THURSDAY, AUGUST 17, 1876

A PHYSICAL SCIENCE MUSEUM

MANY of our readers will, no doubt, entertain the belief that the proposal to establish a Museum of Pure and Applied Science, to include what is known as the Patent Museum, recently laid before the Duke of Richmond and Gordon by the President of the Royal Society and other distinguished men of science, has been a thing of sudden growth. Some justification for such a belief may seem to be derived from the Loan Collection of Scientific Apparatus now being exhibited at South Kensington, and many of those who have witnessed its success would like to see it developed into a permanent institution. No doubt, this Collection has helped to bring into practical shape the desire which for years many men of science in this country have possessed of seeing this country possessed of an institution similar to the Paris Conservatoire des Arts et Métiers, which desire has at last taken the form of the all but unanimous memorial on the subject which was recently presented to the Lord-President of the Council, and which we published in a recent number. But the truth is that this memorial is strictly in accordance with an official recommendation made to the Earl of Granville, then Lord-President of the Council, as far back as the year 1865. At that time the Secretary of the Science and Art Department and Director of the South Kensington Museum, Mr. (now Sir) Henry Cole, along with the late Capt. Fowke, were instructed by the Lord-President to proceed to Paris and report upon the relations between the Conservatoire des Arts et Métiers and the French Patent system.

The results of this official visit to Paris were given in a report by Mr. Cole and Capt. Fowke to the Lord-President, which will be found in the "Twelfth Report of the Science and Art Department" (1865), and was laid before Parliament. As few of our readers can have access to this Report, and as those with whom the decision as to the memorial will rest, cannot be expected to know all that has been previously said and done in this matter, and as, moreover, the subject is one of prime importance to the country and to science, we believe we shall be doing good service by exhuming from this old blue-book the special Report to which we refer :—

REPORT ON THE CONSERVATOIRE DES ARTS ET MÉTIERS AND BREVETS D'INVENTION.

TO THE LORD PRESIDENT OF THE COUNCIL.

South Kensington Museum, January 1865.

MY LORD,—In obedience to your Lordship's instructions that we should proceed to Paris and examine into the relations which exist between the *Conservatoire des Arts et Métiers* and system of French patents, we have prepared and have now the honour of submitting, the following report.

1. The *Conservatoire* of late years, under the able direction of General Morin and M. Tresca, has become one of the most popular institutions in Paris.

2. This establishment, first created in 1788, has passed through many phases of constitution and management. At the present time it has three predominant features: (*a*), the public exhibition of machinery, manufactures, and models of an industrial and scientific nature; (*b*), a scientific library open gratuitously to all; and (*c*), courses of gratuitous lectures given during the autumn and winter in the evening by the most eminent professors in France. These lectures are attended by several hundred persons. A prospectus of the courses for the present session is appended (p. 280).

3. Besides these three features, the *Conservatoire* is the repository for the *Brevets d'Inventions* and the models deposited with them, which have exceeded the age of 15 years from the first issue of them. This connection of the institution with extinct *Brevets d'Invention* is a subordinate feature to its chief operations.

4. The *Conservatoire* consists of a series of ancient and modern buildings. The ancient, belonging to the abbey of St. Martin des Champs, date from A.D. 1060, and are highly interesting to the archæologist. They have been well adapted to the purposes of the establishment, especially the old refectory, now converted into the library.

5. The principal façade is now opened to the new *Boulevard de Sevastopol*, fronting a large square. Additional parts of the old monastic buildings of the convent of St. Martin are being restored and brought into use, whilst new buildings are being constructed to afford additional space. The ground already occupied by the establishment is 5·178 acres (or 20,956 métres carrés), and this is being extended to 6·558 acres, or 26,540 métres carrés de terrain. The buildings themselves occupy at present 8,383 métres carrés, or 10,026·346 square yards, which will be enlarged to 16,744·565 square yards.

6. The laying out of the ground and the divisions into which the collection is arranged are shown by the accompanying plan (App. C).

7. The divisions are—machinery in motion, hydraulics in motion, agricultural implements, locomotives, horology, building models, &c.

8. These plans show the position of the two chambers, the lower of which contains the specifications of *Brevets d'Invention*, whilst the upper contains the models. These chambers are on the opposite side of the court to the library, and have no connection with it. These rooms are about 60 feet long by 20 feet wide. The contents are very miscellaneous, and covered with dust, such as old hats, and woven fabrics, traps, tin ware, surgical appliances, and broken wooden models. It is not surprising that they are not considered of sufficient value or public interest to be kept with the general collection. They are never consulted. M. Tresca, the sous-directeur, has kindly answered some questions which we put to him (see p. 287). He shows that they do not influence the extent of the general collection of machinery, &c., and their value to it is explained to be nothing.

9. On Thursdays and Sundays the galleries are open free, and are crowded. On other days, reserved for students, the principle of admitting the public by a moderate charge, as at South Kensington, has been adopted, and visitors pay one franc each.

10. Four separate authorities throughout France are concerned in the issues and searches of *Brevets d'Invention*.

a. The Ministry of Finance.
b. The Ministry of Agriculture and Commerce.
c. The Prefecture of the Department.
d. The *Conservatoire*.

The necessary instructions, &c., for obtaining a brevet are given in a paper appended (page 282). It will be observed that the instructions make no mention of models as any part of a *Brevet d'Invention*, and, as M. Tresca shows, they are of no value whatever.

11. In Paris all *Brevets d'Invention* are kept and registered. Those under 15 years of age are preserved in the *Rue de Varennes*, on the south side of the Seine; those above that age in the *Conservatoire des Arts et Métiers* on the north side, about two miles apart.

12. The steps necessary to be taken in Paris for ob-

taining a *Brevet d'Invention* are as follows:—The applicant for a patent must first apply to No. 24, *Rue de Mont Thabor*. This is a subordinate bureau of the Ministère des Finances, not very readily found or publicly indicated. He passes through a gateway between the *Café des Finances* and a stable for *remises*. He ascends to the second stage up narrow stairs, dark and odorous. Here is the bureau for the first stage of proceeding. He pays 5 francs, and obtains the necessary forms to be filled up; fills them up and pays 100 francs.

13. These forms being filled up, he takes them with the receipt to the *Hôtel de Ville*, and there he deposits his specification.

14. This specification is sent to a third bureau, which is on the opposite side of the Seine, No. 78, *Rue de Varenne*, the Ministère de l'Agriculture et du Commerce, and is also up two pairs of narrow dark stairs. Here the specifications are kept during 15 years, whilst the patent lasts; after that period they are transferred with any models accidentally accompanying them to the *Conservatoire des Arts et Métiers*. The room for searches is about 60 feet long and 16 feet wide. The specifications are arranged in *carton* boxes on shelves. It is rather crowded. Anyone enters and searches in the printed catalogues and calls for the *brevet* without let or hindrance; but he is not permitted to make notes even in pencil. Copies must be ordered of the office at a given tariff, and if a copy of a drawing is required, he must bring his own draughtsman.

15. The catalogue of the specifications is printed, and may be bought at V. Bouchard Huzard, Rue d'Eperon, No. 5.

16. It has been already pointed out that the law does not require that any models should be made, but some are sent. The officers kindly showed us what they possessed. We were conducted up back stairs into a little room about 10 feet wide by 20 feet long. The floor was covered with models unarranged, and very dusty. On a shelf were some models in tin, also very dusty. A model of a shoe was here, a candlestick there, &c. The officer said that they were very rarely looked at, and the accuracy of the statement was fully borne out by the condition of the room. He said that all the models in this small chamber were the products of some 20 years.

17. These facts show that the *Conservatoire des Arts et Métiers* did not arise and is not at all dependent on any connection with models accidentally delivered with the *Brevets d'Invention*, which are not recognised by the French law. The *Conservatoire* is a great educational institution, teaching the general public through its exhibitions, and a special public through its lectures. It seems to us to afford an example which our own country might imitate with advantage generally as to scope and also in many of its details.—We have, &c.

(Signed) HENRY COLE,
FRANCIS FOWKE, Capt. R.E.

A map accompanies this Report which shows the buildings then occupied by the Conservatoire and those which it was proposed to build in addition. If the Commissioners of the 1851 Exhibition, to whose laudable scheme we recently referred, have not already consulted this map and the Report, we think they might do so with great advantage. There are many points in common between the scheme which they are considering and the plan which was then being carried out by the French Government, and which resulted in an institution that has been in working order for years, with, it is universally acknowledged, the best results to science and to France.

In the same Appendix M. Tresca furnishes answers to a number of questions with reference to the actual use made of the models of patents in the Patent Museum of Paris. The information thus afforded we would recommend to the notice of the Treasury Commission which has for some time been cogitating as to what course to pursue with regard to our own Patent Museum. The analogy between the two cases is very complete, and it suggests that the best solution lies in a course similar to that which has been followed in France. From M. Tresca's answers we learn that in the Catalogue of Patents there were 7,300 entries of models, only 10 of which are accompanied by specifications. While 1,400 specifications had been consulted during 1864, not a single model had been examined or asked for, thus showing that the models were a practically useless part of the Patent Museum. M. Tresca states that the place of a model can be supplied by a drawing, leading to more complete, exact, and certain results, and thus avoiding useless expense. Their loss, therefore, would really be a gain to the Conservatoire; they cause, M. Tresca states, embarrassment by their compulsory preservation, the objects rarely representing the final idea of the inventor. They for the most part get destroyed by time without having been consulted by any one. Might not a somewhat similar report be made of our own Collection of "Patents"?

The same blue-book contains some valuable information with regard to the lectures which were then given in the Paris Conservatoire, which is worth consulting. Later and more complete information in this department may, however, be found in the appendix to the Report of the Duke of Devonshire's Commission. From what we have said, it will be seen that the idea of a Government Science Museum is by no means of recent growth, but that, on the contrary, it has taken many years to come to a practical issue; and that, moreover, we have a ready-made example which has stood the test of years, and is now doing work of the highest practical value in the Paris Conservatoire des Arts et Métiers.

COHN ON THE BIOLOGY OF PLANTS

Beiträge zur Biologie der Pflanzen. Herausgegeben von Dr. Ferdinand Cohn. (Breslau, 1875.) Drittes Heft.

THE third part of Cohn's "Beiträge," now before us, completes the first volume, and let us express the hope that we may have another volume before very long. Curiously, each of the three parts has been separately paged, an arrangement which renders it necessary to note the part as well as the page when the index is consulted. If we may judge from the size and price, each part has increased in importance, so that the third part has more papers and is nearly double the size of the first. In all the parts there have been papers of great interest and value, and those in the present part are in no way behind their predecessors. Dr. Cohn himself contributes three papers to the present part, Dr. J. Schrœter two, while Drs. L. Just, A. B. Frank, Richard Sadebeck, and Eduard Eidam, each one. The first paper is by Dr. Schrœter on the Development of certain Rust-Fungi. On *Carex hirta*, one of the Uredineæ was observed which Dr. Schrœter believes to be *Puccinia caricis* of De Candolle; and as he had reason to suspect that *Æcidium urticæ* of Schum was only a stage in the life history of *P. caricis*, experiments were made to ascertain definitely whether *P. caricis* was heterœcious, and if so, whether *Æcidium* *urticæ* was one of the stages. Details of the experiments are given, and Schrœter concludes that *Æcidium urticæ* is a stage of *Puccinia caricis*. In a note to his paper, Dr. Schrœter mentions that Dr. Magnus, of Berlin, has made similar experiments with the same result, an important confirmation of the remarkable habit these curious plants have of changing from one host to another, and at the same time changing the form of their spores, a condition described by De Bary long ago in the rust of wheat. A second form noticed by our author is a species of rust common on many grasses. It has many names, and Dr. Schrœter calls it *Uromyces dactylidis*, Ottli, (*Uromyces graminis*, Cooke). One stage is spent in our common grasses, such as *Dactylis glomerata*, *Poa nemoralis*, *P. trivialis*, *P. annua*, *P. pratensis*, &c. The other stage occurs on *Ranunculus bulbosus*, *R. repens*, and *R. polyanthemos*, and is known as *Æcidium Ranunculacearum*, D.C. The Æcidia occurring in other Ranunculaceæ (*Clematis*, *Thalictrum*, &c.) seem to belong to other species. Dr. L. Just's paper is a physiological one, showing the effect of the epidermis of the apple in preventing loss of water by transpiration. The third paper, by Dr. J. Schrœter, on the effect of disinfectants in lower organisms, shows markedly the value of carbolic acid in destroying germs. In the fourth paper Dr. A. B. Frank shows how light influences the relative time of development of the flowers in a catkin, those flowers opening first which receive the most light. Next follow two papers by Dr. Ferdinand Cohn, one on the "Function of the Bladders of Aldrovanda and Utricularia," the other on the "Development of the genus Volvox." English readers are already acquainted with the more important facts recorded in the first paper, as they have already been made use of by Mr. Darwin in his work on "Insectivorous Plants." The second paper is of especial interest in relation to the re-distribution of the Thallophytes, by Prof. Sachs, in the fourth edition of his justly celebrated "Lehrbuch." The structure of volvox is carefully described, and its modes of reproduction both sexual and non-sexual. The non-sexual reproductive cells Cohn calls Parthenogonidia. Non-sexual reproduction seems to take place during the whole year, and the alternation of generations is completed by the occurrence of sexual reproduction in the spring. The volvox-colony, or cœnobium, is either monœcious or diœcious, the female cells, or Gynogonidia are either produced along with the male cells, or Androgonidia, in the same colony, or they are not. Cohn proposes to divide the Linnæan Volvox globator into two sub-species, namely, (*a*) *Volvox monoicus*, and (*b*) *Volvox dioicus*, the former having both andro- and gynogonidia, the latter either one or other. The structure of Volvox is very like that of Pandorina, but the reproduction is like that of Sphaeroplea, and it belongs, not to the Zygosporeæ, which have conjugating zoospores, but to the Oosporeæ. Cohn, however, does not consider the Zygosporeæ and Oosporeæ to be separate classes of the Thallophyta, but only to be subdivisions of one class, to which he gives the name of Gamosporeæ. The next division Cohn calls the Gamocarpeæ, a division quite equivalent to Sachs' Carposporeæ. In the Gamocarpeæ there are two methods of fertilisation. One by means of the Pollinodium, analogous to the conjugation in the Gamosporeæ, the other by Spermatia, resembling the Spermatozoids. In the higher plants a somewhat similar arrangement exists; the Muscineæ and Vascular Cryptogams having Spermatozoids, while the flowering plants have pollen and pollen-tubes, showing a certain analogy to the pollinodium of some of the Carposporeæ.

Dr. Richard Sadebeck contributes a paper on the remarkable parasite living in the cells of the prothallium of Equisetum, and called *Pythium equiseti*. It belongs to the Oosporeæ, and its structure and life-history is here well described.

The part concludes with two papers, "Researches on Bacteria," Parts II. and III. The first is by Dr. Cohn, and is a continuation of his paper with the same title in the second part of the "Beiträge," while the other is by Dr. Eduard Eidam. In the latter paper Dr. Eidam gives details of a series of very interesting researches on the action of different degrees of temperature and of drying on Bacterian Termo. The Bacteria were cultivated in Prof. Cohn's normal nutrient fluid, and the solution kept at definite temperatures for definite periods of time. The activity of Bacteria does not begin until the temperature rises above + 5° C. + 5½°, being the temperature at which they begin to multiply, although very slowly. Between 30° and 35° C. the multiplication is most rapid, but at 40° the activity again diminishes, and the Bacteria in the nutrient fluid are killed by exposure for fourteen hours to a temperature of 45° C., or for three hours at a temperature of 50° C. When dried the Bacteria can retain their vitality for a long time at high as well as at low temperatures. All these experiments are of especial interest at the present time and seem to have been conducted with great care. Prof. Cohn's paper deals chiefly with descriptions of new or imperfectly known genera and species, and concludes with an attempt at grouping the different genera of Bacteriaceæ according to their natural affinities. The close relation of Bacteria to the Phycochromaceæ is pointed out, and it is shown to be impossible to erect the Bacteriaceæ into a family separate from the Phycochromaceæ. Naegelis' name of Schizomycetes is objected to on the ground that Bacteria are not fungi, and the term Schizophyta proposed for the group instead. This group is nearly equivalent to and would take the place of Sachs' first class of Thallophyta, namely, the Protophyta. The Schizophyta includes two tribes: (1) Glœogenæ, in which the cells are either free or united by gelatinous substance; and (2) Nematogenæ, which are filamentous. To the first tribe belong such genera as Chroococcus, Micrococcus, Bacterium, Aphanocapsa, Glœocapsa, Clathrocystis, Sarcina, Polycystis, &c.; while to tribe 2 belong Beggiatoa, Oscillaria, Vibrio, Spirulina, Anabæna, Nostoc, Rivularia, Cladothrix, Scytonema, &c. The paper is an exceedingly interesting one, and has most important bearings on the classification of the Thallophytes.

W. R. McNab

FERNET'S PHYSICS

Cours de Physique. Par É. Fernet. (Paris: G. Masson, Editeur, 1876.)

FROM the great success which attended the publication of Prof. Ganot's "Éléments de Physique," due in a great measure to the excellence of its illustrations, and followed as it was a few years later by the splendidly got up "Traité" of M. Deschanel, which has been so ably translated into English by Prof. Everett, there has been an almost continuous stream of works upon Physics from our neighbours across the Channel. French publishers of technical works appear to be of opinion that the production of a "Traité de Physique" is an indispensable part of their duty, and that their good name will suffer unless they bring one out. France is fortunately rich in physicists, so that there are always good men to be found to do the work. The result is that each Paris season introduces one or more new books upon Physics, which are in most cases well written, and generally abound with excellent illustrations.

The "Cours de Physique" of Prof. Fernet is at once both ably written and singularly incomplete. It is intended as a text-book for the *Classe de Mathématiques Spéciales*, and as such cannot altogether be classed with the books of which we have been speaking. It is written for a special purpose, and its value to the general student is much impaired thereby.

The chapters treating of the molecular construction and of the various forms of matter is a concise digest of the modern theories of this most speculative subject, and the definitions of the solid liquid and gaseous states of matter are particularly clear. On the other hand, no reference whatever is made to the all-important subject of gravitation, so that the laws of falling bodies and projectiles, centre of gravity, and even the pendulum itself, are necessarily cut out.

Again, hydrostatics is both fully and ably treated, the law of Archimedes and the determination of specific gravities being very clearly explained.

The whole subject of heat is confined to the expansion under its influence of solid, liquid, and gaseous bodies, which occupies one-fourth of the whole book. The reader looks in vain for some reference to the laws of freezing and evaporation or of conduction and specific heat. More extraordinary still is that the entire subject of radiant heat is conspicuous by its absence, no reference being made to diathermancy or to the reflection and refraction of heat, and the dynamical theory is ignored altogether.

In Optics the laws of reflection and refraction are more fully treated than any other subject in the book, the properties of mirrors and lenses of various forms being thoroughly and mathematically considered. No reference is, however, made to dispersion, and the question of colour is left out altogether, necessitating of course the omission of the important subject of spectra and of the Fräunhofer lines. Again, double refraction and all the phenomena connected with polarisation are not even alluded to, nor are the interesting subject of the velocity of light and the beautiful experiments of Foucault, of Fizeau, and of Cornu for its determination.

Acoustics is entirely left out, and statical electricity occupies but a short chapter, in which induction is fairly treated, and the various forms of electrical machines are well described.

What is perhaps the most remarkable omission of all is that of the entire subject of Electro-dynamics. No mention is made of the voltaic battery, of the great subject of electro-magnetism and the electric telegraph, of electrolysis or of induced currents as exemplified in the Ruhmkorff coil, neither are magneto-electricity or thermo-electricity referred to.

The only explanation offered for the omission of so important a branch of physical science in a "Cours de Physique" is the following foot-note to the chapter upon Statical Electricity :—

"By the rules for admission into the *École polytechnique* —which are identical with those for the *Classe de Mathématiques Spéciales*—candidates are required to possess an elementary knowledge of statical electricity and of magnetism only. The importance, therefore, of these two subjects in the present course does not admit of their being treated as fully as those in the preceding chapters. The further study of them must be reserved for the course in the *École*, where students are required to work up the subjects of both dynamic electricity and electro-magnetism."

We may assume from this note that the other omissions to which we have referred are due to the same regulations. It is difficult to understand how such rules can exist, or what considerations could have guided those who framed them when they required candidates for admission to read up statical electricity, leaving the more important subject of electro-dynamics alone, as well as the science of electro-magnetism, notwithstanding its important applications.

From what has been said it will be seen that Prof. Fernet's "Cours de Physique" is evidently a "cramming" book for students seeking admission to a particular class which has very exceptional requirements. For that purpose it is no doubt of value, but it is practically unavailable to the general student of Physics by reason of the number and the importance of its omissions.

THE CHEMISTRY OF LIGHT AND PHOTOGRAPHY

The Chemistry of Light and Photography in their Application to Art, Science, and Industry. By Dr. Hermann Vogel, Professor in the Royal Industrial Academy, Berlin. New and thoroughly revised edition, with 100 Illustrations. (London: H. S. King and Co., 1876.)

LAST year, in reviewing in the columns of NATURE this volume of the International Scientific Series, it became our duty to point out the very serious errors in chemistry with which the translation abounded.

We are happy to find that in this "new and thoroughly revised edition," the whole of the objectionable passages have been corrected, and that the same measure of correction has been extended to the English throughout, so that the work is now a very creditable translation. With regard to the author's share of the work, we can, on a re-perusal, recommend it as a thoroughly good *résumé* of the principal photographic processes, and we note that the very numerous variations of the photo-printing and lithographic processes have been very fully noted and their chief points described, for, although this description of what are, as a rule, trivial variations of one or two processes may seem useless, it cannot fail to call the reader's attention to some of the vagaries permitted by patent laws in various countries. We also notice that some considerable space has been given to astronomical photography (in connection with which we would note that the name of the eminent American astronomer who produced the negative of the moon from which the frontispiece of the book is taken is Rutherfurd, and not Rutherford, as printed). Slight notices have also been given of spectrum-photography, which we hope to find fuller in a new edition, and of the effect of colouring matters in modifying the action of light on various reagents, the study of which latter point appears to be undergoing considerable development both at home and abroad.

Taken as a whole, the book is an admirable guide to one who has some considerable knowledge of the subject, or for giving the general points of the art to an ordinary reader, but we do not think that it is equal to Van Monckhoven's book as a practical treatise on the art. It abounds, however, in valuable hints and suggestions, and we would recommend Chapter XII., "On the Correctness of Photographs," to the attention of everyone who wishes to become a competent photographer, whether for the purposes of Science or of Art. With regard to the latter we cannot do better than conclude with the following quotation from the chapter in question, page 129:—

"It may, perhaps, excite surprise that the writer ascribes greater truth to painting than to photography, which is generally regarded as the truest of all methods of producing pictures. It must be self-evident that this remark can be made only of the works of masters . . . the picture of the photographer is not self-created. He must test, weigh, consider, and remove the difficulties which oppose the production of a true picture. If his picture is to be true he must take care that the characteristic is made prominent and the accessories subordinate. . . . To do this he must, of course, be able to detect what is characteristic and what accessory in his original. The sensitive plate of iodide of silver cannot do this; it receives the impression of all that it has before it, according to unchangeable laws. . . . The photographer will not, indeed, be able to control his matter like the painter, for the disinclination of models and optical and chemical difficulties often frustrate his best endeavours; hence there must always be a difference between photography and a work of art. This difference may be briefly summed up by saying that photography gives a more faithful picture of the form, and art a more faithful picture of the character."

R. J. FRISWELL

OUR BOOK SHELF

Les Insectes; Traité Élémentaire d'Entomologie, comprenant l'Histoire des Espèces utiles et de leurs Produits, des Espèces nuisibles et des Moyens de les détruire, l'Étude des Métamorphoses et des Mœurs, les Procédés de Chasse et de Conservation. Par Maurice Girard. (Paris: Baillière et Fils, 1873-76.)

As a compilation this work evidences a considerable amount of industry; judging, however, by the various memoirs quoted in the first 240 pages, it would appear that the author's researches have not extended to a much later date than the year 1868, a fact which will unquestionably detract very greatly from the value of his generalisations.

The author's object being to unite in one book the classification, geographical zoology, and economy of insects, he divides his introduction into the following heads:—1. Anatomy and Physiology; 2. Instinct and Intelligence; 3. Collecting and Preservation; 4. Palæontology; 5. Geographical distribution; 6. Species and Classification; the consideration of which subjects occupies 229 pages.

Owing to the bulk of the work (which, although up to the present time it has only dealt with three orders of insects, nevertheless extends to 840 pages), we cannot strongly recommend it as a pocket companion; still the student of entomology, particularly if he has a taste for preserved viands *warmed up*, should certainly find a place for it upon his library shelves.

The plates are clearly defined and abound in instructive details, the only drawback being that they are for the most part reproductions of the illustrations to Guérin's "Iconographie du Règne animal;" it is, however, satisfactory to note additional representations of an anatomical character, as also of certain highly interesting cave-inhabiting species.

A. G. B.

LETTERS TO THE EDITOR

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

Protective Mimicry

IN the last number of NATURE Mr. Murphy brings forward the following argument against natural selection, with reference to protective mimicry. He advances two classes of cases in which he urges the improbability of the occurrence of a first variation in the requisite direction. "One of these is the change of colour with the season of such animals as the ermine, which is brown in summer and white in winter. Had the ermine been either permanently brown or permanently white, there would have been nothing wonderful in it, but it seems impossible that the character of becoming white in the winter and brown in the summer could ever have originated in ordinary spontaneous variation, without a guiding intelligence."

Now Pallas as quoted by my father ("Descent of Man," second edition, p. 229 and 542) states that wolves, horses, and cattle, as well as *nine* other kinds of mammals become lighter coloured during the winter; and several well marked cases of a similar change of tint in the winter coat of horses in England have either been brought under my father's notice, or have been observed by himself. It is impossible to suppose that these instances of a similar change occurring in widely distinct animals can be put down as partial reversions to an ancestral habit of turning *completely* white during the winter months. We may therefore presume that they are due to the "direct action of the conditions of life;" we might perhaps compare them to the greyness accompanying the impaired nutrition of old age; or to that caused by injuries, *e.g.* in the hair about old sores on the withers of horses; or again to the extraordinary recorded case of temporary greyness of the eyebrow accompanying frontal neuralgia.

But to whatever cause these slight changes of colour in certain quadrupeds taking place at the beginning of winter are due, there can be no question that they supply the identical "first variations," whose occurrence Mr. Murphy thinks so "infinitely improbable." It is impossible to doubt that with such material to work on, a process of rigorous natural selection might develop almost any degree of seasonal change of fur. "The roe, for instance, has a red summer and a greyish white winter coat; and the latter may perhaps serve as a protection to the animal whilst wandering through the leafless thickets, sprinkled with snow and hoar-frost." If the roe "were gradually to extend its range into regions perpetually covered with snow, its pale winter coat would probably be rendered through natural selection, whiter and whiter, until it became as white as snow." ("Descent of Man," p. 542). Mr. Murphy also adduces the manner in which the chameleon, and certain fish, protect themselves by rapid changes of colour. He remarks that it seems "utterly impossible for such a character to originate in spontaneous variation." It would be taking up too much space to enter into this subject; it may, however, be worth noting that according to Pouchet, under certain conditions the changes of colour are only developed in the turbot in several days. Again J. Bedriega asserts that various parts of the body in certain lizards are *permanently* altered in tint by exposure to the sun; and he states that the mechanism by which this change is effected is precisely the same in principle, as that to which the variations in pigmentation are due in the chameleon. Brücke and others have shown that in the chameleon the changes of tint may be produced by agencies having no connection with protection; for example, by the excitements of anger and sexual passion, by illness, and by local irritants and nerve-stimulation.

An accurate observer related to me the case of a lady whose iris changed colour in bright sunlight.

These few instances seem to show that the behaviour and properties of pigment-cells are independent of the protective functions for which they have, in some cases, been specialised and augmented by the action of natural selection.

It seems a pity that Mr. Murphy should write on a question in natural history without making himself better acquainted with what is known on the subject. FRANCIS DARWIN

Down, Beckenham, Aug. 14

IN the last number of NATURE Mr. J. J. Murphy states the difficulty which he finds in accounting for the rise of intermittent variations upon the theory of natural selection. He can understand the origin of a white species from a brown one or *vice versâ*, but not of a species which, like the ermine, is at one season brown and at another season white. He speaks of "facts of colour which it seems impossible for natural selection to produce, from the infinite improbability of a first variation ever occurring." From this mode of expression one might fancy that Mr. Murphy had for the moment forgotten that natural selection is in no way concerned with producing, but acts only by preserving, variations. As in a great number of instances we are ignorant of the precise antecedents which produce variation, whether chronic or recurrent, in such instances, we must be left at liberty, if we choose, to invoke the special action of "a guiding intelligence." The case, however, of an animal which changes its colour with the season does not seem to be one of very exceptional difficulty. It is only necessary to suppose that the animal became possessed of pigments liable to be acted on in the required direction by the seasonal changes of light and heat. It might well be that with some animals the influence of the same changes would be in a direction just the opposite of what was useful to them. In that case the variety would stand but little chance of being preserved. Similar explanations hold with regard to the vegetable kingdom. I have now before me drawings of *Sempervivum spinosum*. The summer rosette is bright green in colour, with the leaves expanded, while the winter rosette is a compact little ball of a dull purple. Thus the plant prepares itself against the cold of winter and the dearth of nourishment which that season brings, but it is likely enough that cold and dearth in the first instance led to the variation in the plant from its summer habit.

In human beings the hair is said sometimes to turn white from sudden grief or terror. Liability to such a change does not probably carry any such advantage to the human species as would make it likely to spread and develop itself further. But in the little shrimp commonly known as *Mysis chamæleon*, we can at least conjecture that a very solid advantage might follow from a similar characteristic. I have sometimes bottled live specimens of this little creature while it was of a dark purple colour, and presently after lost sight of it, the fact proving to be upon closer inspection that it had become almost completely transparent. Among its ordinary enemies the loss of colour might often save its life, in which case natural selection would tend to preserve the aptitude, although the aptitude itself, like the bleaching of human hair from grief, has no connection at the outset with the advantage of the species.

Torquay, Aug. 14 THOMAS R. R. STEBBING

MR. MURPHY'S letter (NATURE, vol. xiv. p. 309) opens up a wide field for speculation. The class of cases to which he directs attention constitutes what I have designated "*variable* protective colouring," and in a paper communicated to the Zoological Society (Proc. Zoo. Soc., 1872), I attempted to show that such cases came to a certain extent within the scope of natural selection. The line of argument pursued is briefly as follows:—Natural selection, working solely for the good of a species takes advantage of all beneficial variations, no matter how they may originate. In but very few cases can the cause of any particular variation be assigned. Natural selection works only on the variations presented to it, the causes of such variations appearing to us, in the absence of observational or experimental evidence, mysterious. If, then, a species deriving advantage from protective colouring under one set of conditions, finds that the conditions vary periodically or irregularly, thus rendering that mode of colouring useless or even disadvantageous, it clearly becomes advantageous to the species to possess a *power of adaptation*. By this means only can *varying* external conditions be met, and it is upon this *adaptive power* that I venture to think the action of natural selection has in these cases been exerted. That the particular cause of such variation cannot be assigned, no more weakens the natural selection argument in these cases than in ordinary instances of permanent protective colouring, the possibility of which having been brought about by the "survival of the fittest," Mr. Murphy seems disposed to admit.

One argument in favour of the natural selection theory of protective colouring appears, so far as I am aware, to have been overlooked. It has been urged that granting the power of natural selection to produce a general resemblance in colour, &c., to inanimate objects, it is difficult to see how the highly perfect finishing touches (instances of which are familiar to all naturalists) could have been imparted by this same agency. To this it may be replied that the marvellously perfect resemblances which we witness have not been brought about to deceive *our* visual sense, but that of far keener-sighted foes whose very means of subsistence may depend upon acuteness of vision.

Apropos of Mr. Power's letter in the same number of NATURE, I have recently had an opportunity of observing how closely the larva of *Trachea piniperda* resembles in the longitudinal green stripes the needle-shaped leaves of the pine on which it feeds. I observed also an equally good adaptation in a larva of *Agriopis aprilina*, which when resting on a lichen-covered oak trunk was barely discernible from the lichen on which it rested.

Belle Vue, Twickenham, Aug. 12 R. MELDOLA

Antedated Books

THE grievance pointed out by your correspondent "F.Z.S." is a real one. Nevertheless I trust that the writer is himself free from the charge that he so glibly brings against a brother naturalist of endeavouring to obtain for his generic titles an "unjust priority of fifteen months over what they are entitled to." I am sorry that there should be a Fellow of the Zoological Society who believes me capable of doing this, but, as the charge has been thus publicly made, I lose no time in flinging it back upon my anonymous accuser. The new edition of Layard's "Birds of South Africa" was announced to appear in six parts, and the first was published in May, 1875. The number of wrappers required for the six parts was printed off at the time, and "F.Z.S." will find that Part 2, which was published last autumn has precisely the same wrapper as Part 1, and this is the case with the part now issued. I admit that it would have been better to have altered the date on each wrapper in writing; but this, probably, did not occur to my publisher, who is doubtless not aware of the importance attached to the law of priority by "F.Z.S.," your correspondent, who, apparently, in his hurry to attribute an unworthy motive, has scarcely taken the trouble to look beyond the cover of the book. Had he done so he might have been satisfied that the letterpress contained abundant evidence of having been written long after the date which he would have the scientific world believe I had endeavoured to claim for its publication. Such an attempt would be absurd, when documents are quoted in the letterpress which were *not in existence in the year* 1875.

May I at the same time reply to a paragraph of your reviewer (p. 318) on the "Birds of Kerguelen Island." This pamphlet deserves all the praise which the reviewer bestows on it, but in his endeavour to disparage his own countrymen, and to trumpet the superior energy of American ornithologists, he seems to have done an injustice to Mr. Eaton and myself. Two new species were mentioned by Dr. Coues, viz., *Æstrelata kidderi*, which Mr. Salvin (*Orn. Misc.*, p. 235) shows to be *Æ. brevirostris* (Less.), and secondly, *Querquedula eatoni* (Sharpe). This latter name looks as if the English ornithologists had not been so far behind their American brethren, after all, if the description of the new Teal was available for quotation in Dr. Coues' work! R. BOWDLER SHARPE

British Museum

FULLY agreeing with "F.Z.S." in reprobating the evil practice of which he complains, I think that in the particular instance he cites, of the recently published third part of the new edition of "The Birds of South Africa," he will, on looking again at its wrapper, see that the information it affords is so contradictory as to be worth nothing. The first words upon it are "To be completed in *Six Parts*;" but on its second page we read that the publisher "has decided upon issuing this work in *four* parts!" Which of these statements is to be believed? In justice to the publisher, however, it is to be observed that the number "3" is not printed, but inserted with the pen, in the copy I have received, and also that the "May, 1875," has a line drawn through it. While on the subject let me add that the Zoological Society itself, in its "Transactions," sets a bad example in this respect. Each paper bears a date at the foot of its first page, but the date is likely to be misleading in years to come, for it is that of the *printing* off the sheet—an essentially private matter, with which the public has nothing to do—and not that of the *publication*. Another F. Z. S.

Meteor Observations

A BRIEF summary of the August (Perseid) meteor observations at York may be of interest.

Watch was kept on the 10th, 11th, 12th, and 14th. The night of the 11th was very hazy, the nights before the 10th cloudy. There was also much moonlight, except on the 14th. Yet, after making all due allowances, Prof. Herschel thinks that this year's shower indicates a minimum; the last decided minimum being in 1862.

The hourly number on the four nights mentioned were, for one observer, 22, 8, 12, 15, respectively. Perseid radiant and sub-radiants gave 18, 6, 9, 7. Thus, as the shower progressed, there was a regular decrease in the number of Perseids. The apparent exception of the 10th was due to the haze. Prof. Herschel gives 15-20 as the hourly number in Kent. On the 14th half the Perseids came from Mr. Greg's sub-radiant at γ Cassiopeiæ.

In the south large meteors appear to have been scarce. Here eight, brighter than 1st mag. stars, were seen. One, a bolide, low down in the N.W. was very fine. A meteor in the south-west, brighter than Jupiter, was observed by Mr. Waller at Birmingham as a very brilliant object.

The total number observed at York was 105, and 90 of these were mapped. Of the latter 66 were Perseids, 43 with trains. On the 10th five other radiants produced eight meteors out of 53; viz., Cygnus, three; Pegasus, two; Polaris, one; Draco (Hercules), one; and Ursa Major, one. Fifteen meteors on this night were as bright, or brighter, than a 1 mag. star. Only two of 4th mag. brightness were seen, in consequence of the moonlight.

Of meteors stationary, or nearly so, three were mapped:—A Perseid on the 12th at Æ $32\frac{1}{2}$ and $\delta + 58\frac{3}{4}$, its train lasting $2\frac{1}{2}$ secs.; on the 14th a Cygneid at Æ $306°$ $\delta + 35°$, and an unknown radiant, probably near 5 Vulpeculæ, gave the third at Æ $295°$ $\delta + 28$.

Three meteors unmistakably confirm Mr. Greg's sub-Perseid radiant by γ Cassiopeiæ, whilst several others probably radiate from the same. The radiant, Greg 83, by η Draconis, gave two meteors on the 12th and one on the 14th. It is put down, however, as lasting only from July 12-31.

Six Perseids on the 10th, and four on other nights, seem pretty clearly to indicate a sub-radiant at Æ $50°$, $\delta + 40°$, near α Persei. The rest, as Prof. Herschel also noticed, shot very constantly from the chief radiant, between η and χ Persei. Here, however, η Persei seemed the most central point.

York, Aug. 15 J. EDMUND CLARK

THE FRENCH ASSOCIATION

IN addition to the notes already given with regard to the forthcoming meeting of the French Association at Clermont, the following particulars relating to the Puy-de-Dôme (furnished by our correspondent there) will doubtless be found interesting:—

Clermont, August 13

The Puy-de-Dôme is connected with most important scientific events, which render it notable amongst more lofty mountains.

Pascal, in 1644, then quite a young man, was apprised by Père Mersenne, the celebrated friend of Descartes, that Torricelli had invented his tube. The then admitted explanation was that nature abhorred a vacuum.

He entered into a correspondence on the subject with Father Noel, a Jesuit professor of natural philosophy in the College of Clermont. Father Noel contended against the very existence of the vacuum, and asserted that the so-called vacuum was filled by luminous matter entering through the glass. Pascal answered by arguments worthy of his genius, and to be recommended for consideration in the discussion about radiometers. He said, "As the nature of light is known to neither you nor me, and as it is very likely it will always be so, I see it will be long before your reasoning acquires the force which is necessary to its becoming the source of any conviction." After having uttered this opinion he reflected more fully upon the subject, and was led to believe that the surplus height of mercury in the tube was equivalent to the weight of the air which could not reach the molecules, being intercepted by the resistance of the glass. This led him to inquire if air-pressure was not lessened by taking the Torricellian tube to the top of a mountain. The experiment was made in Paris first on the top of St. Jacques la Boucherie Tower and Notre Dame. As the difference was found to be only a few lines, Pascal sent his brother-in-law, Perrier, who was a counsellor in the Cour-des-Aules at Clermont, to the top of Puy-de-Dôme with a Torricellian tube. Clermont was supposed to be at an altitude greater than Paris by 400 toises; Font-de-l'Arbre is a village in the vicinity of the mountains where carriages are obliged to stop, at 250 toises from Clermont, and 250 toises from the top of the mountain. All these measurements are incorrect; a toise being 1·94 metres, we find the following differences:—Paris, 60 metres, Clermont, 407; difference, 347 metres, instead of 776, as assumed by Pascal; Puy-de-Dôme, 1,465. Difference between Puy and Clermont = 1,058 metres; according to Pascal only 952 metres.

The loss of mercury from Couvent des Minimes to the top of Puy was found to be $37\frac{1}{2}$ lines; at Font-de-l'Arbre a diminution of $14\frac{1}{2}$ lines from Minimes. A line is equal to $2\frac{1}{4}$ mm.

Perrier discovered no difference, owing to the wind or state of the atmosphere. Such was not the opinion of Pascal, who discovered that the mercury varies according to the atmospheric conditions of the air. But Perrier was only an amateur experimentalist, and his special ideas had little weight with his clever brother-in-law.

In order to ascertain the fact, continuous observations were made at Clermont, by Perrier, during the years 1649, 1650, and 1651. They were simultaneously made at Paris and at Stockholm, where Descartes was then living at the court of the famous Queen of Sweden. They were continued by Descartes up to the time of his demise.

It is strange that the Pascal experiments were made the very year when Torricelli died, and the results published only in 1664, two years after Pascal's death.

THE SCIENCE DEGREES OF THE UNIVERSITY OF LONDON

WE have received from the Registrar of the University of London a copy of the Report of a Committee, and the new regulations which have been introduced in harmony with that Report, in the examinations for the science degrees. From a perusal of the Report, which we subjoin, all will feel how much is gained by the prompt action of the Senate of the University in so speedily modifying the plan of their examinations in accordance with the experience which they have obtained during the last seventeen years. It is not, however, only experience in the examination of science students which has led to the necessity for change, but the stimulus which has been given to the teaching of physics and biology, by the founding of science degrees and otherwise, has so altered the method of teaching these subjects that what was expected to be known formerly is quite different from that taught by the most able exponents of the subjects at the present time.

No change has been made in the Examination for the Doctor of Science degree, which we regret, because in the Report of the Duke of Devonshire's Committee on Scientific Education great stress was laid on the importance of obtaining an original thesis from each candidate.

The Report of the Committee runs as follows:—

"In accordance with the reference made to them by the Senate (Minute 128, May 13, 1874), the Committee, after having revised the regulations relating to the Degree of Bachelor of Arts, have given a long and serious consideration to those relating to the Degree of Bachelor of Science. It will be remembered that when those regulations were first framed in the year 1859, no guidance was afforded by previous experience, the degrees in science instituted by this University being the first of their kind in the United Kingdom. The Committee by which they were drawn up desired to encourage science students, who might intend to devote themselves to some particular department of science as the pursuit of their lives, to base their special study upon a broad foundation of scientific knowledge; and while the regulations for the Doctorate were framed in such a manner as to permit a high degree of specialisation, the regulations for the Bachelor's Degree were designed to secure the possession of such general culture as should be likely to prevent its holder from becoming a mere specialist.

"Eighteen years' experience of the working of these regulations, however, has made it obvious that the present system is not well adapted to the requirements of scientific education as now conducted. Almost every department of science has undergone a higher development, so as to render it more difficult for a student to obtain an adequate mastery of its fundamental principles and conceptions. Again, it has come to be generally felt that scientific knowledge, to be *real*, must be *practical*, as well as theoretical; and that a thorough knowledge limited to a comparatively small range, is preferable to a slighter acquaintance spread over a more extended area. And it is the general experience of teachers, that there is from the commencement of their academical course such a decided preference on the part of nearly all students of science for either the physical or the biological group of subjects, that the attention of each student is given to one group almost to the exclusion of the other. It was further urged that the *hiatus* is too wide between the almost elementary knowledge of the several departments of science required in the Bachelor's Examination, and the very high attainment in some limited department which is required as the qualification for the Doctorate; and that it would be extremely desirable that this hiatus should be narrowed, by limiting the number of subjects to be brought up by candidates for the B.Sc. Degree, and proportionally raising the standard of proficiency required.

"Several of the ablest teachers in institutions connected with the University, and of its most experienced examiners (past and present), concurred, therefore, in recommending to the Committee, that, keeping the First B.Sc. Examination nearly as it is, an *optional divarication* should be allowed at the Second between the mathematico-physical and the biological subjects; and the Committee, feeling satisfied that such a limitation would be advantageous, proceeded to carry it out, by framing (with the assistance of their examiners and other distinguished men of science) new programmes in the several departments of study, that should suit what are now felt to be their respective requirements. But when these new programmes (in which, wherever feasible, *practical* were combined with *written* examinations) were put together, the conclusion was forced on the Committee, that, even when the whole aggregate of subjects it was deemed right to include was divided into two groups, the acquirement of the proficiency expected in the several subjects thus grouped, would be a task too severe for the average capacities of science students. And after much consideration and communication with their scientific advisers, the Committee have arrived at the conclusion that it would be desirable rather to diminish the number of subjects which each candidate should be required to bring up at the Second B.Sc. Examination, than to exact anything short of the "competent knowledge" of each subject for which these programmes provide. They are further of opinion that each candidate, instead of being required to include either the whole or a part of the subjects he selects in one or other of the before-mentioned groups, should be allowed a free option among all of them, so as to combine them in any way that may best suit his taste and ulterior objects—thus leading him onwards to the still higher specialisation of the Doctorate.

"Acting on this principle, the Committee have framed a new set of regulations for the Degree of Bachelor of Science, which they now submit to the consideration of the Senate. In the *First* Examination, which every candidate will be required to pass, while the programmes in mathematics, experimental physics, and inorganic chemistry have been carefully revised, little fundamental change has been made in them. In place of the superficial acquaintance with both *Zoology* and *Botany* formerly required at this examination, the Committee now recommend a single examination (written and practical) in *General Biology*; in which a more thorough knowledge shall be required of the simplest forms and elementary phenomena of animal and vegetable life, such as is now made the basis of the teaching of some of the most distinguished professors in each department. Thus the student who may be intending to devote himself specially to physical or chemical science, will be brought to apprehend the general conceptions common to the two great organic kingdoms, without being required to master the specialities of either. And the student who intends to present himself at the Second B.Sc. Examination in either physiology, zoology, or botany, or all combined, will have laid the best foundation for those special studies in the study of general biology.

"The regulations for the *Second* B.Sc. Examination, on the other hand, are framed with the view of allowing the candidate to bring up *any three* of the following nine subjects:—

1. Pure Mathematics.
2. Mixed Mathematics.
3. Experimental Physics.
4. Chemistry.
5. Botany, including Vegetable Physiology.
6. Zoology.
7. Animal Physiology.
8. Physical Geography and Geology.
9. Logic and Psychology.

"It is intended by the Committee that the examinations in these several subjects should be, as nearly as may be, on the same grade, as to the amount of attainment they require. They have learned from the examiners in mathematics, that their experience justifies them in stating that any candidate who has thoroughly mastered the mathematics of the First B.Sc. Examination, and who has such an aptitude for the study as would lead him to select pure mathematics as one of his subjects at the Second, would find no difficulty in mastering the requirements of its programme, by such an amount of study, carried on through an eight months' academical session, as would leave him free to bestow the same amount of time and attention on *two* or even *three other* subjects. And the Committee would wish it to be understood, therefore, that in proposing that each candidate should have his choice of *any three* out of the nine subjects just specified, the amount of proficiency expected in each would be that which he might attain by the steady devotion to it of about one-third of the sessional work of a diligent student.

"With the further recommendation of the introduction of an efficient *practical* examination in each of the subjects in which it is feasible, the Committee now place the mature result of their deliberations before the Senate, with considerable confidence that it is the plan most suited to meet the peculiar requirements of the case, and to promote the best interests of scientific education.

SCIENCE IN ITALY[1]

IN reviewing a number of scientific pamphlets, &c., from Italy, we took occasion to remark (NATURE, vol. xiii., p. 110) that "the restoration of political unity and freedom in Italy has also brought about a revival of that intellectual vigour which we are accustomed to associate with the names of Dante and Tasso, of Galileo and Torricelli. When Italy was divided and each state politically oppressed, her best men were in exile, and their best scientific work was expressed in a foreign tongue."

In forwarding to us a copy of the handsome volume, the title of which is given above, the editors have written to us, quoting the foregoing passage with approval, while the introduction to the volume is written in the spirit of those remarks. It is gratifying to learn what progress Italy has made during the last ten or fifteen years in education, literature, science, commerce, and industry. "An air more propitious to study is now breathed by united Italy." New scientific schools, institutions, and societies have sprung up, and the old have been renovated. The best men, returned from exile, have resumed their place among the explorers of nature; and the present state of intellectual activity only renders more evident the condition of misrule and division which so long afflicted that noble country, when all free inquiry, whether in nature or in politics, was forbidden, or at least discouraged. In singular contrast to all this, her best minds have at length found that intellectual repose and encouragement at home which are so essential to the carrying on of grave studies.

As an exponent of this new state of things, the editors conceived the idea of publishing a half-yearly report of the scientific progress of Italy; and taking advantage of that wide spirit of tolerant liberality which pervades all true science, they appealed for support to such of their countrymen as were distinguished in the various departments of physics, chemistry, mineralogy, geology, botany, zoology, physiology, anthropology, and geography. This appeal was most liberally and heartily responded to, and the result is a large octavo volume of about 450 pages, well written and carefully edited, very few mistakes occurring, even in the spelling of well-known names, although we find at p. 15, "Poulliet," at p. 68, "Bences Jones," at p. 84, "Edvard Hull," and this odd mode of division at p. 15, "Hel-mholtz." The contributors to these various departments have performed their respective tasks nobly and well. They have not only contributed voluminous abstracts of papers, notes and memoirs, but in many cases have furnished more or less elaborate reports on the state of their respective branches of science, and have also given, in some cases, reviews of the best books by Italian authors. For example, the reporter on mineralogy, in addition to some sensible remarks on the backward state of science in Italy, devotes thirty full pages to a review of Bambicci's "Corso di Mineralogia" (second edition, 1875), and refers to it again and again in terms of such high praise as would seem scarcely to belong to a compilation from standard writers in other languages. Indeed the superlative terms of laudation which occur in many parts of the volume strike our colder northern temperament as being at least exaggerated. Why refer to the *chiarissimo Signor Professore*, So-and-So, while foreign *savans*, whether living or departed, are simply and properly mentioned, as Ampère, Faraday, Helmholtz, &c. When Lord Castlereagh appeared in plain evening dress at a brilliant party at Vienna, amidst a crowd of highly-decorated gentlemen, a lady, asking Metternich who he was, said, "Mais il n'est pas distingué!" that statesman replied, "Ma foi! c'est être bien distingué."

Although we are bound to bestow cordial praise on this volume, yet we should not perform our duty honestly if we omitted to point out a certain backwardness on the part of some investigators in reading up their subjects before they attempted to make what to them appear to be new researches. For example, at p. 66 is an abstract of a memoir by Pelloggio, entitled "Contribution to the Phenomena of Supersaturation," in which the author appears to have no more recent information of his subject than that derived from Löwel. He points out that salts isomeric with the one in solution act as nuclei to it. This was shown to be the case many years ago by Violette. He also insists that porous bodies, such as sponge, charcoal, &c., are powerful nuclei; whereas it has been shown by Tomlinson that such bodies, boiled with the solution which is then left to cool, are purely passive. So also when MM. Mercadante and Colosi affirm (p. 47) that carbonic acid is not emitted by the roots of plants, they are evidently unacquainted with Broughton's researches. We may also point out what seems to be an inaccurate observation on the part of Pollacci (p. 50), namely, that sulphur moistened and exposed to the air absorbs oxygen and becomes converted into sulphuric acid.

At p. 126 there is an interesting account of the fall of a meteor at Supino in the district of Frosinone on Sept. 14, 1875. It was accompanied by a trail of fire and smoke; and after reaching the earth it took a horizontal direction, passed through a house without striking it, thanks to an open passage, and so disappeared. A number of fragments were found in the passage, the heaviest of which weighed 364·2 grammes. The fragments were warm. At p. 134 is a paper on red chalk, which would deserve attention did our space permit.

Anthropology and ethnology are comparatively new to Italy, but they have begun a life of apparent vigour under the auspices of a new society, a museum, and a journal.

There are some interesting details respecting the skulls of Dante, Petrarch, Ugo Foscolo, and Volta, the last being of extraordinary capacity. In the skull of Petrarch the Etruscan type is said to be evident, namely, a voluminous brain, strongly developed in all its parts, and of superior psychological power; but the posterior predominates over the anterior portion, leading to the conclusion that the sentiments and the instincts prevailed over the intellect, although this is of the highest order.

We look out with much interest for the second part of this volume, which the editors promise shall appear shortly.

C. TOMLINSON

[1] Half-yearly Review of the Physico-Natural Sciences in Italy. Edited and published by Drs. G. Cavanna and G. Papasogli. Anno I., 1875, vol. i. Florence, 1875. (*Rassegna Semestrale*, &c.)

THE VOLCANO OF RÉUNION[1]

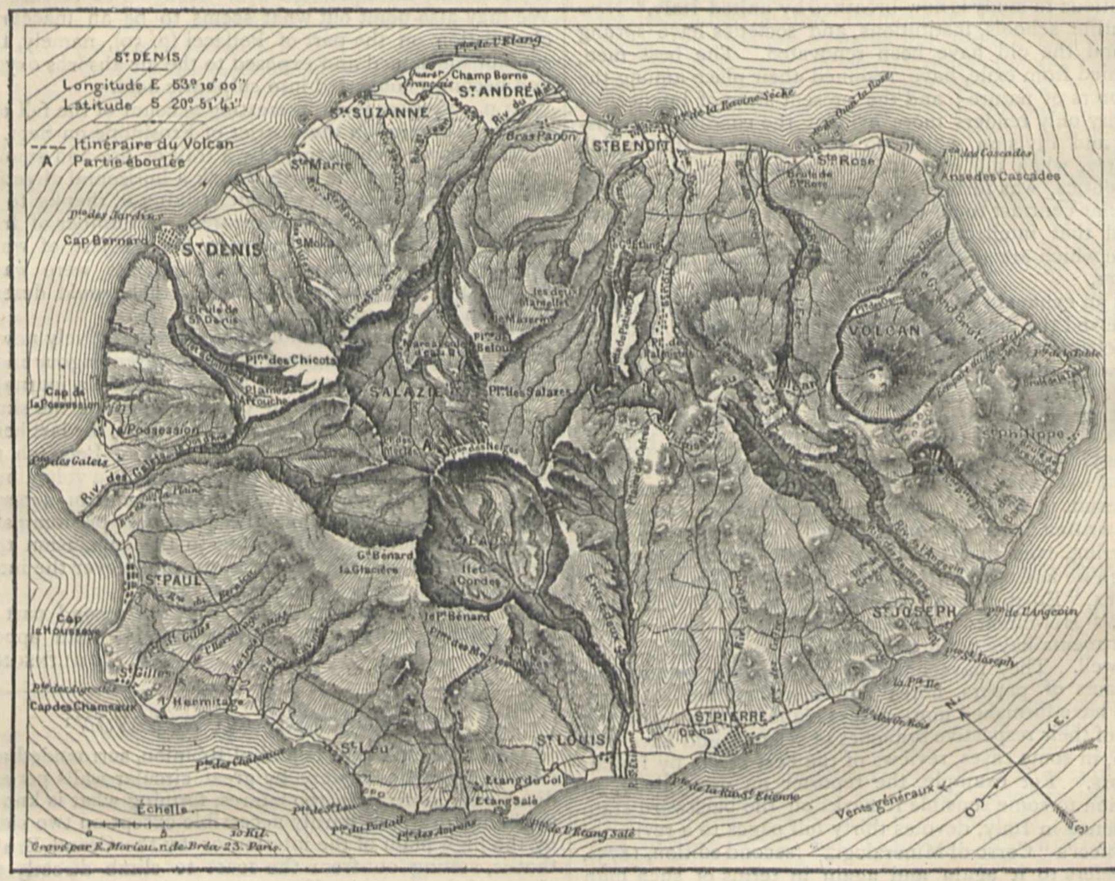
THE volcano of the Island of Réunion, surrounded and defended as it were by great circular walls perpendicular for more than 100 metres, forming what is known as the inclosure, is hardly accessible except on two sides, by the high plain of the interior or by the Grand-Brulé; that is, setting out from the coast to climb directly the slopes of the crater itself.

Far from becoming extinct, as has been supposed, this volcano is on the contrary in great activity, and almost every year torrents of lava overflow in that western part of the island known as the great burnt country; its streams sometimes reach the sea, and there form, at a height of more than 2,000 metres, a regular cascade of fire, which may reach a length, as in 1844, of from 900 to 1,000 metres. But these great eruptions are happily very rare; they are only seen at intervals of six or eight years, and very often the lava is arrested 1,000 or 1,500 metres from the mouth of the crater. Towards the end of August, 1874, loud detonations, sudden tremblings of the ground presaged an eruption of great violence; but the flow lasted only two days; directed towards the rampart of the Tremblet, it was happily arrested at 1,500 metres without causing much damage. It was then that I arrived

[1] From an article in *La Nature*, No. 160, by M. Ch. Vélain.

in the harbour of St. Denis; and on landing I organised, with MM. Rochefort, Cazin, and De l'Isle an expedition to the volcano in the hope of arriving in time enough to witness the end of the eruption. We set out from St. Benoît on Sept. 1, and made for the plain of Palmistes, our first stage. This plain is surrounded on all sides, except the north-east, by perpendicular ramparts, which may reach a height of 200 metres, and whose sides, covered with vegetation, form a semicircular curtain of verdure that shuts out the horizon.

From the plain of the Palmistes we had to climb to that of Cafres by crossing the rampart of the Grande-Montée, a long and difficult ascent on account of the abruptness of the rampart. We reached the summit about an hour after mid-day, and fo nd the temperature to be 14° C., less than half that of the lower part of the island. The plain of Cafres, at a mean height of 1,600 metres, forms a declivity, a sort of saddle-back or pass between the two parts of the island which we have distinguished under the names of Ancient Mass and Recent Mass. It is a very uneven plain, inclined towards the south-west, *i.e.*, in a direction opposite to that of the Palmistes, and formed by a succession of small echeloned plateaus crossed by rounded hillocks covered with vegetation. The soil which results from the disintegration of the lavas is here very argillaceous, as all that savannah presents fresh pasturage during the dry season, and is changed into a vast marsh during the rainy season; it is about two leagues in length. Night surprised us near the source of the river of the Ramparts before we could reach the end of our journey, and we had to sleep on the bare ground; the thermometer reached 3°, and during the night sank to − 2°.

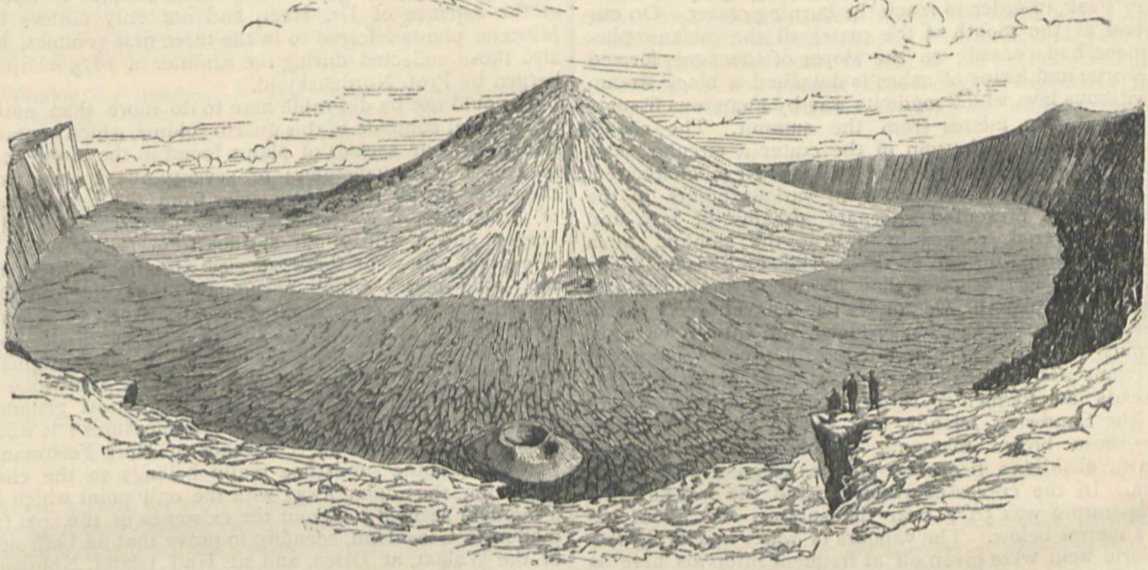


Map of the Island of Réunion (after M. L. Maillard).

At eleven on the next morning we reached the Cavern of the Lataniers, after having visited the vast crater named Commerson, singularly situated on the very edge of the magnificent escarpments which form the great section at the foot of which flows the river of the Ramparts; from thence we directed our steps towards the pass of the sands (2,386 metres), in order to cross the first inclosure of the volcano. The present volcanic cone is, in fact, preceded by two great circles produced by subsidences which have given place to veritable circular walls cut perpendicularly for more than 100 metres from the top, and which are named the inclosures. Of the first there remains only a small part; on the north-east its wall overhangs the river from the east, and on the east the plain of sands; but on the south it is not so easily traced; it is prolonged on this side of the great section of the river Angevin, the formation of which is later.

The plain of sands (about 2,300 metres) which thus circumscribes a basaltic rampart, is formed by a black compact lava covered by a layer of small angular very regular fragments of vitreous lava, often two metres in thickness. In the bottom of the little ravines is noticed, moreover, an accumulation of crystals of olivine and augite which come from the disintegration of certain rocks thrown out by the volcano, and composed almost solely of these two minerals. It is intersected by cones of scoriæ regular in form, terminating in little craters, the limited overflows from which appeared consolidated on the ledge. We had to pass round many of them before arriving at the ridge of the second inclosure, which had to be crossed at the Belcombe pass (2,400 m.). The diameter of the latter is about 5,000 metres; it is disposed in horsehoe form, and is prolonged eastwards by two great parallel walls, which are named respectively the Rampart of Bois Blanc and the Rampart of Tremblet, and which surround the great burnt region; here is the mass of the present volcano.

When we reached the top of the rampart the descent



The *Formica-leo* and the Bory Peak (extinct crater) from above the Pass of Belcombe.

looked dreadful, and appeared perpendicular to a depth of 250 metres. Below, sombre-coloured lavas stretched out in a sort of platform which serves as a base to the volcanic mountain, whose slopes they cover to an equal height all round; there is detached from the foot of the rampart a little cone of scoriæ in admirable preservation,

The Inclosure and the Cone of the present Crater.

which Bory de St. Vincent has named the *Formica-leo* (Ant-lion). Attempting the descent by the help of some shrubs which had lodged themselves in the interstices of the wall, we reached with difficulty the base of the escarpment. The *Formica-leo*, which, seen from above, appeared quite near, was more than 300 metres from us.

It is a very flattened cone, perfectly regular, 15 metres high on a base of from 1,000 to 1,200 metres, presenting at the summit an opening of about 80 metres, with a depth of 6 metres. It is formed entirely of bright-coloured scoriæ, black, yellow, but mostly red.

On the morrow, after having passed the night under a break in the lava of the rampart, exposed to the moisture and to a glacial wind, we ascended the slopes of the Bory Peak, in order to reach the burning crater. On our arrival at the mouth of the crater all the volcanic phenomena had ceased; on the slopes of the cone, formed of scoriæ and heaps of ashes is detached a black stream of vitreous lava which made its way by numerous fissures to about 100 metres from the summit. The cooled lava formed at the bottom of the crater a circular shaft about 80 metres in depth, like a solid crust much fissured. Abundant vapours escaped from various points in the walls, which presented alternate streams of lava and scoriæ, covered, especially towards the summit, by a whitish coating, formed of the crystals of gypsum. The lava of the last eruption had flowed to the north-east towards the plain of Osmondes; it was not very extensive, very scoriaceous, bluish-black, and entirely vitreous. It must have been accompanied or followed by numerous ejections and particularly by a rain of those volcanic threads so frequently thrown out by the volcanoes of the Sandwich Islands, and known as Pelé's Hair; for these brown filaments, which are simply wire-drawn obsidians, bedecked all the irregularities of the lava. In the crevasses which crossed the last flow, the temperature was 50°·7 near the surface, and about 72° at 2 metres below. The vapours of water and of hydrochloric acid were given off at frequent intervals here as well as at various points of the escarpment which directly preceded the volcanic cone. A small inclosure, not hitherto referred to, surrounded the crater; its precipices were about 60 metres high. The mass of the volcano is thus composed of two peaks, the highest of which (2,625 metres) supports the crater Bory, extinct since the beginning of the century; while the other (the Fournaise peak, 2,5·5 metres), which is of later formation, supports the active crater. The products of this volcano are composed mainly of basaltic or vitreous lavas rich in chrysolite; this mineral, so characteristic of modern eruptions, is often ejected in voluminous and compact masses. The products of the old volcano, which must at one time have occupied the centre of the three valleys of Cilaos, Salazie, and Mafatte, are quite different; they are scattered over a trachytic mass which is only seen, however, in the beds of the torrents which drain the three circles above referred to.

Our porters, whom the sight of the volcano deeply impressed, were unwilling to follow us on to the lavas; they remained at the Belcombe Pass, and would not on any account on our return take charge of the rocks and volcano products which I had collected. Some maintained that stones were plentiful enough on the shore, and that it was useless to carry them from such a height; others, affecting a gross superstition, would not touch what came from the "fire of the good God." I had to use a little trickery, and take advantage of the darkness to slip into their sacks my day's collection.

ARCTIC FOSSIL FLORA[1]

THIS third volume of Dr. Heer's "Fossil Flora of the Arctic Regions" contains four very distinct chapters. The first of these relates to the Plants of the Coal-measures of the Arctic Zone; the second to the Plants of the Chalk-Formation of the same Zone; the third gives an account of the Miocene Flora of Greenland; and the fourth is a review of the Miocene Flora of the Arctic Zone. For the material for the first three chapters of this volume the author has the Swedish naturalists alone to thank, and in addition, the Swedish Academy of Sciences has been at the expense of the several parts composing it, which will also be found in Vols. 12 and 13 of their "Abhandlungen." The fourth chapter is added at the expense of Dr. Heer, and not only notices the Miocene plants referred to in the three first volumes, but also those collected during the summer of 1873 in Spitzbergen by Prof. Nordenskjöld.

It would not be desirable here to do more than notice the general contents of this quarto volume, which contains notices of four species of plants found in the lower coal-measures of Spitzbergen; of seventy-five species from the lower and of sixty-five species from the upper chalk of Greenland, of sixteen species from the chalk of Spitzbergen, and of thirty-four species from the Miocene of Greenland, most of these species are illustrated in the forty-nine plates which accompany the volume. One remarkable fern, *Protopteris punctata*, Stbg., is referred to in the text as a proof of the occurrence of the coal-measures at Ujarasusuk at Disco. It was originally described from specimens found in the sandstone of Kaunitz, in Bohemia, which had been most generally described as belonging to the coal-measures; it would seem, however, from the researches of Herr Feistmantel that the Kaunitz sandstone really belongs to the chalk formation, thus doing away with the only point which for a moment seemed to favour the existence of the coal formation in Greenland, seeming to prove that on both sides of the Waigat, at Disco, and at Half Island, Noursoak, the oldest sedimentary formations are chalk deposits. These from the former locality apparently belong to the Upper Cretaceous period, while the dark-brown rocks and sandstones of the north side of the latter locality belong to the Lower Cretaceous period. Higher up succeed the Miocene deposits, which are covered and penetrated by intrusions of the mighty basalt rock.

From the many various localities now known in the Arctic regions for fossil plants, none indicating a marine origin have occurred to Dr. Heer. Steenstrup, jun., however, has detected the remains of some marine animals from the district of Atane, between Patut and Nück Kiterdlek; here, in several places at an elevation of some 2,000 feet over sea-level, he found Echinoderms and marine shells. *Cyclostigma Nathorsti*, very near *C. Kiltorkense*, Haughton, is described as new from the coal of Spitzbergen.

A glance at the list of the Miocene plants shows how changed the seasons in the Arctic Zone must be from the time when these plants were living and bearing the leaves which have been so well preserved. Hawthorn and brambles, walnuts, magnolias, and vines, not to allude to planes, Macclintockias, and many of the more delicate Conifers, seemed to have flourished ere the reign of ice came and burnt them up. The list of cretaceous fossil plants from North Greenland is accompanied by a list of the localities where they were collected. The collection, a very large one, is for the most part in the museum at Stockholm; many of the species are described as new. The absence of insect life amid all this plant life is noteworthy, but two species, probably weevils, being described in this volume.

Many countries have contributed the material for Prof. Heer to work out the history of the "Flora of the Arctic World." A great deal still remains to be done. Now that England, Denmark, and Sweden have done so much, we must look to Russia to contribute according to her means and the extent of her Arctic possessions; she has done nobly in tracing out the contour line of her northern coast. We would now know more of the rocks that form it.

E. P. W.

[1] "Flora Fossilis Arctica." Die Fossile Flora der Polarländer von Dr. Oswald Heer. Dritter Band. (Zurich, 1875.)

OUR ASTRONOMICAL COLUMN

THE DOUBLE-STAR B.A.C. 1972.—Capt. Jacob, reviewing the measures of this object, first registered double by Dunlop with his 9-feet reflector at Paramatta (No. 23 of the Catalogue of 253 stars), remarked of it in 1858: "the angle is, on the whole, evidently advancing, and the distance decreasing, but the measures are strangely wild, considering the easiness of the object, and seem to indicate the presence of some perturbing body." For comparison the following may be selected:—

Dunlop	...	1826·00	Position	329°·0	Distance	3″·00
Herschel	...	1835·02	„	342·5	„	3·86
Jacob	...	1846·94	„	348·5	„	3·22
„	...	1852·73	„	350·7	„	2·81
„	...	1858·17	„	354·7	„	2·18

Jacob's measures of 1858 are the last we find; he considered an appulse would take place about 1875.

Dunlop says of the results in his catalogue similar to the above, the "positions and distances are only estimations while passing through the field of the 9-feet telescope," and no great stress, therefore, need be placed upon them. If we assume that the change of angle and distance is the effect of proper motion, a comparison of Sir John Herschel's measures of 1835, with the later ones at Madras, leads to the following formulæ:—

$$\Delta\alpha = -0''\cdot7876 + [8\cdot80975]\,(t - 1850)$$
$$\Delta\delta = +2\cdot6926 - [8\cdot81900]\,(t - 1850)$$

Whence we find for 1876·75, position 34°·4, distance 1″·13, showing a considerable change since the last published measures, which should render it easy for one of our southern readers to decide upon the cause of the apparent motion. In the case of rectilinear motion the nearest approach would fall in 1881 or 1882, on an angle of from 50°–55°, and in 1891 the component which we are taking for the companion (though the stars appear of equal magnitude—the seventh) would be upon the parallel following 1″·2. So much is to be gathered from the data at present in our possession. The position of the star for 1876 is in R.A. 6h. 1m. 35s., N.P.D. 138° 27′.—It should be added that the above formulæ give an angle of position for 1826·0, differing 11° from Dunlop's estimation and the distance greater by 2¼ seconds.

THE SECOND COMET OF 1844.—The period of revolution assigned to this comet by Prof. Plantamour, of Geneva, after a most minute discussion of the observations, is upwards of a thousand centuries, with a probable error of about thirty centuries! Such a result may be regarded with suspicion by many, but let us see upon what grounds it has been founded.

The second comet of 1844 was independently discovered by Mauvais, at Paris, on July 7, and two nights later by D'Arrest, at Berlin. It was observed before the conjunction with the sun and perihelion passage until September 7, and was found at the Royal Observatory, Cape of Good Hope, on October 27, and observed with great precision on forty-eight days at that establishment until March 10, 1845, when it was distant from the earth 2·9, and from the sun 2·4. The later European observations are those taken at the Royal Observatory, Greenwich, on March 4, and at Berlin on March 6. 545 observations of position were available for the determination of the orbit, and are discussed in the *Mémoire sur la Comète Mauvais de l'année*, 1844, by Prof. Plantamour. He started with the parabolic elements of Nicolai, which had led to the re-discovery of the comet in Europe after the perihelion passage, on January 27, 1845. The perturbations due to the action of Venus, the Earth, Jupiter, and Saturn, during the whole interval of observation, were rigorously determined and taken into account, and after a double solution of equations of condition founded upon normal positions, thus freed from the slight distortions due to planetary attraction, the deviation of the eccentricity from unity was found, with a probable error of only $\frac{1}{30}$th part of the amount of this deviation. The resulting definitive orbit is an ellipse with a semi-axis major = 2183·8; the corresponding period is 102,050 years ± 3,090. This value of the time of revolution is founded upon an arc of the comet's orbit, extending to 204°, described in eight months.

The aphelion distance of the comet is 4,366 times the earth's mean distance from the sun, a space which light would require twenty-five days to traverse, and yet little more than a fiftieth part of that of the nearest fixed star according to our present knowledge, a suggestive fact when the visits of comets to other systems are under discussion.

NEW NEBULÆ.—M. Stéphan, Director of the Observatory at Marseilles, has communicated to the Paris Academy a list of twenty-three new nebulæ detected with the Foucault telescope of 0·80 m. aperture, which raises the number of such discoveries, so far published, to 120; but M. Stéphan mentions that he has approximate positions of about 400 new nebulæ, between 45° and 100° N.P.D., and hopes yet to considerably increase this number. As might be expected, the twenty-three new nebulæ are mostly very faint; one only is called "pretty bright—very small—round" in R.A., 17h. 6m. 47s.; N.P.D., 48° 11′·7, for 1876·0.

THE NORWEGIAN NORTH ATLANTIC EXPEDITION

Reikiavik, July 27

IN continuation of our last account we hear that the expedition has been not at all favoured by the weather. Since it left Christiansund, June 27, it has met with no less than five storms (wind velocity, forty-five miles an hour); two in the "Lightning" Channel early in July, one at Thorshaven, one north of Färoë, and one at the Westman Islands (off the south coast of Iceland). It has been only in the short intervals between these storms that any deep-sea work has been done. The last days of June were fine, so the expedition sounded, dredged, and trawled off Christiansund on the bank called "Storeggen." Here the fauna was quite Atlantic; on the outer edge of the bank the water deepened to 300, 400, and 500 fathoms, and the ice-cold water was met with, yielding an Arctic fauna. Two large specimens of *Umbellularia* (the same as earlier) were found, with a new star-fish and an animal which is quite new to the naturalists on board. Of smaller organisms there were also several new ones.

In lat. 63° 10′ N., long. 1° 30′ W., a sounding in 1,050 fathoms gave a temperature under 32° below 300 fathoms. The *Vöringen* had to leave this station to refit, as a sea had carried away the two fore-hatches. The course was shaped for Thorshaven, where the expedition stayed eight days to refit (July 8–15). The stay there was very interesting, especially for the geologists. The formation of caverns at sea-level was an operation visible in all stages of progress. In the zoolite caverns of Naalsö a rich harvest of minerals was secured.

The inhabitants of Thorshaven received the expedition very hospitably, and remembered, with great pleasure, the stay of the *Lightning* and *Porcupine*.

After a trip round the main island to Westmanhaven, the *Vöringen* left Färöe, July 16, and steered for its last station. Bad weather brought work here to a speedy conclusion; however, a series of temperatures were obtained, indicating ice-cold water at a depth of 300 or 400 fathoms. On the north-eastern corner of the Färöe bank the depth increases very rapidly. In lat. 63° 22′ N., long. 3° 30′ W., soundings gave 1,180 fathoms. A series of temperatures gave 32°·4 in 400 fathoms, 31°·8 in 500 fathoms, and the bottom temperature was 29°·8. In lat. 63° 55′ N., long 7° 10′ W., 30°·2 in 677 fathoms; in lat. 63° 3′ N., long. 10° 15′ W., 37°·2 in 256 fathoms. Further west the bottom temperature was found to be 46°·2. Bad weather prohibited dredging, so the course was laid for Reikiavik, but heavy S.W. winds and sea made the progress very slow. July 22, Iceland was made in the morning, but in the afternoon the weather got so wild and thick that shelter was sought at the Westman Islands, a group of small islands off the south coast of Iceland. Here a stay of three days was made; during one of them there was a heavy gale, in which steam was kept up. The visit here proved very interesting. The whole of the islands are volcanic; a large old crater, with perpendicular walls 400 to 500 feet high, is visible; one side is standing, the other has been washed away by the sea. Two miles off is a more recent cone, 770 feet above sea-level, in full preservation, with a hollow 50 feet deep on top. The base of the cone is lava; the cone itself, whose outline is beautifully geometrical, is composed of loose stones. The sea-birds are very numerous, living in the countless hollows in the cliffs, where they were hatching at the time of the visit. Whales, large and small, were about the ship.

Westmaney was left July 26, and Reikiavik reached that evening. On the south coast of Iceland the current was very strong to the eastward, and from Cape Skagi to Reikiavik its violence was fearful.

The Icelanders reported that they have very seldom had so bad a summer as this one—perpetual storm and rain. This has not been favourable to the expedition except as regards meteorology. In this branch hourly observations have been regularly taken when at sea.

The expedition was to stay at Reikiavik five or six days for coaling and for magnetic base observations. Hardly any magnetic observations have been obtained at sea, the weather having been so boisterous. It was intended to give up making the circuit of Iceland (the ice on the north side went away in June), and to take up a line south of Iceland, and then straight across to Norway, about to Namsos. The scientific staff is very well contented with the results gained, in spite of the bad weather.

(*From another Correspondent.*)

The Atlantic Expedition, under the leadership of Prof. Mohn and Prof. Sars, sent by the Norwegian government for the exploration of the North Atlantic and for making a *tour* round Iceland, give some intelligence as to their proceedings in a letter from Thorshavn (Färöe Islands), dated July 11 and 14, printed in the Christiania newspaper, *Morgenbladet*, of Aug. 2. This letter, the substance of which we reproduce, gives information on the cruise of the expedition in open sea, after its having left Christiansund. On June 27 the steamer left Christiansund and went westward. In the evening soundings were taken at a depth of 87 fathoms, and the temperature of the water proved to be as high as 7° C., between 10 fathoms and the bottom. The following day, the island Storeggen was reached; the temperature of the water was here 7½° C., at a depth of 230 fathoms, and the animal life, belonging all to the "warm region," was of the highest interest. On the 29th, the steamer going further westward, the depth still increased and soon reached 418 fathoms, where the thermometer showed an icy-cold sheet of water, sharply divided from the upper warmer sheet, the temperature at 300 fathoms being + 6°, and − 1° at the depth of 418 fathoms. On the 30th the weather was very fine, and the trawl-net was used, an English fishing-net, which brought some remarkable forms (*e.g.* large *Umbelliferæ*) from the depths of the cold sheet of water. On July 1 the thermometer showed − 1° C. at the depth of 570 fathoms. In the afternoon the weather changed, the wind began to blow very strongly from S.S.E., the barometer fell, and the steamer took a S.E. direction. On July 2 the wind reached the strength of a storm, the waves had a height of 18 feet, which height diminished afterwards to 12 and 10 feet. The bad weather continued until July 4, and it was not till the 5th that the steamer could return to her former route, and the soundings and the fishing could be continued. On the 5th soundings were taken at a depth of 1,050 fathoms, temperature at the bottom − 1° C. The dredging apparatus was sent to this depth, and dragged for six hours: it brought up a very interesting collection, which proved that even at this depth, and in such cold water, animal life is very variable at different parts of the bottom. But the zoological labours were soon interrupted anew by a gale coming from the south; the height of the waves was measured and found to be 25 feet, and the steamer received some damage, which forced the expedition to go to the Färöe Islands. On the 8th the expedition landed at Thorshavn, and it was not till July 14 that, necessary repairs being made, the steamer could go further. These circumstances, and the reports of much ice round Iceland made it very probable that the expedition will not make, this year, the proposed *tour* round that island.

The scientific results of the expedition—says the writer of the letter—are already considerable. The depths of the sea, and the distribution of temperature with the depth are certainly such as might be supposed, but the animal life exhibits a much greater variety of forms than could ever have been expected, so that the explorations of the summer will give a very general idea as to the organic life of this latitude.

MR. O. C. STONE'S EXPEDITION TO NEW GUINEA

A GOOD deal of speculation has been rife as to the above expedition of Mr. Stone (Cf. *Ibis*, 1876, p. 363) into south-eastern New Guinea, as the collections sent by the Italian traveller, D'Albertis, had by no means answered the expectations of naturalists as regards novelties, and as Mr. Stone was known to have engaged the services of two good *préparateurs* in the persons of Messrs. Petterd and Broadbent, it was confidently expected that a great deal that was new to science would be brought to light. After a cursory examination of the birds obtained during the expedition, it becomes quite evident that the neighbourhood of Port Moresby is a very unproductive one as regards ornithology, when compared with the rich fields in the north-western part of New Guinea, which have lately yielded as many as fifty-two undescribed species of birds to the Italian traveller, Dr. Beccari. At the same time Mr. Stone's collection has taught us some very interesting facts by proving that the Papuan element in the avifauna of south-eastern New Guinea, consists rather of Aru forms than of Salwatti or Dorey species. Many birds are, as might be expected, specifically the same as those of Cape York, but the large number of Aru birds is very striking. I am preparing a full account of the collection for publication, but meanwhile I send a notice of the expedition for the readers of this journal, and add short details of one or two species which appear to be new to science.

Mr. Stone started from Somerset, Australia, on October 21, 1875, and after remaining a few days at Yule Island, where Signor d'Albertis was then collecting, he reached Port Moresby, New Guinea, about sixty miles further to the south-east, on the 29th of the same month. Although his principal object in visiting the island was to gain ethnological and geographical information, he took with him, as mentioned above, two taxidermists. Anuapata, where he erected his tent, is situated upon the shores of Moresby harbour, in long. 147° 7′ E., and lat. 9° 28′ S., and from here several preliminary excursions were made. At first the natives showed some fear, but on seeing that the object of the visitors was peaceable, they soon gained confidence, and the younger members of the community frequently assisted in carrying back the game shot. During the months of December and

January rain fell in considerable quantities, and both the collectors were laid up for many days with fever and ague, which retarded collecting, but altogether about 450 skins of birds were obtained from a radius of about thirty miles inland from Port Moresby. In the immediate neighbourhood of Port Moresby birds were plentiful, but the beautiful Bird of Paradise (*P. raggiana*) is only found in the thick forests on the mountains of the interior. Parrakeets, parrots and cockatoos, pigeons and doves, were numerous among the jungle, and the belts of tall trees along the rivers Laroki and Vetura. The farthest point reached inland was Munikaira, situated about thirty miles to the north-east, the difficulty in procuring natives as carriers preventing Mr. Stone from proceeding further; at this point he made a camp for several days, but the wet season and consequent unhealthiness of the place precluded further exploration.

The following birds appear to be undescribed:—*Æluredus stonii*, Stone's Cat-bird, like *Æ. buscoides*, of N.W. New Guinea, but distinguished by a black head and unspotted abdomen. Hab. Laroki River.

Dicæum rubro-coronatum (Red-crowned Flower-pecker). Although having a red spot on the breast, like *D. vulneratum*, *D. schistaceiceps*, &c., this species differs from them all in having the back purplish, with a scarlet crown and rump. I cannot find any species agreeing with it. Hab. Port Moresby.

Janthœnas rawlinsoni, closely allied to *J. hypœnochrous*, but differing in its crown being of a ruddy violet, the under tail-coverts being black, and the under-surface also ruddy violet, without the strong chestnut appearance of *J. hypœnochrous*. Hab. Laroki River.

R. BOWDLER SHARPE

ABSTRACT REPORT TO "NATURE" ON EXPERIMENTATION ON ANIMALS FOR THE ADVANCE OF PRACTICAL MEDICINE[1]

VI.

Experimentation with Nitrite of Amyl.

IN the progress of scientific therapeutics no addition to the curative resources of medicine has of late attracted more attention than the nitrite of amyl. This agent is now one of the useful agents in the hands of the physician, and, what is most to the purpose, it is one of the most useful for relieving the cruellest and painfullest diseases. The discovery of the properties it possesses resulted in the purest way from experimental study, the record of which I am entitled to write as the one who introduced the agent into medicine, defined its mode of action, and thereby determined its place in the lists of curative chemical substances.

Nitrite of amyl was discovered by Balard thirty years ago. It was examined afterwards by Rieckher. It was made by the action of nitrous acid on amylic alcohol, and the vapour of it was said to produce headache when it was inhaled. Many years passed before any further observation was made upon the substance, and indeed, Gregory, in his edition of "Organic Chemistry," published in 1852, merely refers, and that incidentally, to the nitrate of amyl. He passes over the nitrite in silence.

The observation that the vapour of nitrite of amyl causes headache, or rather a sense of fulness of the head than headache, rested, I believe, on the observations of Rieckher, and was not improved upon until Prof. Guthrie, of Edinburgh, and now of the School of Mines, London, noticed, while distilling the nitrite, the further facts that the vapour, after being inhaled, induces flushing of the face, rapid action of the heart, a peculiar breathlessness such as occurs from fast running, and disturbance of cerebral action. These facts, published by the learned professor, became known to Mr. Morison, a dentist practising in Edinburgh. Mr. Morison thought that the vapour of nitrite of amyl might be a powerful stimulant, and might be made use of in cases of syncope and exhaustion. He brought a specimen of the compound to London, and placed it before the College of Dentists, of which he was a member. The Council of that Institution thereupon submitted the specimen to me for investigation and report, with the request that I would fully inquire into its physiological and therapeutical properties by experiment.

The first public record of my researches, commenced in this manner, was read to the physiological section of the British Association for the Advancement of Science at the meeting of the Association held at Newcastle-on-Tyne in 1863. It is unfortunate that by some accident the original paper as it was read at the meeting was not included in the volume of Transactions of the Association. A short and fair abstract of it was, however, published in the *Medical Times and Gazette* (Sept. 26, 1863, pp. 334-5). The first remarkable effect I observed upon the living body from the vapour of the nitrite was the peculiar redness of the skin. On the face a deep blush was excited by inhalation of the vapour, which blush soon became a perfect crimson. With this there was a rapid increase in the motion of the heart, and following upon the same there was quickened respiration and panting. These observations, which resembled those noted by Prof. Guthrie, were taken in a systematic manner from symptoms produced on myself. A piece of paper was rolled into the form of a funnel, the nitrite was dropped into the open mouth of the funnel, and then I inhaled vapour from the funnel until distinct objective and subjective symptoms were recognised. Dr. Gibb, afterwards known as Sir George Duncan Gibb, took notes of these signs as they were developed in me, and then he himself inhaled while I recorded symptoms. Afterwards Mr. Kempton, a member of the Council of the College of Dentists, submitted himself to experiment. The result was the confirmation of certain very extraordinary phenomena induced by the nitrite, but what the nature of those phenomena could be was unknown. One thing was certain, that here was an agent of great potency in its action on the animal economy, and therefore of promise as an agent for cure. The question was what disease would it cure or alleviate? Towards the relief of what class of human maladies could it be applied?

I should have been well content if I could have pursued this inquiry solely by observation on man. But soon I found that the experimental pursuit on the human animal was far too dangerous a risk to be ventured upon. An enthusiastic adventurous experimentalist in my laboratory made a few inhalations too many, and well nigh paid the penalty with his life. The rapid action of his heart was followed by confusion of the senses and by sudden prostration, and extreme pallor and faintness from which there was not a safe recovery for two hours, nor a complete recovery for two days. The only lesson taught by this experience was that the original idea of using nitrite of amyl for the cure of syncope was false. All else was as dark as ever, and if I had had no other means of research at command, I should have laid this now valuable remedy aside as a dangerous substance, a substance not to be added to the armoury of practical medicine.

In this dilemma it seemed to be justifiable to test the action of the agent on animals inferior to man.

The first point to be ascertained was whether this substance acted after the manner of an anæsthetic. Animals therefore of different classes, frogs, guinea pigs, cats, and rabbits, were subjected to its vapour as I had been; but the inhalation in their case was carried further, and they were allowed to pass into insensibility. The insensibility appeared to be death, and in the warm-blooded animals was death. The consciousness of external impressions remained until the moment of collapse, then there was insensibility, but then also in the warm bloods the

[1] Continued from p. 291.

life had ceased. Thus it was shown that nitrite of amyl was not an anæsthetic. It did not produce sleep.

After the life of the animals of warm blood was suddenly extinguished by the vapour,—and apparently the extinction was without pain,—I remarked that the internal organs of the body after the death were in some instances exceedingly congested with blood. The lungs and the brain were commonly in this state; but it struck me, though I could not explain the fact at the moment, that exceptionally these organs, when the death of the animal was instantaneous, were left quite bloodless, and actually white in their texture. Further, I observed that in the warm bloods the muscular irritability remained for a very long time after death, often for many hours. These phenomena were strange on the warm-blooded animals, but they were trifling in comparison with what was observed on cold-blooded animals. I discovered that in the frog the complete insensibility, and, as it seemed, absolute death, produced by the nitrite was not death really, but a suspended animation, a condition like that which has been called trance in the human subject. A condition of simulated death so perfect that no sign of life could be obtained, and yet from which, after so long an interval of time as nine days, the animal would wake up and enter again into life as if nothing had been done to derange its life. During all this time the limbs of the animal remained mobile; not a muscle was stiffened into the rigidity of death. There was induced, in fact, not only the trance of the human subject, but the corresponding cataleptic state of the muscular fibre. In addition I learned that during this state of suspense of life, the blood, though it was darkened and deprived of its capacity of becoming oxidised, and otherwise changed, was held in the fluid state. Like the muscles, it remained free of the change called pectous; it did not coagulate.

The next step in the investigation had relation to the action of the nitrite on the vessels which constitute the minute circulation. The change in the circulation in the web of the frog under its influence was carefully investigated; the condition of the circulation through the semi-transparent ear of the rabbit while the animal was breathing the vapour was also carefully investigated. The result of these inquiries was to discover that nitrite of amyl exerts a direct action on the nervous function, and that the action consists of a paralysing influence on the nervous mechanism by which the minute arterial system is controlled and governed. To repeat the words of the report I made to the meeting at Newcastle, "the action of the nitrite was directly on the nervous system, and that such action, transferred to the filaments of nerves surrounding the arteries, paralysed the vaso nerves, on which the heart immediately injected the vessels, causing the peculiar redness of the skin and the other phenomena that have been narrated."

In this preliminary inquiry I advanced the new propositions that we had in our possession a chemical substance which, being introduced into the body, overcomes the arterial tonicity, and causes phenomena analogous to those changes in the vascular current which follow upon division of the sympathetic nerve.

I further suggested that in cases of trance and catalepsy in the human subject, some substance analogous in its action to the nitrite is produced in the body by some error of secretion, some modification of the animal chemistry, and that the foreign substance so engendered is the cause of the disease. The first of these propositions is, I consider, proven; the second is not proven by any new research, but is still the most reasonable exposition of the phenomena to which it refers.

In continuation of experiment on the action of the nitrite of amyl on the nervous system, I studied next its local action, and came to the conclusion that its action on the nervous matter is not through the blood, but by direct impression through the nervous cords to the vascular motor nervous supply. I compared other bodies of the nitrite order—such as nitrite of methyl, ethyl, and butyl—with it in their operation. I compared it in its action with emotional shocks, and correlated the blush on the cheek or the pallor of the cheek which it produces with the blush or pallor induced by the impressions creating shame, fear, or other similar passions. I traced, through the whole of the phenomena induced by the agent, the action of the base amyl, and the effect of the addition of the elements, nitrogen and oxygen; and I showed that when oxygen and nitrogen are brought into combination with the base, the physiological effect is modified and the specific influence of the substance on the vascular system is declared. I was led to compare the action of nitrite of amyl with other chemical bodies, and, using it as a key, was enabled to show the analogical action of many other compounds. Notably, I pointed out from the observations collected during this inquiry, that alcohol produces its influence on the extreme vascular system by the same paralysing process. By investigating the effect of the agent after its long-continued inhalation, I was able to show that it induces changes in the circulation of the lung which lead to congestions and even to hæmorrhages like those which occur in some forms of pulmonary consumption, and thus the nervous origin of consumption of the lungs was brought fairly under notice as a new element of study in the clinical history of that fatal disease. In yet another series of observations I learned that rabbits afflicted with a singularly loathsome skin disease—resembling *lepra* in man—recover rapidly in an atmosphere containing the nitrite vapour; that the dry and colourless and scaly skin of the animals become suffused with blood; that with this increased capillary circulation the scales fall off and healthy skin begins to appear; that the fur of the animals begins to grow; that the general nutrition of the animals is soon improved, and that within a month their cure is completed.

From my point of view the disclosure of these facts alone were a sufficient vindication of the line of research by experiment on living animals pursued with the nitrite of amyl. They were, however, very poor indeed, when they are compared with another disclosure of fact which came out of the same experimental research.

In 1863 I had learned that the influence of the nitrite of amyl was on the nervous vascular supply, that it paralysed temporarily the nervous action, and that the vascular redness it induces is due to this paralysis. In the succeeding year I followed up this subject more closely, and by an extension of observation I was led to the conclusion that in the nitrite of amyl we had found the most potent chemical agent that had ever been discovered for overcoming muscular spasm generally. The singular cataleptic and passive state of the voluntary muscles was an evidence of this fact, and it tallied with the earlier observation of the effect on the vascular tension. In addition, I saw that in this nitrite I held a substance which would not fix itself with the tissues of the animal and require to be eliminated by the slow process of fluid excretion through the kidney or skin, but that, owing to its insolubility and volatility, it would escape by the organs of respiration as well as by the other channels of elimination. I had learned, indeed, that in animals like frogs, from the bodies of which, owing to the thickness of the cutaneous tissue, the transpiration is easy, the spontaneous evaporation of the nitrite, extending over the long period of nine days, was sufficient of itself to lead to restoration of vital function. The study of the whole series of facts, when the facts were carefully collected and weighed, led to the demonstration that the original view as to the nitrite of amyl being a stimulant and an extreme excitant was wrong; it disclosed that the phenomena of excitation, as they at first seemed, were phenomena really of suppressed nervous function, that the vascular injection meant loss of vascular resistance, and that the supposed stimulant was indeed a paralyser of the most active kind.

In turn this reading of the true physiological action of the nitrite of amyl led me safely to its true therapeutical value, and the result was that its exact place in therapeutics was fixed correctly before ever it was used for the treatment and cure of disease. At the meeting of the British Association for the Advancement of Science held at Bath in 1864, I pointed out its therapeutical position. The application of nitrite of amyl as a new remedy for the use of the physician was clear: it was a remedy to be applied in controlling muscular spasm. It was, I said, selecting for my illustration the most terrible and typical of all the spasmodic diseases, it was the remedy even for tetanus or lockjaw, and this view I afterwards demonstrated by the direct experiment of neutralising strychnine tetanus in the frog by the application of the nitrite, of suspending the tetanic symptoms by the agent until the strychnine was eliminated, and of physiologically curing a disease which had been physiologically produced and which, but for the antidote, would have been irrevocably fatal.

So soon as the therapeutical position of nitrite of amyl had been discovered by experiment the practical adaptation of it was comparatively easy. I had only to learn how it had best be administered; how to administer it, by inhalation, by the mouth, by subcutaneous injection; how to make it combine with other medicinal substances, and how to select the most suitable substances with which to join it in combination. The researches in these directions were all conducted on human animals, or rather on one animal—the experimentator himself. The modes of administration were also recorded for the guidance of practitioners, and the remedy was in time fairly launched on a true scientific basis, its action explained, its use described, its effects predicated.

I spent three years in research on the physiological properties of nitrite of amyl in order to discover its place as a means of cure of human maladies. If I had spent thirty years instead of three the time and labour had not been badly repaid. The practical results of my work in the benefit conferred on mankind in mitigation of suffering and in cure of diseases of an intractable nature have been rapid in their course beyond expectation. Dr. Lauder Brunton first tried the application of the nitrite of amyl for the relief of one of the most acutely painful of the spasmodic diseases, the disease known as angina pectoris, and gained an immediate success. Dr. Anstie came to me for the remedy in a case where a man was in the pangs of death from acute spasmodic asthma, and after five minutes of the inhalation of the vapour found his patient breathing with the most perfect freedom, or, as he expressed it to me, "the man became conscious and natural in a few seconds so soon as the physiological action of the remedy took effect; it was like dragging a drowning man out of the water." Dr. Farquharson administered the vapour to a man in excruciating agony from colic, and witnessed the same relief so soon as the physiological effect was produced.

A little later came the application of the nitrite of amyl for the treatment of tetanus, the crucial trial of the agent which I had originally proposed. Mr. Foster, of Huntingdon, was the first surgeon to put it to the test in this disease. A man, after an injury, was seized with tetanus. In the spasmodic grasp of the malady he "was rolled up like a ball." Under the inhalation of the vapour of the nitrite of amyl his muscles relaxed, and whenever the spasm threatened to recur the administration of the vapour of the paralysing agent relaxed the contraction. So for nine days, during which an ounce of the remedy was given by inhalation, the death from the spasm was prevented; by that holding on, the cause of the spasm became inactive, as I had anticipated, and the recovery was secured.

Two other equally successful instances of this same kind have been recorded, and recently Dr. Fowler, of New York, has published a fourth experience identical in character, but with a remarkable additional fact appended. The sufferer who was, as we should once have said, fatally stricken with tetanus, made a primary recovery under the administration of the nitrite of amyl. Unfortunately the supply of the remedy ran out, and before a new supply could be obtained the tetanic spasms returned and continued with increasing violence. At last the remedy was reobtained, and after a lapse of sixty hours was re-administered. The relaxation of the tetanus was again secured, the return of the spasm was controlled over a period of several days, and once more the art of the physiologist was rewarded in the recovery of that stricken patient from one of the most terribly excruciating forms of painful death.

I have put no word of my own experience on the use of nitrite of amyl, long and successful though it has been, on the present record. I have supplied but a few typical facts from the experiences of other observers, and if I could put in all it would be but the record of the uses of a remedy which is as yet but beginning to be applied for the cure of painful diseases not only of men, but of lower animals also, especially of dogs and horses. The point I want to keep in mind is that the results already obtained are the fruits of experimental inquiry. I stood at the gate of the place where this new remedy came from. I took it first as a physician, from the hand of the chemist. I determined its place in medicine. Then other men took it from me, and confirmed my estimate. Thus the history of this remedy is made clear from its beginning, and it is most just to say that if I or some one else, given to like method of research by experiment, had not tested the agent in the same way, the results that have already been obtained from it had been lost. Whether the results are worthy the method—whether, for instance, the experiment of producing and curing tetanus in a frog is warrantable in order to discover a plan by which tetanus induced in man by natural disease can be cured by art—these are the serious kind of questions on which opinion is now divided. It is my duty to show the practical arguments in favour of the experimentation.

BENJAMIN W. RICHARDSON

(*To be continued.*)

NOTES

ON Friday last, in the House of Commons, Mr. Reed asked whether the memorial, already printed in our columns, signed by many of the most eminent men of science in the kingdom in favour of the establishment of a permanent Museum of Science had been presented to the Lord President of the Council; if so, whether he had any objection to laying it upon the table of the House; and whether the Government propose to take any action in the matter.—Lord Sandon in reply stated that he was glad the hon. gentleman had called attention to the important memorial to the Lord-President of the Council, which had been signed by, he might almost say, all the most eminent men of science in the kingdom, in favour of the establishment of a permanent Museum of Science at South Kensington. He added that it was one of the many gratifying results of the remarkable exhibition of scientific apparatus which we have had the satisfaction of getting together at South Kensington, with the assistance of the leading men of science both of this country and of almost every civilised State. Lord Sandon promised to at once lay the paper on the table of the House. He was not in a position to say what action will be taken respecting it, but assured the hon. gentleman that it was receiving the best consideration of Her Majesty's Government.

A MOVEMENT at last has been made by Lord Aberdare, late Lord President of the Council, to obtain statistics relating to Secondary Education. On the 4th he asked the Duke of Richmond, the present Lord President, whether he had the means of making a return of the number of schools in England and Wales in which instruction was given to children above thirteen years of age, and if he had not, whether he would take any measure to supply such deficiency. There had been exhaustive inquiry into the universities, public schools, and elementary schools, followed by legislative action, but there had been no inquiry into the state of the schools—such as the endowed schools throughout the country—which occupied a position between the elementary and higher-class schools, and he believed that on inquiry it would be found that large districts were insufficiently supplied with the means of obtaining such education. He knew it would be impossible for the Lord President, however well disposed, to furnish the same amount of information on this subject which would be supplied through the medium of a Royal Commission. We certainly want not only these statistics, but town and country organisations, which are impossible without them.

NO occasion has before drawn together so many distinguished men of science from abroad, in various departments, as the Centennial Exhibitition at Philadelphia. Without attempting to enumerate all who might be mentioned in this relation, *Silliman's Journal* recalls, from Great Britain, Sir William Thomson, the well-known physicist, who is President of the Judges on the XXVth Group—Instruments of Precision and Research; Sir John Hawkshaw, the eminent engineer who was last year President of the British Association; Sir Charles Reed, President of the XXVIIIth Group of Judges—for Education and Science; Capt. Douglas Galton, President of the Judges under the XVIIIth Group—Railway Plans, &c.; Mr. Isaac Lowthian Bell, the most eminent iron metallurgist in Great Britain, and author of the well-known treatise on the "Chemistry of the Blast Furnace," President of the Judges of Group I.—Minerals, Mining, Metallurgy, &c.; Dr. William Odling, Waynflete Professor of Chemistry in the University of Oxford, Secretary of the Board of Judges on Group III—Chemistry and Pharmacy, &c.; from Sweden, Prof. Adolf E. Nordenskjöld, Prof. C. A. Angström, Polytechnic Institute, Prof. O. M. Torrell, Chief of the Geological Survey of Sweden, and Richard Akerman, of the Royal Swedish School of Mines, all from Stockholm, under whose immediate superintendence the excellent geological, mineralogical, and metallurgical display of Sweden, at the Exposition, has been made; from Russia, Major-General Axel Gadoline, an eminent Russian engineer, and Prof. L. Nicholsky, Mining Engineer and adjunct Professor at the Mining School of St. Petersburg, who is in charge of a systematic collection of Russian minerals—the only systematic mineral collection in the Exposition; from Germany, Dr. Wedding, Royal Prussian Counsellor of Mines, Dr. Rudolph von Wagner, the well-known editor of *Wagner's Jahresbericht*, and Dr. G. Seelhorst, of Nuremberg; from France, M. L. Simonin, J. F. Kuhlman (fils),* M. E. Levasseur, and M. Emile Guimet, of Lyons; from Italy, Prof. Emanuel Paterno, of Palermo; from Mexico, Mariano Barcena, the mineralogist. The Emperor of Brazil, without claiming the position of a man of science, manifests the most intelligent and cultivated understanding of all that is most worthy of notice in scientific methods, his inquiries extending to everything which should interest the head of a great Continental empire. Prof. Nordenskjöld, on July 1, left on his return to join a new expedition of discovery to the seas of Northern Siberia.

THE number of statues erected by the French to their men of science is fast enlarging. Lately we had to mention the inauguration of M. Elie de Beaumont's monument in Normandy. We learn from the papers of Dauphiné (in the south-east corner) that Grenoble has just rendered the same honour to the celebrated Vaucanson, one of the greatest mechanicians of the last century. It was he who invented the chain for communicating motion at a distance. He used it with an admirable sagacity for constructing the first spinning machine and automata. Vaucanson's automata were deemed a century ago a wonder of the age. He was a candidate for admission to the Academy of Sciences, but was rejected by the influence of the Court party, to whom he was obnoxious. Louis XV. was highly pleased with the result of the election, and he was heard saying, "We will ask him to construct for us an automaton Academician." It was Vaucanson's own collection which formed originally the primitive stock out of which the Conservatoire des Arts et Métiers was grounded.

THE number of visitors to the Loan Collection of Scientific Apparatus during the week ending August 12 was as follows:—Monday, 8,991; Tuesday, 3,458; Wednesday, 424; Thursday, 388; Friday, 359; Saturday, 3,372; total, 16,992.

A NEW geological map of Scotland by Prof. Geikie, Director of the Geological Survey of Scotland, is about to be published by Messrs. W. and A. K. Johnston. It is on the scale of ten miles to one inch, like the tourist map which the same firm published some years ago, and which has been found so useful by all travellers in Scotland. The new map has been engraved with special reference to the requirements of the geologist. It is not too crowded with names, and instead of the old meaningless hill-shading, it has the heights marked by small triangles and reference figures. The geological information includes the most recent observations. The chief lines of dislocation are marked in strong black lines; the general dip of the formations is shown by arrows. In addition to the older rocks, the map shows the position of the more important raised beaches, river alluvia, tracts of blown sand and glacier-moraines. Round the edge of the sheet a series of sections has been engraved to illustrate the geological structure of each great division of the country. We understand that the map is to be ready for the meeting of the British Association next month in Glasgow, and therefore in time for the geological tourists, who will, no doubt, spread themselves over Scotland at the close of the meeting.

WE learn from the *New York Tribune* that Prof. Henry took the opportunity at the last meeting of the National Academy of Sciences, to say a few words about the Smithsonian Institution. Its funds at present, having been increased by donations and judicious management, amount to $717,000, although $600,000 has been expended on the building, and the original legacy produced only $541,000. Congress has enacted several liberal measures which have been of great service to the Institution and have relieved it of many expenses, such as the cost of caring for the grounds and library; and latterly an appropriation of $20,000 per year has cleared the expense of the National Museum. This liberality has enabled the Smithsonian to devote a larger share of its income towards publishing works of original research, and to defray the expense of its system of scientific exchanges, which has the whole world for its field. The publications already issued and under way were enumerated. Prof. Henry said that it was contemplated to authorise a series of experiments to determine accurately the rate of increase of the earth's temperature at progressive depths. This was now rendered more practicable than before by the number of artesian wells in the country. Another project included new and careful experiments on the velocity of light; that furnishing one of the means for ascertaining the distance of the sun. Some steps had been taken to carry out this project, and a gentleman had promised to give a special fund for the purpose. The work of obtaining accurately the weight of the earth by the method devised by Cavendish would also probably be undertaken anew, there being at the present day better means for this purpose than those of the old experiments. Prof. Henry alluded to his own advancing years and his anxiety to have the Smithsonian in a position of permanent security before the close of his life. The accumulations of the museum already overstock the building, and when the collections that have been sent to Philadelphia are returned there will be no room for them. Conversing on the subject with a prominent member of Congress, he had recently stated his firm conviction that the problem could best be solved by abandoning the present building to the National Museum and erecting a new structure, to cost $100,000. The new building could be adapted solely to the needs of the Smithsonian in its proper work, and should contain besides accommodation for the system of exchange, a chemical, a physical, and a biological laboratory with a lecture-room.

MESSRS. WILLIAMS AND NORGATE have sent us the following new foreign publications :—"Die Dynamite, ihre Eigenschaften und Gebrauchsweise sowie ihre Anwendung in der Landwirthschaft und im Forstwesen," by Isidor Trauzl (Berlin, Wiegand and Co.); "Die Leitungsbahnen in Gehirn und Rückenmark des Menschen, auf Grund Entwickelungsgeschichtlicher Untersuchungen," by Dr. Paul Flechsig (Leipzig, Engelmann); "Studien über die ersten Entwickelungsvorgänge der Eizelle die Zelltheilung und die Conjugation der Infusorien," by O. Bütschli (Frankfurt, Ch. Winter).

IN a reference to Bessels' *Protobathybius*, in NATURE, vol. xiv., p. 238, the statement is made that it has not been described and figured. This, it would appear, is erroneous, for Mr. A. S. Packard, jun., of Salem, Mass., has published a drawing and brief description of it, furnished to him by Dr. Bessels, in his little work entitled "Life Histories of Animals, including Man," which appeared a few months since.

THE following is the title of the essay to which the Howard medal of the Statistical Society will be awarded in Nov. 1877 (the essays to be sent in on or before June 30, 1877). "On the condition and Management—past and present—of the Workhouses and similar Pauper Institutions in England and Wales, and their effect on the Health, Intelligence, and Morals of the Inmates." Further particulars at the rooms of the Society in Somerset House Terrace, Strand, W.C.

MR. CHARLES DARWIN has been elected an Honorary Vice-President of the Birmingham Natural History Society.

WITH regard to the statement in our recent paper on Oyster Fisheries, that some fix three, others four, years as the age at which an oyster becomes reproductive, Mr. W. Fell Woods, a Director of the South of England Oyster Company, writes us that it has been known to many that oysters breed when two years old, and in the course of his own investigations (as stated in his evidence before the Select Committee), he had found them to spat when twelve months and *even barely* twelve months old. The conditions then have, no doubt, been somewhat exceptional, whilst at two years it is comparatively frequent.

THE Abstracts of Meteorological Observations made in New Zealand during 1875 have come to hand. They show for fourteen places the monthly results of pressure, temperature, humidity, rain, wind, and cloud, compared with previous years' averages, together with notes descriptive of the general character of the weather and the unusual phenomena at each station, and a rapid and graphic summary for the whole of New Zealand, the earthquakes being specially recorded. The publication might be made still more valuable if pressures were given not reduced to sea-level, if the methods of computing the different averages were clearly stated, and if some of the more important results were also published for different hours.

IN the June number of the *American Journal of Science and Arts*, there appears a short article on "The Curve of Eccentricity of the Earth's Orbit," by Mr. R. W. McFarland, of the Ohio Agricultural and Mechanical College, Columbus. Mr. McFarland has performed the self-imposed task—one of great labour—of testing the accuracy of the tables given by Mr. Croll and by Mr. Stockwell. Mr. Croll, it will be remembered, computed the values by Le Verrier's formulæ, and Mr. Stockwell by formulæ of his own. Mr. McFarland has now re-computed the values by Le Verrier's formulæ, and finds "Croll's figures correct in most cases, and not in error to the amount of ·001, except in one instance."

THE operations of the United States Fish Commission in the way of stocking the Connecticut and other rivers of the United States with shad, promise to be very successful during the present season, unless the great heat should bring up the temperature of the water to such a degree as to interfere with the proper hatching of the eggs. More than a million and a half of eggs were taken during the first week of the work, and a large number of the fish therefrom were placed in the river at Bellows Falls. As the hatching establishment is below the Holyoke Dam, the fish are introduced above it, so that in their return from the sea they may proceed up the fish-way to their starting-point, instead of remaining below it, as would otherwise be the case.

IT appears from reports brought from Iceland and the north by Capt. Ambrosen, of the *Arcturus*, that boisterous weather has been experienced within the whole navigable portion of the Arctic circle, the high winds driving the field-ice southward in large quantities. It is thence inferred that the ice within the polar basin has been broken up to a larger extent than usual, thus probably favouring the Arctic Expedition in carrying out its objects.

THE ninth annual report of the trustees of the Peabody Museum of American Archæology and Ethnology, presented in April of the present year, has been published, and gives an account of the additions to this extremely extensive and important collection. Since the death of the lamented Prof. Jeffries Wyman, the museum has been under the charge of Prof. F. W. Putnam, who has continued the cataloguing and arrangement begun by his predecessor, and brought the whole establishment to a condition of thorough efficiency. Many valuable additions are recorded during the year, the most important, and, indeed, the largest donation ever made to the museum, being that from Peru and Bolivia, collected at the expense of Mr. Alexander Agassiz, and presented by him, embracing nearly six hundred specimens. These consist largely of objects from the ancient burial-places at Anton, Chancay, Pasagua, Pacasmayo, and the island of Titicaca. The total number of additions to the museum amounts to over eleven hundred specimens. The report as published contains a general index to the nine annual reports of the museum, which are arranged to form volume one of the collective series. It is accompanied by portraits of Mr. George Peabody and Prof. Wyman.

THE additions to the Zoological Society's Gardens during the past week include a Grizzly Bear (*Ursus ferox*) from California, two Black Iguanas (*Metopoceros cornutus*) from San Domingo, purchased; two Booted Eagles (*Aquila pennata*), three Common Bustards (*Otis tarda*) European, a Leopard Tortoise (*Testudo pardalis*) from Port Elizabeth, deposited; five Gold Pheasants (*Thaumalea picta*), an Amherst Pheasant (*Thaumalea amherstiæ*), a Siamese Pheasant (*Euplocamus prælatus*), a Crested Pigeon (*Ocyphaps lophotes*), a Porto Rico Pigeon (*Columba corensis*), bred in the gardens.

SOCIETIES AND ACADEMIES

Geneva

Physical and Natural History Society, March 2.—M. Casimir de Candolle gave the result of his researches on the movements of the leaves of *Dionæa muscipula*, undertaken for the purpose of ascertaining if the anatomical constitution of these leaves furnished a sufficient explanation of these movements. His investigation has confirmed this hypothesis and has proved to him that the movements referred to, as well as those of the sensitive, for instance, are the result of the turgescence of the tissues and not of electric currents or other causes. The leaf of Dionæa is composed of two essential parts; one part petiolary, and at the extremity of that a limb or circular leaf, whose two halves are movable around the central nerve. Each of these two valves carries three hairs, which it is sufficient to touch very gently, with a human hair for example, to cause the valves to close. Having investigated the internal structure of these valves, M. de Candolle has found that they are composed of two different kinds of tissues. The upper layer is composed of parenchymatous cells, relatively young and yet turgescent; the inferior layer of cells much older, which are no longer turgescent. At a given moment, and in consequence of the shock communicated to the upper layer, the water which it contained is expelled, a contraction is produced, and the leaf closes. All the arrangements of the leaf and especially that of the secondary nerves, which are perpendicular to the great nerve, contribute to bring about this maximum movement. The gradual development of these leaves is in favour of this theory; the valves of all the young leaves are at first rolled up and they are stretched out at the moment of complete expansion. The leaf does not close if one simply touches the leaf; it is necessary to touch one of the hairs. Their anatomical structure was then examined and M. de Candolle found that they are composed of very elongated cells, forming a rigid cone, which rests on an articulation formed by two great cells, round which it turns very easily. The least shock communicated to this long arm of the lever, is transmitted with great readiness to the internal layers of the leaf, and develops the phenomenon of turgescence, which is not produced when simply the epidermis of the leaf is touched. These hairs are not true hairs, but excrescences in intimate relation with the interior parenchyma; hence their energetic action in the internal portions of the leaf.

Paris

Academy of Sciences, Aug. 7.—Vice-Admiral Paris in the chair.—The following papers were read:—Experimental critique on glycæmia (continued), by M. Claude Bernard. He illustrates three statements:—1. Glycæmia does not differ in carnivorous and in herbivorous animals; it is independent of alimentation. 2. In traversing the arterial system the blood contains nearly the same proportion of sugar. 3. In the general venous system the proportion of sugar is variable, but always inferior to that of the arterial blood.—Observations of M. P. Thenard with reference to M. Bernard's communication. He calls attention to capillary affinity, and a mode he found of destroying it. He left a large vessel of gelatinous alumina in a chamber where it froze during winter. In spring he found the vessel filled with water, and, at the bottom, a thin layer of an alumina, which as to its capillary affinity, shared but little the properties of the frozen alumina. He has practised the method artificially in purification of his black acids. Now M. Bernard pours into a maximum solution of sulphate of soda an equal volume of blood. The blood coagulates, then by evaporation and cooling, crystallisation of the salt is effected. This crystallisation, the author points out, is virtually the same as his congelation.—On the alteration of urine; reply to Dr. Bastian, by M. Pasteur. He considers Dr. Bastian's reply as aside from the point in discussion. The difference is solely with regard to interpretation of the facts.—On the carpellary theory according to the Loaseæ (second part), by M. Trécul.—Reply to the last communication of M. Hirn, by M. Ledieu.—On radiometers of intensity, by M. de Fonvielle. The dissymmetry of action necessary to rotation may be obtained by substituting a dissymmetry of figure, relatively to the axis, for dissymmetry of substance or of coloration. The arrangement of feather mills might be imitated, or that of cup anemometers, or that of screws actuated by an air current, or that of the orreries turned by the current from a Holtz machine.—On a new process for preparing tinder wicks without poisonous substances, by M. Monier. Oxide of manganese is substituted for chromate of lead. The wicks are impregnated with sulphate of manganese, which is decomposed by caustic soda, or they are simply immersed in a solution of permanganate of potash.—On the phylloxerised spot (4 hectares) of Mancey (Saone-et-Loire), by M. Rommier. The facts show that in its progress northwards, the phylloxera is not prevented by the greater coolness of climate, and that application of sulphocarbonates to advanced spots at the proper time, may reduce the swarming, and save, for a long period, the neighbouring unattacked vineyards.—On determination of the carbonic acid contained in waters (of irrigation, of drainage, of springs, of rivers, &c.), by M. Houzeau. The method is to liberate successively, in the gaseous state, the free and the combined carbonic acid, and absorb by 5 cubic centimetres of a concentrated solution of soda with addition of $\frac{1}{1000}$ of oxide of zinc. The carbonic acid is then estimated volumetrically by a method the author described in *Ann. de Chimie et de Physique*.—On a new process of qualitative testing and determination of potash, by M. Carnot. He uses the new reaction given by salts of potash in presence of hypo-sulphite of soda and a salt of bismuth in a charged solution of alcohol.—On the different rotatory powers possessed by sugar-cane according to the process employed for measuring them, by M. Calderon.—Process for determining hydrocarbons, and especially fire-damp in mines, by M. Coquillion. He composes a certain number of mixtures of air and protocarbonised hydrogen, introduces a given quantity of the mixture into a tube in which is soldered a palladium spiral, reddens the wire, awaits cooling, then measures the remaining gas. (Platinum wire gives frequent detonations in hydrocarbons with air, but palladium does not.) By comparison, the quantity of fire-damp in a given atmosphere may be estimated.—On the employment of chloride of calcium in watering of streets, promenades, and public gardens, by M. Cousté. He calls attention to his experiments on the subject, previous to those of M. Houzeau.—On some peculiarities of reflex movements produced by mechanical excitation of the cranial dura mater, by M. Rochefontaine. Such excitation on one side will cause contraction of one or of several muscles of the face on the same side, and for this a slight excitation suffices, or the animal may be but partly anæsthetised. A stronger mechanical stimulation causes also movement of the limbs on the same side, and a still stronger one movements of all four limbs. In the second case the excitation must be transmitted directly to the corresponding half of the chord; and in the third there is both direct and cross transmission; the direct being more intense, however, for the movements on the corresponding side are stronger.—Botanical affinities of the genus Neuropteris, by M. Renault.—On the annual revision of the magnetic map of France, by MM. Marié Davy, and Decroix. Table of declinations given. From June, 1875, to June, 1876, the mean annual variation of Paris was about − 0° 2′ 12″.

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