy of each photograph to be the property of the British Association, and one other copy to be given to the Geological Society of London.

[1] Including Compass Direction.—*Sec. Corr. Soc. Comm.*

"(7) Each photograph officially received to be numbered and recorded in a reference-book, and a list published and circulated showing price at which members and others may purchase them.

"(8) A circular to be issued to all geological Societies, inviting their co-operation."

Mr. Jeffs said that a large number of Societies in different parts of the Kingdom had taken, from time to time, photographs of various geological sections and features as they came under their notice, but there had been no systematic way adopted either of collecting the photographs or of recording them, so that geologists interested might really know what had been taken. He thought that, if some arrangement could be made, a great deal of good might be done not only for the benefit of geological science, but also for educational purposes. Regarding regulations, he was not desirous of laying down any strict rules, but he thought that if the scheme were to be carried out at all satisfactorily, and at a minimum expenditure, some few regulations would be necessary.

Mr. Whitaker thought it a very fit subject for the Conference, and trusted that delegates would get their Societies to think it over. The object was to interest all the Societies, and to have a harmonious result.

Some further discussion took place with reference to the requirements of the proposed Committee and the mode of procedure in the field, in the course of which it was pointed out that the chief object was to secure photographs of typical and especially of *temporary* sections. The details of manipulation, the size of the photographs, method of mounting, registration of scale, &c., could only be settled when the Corresponding Societies had taken action in the matter, and the Committee had been formally appointed.

Section D.

The Committee of this Section was represented by Prof. Hillhouse.

Life-histories of Native Plants.—Prof. Meldola said that since their last meeting at Manchester, Prof. Bayley Balfour had received several applications for further particulars with reference to the suggestion which he communicated to last year's Conference. Prof. Balfour was unable to be present at Bath, but had forwarded the following:—

"*Suggestions for those studying the Life-histories of British Flowering Plants:*—

"(1) Seeds should be collected, and opportunity may be taken at the time of collection to note how they are disseminated in Nature—whether the fruit opens or not, whether they have appendages for promoting transport by animals or otherwise, whether they have colour or other features of attraction, &c.

"(2) The seeds being sown, their germination should be watched; its rapidity and manner noted. The variations and differences between albuminous and exalbuminous seeds are worthy of special note. The movements of the parts of the embryo in germination until it acquires its fixed position are also deserving of study. Further, the form of the parts of the embryo is various and instructive.

"(3) The development of the seedling into the adult can be readily watched in annuals and biennials, and smaller perennials. The succession of leaves after the cotyledons should be noted, and the forms which the leaves assume, and their positions and spread. The relative succession of buds in or adjacent to the axils of the later leaves and of the cotyledons should be observed, as also the ultimate fate of the buds developed. This will give a clue to the branching of the main axis of the plant, upon which its whole form and habit depend.

"(4) An important point to look at in the development is the amount, character, and position of any clothing of hairs the seedling may possess.

"(5) The development of the underground part of the seedling must not be neglected. The continuance of the primary root and its branching or its replacement by adventitious roots are points for particular attention, and also the formation upon it of any excrescence or buds. A sufficient number of seedlings must be grown to allow of proper study of these features.

"(6) The form of branching of the stem and leaves may be studied in the mature plant, which may be gathered wild. The formation of false axes should be specially looked for, and the complex relations often resulting from branching may be worked out upon the young top of a mature plant. It is not necessary to wait for the maturing of the seedling, but reference back to the seedling will show whether any observed relations are of late or early development in the life-history.

"(7) In the case of perennials, the mode of perennation is an interesting feature for observation, as well as the methods of vegetative propagation. In some cases the two processes are merged in one. Properly to understand perennation the perennating portions must be examined at all periods of the resting season as well as when they are starting anew into vegetative activity. Seedlings of perennating plants watched during two or three seasons will give a clue towards elucidation of the development.

"(8) When the seedlings begin to form flowers, the relation of the flower-shoots to the vegetative organs should be noted, and especially their sequence with reference to vegetative shoots. The succession of the flowers should be noted, as of course should be their structure and their adaptations to proper pollination. Many seedlings will not, of course, flower for years, and the sequence of flowers in such plants, and, indeed, in all cases, may be well traced in the mature plant growing wild.

"(9) After flowering and pollination the development of fruit must be studied. The parts concerned in forming fruit, the adaptations to scattering of the fruit or seed are points to be precisely noted.

"(10) The presence and position of any nectar-secreting structures outside as well as inside the flower are of much significance, and they should be carefully studied.

"(11) In connection with every point observed of structure and development the observer should ask himself, Why is this? What is this for? and endeavour to obtain some answer to the query.

"(12) A series of observations upon a specific plant made by a careful observer will enable him or her to draw up a complete history of its life, such as is hardly to be found recorded at the present day.

"I may add as a corollary that an interesting field for observation which local Societies might do good work in is that of the relation of plants to animals as food-plants. Some are discarded by browsing animals, others are preferred, and there are degrees of favouritism. Is there any principle of selection?"

Prof. F. O. Bower, the delegate from the Natural History Society of Glasgow, who was unable to be present at the meeting, forwarded a communication with reference to this subject, in which he pointed out that the chief precaution which would have to be observed in the carrying out of observations in accordance with Prof. Balfour's scheme, would be the correct identification of the species being worked upon.

Disappearances of Native Plants.—Prof. Hillhouse said that he was in charge of a Committee appointed two years ago for the purpose of collecting information as to the disappearance of native plants from their local habitats. Their report for 1887 said the Committee intended presenting a report in 1888 concerning its inquiries in Scotland. He came to that meeting prepared with a report, and learnt to his surprise that the Committee had lapsed, but an application had been made to the Committee of Section D to have it reappointed. He would give some brief account of their work in the past year. The report for Scotland covered eighty-five flowers which were extinct, or were "practically extinct," and they were of the most varied kinds. It had been discovered that *Nymphæa alba* (the white water-lily) had been almost exterminated in the lochs about Dumfries; the name of the person who had committed the ravages upon it was brought before the local Natural History Society, an appeal was made to the proprietors of the lochs, and the individual was warned off estates in the neighbourhood on pain of prosecution for trespass. There was one plant that had only a single station in Scotland, *Scheuchzeria palustris*, which was found in the Bog of Methven, and it had been destroyed in all probability by 300 or 400 black gulls settling in the bog and devouring everything in the shape of vegetation. Another plant which had been completely exterminated was one known as *Mertensia maritima*, which grew in shingle on the Bay of Nigg, and which had been destroyed by the shingle having been used to make concrete blocks to be used in the construction of a pier near at hand. Then a grass which grew in a patch near the Moray Frith had been destroyed by the overturning of a tree, which caused a large hole into which all the moisture of the patch drained; this grass was *Melica uniflora*. The Committee found that the disappearance of plants was caused in a great measure by the injudiciousness of individual botanists, and also by botanical exchanging clubs, who held out inducements

for the collection of eighty or a hundred specimens of extremely rare varieties. The Committee hoped to present a report next year.

At the conclusion of the Conference, votes of thanks were passed to the Chairman and Secretary.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Sheepshanks Astronomical Exhibition at Trinity College, open to the competition of any undergraduate of the University, has been awarded to Frank Watson Dyson and Gilbert Thomas Walker, brother scholars of the College, who are declared to be equal in merit. The value of the Exhibition is 50*l.* per annum, tenable for three years, and it will be divided between the successful candidates.

SCIENTIFIC SERIALS.

American Journal of Science, December.—The invisible solar and lunar spectrum, by S. P. Langley. This paper, which is an abstract of a memoir about to appear in the publications of the United States Academy of Sciences, summarizes the result of investigations carried on at the Allegheny Observatory in continuation of the author's previous researches on the infra-red of the solar spectrum to the extent of about three microns. By means of the improved apparatus here described, the extreme infra-red solar spectrum has now been searched from three to over eighteen microns; and it is shown that in this region the ratios between solar and lunar heat are completely changed from what they are in the visible spectrum. While the solar *light* in the latter is about 500,000 times that of moonlight, the solar heat received in the invisible part of the spectrum is probably less than 500 times the lunar. These studies also promise important results for meteorology, by opening to observation the hitherto unknown region of the spectrum, in which are to be found the nocturnal and diurnal radiations, not only from the moon towards the earth, but from the soil of the earth towards space.—A brief history of Taconic ideas, by James D. Dana. The Taconic question is here treated in chronological order from 1818 till the present year, in which the controversy may be regarded as practically closed. The conclusion is now firmly established that this system is not pre-Silurian, but merely another name for the older term "Lower Silurian."—Certain generic electrical relations of alloys of platinum, by C. Barus. In this paper are given the chief results of the investigations on the measurement of high temperatures already described in vol. xxxv. p. 407, of the *Journal*. The results generally point to a limit below which, in the case of solid metals and at ordinary temperatures, neither electrical conductivity nor temperature-coefficient can be reduced. It thus appears that a lower limit of both conductivity and temperature-coefficient is among the conditions of metallic conduction, not to say of the metallic state absolutely.—On the Puget group of Washington Territory, by Charles A. White. A careful study of some fossil Mollusca from the coal-bearing formation in the Puget Sound basin, shows that they belong to a hitherto unknown brackish-water fauna, characterizing a deposit of unusual interest. A section of this formation measured at the town of Wilkeson gives a minimum thickness of no less than 13,200 feet, with a probable maximum of 14,500 feet. The surprise caused by the discovery of such an extraordinary thickness in an estuary deposit is increased by the fact that its Molluscan fauna appears to range vertically throughout the whole formation. The fauna itself seems to be of the same age, but distinct from, the Laramie, which flourished, not in an estuary, but in a land-locked basin. The area of the Puget group includes the Cascade Range, but is not otherwise yet clearly defined eastwards from the Pacific seaboard.—Papers are contributed by L. G. Eakins, on some sulphantimonites from Colorado; by A. E. Kennelly, on the voltametric measurement of alternating Currents; by Dr. C. Hart Merriman, on the fauna of the Great Smoky Mountains, with description of a new species of red-backed mouse; by W. E. Hidden and J. B. Mackintosh, on anerlite, a new thorium mineral; and by O. C. Marsh, on a new family of horned Dinosaurians (*Ceratops montanus*) recently discovered *in situ* in the Laramie deposits of the Cretaceous period, in Montana. This reptile was a very formidable animal, armed not only with horns of great strength, but with a thick dermal hide, and varying in length from 25 to 30 feet.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 6.—"Some Observations on the Amount of Light reflected and transmitted by certain kinds of Glass." By Sir John Conroy, Bart., M.A., Bedford Lecturer of Balliol College and Millard Lecturer of Trinity College, Oxford. Communicated by A. G. Vernon Harcourt, F.R.S.

Conclusions.—It seems probable that the amount of light reflected by freshly polished glass varies with the way in which it has been polished, and that, if a perfect surface could be obtained without altering the refractive index of the surface-layer, then the amount would be accurately given by Fresnel's formula, but that usually the amount differs from that given by the formula, being sometimes greater and sometimes less.

The formation of a film of lower refractive index on the glass would account for the defect in the reflected light; but to account for the excess, it seems necessary to assume that the polishing has increased the optical density of the surface-layer, and the changes produced in the amount of light transmitted and in the angle of polarization support this view.

After being polished, the surface of flint glass seems to alter somewhat readily, the amount of the reflected light decreasing, and the amount of the transmitted increasing, whilst with crown glass the change, if any, proceeds very slowly.

There is no evidence to show to what particular cause these changes are due.

The values of the transmission coefficients for light of mean refrangibility for the two particular kinds of glass are given, and show that for 1 cm. the loss by obstruction amounts to 2·62 per cent. with the crown glass and 1·15 per cent. with the flint glass.

Linnean Society, December 6.—Mr. W. Carruthers, F.R.S., President, in the chair.—Mr. W. H. Beeby exhibited and made some remarks on specimens of *Valeriana mikanii* and *sambucifolia*, and a series of *Potamogeton fluitans*.—Mr. F. W. Oliver described the nature and growth of leaf-emergences in *Eriospermum folioliferum*.—Mr. E. M. Holmes exhibited specimens of a new Assafœtida plant (*Ferula fœtidissima*), and a monstrosity of *Zea Mays*.—Mr. J. G. Baker exhibited a curious variety of *Vicia sepium*, found in North Yorkshire.—Mr. T. Christy exhibited specimens of an undetermined species of *Echium* received from Persia, and employed medicinally as a good alterative.—The first paper read was one by Dr. Costerus on malformation in *Fuchsia globosa*, upon which Prof. Bower offered some critical remarks.—The next paper was by Mr. B. T. Lowne, who gave an admirable demonstration of the mode of development of the egg and blastoderm of the blow-fly. His conclusions were criticized by Prof. Stewart, Prof. Howes, and Mr. A. R. Hammond.—In continuation of the Reports on the collections made by Mr. Ridley in Fernando Noronha, a paper was read on behalf of Mr. Boulenger, enumerating the fishes and reptiles which had been identified by him.

Physical Society, December 8.—Prof. Reinold, F.R.S., President, in the chair.—The following communications were read:—Note on a modification of the ordinary method of determining electro-magnetic capacity, by Dr. J. W. W. Waghorne.—On some facts connected with the systems of scientific units of measurement, by Mr. T. H. Blakesley.—Some improved polarizing apparatus for microscopes were exhibited and described by Dr. S. P. Thompson. For polarizer, he uses an Ahrens' prism, and for analyzer a flat-ended one of his own design. The Ahrens' prism is formed from a rectangular block of spar, two faces of which are perpendicular to the optic axis; two cuts parallel to the axis are made from the middle of one side to the ends of the opposite, and the cut faces are polished and cemented by Canada balsam. A short prism with wide angle is thus obtained, which can be readily fitted to the substage of the microscope. The analyzer, which consists of two wedges of spar, is mounted in a tube which fits on the eye-piece, and by recognizing that the upper end need not be larger than the pupil of the eye, the author has been able to considerably reduce the length of the prism, and still keep the bottom end large enough to collect all the rays passing through the eye-piece. Several ingenious methods of cutting spar so as to produce prisms with minimum waste were described and illustrated by models, and a "Nicol" made by the inventor at the age of 79 was exhibited. Mr. Lant Carpenter asked the author why he condemned analyzers placed directly behind the objective, for in

his experience this arrangement gave the most satisfactory results. In reply, Dr. Thompson said his experience was decidedly different from that of Mr. Lant Carpenter, and mentioned that Zeiss had abandoned the common arrangement, and now introduced his analyzers between the two lenses of his Huyghenian eye-pieces.

Chemical Society, December 6.—Mr. W. Crookes, F.R.S., President, in the chair.—The following papers were read :—A method of determining vapour-density, applicable at all temperatures and pressures, by Dr. W. Bott. The apparatus consists of a large Victor Meyer's bulb, carrying a detachable head-piece, which can be connected with the air-pump. The neck of the bulb communicates with a mercury pressure-gauge, which again is connected with a wide measuring tube attached to an adjustable mercury reservoir. The experiment is conducted as follows. The substance having been placed in the head-piece of the vessel, the latter is heated until the volume has become constant. The apparatus is then exhausted as far as may be requisite, and the reservoir so adjusted that the graduated measuring tube is filled with mercury. The pressure indicated by the gauge having been carefully noted, the substance is allowed to drop into the hot part of the vessel, and the surplus pressure produced by its evaporation is removed by drawing off an equivalent volume of air into the measuring tube until the initial pressure in the gauge has been restored. From the volume of gas measured in the graduated tube, the density referred to hydrogen is obtained by the formula $d = 8484893\frac{S(1 + 0{\cdot}00367t)}{VP}$; in which S = weight of substance, V = volume of gas in measuring tube, P = pressure of gas in measuring tube, t = temperature of gas. In the discussion which followed, Prof. Ramsay, remarking on a statement made by the author that he proposed to make use of the apparatus in studying the influence of pressure on dissociation, said that recent investigations had shown that the Victor Meyer form of apparatus was by no means a suitable one for the study of such problems ; and he expressed the opinion that for this reason results such as those recently published by Nilson and Pettersen could not be accepted as final.—Some derivatives and new colouring-matters of α-pyrocresole, by Dr. W. Bott and Mr. J. B. Miller. The authors have prepared di- and tetranitro- and di- and tetramido- derivatives of α-pyrocresole oxide. Both amido-derivatives can be diazotized, and the diazo-salts interact with β-naphthol in alkaline solution, yielding two oxyazo-compounds ; these are insoluble in water, but can be converted into soluble sulphonic acids, which dye silk and wool maroon and salmon colour respectively.—Berberine, by Prof. W. H. Perkin. When oxidized with excess of potassium permanganate in slightly alkaline solution, berberine yields, as principal product, hemipinic acid, $C_{10}H_{10}O_6$, as Schmidt and Schilbach (*Arch. Pharm.* [3], 164–170) have already shown. In view of the interesting results lately obtained by Goldschmiedt in his examination of hemipinic and methemipinic acids, the author has carefully re-examined the hemipinic acid from berberine, and is convinced that it is identical with that obtained by the oxidation of narcotine. The acid from berberine contains two (OCH_3) groups : on fusion with potash it yields protocatechuic acid ; and on distilling it with ethylamine, hemipinethylimide, melting at 96°, is formed. This latter substance possesses all the properties of the hemipinethylimide obtained by Liebermann by the action of ethyl iodide on the potassium salt of hemipinimide (from narcotine), and thus the identity of the two hemipinic acids from berberbine and narcotine is proved. Oxidation with a limited quantity of permanganate results in the production of a number of new substances, three of which have been obtained in a state of purity : a new acid, $C_{20}H_{17}NO_9$ (m.p. = 143°), and two neutral substances, $C_{20}H_{17}NO_8$ (m.p. = 236°) and $C_{20}H_{15}NO_7$ (m.p. = 150°), all of which yield protocatechuic acid on fusion with potash. Employing Zeisel's method, the author finds that two methoxyl (OCH_3) groups are present in the berberine molecule.—The action of ammonia on some tungsten compounds, by Dr. S. Rideal.—Condensations of α-diketones with ethylic acetoacetate, by Dr. F. R. Japp, F.R.S., and Dr. F. Klingemann. A preliminary note on the reactions of ethylic phenanthroxylene-acetoacetate, the condensation compound of phenanthraquinone with ethylic acetoacetate.—Thionyl thiocyanate, by Mr. G. C. McMurtry.—Mercuric chlorothiocyanate, by the same.—The action of chromium oxychloride on pinene, by Messrs. G. G. Henderson and R. W. Smith.—Tectoquinone, by Dr. R. Romanis. A continuation of the author's work on the quinone-like compound, $C_{18}H_{16}O_2$, found in teak resin (*Tectonia grandis*), and also in the products of the destructive distillation of the wood. Tectoquinone crystallizes in oblique rhombic prisms of an amber colour, resembling sulphur, melts at 171°, and is a very stable substance, dissolving in nitric and sulphuric acids without change. On reduction it yields a hydrocarbon, $C_{18}H_{22}$, and it is suggested that it may be the hitherto unknown retenequinone.—The decomposition of nitroethane by alkalies, by Prof. W. R. Dunstan and Mr. T. S. Dymond. Nitroethane in contact with potassium carbonate or its aqueous solution readily yields potassium nitrite and an oily liquid having the formula C_6H_9NO, which boils at about 170°, decomposing at a somewhat higher temperature with the formation of what appears to be a pyridine derivative.

Zoological Society, November 20.—Prof. Flower, F.R.S., President, in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the months of June, July, August, September, and October, 1888, and called attention to the acquisition of three specimens of Pallas's Sand-Grouse (*Syrrhaptes paradoxus*), captured out of the many flocks of this Asiatic bird that have lately visited the British Islands.—A letter was read from Prof. J. B. Steere, giving a preliminary account of the "Tamaron," a bovine animal found in the Island of Mindoro, Philippines, which he believed to be allied to the Anoa of Celebes.—Mr. Edgar Thurston exhibited and made remarks upon a collection of Corals from the Gulf of Manar, Madras Presidency.—Mr. H. Seebohm exhibited and made remarks on a specimen of a new species of Pheasant (*Phasianus tarimensis*), obtained by General Prjevalsky at Lob Nor, Central Asia.—Mr. H. Seebohm also exhibited a specimen of a species of Plover new to the British Islands (*Vanellus gregarius*), which had been shot in Lancashire about twenty-five years ago, and had been previously supposed to be a Cream-coloured Courser.—Mr. J. W. Hulke, F.R.S., read a paper on the skeletal anatomy of the Mesosuchian Crocodiles, based on fossil remains from the clays near Peterborough, in the collection of Mr. A. Leids, of Eyebury.—Mr. Oldfield Thomas read a paper on a collection of small Mammals obtained by Mr. William Taylor in Duval County, South Texas. The collection contained examples of one new species and one new geographical variety, besides adding no less than six species to the national collection of Mammalia.—A communication was read from M. L. Taczanowski, containing a supplementary list of the birds collected in Corea by Mr. Jean Kalinowski.

December 4.—Prof. Flower, F.R.S., President, in the chair.—Mr. Howard Saunders exhibited and made remarks on an adult male of the American Green-winged Teal (*Querquedula carolinensis*), shot in Devonshire in 1879.—Mr. Oldfield Thomas gave an account of the Mammals obtained by Mr. C. M. Woodford during his second expedition to the Solomon Islands. The author stated that the total number of species of Mammals now known from the Solomons was brought up by the present collection from 13 to 22, and that of these no less than 8 had been discovered by Mr. Woodford, his previous collection having contained examples of 2 and the present of 6 new species. There were also two new genera of Bats to be added to the one previously described.—Mr. F. E. Beddard read a paper upon the genus *Clitellio*, which had been recently investigated by him at the Marine Biological Station at Plymouth.—Prof. Howes and Mr. Davies read a paper on the distribution and morphology of the supernumerary phalanges in the Anurous Batrachians.—A communication was read from Mr. J. J. Lister, giving a general account of the natural history of Christmas Island, in the Indian Ocean, which he had visited in 1887 as naturalist to H.M. surveying-vessel *Egeria*.—Mr. Oldfield Thomas read a paper on the Mammals of Christmas Island, obtained by Mr. Lister during the same expedition.—This was followed by reports on the Reptiles of Christmas Island obtained during the expedition, by Mr. G. Boulenger ; on the Terrestrial Mollusks, by Mr. Edgar A. Smith, on the Coleoptera, by Mr. C. J. Gahan ; on the Lepidoptera, by Mr. A. G. Butler ; on the other Insects, by Mr. Kirby ; and on the Annelida, Myriapoda, and Land Crustacea, by Mr. R. I. Pocock.

Entomological Society, December 5.—Dr. D. Sharp, President, in the chair.—Mr. W. F. Kirby exhibited, for the Rev. Dr. Walker, a variety of the female of *Ornithoptera brookiana* ; also, for Major Partridge, an undetermined species of the genus *Hadena*, captured last summer in the Isle of Portland.—Mr. R. South exhibited a series of *Tortrix piceana*, L.,

from a pine wood in Surrey; also melanic forms of *Tortrix podana*, S.—Prof. Meldola, F.R.S., exhibited, for Dr. Laver, a melanic specimen of *Catocala nupta*, taken last September at Colchester.—Mr. E. B. Poulton exhibited preserved larvæ of *Sphinx convolvuli*, showing the extreme dark and light forms of the species.—Mr. McLachlan, F.R.S., called attention to a plate, representing species of the genus *Agrotis*, executed by photography, illustrating a memoir by Dr. Max Standfuss, in the *Correspondenz-Blatt*, Verein *Iris*, in Dresden, 1888. He considered it was the best example of photography as adapted for entomological purposes he had ever seen.—The Rev. Canon Fowler exhibited a specimen of *Mycterus curculionides*, L., sent to him by Mr. Olliff, and taken near Oxford about 1882.—Mr. W. Nicholson exhibited several melanic varieties of *Argynnis niobe* and *A. pales*, collected by himself last summer in the Engadine.—Mr. J. H. Leech exhibited a collection of Lepidoptera formed last year at Kiukiang. It included several new species.—Mr. H. Goss exhibited, for the Rev. T. A. Marshall, fifteen undescribed species of British *Braconidæ*.—M. A. Wailly exhibited a collection of Lepidoptera lately received from Assam, containing upwards of thirty-five species of *Papilio*, *Ornithoptera*, *Charaxes*, *Diadema*, *Cyrestis*, and other genera.—Mr. Meyer-Darcis exhibited specimens of *Sternocera tricolor*, Kerr, and *S. variabilis*, Kerr, from Lake Tanganyika; and two new species of *Julodis* from Syria.—Mr. F. Merrifield exhibited, and made remarks on, a long series of *Selenia illustraria*, *S. illunaria*, and *E. alniaria*, in illustration of his paper on "Pedigree Moth-breeding."—Lord Walsingham, F.R.S., exhibited, and made remarks on, a series of species representing the genera *Snellenia*, Wlsm., *Œdematopoda*, Z., and *Eretmocera*, Z.—The Rev. T. A. Marshall communicated a paper entitled "A Monograph of British *Braconidæ*, Part III."—The Rev. Dr. Walker communicated a paper entitled "Description of a variety of the female of *Ornithoptera brookiana*."—Lord Walsingham read a paper entitled "A Monograph of the genera connecting *Tinagma* Wlk., with *Eretmocera*, Z." A discussion ensued, in which Mr. Stainton, F.R.S., and Dr. Sharp took part.—Mr. Merrifield read a paper entitled "Incidental Observations in Pedigree Moth-breeding." This paper contained a detailed account of experiments with *Selenia illustraria*, *S. illunaria*, and *E. alniaria*, which, so far as they had yet proceeded, indicated that retardation of development in the growing stages of the larvæ, as well as in the pupal stage, was the cause of the darkening of colour in the perfect insects; and that a low temperature had the effect of causing such retardation. Lord Walsingham, Mr. Poulton, Prof. Meldola, Mr. White, and Mr. Merrifield took part in the discussion which ensued.—Mr. J. H. Leech read a paper entitled "Description of a small collection of Lepidoptera from Kiukiang." Captain Elwes said he had examined this collection with very great interest, and was struck with the similarity of many of the species to those from Sikkim.

Geological Society, December 5.—Dr. W. T. Blanford, F.R.S., President, in the chair.—The following communications were read:—Notes on two traverses of the crystalline rocks of the Alps, by Prof. T. G. Bonney, F.R.S. These journeys were undertaken in the summer of 1887, in the company of the Rev. E. Hill, in order to ascertain whether the apparent stratigraphical succession among the gneisses and crystalline schists which the author had observed in the more central region of the Alps, held good also in the Western and Eastern Alps. At the same time all circumstances which seemed to throw any light on the origin of the schists were carefully noted. The author examined the rocks along two lines of section:—(1) By the road of the Col du Lautaret from Grenoble to Briançon, and thence by the Mont Genèvre and the Col de Sestrières to Pinerolo, on the margin of the plain of Piedmont. (2) From Lienz, on the upper waters of the Drave, to Kitzbuhel; besides examining other parts of the central range, east of the Brenner Pass. The specimens collected have subsequently been examined microscopically. The results of the author's investigation may be briefly summarized as follows:—(1) While rocks of igneous origin occur at all horizons among the crystalline series of the Alps, these, as a rule, can be distinguished; or, at any rate, even if the crystalline schists in some cases are only modified igneous rocks, these are associated with recognizable igneous rocks of later date. (2) There are, speaking in general terms, three great rock-groups in the Alps which simulate curiously, if they do not indicate, stratigraphical sequence. The lowest and oldest resembles the gneisses of the Laurentian series; the next, those rather "friable" gneisses and schists called by Dr. Sterry Hunt the Montalban series; the third and uppermost is a great group of schists, generally rather fine-grained, micaceous, chloritic, epidotic, calcareous, and quartzose, passing occasionally into crystalline limestones, and (more rarely) into schistose quartzites. (3) The Pietra Verde group of Dr. Sterry Hunt, so far as the author has been able to ascertain, consists mainly of modified igneous rocks, of indeterminable date, and is at most only of local, if, indeed, it be of any classificatory value. (4) Of the above three groups the uppermost has an immense development in the Italian Alps and in the Tyrol, north and south of the central range. It can, in fact, be traced, apparently at the top of the crystalline succession, from one end of the Alpine chain to the other. (5) The middle group is not seldom either imperfectly developed or even wanting, appearing as if cut out by denudation. It was not seen in the traverse of the Franco-Italian Alps, except perhaps for a comparatively short distance on the eastern side, being probably concealed by Palæozoic and Mesozoic rocks on the western side. It is not very completely developed in the Eastern Tyrol, and seems to prevail especially in the Lepontine Alps, and on the southern side of the watershed. (6) The lowest group is fairly well exposed, both in the French Alps and in the Central Tyrol. (7) As a rule, the schists of the uppermost group had a sedimentary origin. The schists and gneisses of the middle group very probably, in part at least, had a similar origin. In regard to the lowest group it is difficult, in the present state of our knowledge, to come to any conclusion. (8) The slates and other rocks of clastic origin in the Alps, whether of Mesozoic or of Palæozoic age, though somewhat modified by pressure, are totally distinct from the true schists above mentioned, and it is only under very exceptional circumstances, and in very restricted areas, that there is the slightest difficulty in distinguishing between them. The evidence of the coarser fragmental material in these Palæozoic and later rocks indicates that the gneisses and crystalline schists of the Alps are very much more ancient than even the oldest of them. (9) The remarks made by the author in his Presidential address, 1886, as to the existence of a "cleavage-foliation" due to pressure, and a "stratification-foliation" of earlier date, which seemingly is the result of an original bedding, and as to the importance of distinguishing these structures (generally not a difficult thing), have been most fully confirmed. He is convinced that many of the contradictory statements and much of the confusion in regard to the origin and significance of foliation are due to the failure to recognize the distinctness of these two structures. In regard to them it may be admitted that sometimes "extremes meet," and a crystalline rock pulverized *in situ* is very difficult to separate from a greatly squeezed fine-grained sediment; but he believes these difficulties to be very local, probably only of a temporary character, and of little value for inductive purposes. After the reading of this paper, the author's conclusions were discussed by the President, Mr. Teall, Dr. Hicks, Mr. Bauerman, Prof. Blake, and Dr. Geikie.—On fulgurites from Monte Viso, by Frank Rutley.—On the occurrence of a new form of tachylyte in association with the gabbro of Carrock Fell, in the Lake District, by T. T. Groom. Communicated by Prof. T. McKenny Hughes.

PARIS.

Academy of Sciences, December 10.—M. Daubrée in the chair.—Observations of Faye's comet, made at the Marseilles Observatory, with the 0·80 m. Foucault telescope, by M. Stephan. These observations cover the period from December 5-8, when the nucleus was equal to a star of the eleventh or twelfth magnitude.—Geographical work in Brazil, by M. L. Cruls. The Imperial Observatory of Rio de Janeiro having undertaken to determine the geographical positions of a number of stations on the railway between the capital and Sabara, the results are given for the first two stations of Rodeio and Entre-Rios.—On the application of the theta functions of a single argument to the problems of rotation, by M. F. Caspary. A *résumé* is given of the calculations which the author has worked out with a view to determining the formulas relative to the problem of rotation of a heavy body suspended at a point of its axis.—On a general proposition regarding linear equations with partial derivatives of the second order, by M. Emile Picard.—On the employment of oxygenated water for the quantitative analysis of the metals of the iron group: (1) chromium, by M. Adolphe Carnot. On the solutions of various metals of the iron group oxygenated water determines certain reactions, sometimes of a reducing, sometimes of an oxidating, character. This property is capable of being

turned to account in chemical analysis, and the author proposes to deal successively with chromium, manganese, iron, cobalt, and nickel. In the present paper he shows the remarkable reaction furnished by chromic acid with oxygenated water, known as the Barreswil reaction.—On a latex of *Bassia latifolia*, Roxb., by MM. Edouard Heckel and Fr. Schlagdenhauffen. This plant, the well-known *Mohwa* of British India, is found to yield by incision a latex capable of supplying a kind of gutta-percha. When evaporated to about one-fourth of its volume, the sap furnishes an adhesive mass in the proportion of 6·67 per cent., which is partly soluble in alcohol and acetone, and which in the insoluble state leaves 27·027 per cent. of a gutta, the composition and industrial properties of which will form the subject of a future memoir.—On some new or little-known Infusoria, by M. J. Kunstler. Several minute intestinal parasites of various animals are described, including a remarkable ciliated Infusorium peculiar to *Periplaneta americana*.—On the *coussinet* (*cushion* or *pad*), a new organ attached to the sting of the Hymenoptera, by M. G. Carlet. This organ, here for the first time described, appears to be a sort of pivot round which the sting revolves, preventing this weapon from adhering to the teguments, and facilitating its movements. But the chief function of the "pad" is to retain in the sacs of the trachea the supply of air necessary for their inflation. This it effects by facilitating the action of the operculum, which thus appears to be a veritable safety-valve in the abdominal region.—On the measurement of the large bones in the human system, and on its applications to anthropological and medico-legal questions, by M. Etienne Rollet. The results are given of the measurements, made with Broca's apparatus, of the large bones of fifty men and fifty women lately deceased in the hospitals of Lyons. Much asymmetry was discovered between the bones on the right and left sides of the skeleton. An attempt made to determine stature from the size especially of the femur and humerus yielded satisfactory results. Compared with those of negroes and negresses, these measurements show generally that in the black race the upper and lower members, especially tibia and radius, are longer than in the South European, the difference being more marked in the female than in the male sex.—On the phosphated deposits of Montay and Forest, Département du Nord, by M. J. Ladrière. The author describes the origin and composition of these deposits, which in some places are rich enough to be worked with profit.—The dislocations of the primitive formations in the north of the central plateau of France, by M. L. de Launay. The lacustrine and independent origin of the various coal basins in this region is generally admitted by modern geologists. Here the author goes further, and endeavours to determine the causes to which was due the creation of the pre-Carboniferous lakes themselves, as well as their actual position on the plateau. This study is largely based on an entirely new and minute examination of the foldings to which the gneisses and mica-schists of the underlying systems have been subjected. The history of these movements, comprising a considerable number of progressive phases, shows that the successive dislocations invariably took place in the same direction, each great disturbance being merely an intensified repetition of the preceding. The general result in this region was to connect in one vast V-shaped system the Breton and Morvan foldings running respectively in the directions from north-east to south-east and from north-east to south-west.

AMSTERDAM.

Royal Academy of Sciences, November 24.—M. Hugo de Vries read a paper on the pangenesis of Darwin, expressing the conviction that Darwin's doctrine presents a great many more data for the explanation of various phenomena in the domain of heredity than the doctrine of Weismann. The author especially tried to demonstrate that the hypothesis of the transport of gemmules may be rejected without endangering the validity of the arguments implicated in that hypothesis, which would connect the separate properties of any organism with some definite species of particles of living matter. He also pointed to the fact that the theory expounded after Darwin's time, according to which the nucleus of the germ-cell must be the seat of heredity, is in accordance with the import of the last-mentioned hypothesis.—On tænodal points, by M. Korteweg. The author treated of their first appearance and disappearance on a gradually deformed surface. There exist four kinds of singular points of the first order of exceptionality, where two or more tænodal points come together, viz. two quite different species of double tænodal points—oscular points and conical points. When a double tænodal point occurs on the variable surface, a couple of tænodal points pass from reality to non-reality, or *vice versâ*. An oscular point is not accompanied by any change in the number of real tænodal points. In a conical node, as many couples as there are real double lines (six at most) at the conical node of the cubic surface obtained by neglecting all terms of the fourth order and higher, become real or imaginary according to the direction of the deformation. The other couples (six at least) cannot emerge from non-reality. As an immediate result of his general theory, the author deduces the theorem: The difference between the number of real tænodal points and real lines is the same for every cubic surface, and equal to three.—M. Martin showed that the lower jaw, found in the year 1823 when digging the canal called "Luid-Willemsvaart," in the Kaberg, near Maestricht, and hitherto regarded as the remains of a so-called fossil or diluvial human being, was not found in the geological formation which harbours such remains, but in another of more recent date, so that the importance of this jaw—found by the author after a long and troublesome search in the anatomical cabinet of the Leyden University—can no longer be maintained.—M. Martin stated that he had discovered recently, in a parcel of petrifactions collected by the mining engineer, J. A. Hooze, in Martapoera, some characteristic fossils from the chalk-formation; so that it is positively ascertained that in the south-eastern part of Borneo there exists a chalk-formation, as was formerly supposed by Geinitz.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Seas and Skies in many Latitudes: Hon. Ralph Abercromby (Stanford).—The Region of the Eternal Fire, Popular Edition: C. Marvin (Allen).—The Floral King; a Life of Linnæus: A. Alberg (Allen).—The British Journal Photographic Almanac, 1889 (Greenwood).—Nature's Fairy-Land, 2nd edition: H. W. S. Worsley-Benison (E. Stock).—Hand-book to the Optical Lantern: Welford and Sturmey (Iliffe).—The Blowpipe in Chemistry, Mineralogy, and Geology, 2nd edition: Lieut.-Colonel W. A. Ross (Lockwood).—Round about New Zealand: E. W. Payton (Chapman and Hall).—Through the Heart of Asia, 2 vols.: G. Bonvalot (Chapman and Hall).—Natural History Collections made in Alaska between the Years 1877 and 1881: E. W. Nelson (Washington).—Our Rarer Birds: C. Dixon (Bentley).—The Alps: Prof. F. Umlauft, translated by L. Brough (K. Paul).

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