THURSDAY, FEBRUARY 11, 1886

PRECAUTIONS AGAINST HYDROPHOBIA

THE frequency of the terrible and incurable disease known as hydrophobia has led to precautions being adopted in London, which, if universally carried out, would probably rid us of the plague.

The recent progress of scientific pathology, *i.e.* of medical knowledge which advances by the methods of observation and experiment—has made clear much which was previously obscured by traditional fables.

It is now certain that hydrophobia is a real disease, not the mere result of fright, not primarily a mental disorder at all, but a definite sequence of bodily symptoms. Even its anatomy has been investigated by the beautiful methods of modern microscopical research; and the coincidence of the results obtained by skilled histologists, working independently, makes it probable that the lesions discovered are essential and not accidental. If so, the anatomical part of the disease consists in a perivascular inflammation of the central nervous system, and particularly of the part known as the "bulb," or *medulla oblongata*, which is situated between the spinal marrow and the brain. Moreover, it has been ascertained that hydrophobia belongs to the group of "specific," or, as they were termed by the late Registrar-General, "zymotic," diseases, which always arise by contagion, and always "breed true." It is most improbable that it ever appears, either in man or animals, spontaneously or from common causes. In men and in brutes alike it follows the bite of a rabid dog, or other animal. How it first arose, and whether in dogs, wolves, foxes, cats, badgers, or in Carnivora before they were differentiated into the three groups of cats, dogs, and bears, with their several allied kinds—is quite unknown. But we have no historical knowledge of the origin of small-pox or measles, or even of diseases once thought to be unknown before modern times, such as syphilis, diphtheria, and cholera. The evolution of diseases, like that of the human beings and the brute creation they infest, is matter of speculation only.

Now there are three ways of dealing with these specific diseases. One is by treatment when they are fully developed. This is the business of the physician, and in many of them his treatment is so far effectual that, though prevention would be better than cure, yet cure is generally the result of rational treatment. But no effectual treatment of hydrophobia is known. In spite of the pretensions of charlatans and the constant attempts of physicians, no plan of treatment has yet been discovered which can show a single instance of success.

The second method is to arm the domain of life against an invading pest beforehand, instead of driving it out when already an entrance has been gained. This is the method first applied to small-pox by inoculation with imperfect success, and afterwards far more efficiently by Jenner's discovery of vaccination. No corresponding process of protection against other human diseases had been discovered until Pasteur's recent attempts to apply the principle to hydrophobia; but the same eminent *savant* had before devised similar inoculations to prevent more than one epidemic disease peculiar to domestic animals. We referred in a previous number to his system of inoculation as a preservative against hydrophobia, and since then the cases on which he has operated have multiplied. One difficulty of judging as to the efficacy of his method is that not more than half the persons bitten by rabid dogs develop hydrophobia; the poisonous saliva may have been wiped off the teeth by the clothing as it was penetrated, or the effusion of blood may have immediately washed it away, or some local application may have destroyed it. Another is that hydrophobia has such an uncertain and often protracted period of "incubation," more uncertain and more protracted than that of any other specific disease, varying from a few weeks, or even possibly a few days, up to eleven or twelve months, and in some rare cases reaching two years, or possibly a longer period. But now that Pasteur's inoculations have considerably exceeded a hundred in number, these sources of fallacy are more likely to be eliminated, and as the mass of evidence increases, and the time grows longer, a conclusion one way or the other will become inevitable.

There is, however, a third method of dealing with hydrophobia, independent of future possible treatment and of inoculation. It is what the late Sir James Simpson called "stamping out" the infection in the case of cattle-plague. If we could kill every rabid dog and wild animal throughout the world at once, we have reason to believe that hydrophobia would become of only historical interest. Happily it has never (so far as we know) been transmitted from one human being to another, so that it would not be necessary even to await the death of the victims already bitten before feeling secure. Destroy the disease in animals, and it would perish from among men.

But since the infection takes place in the great majority of cases by means of a dog's bite, it would be sufficient to prevent every rabid dog from biting. This of course is impossible: but if we could make a dog's bite a very rare instead of a very common occurrence, the chance of being bitten by a rabid dog would become indefinitely remote. If we could prevent dogs from biting one another, hydrophobia would cease from among dogs also. The rabid dogs would die innocuous. It has been proposed to draw the large canine teeth, but this would not entirely prevent dangerous bites, it could never be carried out thoroughly, it would give needless pain to intelligent animals, and in attempting to enforce it more bites would probably be inflicted on the operators than if the dogs had been let alone.

The only rational methods yet proposed of preventing, or rather of reducing, the number of dog-bites is first to diminish the number of dogs by imposing a higher tax on those kept as domestic animals, and by destroying ownerless, miserable, and half-starved curs; and secondly to prevent dogs biting when abroad by enforcing the use of muzzles. These may be constructed so as not to interfere with the animal breathing, perspiring, and even drinking with comfort, and yet to prevent his using his teeth.

Such muzzles are enforced and worn by a recent regulation of the Metropolitan Police, and troublesome as such interference with individual liberty (whether of dogs or their masters) is felt to be in this country, it may be hoped that the rational part of the community will see its reasonableness, and will do their best to have it thoroughly carried out.

Similar measures have long been enforced in Berlin and other Continental cities, and have been followed by the most gratifying results in the diminution or suppression of the dreaded hydrophobia.

BOTANICAL RESULTS OF THE "CHALLENGER" EXPEDITION

Report on the Scientific Results of the Voyage of H.M.S. "Challenger" during the Years 1873-76 *under the Command of Capt. G. S. Nares, R.N., F.R.S., and Capt. F. T. Thomson, R.N.* Prepared under the Superintendence of the late Sir C. Wyville Thomson, F.R.S., &c., and now of John Murray, one of the Naturalists of the Expedition. Botany—Vol. I. By William Botting Hemsley, A.L.S. (Published by Order of Her Majesty's Government, 1885.)

THE botanical results of the voyage of the *Challenger* hitherto published have been confined to the reports of Mr. Moseley, sent home from time to time during the voyage, along with collections of plants made by him, to Kew, and published, along with lists of the species, in the *Journal* of the Linnean Society. In the volume before us we have the results of a more detailed working up of the material thus obtained so far as it belongs to insular floras. Mr. Hemsley, who is responsible for the book, brings to his task botanical experience which begets the liveliest confidence in the thoroughness and accuracy of the work, and the volume will certainly compare with any of those upon the zoological results of the voyage already published. It is necessary to emphasise the fact that Mr. Hemsley is the author of the book, for it is not patent on first inspection. The title-page, where one naturally looks for information upon the subject of authorship, tells that the volume is published under the superintendence of Mr. John Murray, who writes barely a page of preface, but it says nothing of Mr. Hemsley, the author of the rest of the book—over 900 pages—and it is only by turning up the table of contents that his connection with the book is found recorded. This may be consistent with uniformity in the appearance of the *Challenger* publications, but hardly, we think, with consideration for the author.

Although appearing amongst the scientific results of the *Challenger* voyage, Mr. Hemsley's work has a considerably wider basis than the botanical insular collections made during that voyage. From the rich stores of the herbaria at Kew and the British Museum he has sought out and made use of collections and records of observations of travellers, both old and recent, so far as they relate to islands from which Mr. Moseley procured specimens, and he is thus enabled to present an account of all that is known of the vegetation of these islands,—in some cases their complete flora. The book is, then, no mere descriptive synopsis of the botany of the *Challenger* Expedition. Its nature may be gathered from Mr. Hemsley's own description:—

"In the introductory notes on the vegetation of the various islands included in the reports on the botany of the Expedition are embodied tables showing the distribution of the genera and species of each island or group of islands. There are also observations on the composition, affinities, &c., of the different insular floras, together with references to the diverse agencies operating in the dispersal of plants, whilst numerous facts and suggestions bearing upon the same subject are scattered throughout the lists. Finally, the appendix to the third part of the botany is devoted to the record of evidence of the part played by oceanic currents and birds in the transport of seeds from place to place. The general introduction is not limited to a mere summary of the facts contained in the reports, and speculations thereon; it has been so extended as to form an epitome of the botany of a large number of oceanic islands and of the Antarctic regions generally. The special characteristics of insular vegetation in various parts of the world are set forth and compared with continental vegetation; and, as a whole, the work may perhaps serve as an indication to travellers of the nature and extent of the observations required for the advancement of this most interesting subject."

As to method the book is divided into four parts. The first is a "Report on the Present State of Knowledge of various Insular Floras," being an introduction to the botany of the *Challenger* Expedition. The second and third parts are Reports "On the Botany of the Bermudas and various other Islands of the Atlantic and Southern Oceans," namely, St. Paul's Rocks, Fernando Noronha, Ascension, St. Helena, South Trinidad, Tristan d'Acunha Group, and St. Paul and Amsterdam Islands, and the chain of islands from the Prince Edward Group to the Macdonald Group. The fourth part consists of a "Report on the Botany of Juan Fernandez with Masafuera, San Ambrosio, and San Felix, the South-Eastern Moluccas, and the Admiralty Islands," to which is added an Appendix "On the Dispersal of Plants by Oceanic Currents and Birds."

The scope of the volume is so comprehensive, and the subject is in touch with so many of the interesting problems connected with plant-distribution, that in this notice we must content ourselves with merely indicating some of the more prominent features that characterise the book. At the outset we may state that it abounds with interesting and new facts, and the analytical tables graphically representing various facts of distribution, compiled evidently with great care, are exceedingly striking, and bring out contrasts in a manner no amount of writing could effect.

The introductory part is really a series of essays upon various interesting subjects connected with phytogeography, which are mainly treated in their bearing on insular floras. An early chapter deals with the classification of islands in relation to the composition of their vegetation. Wallace's classification of oceanic and continental islands, whilst harmonising with the features of vegetation of many islands, is not adapted, Mr. Hemsley thinks, for exhibiting the floral peculiarities of islands generally. The Bermudas and Galapagos, for example, included in Wallace's oceanic group, cannot be fairly placed in the same category. He therefore proposes a classification which in effect, so far as it is applied in this volume, amounts to the subdividing of Wallace's oceanic group into ancient, more recent, and new sub-groups. Islands may be arranged, he says, for phytogeographic purposes, in three categories, according to their endemic element, namely:—(1) Those with "vegetation comprising a large endemic element, the nearest affinities of which are not always found in any one continent"; to this category belong St. Helena, Juan Fernandez, the Sandwich, Galapagos, and Seychelles Groups. (2) Those with "vegetation comprising a small, chiefly specific endemic element, the origin of which is easily traced"; here are included the Bermudas, Azores, Ascension, the islands in the southern part of the Indian Ocean, and the Admiralty Islands. (3) Those with a "vegetation comprising no endemic element" (which have become stocked with plants in very recent times); such are the Keeling and other coral islands in the Indian and Pacific Oceans. A statistical account of floras of several islands not treated of in detail in the subsequent reports is given to illustrate the feature characteristic of these several categories.

A very prominent place is given by Mr. Hemsley to the question of the "dispersal of plants by oceanic currents and by birds." In the appendix to Part III. there are descriptions of drift-seeds and seed-vessels, and of seeds and fruits from the crops of birds, collected by Mr. Moseley, Dr. Guppy, and others, to which is prefaced an historical *résumé* of the subject. We have in fact an epitome of all that has been written upon the subject up to the present time. The evidence Mr. Hemsley brings forward of the potency of these agencies in plant-dispersion is irresistible, and effectively overthrows the opinion so frequently expressed by Alphonse de Candolle—an opinion founded in great part upon the capacity of seeds to retain vitality when immersed in sea-water, as determined by experiment—that oceanic currents have played and play an unimportant part in plant-diffusion. The views of the two botanists are placed in striking contrast by a comparison of the list of species certainly or probably dispersed by ocean currents given by each: De Candolle's contains about two dozen, Hemsley's over 100. Mr. Hemsley guards himself against being supposed to regard the sea as the principal agent, or indeed as anything more than a subordinate agent in bringing about the present distribution of plants, "for it is manifest that the action of currents and birds of passage are insufficient to account for certain elements in the vegetation of many islands." But at the same time he goes so far as to maintain that the littoral flora owes its present characteristics to the fact that the seeds of the plants composing it are capable of withstanding long immersion in sea-water, and are thus suited for oceanic transport. That the present general diffusion of a large proportion of the plants inhabiting the tidal forests and sandy and muddy sea-shores of the tropics is in a great measure due to oceanic currents is, in his opinion, quite certain from the evidence; a view from which few, we imagine, will be inclined to dissent. In illustration of this subject he gives (taking a small selection of flowering-plants whose seeds are transported by oceanic currents and by birds) the following picture of the gradual invasion of an island by herbs, shrubs, and trees. "The seeds of many almost ubiquitous sand-binding grasses may be reckoned among those which are cast ashore in a vital condition, and we assume that these grasses are amongst the first flowering-plants to obtain a footing. Other herbaceous plants met with in the earliest stage of such an insular flora are *Portulaca*, *Sesuvium*, *Canavalia obtusifolia*, and *Ipomœa biloba* (*I. pes-capræ*); all of which seem to possess an unlimited power of colonisation. Moreover, they provide the conditions necessary for other plants to be able to establish themselves. Among the early shrubby occupants, *Suriana maritima*, *Pemphis acidula*, *Scævola Kœnigii*, and *Tournefortia argentea* are prominent, being found on the most remote islets of the Pacific and Indian Oceans within the tropical and sub-tropical zones. Where there are muddy shores, there the various mangroves (*Rhizophora*, *Bruguiera*, *Avicennia*, *Vitex*, &c.) take possession. Among the first real trees are *Heritiera littoralis*, *Hibiscus tiliaceus*, and *Barringtonia speciosa*, together with screw-pines. After this nucleus of a flora has been formed, it is comparatively easy for other arrivals to establish themselves; and every addition in a measure helps to provide the conditions for a still more varied vegetation." And he concludes:—"It may be safely assumed, therefore, that if oceanic currents and birds have not been the means of dispersing a large number of species of plants, and it is not certain that they have not, they are certainly the most important agents in stocking islands, for without their action the numerous remote coral islands, at least, would still be utterly devoid of phanerogamic vegetation, and consequently uninhabitable."

As a concrete illustration of the influence of these agencies in stocking islands, an analysis of the indigenous vegetation of the Bermudas is given, which shows that 45 species are chiefly littoral plants, the seeds having been probably conveyed to the island by oceanic currents; 38 are marsh plants, with small seeds, possibly conveyed to the island in mud adhering to birds, though many may have reached in vegetable drift; 13 are plants with more or less fleshy fruits, and probably were carried by frugivorous birds, leaving a very small number of species introduced, probably indirectly, by man.

In a chapter upon the Antarctic flora, and the origin of the vegetation of the islands of the South Indian Ocean, Mr. Hemsley subscribes to the view advanced by Sir Joseph Hooker, and maintained by others, that a former greater land connection in the southern hemisphere is necessary to account for the present distribution of the vegetation in this region, and that a northward migration of southern forms has taken place in the past, and has perhaps hardly ceased. He thinks a greater land connection than Wallace allows must have existed, though the continental extension demanded by Hutton is unnecessary. At the same time he admits that a land connection so great even as Wallace assumes, along with alternations of climate, removes many of the difficulties in the way of accounting for present distribution, and if Thiselton Dyer's hypothesis be accepted, that the northern hemisphere is the primary home whence a southward migration of the forms of vegetable life has taken place, he considers a sufficient explanation is obtained. But he dissents entirely from Thiselton Dyer's view, holding that "until more conclusive testimony is forthcoming of the former existence of *Proteaceæ*, *Eucalypti*, &c., in Europe, we cannot avoid the conviction that they originated in the south."

Mr. Hemsley points out that the absence of general structural peculiarities in insular plants, and the occurrence of their physiognomic features in many continental areas, adds to the difficulties of plant geographers. He shows that no order, no sub-order, not even a tribe, is endemic in the smaller oceanic islands, and that the very distinct genera that occur are not disproportionate. To the question, Do the flowers of endemic insular plants present any peculiarities of size, shape, or colour? we get an instructive answer in the tabulated analysis of the endemic plants of St. Helena. From it we learn that "the size of the flowers and flower-heads in this flora is on the whole rather above than below the average of those of their allies in other parts of the world. When we come to colour, however, the equality fails altogether, red being almost entirely wanting in the insular plants, and blue unknown." The absence of butterflies and the abundance of moths on the island is a significant concomitant circumstance, as Mr. Hemsley remarks. Particulars are not yet forthcoming from other islands to permit of like analysis, and Mr. Hemsley merely concludes that brilliantly-coloured flowers are rare in such islands.

Amongst the special features of insular floras discussed and illustrated by Mr. Hemsley in the introductory portion of the volume, is the preponderance of shrubby and arboreous Compositæ, and of woody plants generally. That islands "often possess trees and bushes belonging to orders which elsewhere include only herbaceous species" as Darwin stated, he shows, by tabulated evidence of the occurrence of arboreous or shrubby forms allied to insular ones upon continental areas, requires modification. To illustrate the difficult problem of the absence or rarity of large, almost ubiquitous, orders in oceanic islands, he selects Leguminosæ, Orchideæ (the table showing the absence of species or the number of species of Orchideæ in various islands is extremely interesting), and Gymnospermæ; and the concomitant rarity of insects is suggested as a probable explanation so far as the first two orders are concerned. We cannot further notice these and other fascinating subjects dealt with by Mr. Hemsley in the introduction, but must recommend botanists and all interested in the subject of plant-distribution to peruse the volume, where, in addition to the information imparted by Mr. Hemsley himself, they will find a serviceable bibliography of insular floras and an index of islands with the names of authors who have written about them.

In the introductory notes to the several floras in the second, third, and fourth parts of the book Mr. Hemsley manages to convey a vast deal of information. Accounts of the physical features, the history of the island, as well as analyses of the vegetation are given, and he finds room for illustrative extracts from the works of travellers who have visited the islands. Many interesting subjects crop up in these—for example, the question of the sandal-wood in Juan Fernandez; but space forbids our noticing them. It needs, however, little examination of this portion of the book to convince one of the genuine character of the work which has been put into the preparation of the floras. The synonymy, the distribution, the critical notes, and the general information regarding each species, all testify to a conscientious search after completeness and accuracy, the result being a thoroughly trustworthy record of what is at present known regarding them. One point we may criticise unfavourably. We notice Mr. Hemsley has adopted the system of writing all specific names with a commencing small letter. This, though a prevailing custom with zoologists, is an innovation in botanical description in this country, and without discussing methods of nomenclature, which would be beside our purpose here, we would simply say that we do not agree with Mr. Hemsley in admiring it.

We have only been able to touch upon a few points in this excellent volume, sufficient, we hope, to indicate its importance. Problems of plant-distribution meet us frequently throughout the volume, and Mr. Hemsley's work is a most important contribution towards their solution. Of especial value is his treatment of the subject of the sea and birds as factors in distribution. A somewhat disjointed character in the book and frequent repetition are defects which are perhaps inseparable from the method of its preparation. For inequalities the author apologises, and the merit of the book as a whole fully atones for them. Mr. Hemsley's deservedly high reputation as a systematic botanist, confirmed by his "Botany of Central America," now approaching completion, is still further enhanced by this his most recent work.

We may add that the volume is illustrated by many excellent plates, chiefly drawn by Miss Smith.

Besides bearing witness to the good fortune which placed the making of botanical collections during the voyage of the *Challenger* in the hands of so able a naturalist as Mr. Moseley, the volume testifies in a very emphatic manner to the inestimable value of our national herbaria, especially that at Kew. Collections of plants, small and incomplete in themselves, are there accumulated ready for use when occasion requires, forming the material from which such volumes as this we notice may be constructed. We cordially join Mr. Hemsley in his hope that his work may direct attention to the nature and extent of the observations required from travellers for the advancement of our knowledge of the subject of plant-distribution, and we may conclude with one other aspiration. There is at present no authoritative book in our language on the subject of botanical geography, and too many of the phytogeographical works published nowadays are purely statistical compilations. Is it, then, too much to expect from the pioneer in the philosophical treatment of plant-distribution, Sir Joseph Hooker, whose name is in so special a manner associated with the subject of insular floras, a comprehensive work on botanical geography such as he alone could write? We hope not.

HALSTED'S "ELEMENTS OF GEOMETRY"

The Elements of Geometry. By G. Bruce Halsted. (New York: John Wiley and Sons, 1885.)

MR. HALSTED is already favourably known to English mathematicians by an excellent "Elementary Treatise on Mensuration" (published in the summer of 1881), and by one or two carefully compiled bibliographies in the *American Journal of Mathematics.* The faithful chronicler records of Tom Tulliver that he called his Manual of Geometry "the exasperating Euclid," a title richly deserved if his desire to be excused the "doing" of it were really based upon the reason he assigned, viz. "It brings on the toothache, I think." Now we have not an annotated copy of the "Mill on the Floss," and so cannot identify the particular edition which produced such a wretched result, but we doubt not it was one of the ordinary small text-books with which youth were well acquainted, in shape at least, at the time referred to. And this makes us allude to the portentous dimensions of the book before us, which consists of some 370 large octavo pages. The book is not for schoolboys, but is intended for students of larger growth. It commences, as does also "The Elements of Plane Geometry" (brought out by the Association for the Improvement of Geometrical Teaching), with a preliminary chapter on Logic, which gives sufficient introduction to a subject in which "the mind first finds logic a practical instrument of great power."

We turn aside for a moment to state a *raison d'être* for the volume before us. "In America the geometries most in vogue at present are vitiated by the immediate assumption and misuse of that subtile term 'direction'; and teachers who know something of the non-Euclidian, or even the modern synthetic geometries, are seeing the evils of this superficial 'directional' method. Moreover, the attempt, in these books, to take away by definition from the familiar word 'distance' its abstract character and connection with length-units, only confuses the ordinary student. A reference to the article *Measurement*, in the 'Encyclop. Britannica' will show that around the word 'distance' centers the most abstruse advance in pure science and philosophy. An elementary geometry has no need of the words 'direction' and 'distance.' The present work, composed with special reference to use in teaching, yet strives to present the elements of geometry in a way so absolutely logical and compact that they may be ready as rock-foundation for more advanced study."

This lengthy extract puts our readers in possession of Mr. Halsted's views: the result of his efforts is an edition which will, we think, repay perusal.

Now, in reply to old Tulliver's query, "Wat's Euclid?" it was replied, "It's definitions, and axioms, and triangles, and things. It's a book I have got to learn in—there's no sense in it." (Such is the view of some boys of the present day, as we discovered in looking over answers to a recent examination paper.)

Mr. Halsted defines a straight line thus:—It is a line which pierces space evenly, so that a piece of space from along one side of it will fit any side of any other portion. In his definition of an angle (*AOB*) one of the angles is said to be the *explement* of the other; he uses the term "straight angle," calls a terminated line (as in his "Mensuration") a *sect*, and "the whole angle which a sect must turn through, about one of its end points, to take it all around into its first position, or, in one plane, the whole amount of angle round a point, is called a *perigon*." Other definitions do not call for notice, except that in the definition of a circle he has, by an oversight, omitted to state that the sect must revolve in a plane.

The First Book is divided into eight chapters, and embraces the matter of Euclid's First Book, with several other important propositions: the order is not that of Simson's text, but propositions are grouped under problems, inequalities, parallels, triangles, and polygons. This last head is broken up into the divisions, general properties (congruence), parallelograms, equivalence, and axial and central symmetry.

In Book II. the commutative law (for addition and multiplication), the associative law, and the distributive law are established, and the propositions proved symbolically. Books III., IV., V., and VI. correspond to Euclid's divisions, but the selection of propositions and their arrangement and treatment agree with results we have seen nearer home.

But we hasten to a close, remarking that the remaining books treat of planes and lines (VII.); tri-dimensional spherics (VIII.); two-dimensional spherics (IX.); polyhedrons (X.); mensuration or metrical geometry (XI.) in five chapters, length, area, ratio of a circle to its diameter, measurement of surfaces, space-angles, and the measurement of volumes. The work closes with short paragraphs on direction, principle of duality, linkage, and cross-ratio.

There are some 234 exercises grouped together at the end, and also interspersed throughout the text.

There are a few typographical errors and a few slips in statement, and very many novel terms, *i.e.* to persons who have not read the "Mensuration" referred to above. We understand that the book is about to be published in this country, when geometers will be easily able to procure a copy for an examination, which will not be unattended, we believe, with profit.

The figures are in the main carefully drawn, though some few require correction.

OUR BOOK SHELF

The Zoological Record for 1884. Edited by Prof. F. Jeffrey Bell, M.A. (London: John Van Voorst, 1885.)

We have to congratulate the *Zoological Record* Association on having brought out this the twenty-first volume of the *Record* within the year. The publication of the *Zoological Record*, begun in 1865, was continued from 1871 by this Association, which well deserves every encouragement that the biologist can give to it. It would be a deep disgrace to our British School of Natural History if so valuable a work should be allowed to come to an end after having well and bravely struggled for existence for one-and-twenty years. At present, the Association numbers only fifty-three members and seventy-one subscribers, in addition to which several of our public libraries no doubt take their copies from the publishers; but to make the Association a self-supporting one, it should have a couple of hundred new subscribers, and such a number ought to be had from among the numerous students of zoology in this country. A vigorous effort now made might mark this year in the history of the *Zoological Record* as one of financial success.

While writing thus of the present, our thoughts also wander to the past. Although none of the original writers for the *Record* have gone to their long account, yet with the present volume, the last of them, Prof. E. von Martens, ceases from his *Record* labours, and his place is to be taken by four very excellent recruits,—Prof. Herdman, Messrs. W. E. Hoyle, G. R. Vines, and G. H. Fowler. The only one of the Recorders who kept in the race for the whole of the twenty one years—Prof. von Martens—had all through the great group of the Mollusca to record, and then, on the dropping out of the ranks of other Recorders, he took the Molluscoida and Crustacea. It is not possible to part with such a contributor without publicly recording the great debt that all interested in zoology owe to him for his labours.

One other contributor, also of long standing, now parts company from his comrades. On Mr. Kirby had fallen the parts of Dallas and Rye. No less than Prof. von Martens he deserves our thanks. His part we are delighted to know will be for the future filled by Dr. Sharp.

The editor's preface opens with a few feeling words relating to the death of the late editor, E. C. Rye; he is also obliged to record a broken promise, which thus recalls to mind an almost similar one recorded in vol. i., but with this difference—that for vol. xxi. though at the last hour a Recorder was found to supply the not forthcoming record, and has done so in a manner that, novice though he may be, shows the master's hand, for Mr. P. L. Sclater's record of the Mammalia forms not alone a scientific record, but its arrangement and style is so good and the summary of work on the general subject is so excellent as to mark it out for special notice.

Mr. Bowdler Sharpe, owing to his visit to Simla, left the record of the birds to Mr. A. H. Evans.

Mr. Gibson-Carmichael, in his record of Arachnids for 1883 and 1884, apologises for not recording a list of the new species described in the papers quoted owing "to his not feeling competent to judge of the value of new species." Here we may be allowed to utter a word of caution. A record should not of necessity be a criticism, and we would have preferred to have seen a statement of all the new species and their habitats than merely the titles of papers. For a zoological inquirer the habitat is often an assistance, and we notice that the same Recorder has not in the case of the Myriapoda been as particular in quoting these as we could have wished. Prof. Haddon has recorded the Infusoria. Certain very desirable changes in the sequence of some of the groups have been made by Prof. Jeffrey Bell, who acknowledges the receipt of money grants in aid of the publication from the Government Grant Committee of the Royal Society and the British Association, and whom we wish every success in his arduous and difficult task as editor of our British Record of Zoological Science.

Elemente der Lithologie. Von Dr. Ernst Kalkowsky. (Heidelberg: Carl Winter, 1886.)

THIS is an attempt, and a very successful one, to present to the student an elementary treatise, which shall be at once brief but well up to date; a difficult task in the case of a subject of which our stock of knowledge is being continually increased by results scattered through, or buried in, countless separate memoirs. The work is without figures, and is compressed into 316 pages, the first 57 of which are given to a general and introductory discussion of the characters of rocks and the methods of investigation. The reader's sound knowledge of the principles of chemistry, mineralogy, and physical optics is assumed by the author. The classification used in the larger treatises is generally adhered to. The arrangement of the information relative to each rock-family is very neat and compact: first is given a list of chemical analyses, and next a description of the macroscopical and microscopical characters of the component minerals; then follow accounts of the modes of occurrence, alteration, and genesis; and finally a short description of the varieties. The work is altogether satisfactory.

Notions Générales sur l'Éclairage Électrique. Par Henry Vivarez. (Paris: J. Michelet, 1886.)

THIS is a second edition of one of those readable and well-illustrated *brochures* that the French know so well how to write, and that have such a ready sale in their country, but which fail to secure even a publisher in this. The author is known in this country principally as a contributor to *Engineering.* His name has not been associated with any electric light enterprise, but he clearly understands that which he writes about. There is not much in the book that is new, indeed there is much that is obsolete, but what there is is clear and comprehensive. That which is French has naturally a preference over that which comes from "barbarians." The chapter on meters and photometers is excellent. The following table is useful:—

One carcel	=	8·3 English standard candles.
	=	7·5 German " " "
	=	6·5 Munich " " "
	=	105 litres per hour of gas

The work is not scientific. It is popular, readable, and useful.

Rome in Winter and the Tuscan Hills in Summer; a Contribution to the Climate of Italy. By David Young, M.D. (London: Lewis, 1885.)

THIS little volume must prove of practical value to a considerable class of people, that class which every year furnishes a large contingent of visitors to Italy and winter residents in Rome. Dr. Young has himself long resided in Italy, and has had ample opportunity of observing its climatal and sanitary conditions. He shows in his instructive book that Rome has got an undeservedly bad name for its climate, and the object of the volume is to show exactly what that climate is, under such heads as—the climate of Rome and its effects upon health and disease; the unhealthiness of Rome; Roman fever and malaria; water-supply of Rome; how to live in Rome; class of invalids likely to derive benefit from a residence in Rome, and so on.

LETTERS TO THE EDITOR

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

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

Barometric Pressure in the Tropics

THE American Eclipse Expedition to the Caroline Islands in May 1883 also made exceedingly interesting meteorological observations, of which the most important are those on the pressure of the air, as they elucidate some points in the daily period of this phenomenon (*Memoirs* of the National Academy of Sciences, vol. ii.). As this is very regular in the tropics, any difference in it points to exceedingly potent influences, and it is easy to surmise that, in the daytime, *none, except a cyclone, can be more potent than an eclipse, as no other can shade the whole extent of the atmosphere.* The result was an accelerated diminution of pressure from 10.15 to 11.30 a.m. (totality 11.32 to 11.37 a.m.), then a rise to about noon—*i.e.* at a time when there is generally a great fall—and later again an accelerated fall. The explanation is probably the following:—The accelerated fall at the beginning is caused by the diminished temperature and elasticity of the air. Then, as the height of equal pressure diminished in the shaded area, air began to flow in from the vicinity, causing a rise of pressure, and the subsequent rapid fall was a return to the normal condition.

The next total eclipse is to be on August 29 next, being visible in the morning on the Isthmus of Panama, the Leeward Islands, then Tobago, Grenada, the Grenadine Islands, and Barbados, and in the afternoon in South Africa from Benguela to Mozambique and the southern part of Madagascar. It would accordingly be important to have half-hourly barometrical observations (self-recording barometers or aneroids would be better still) at many points both of America and the adjacent islands and of Africa. We should expect to see the morning rise of pressure interrupted on the Antilles Islands (totality 7.23 a.m. at Barbados), and the afternoon fall of pressure also interrupted in Africa (totality 3.10 p.m. at Benguela).

The varying cloudiness in America and the Antilles (as the rainy season there has not the steadiness of the Indian monsoon and does not exclude clear days) would add a feature of even greater interest, as the influence of the eclipse on the daily period of pressure in clear and cloudy days could be compared. In South Africa, except the coast, where fogs are frequent at this season, clear weather prevails, and thus there is much more hope of good observations of the eclipse. As to pressure observations, they would be most interesting at some distance from the coast. A. WOEIKOF

St. Petersburg, January 24/February 5

Parallel Roads

THE following, from an old note-book, may be of interest in connection with this subject:—

I observed, in 1881, the formation of parallel roads on a small scale still in progress in a small plain about 3 miles long and 1 broad, marked in maps of Iceland as a lake, Sandkletta-vatn (lat. 64° 21'). This was surrounded on three sides by mountains, and the fourth was closed by a lava-stream. The plain is a perfect level of dark sandy mud without a vestige of vegetation, and is evidently a shallow lake for the greater part of the year. The shore is regularly terraced, the terraces being 2 or 3 feet apart. I thought at the time that the water must be dammed back regularly during the winter to a certain height, but that this height has diminished at three successive periods owing to fresh channels being found through the lava at lower elevations. In Goddalir there is a most instructive example of the formation of river-terraces. Above the broad valley there are two groups, over 1000 feet deep, terminating in a vast glacier or ice-cap. These seem to have been filled in solid with moraine, the remains of which still cling to the sides at all elevations. The eastern one evidently became cleared out first, with the result that an enormous mass of gravel was spread over the whole width of the valley below. The western one next started a torrent of its own, which cut down the level for some distance on its own side to 30 or 40 feet lower. Finally, both torrents united, and their greater transporting power again cut down the level some 30 feet, with the result that there are now two level terraces and the basis of a third. J. STARKIE GARDNER

Colours in Clouds

THE coloured fringes to, and in, clouds I long ago found to be very common, but I had no idea that there was any novelty, as there would seem to be, in this fact.

When the sun is setting behind a bank of clouds and there are high cumulo-strati or strati, these will almost always, I believe, be found coloured, at the proper distance from the sun, if viewed through a suitable dark glass. The edges of the dark cloud will often be so too. I believe these colours are always present; hidden by the brightness of the cloud which shows them, and the glare of the lower air. The former is removed by the dark glass, the latter by the interposition of the bank.

The tint I believe depends on the density of the cloud where it is formed. But it seems more probable that the real cause is that the particles (of ice?) are larger and more numerous where the cloud is more dense, and that, if their size were increased independently of the density we should have exceptional cases.

I have seen these fringes to bright edges of dense cumulus, but I must own that I never was quite satisfied that I was not seeing two strata of cloud. The colours are very beautiful, and often so strong that it is difficult to realise that the dark glass has only removed a concealing glare. J. F. TENNANT

Ealing, January 29

Movement of Telegraph-Wires

I HAVE frequently noticed the peculiar movement of telegraph-wires noticed by your correspondent. For some time I took it to be an ordinary case of vibration, but it presented so many peculiar features that I was induced to examine it more closely. It frequently happens that when the temperature and dew-point of the air are at or about the freezing-point, and the sky is clear, the wires are chilled by radiation, and hoar-frost is deposited upon them. With an almost imperceptible wind the hoar-frost collects almost wholly upon one side of the wire in the form of a wing, producing a torsional strain. The weight of the hoar-frost, as compared with the weight of line, is so small that their common centre of gravity is almost coincident with the centre of the wire. When in this condition, if a light wind acts upon the frozen wing, it imparts a reciprocating rotary motion to the wire. Each time the vibration brings the plane of the protuberance in a line with the eye, the wire almost disappears from sight, while when it is at right angles to that line it flashes suddenly into view. If looked at from such a point that the wing of hoar-frost moves backwards and forwards behind the black wire, the effect is very much more marked. R. MOUNTFORD DEELEY

Mill Hill, Derby, February 2

The Deltas of Glacial Rivers

AN interesting fact connected with the Lake of Geneva has recently been brought to light by M. Hörnlimann, who is now preparing a hydrographical chart of the Leman basin. From the point where the Rhone enters the lake, to a distance of more than 6 kilometres, the river-water, which is denser than the lake-water, follows a trench in the alluvial deposits which is from 500 to 800 metres wide, and which, even beyond St. Gingolph, where the depth exceeds 200 metres, is 10 metres deep. A precisely similar groove has been observed at the mouth of the Rhine in the Lake of Constance, with a depth of 70 metres and a width of 600 metres; and similar though less deep grooves are found opposite to the old mouths of the Rhone and the Rhine in the two lakes. The greater density of the river-water is owing to its lower temperature and to the vast quantity of sediment suspended in it. The deltas of glacial rivers flowing into lakes differ, then, in a remarkable manner from the deltas of most rivers flowing into the sea; the water of these rivers, being less dense than that of the sea, spreads over the surface, and thus helps to form bars. G. H. W.

MAHWA FLOWERS

ATTENTION has been publicly drawn of late to "Mahwa Flowers"—the corollas of *Bassia latifolia*—as a cheap source of cane-sugar. This species of Bassia is a tree attaining to a height of 40 to 60 feet, and common in many parts of India, especially in Central Hindustan. It has oblong leaves of firm texture, from 5 to 6 inches long; these fall in February, March, or April, and are succeeded in March or April by the flowers. These last for two or three weeks and then begin to fall. The falls take place at night, and continue sometimes for a fortnight. The fruits, which resemble a small apple, ripen in three months; the seeds, one to four in number, yield an edible oil by pressure. It should be added that the trees are self-sown, and that they flourish in very poor and stony soil.

When the Mahwa tree is in bud, the ground beneath it is cleared of weeds, sometimes by burning. A single tree may yield as much as six to eight maunds[1] of flowers; even thirty maunds have been asserted to have been collected from one tree. These flowers have a luscious but peculiar taste when fresh; when dry they resemble in flavour inferior figs. They form a very important addition to the food of the poorer classes in those districts where the tree abounds, particularly in the neighbourhood of woodlands and jungles. They are specially useful in economising cereals in seasons of famine and drought. They are sometimes eaten fresh, but more commonly sun-dried, and are usually consumed with rice and the lesser millets, or with seeds of various kinds, and leaves. It is said that a man, his wife, and three children may be supported for one month on two maunds of Mahwa flowers.[2]

It is not, however, as a direct article of food, nor as a material for the preparation of a rough spirit by fermentation (a very common use of these flowers) that Mahwa blossoms are now recommended. It has been affirmed that they may be employed as an abundant and very cheap source of cane-sugar. In the *Morning Post* of October 15, 1885, appeared an article on this subject, in which it was stated that, "If the Mahwa flowers be available in sufficient quantities for the sugar-makers of Europe, there can be no question that the days of the

[1] A Bengal maund equals 82¼ lbs. avoirdupois.

[2] For an interesting account of the Mahwa tree and its products, see a paper by E. Lockwood in the *Journal* of the Linnean Society ("Botany"), vol. xvii. pp. 87-90.

beetroot are over, and sugar-cane will go the way of all discarded products." This prediction depends, however, upon another condition besides that of the abundance of the flowers. If the sugar they contain be wholly or chiefly cane-sugar, that is, "sucrose," then the argument is not without weight. But the nature of the saccharine matter of the Mahwa does not appear to have been ascertained. MM. Riche and Rémont (*Journ. de Pharm. et Chimie*, 1880, p. 215) stated that the air-dried flowers contain 60 per cent. of fermentable sugar, of which about one-seventh is crystallisable. The material available for analysis in Europe consists, of course, of the dried flowers. These may have suffered some change beyond the mere loss of water, but the evidence they afford on chemical examination is not favourable to the view that they are likely to compete with sugar-beet or sugar-cane as a source of cane-sugar. Here is the result of an analysis of a sample of Mahwa flowers (from the Kew Museum) in their air-dried condition:—

	In 100 parts
Cane-sugar	3·2
Invert-sugar	52·6
Other matters soluble in water ...	7·2
Cellulose	2·4
Albuminoids	2·2
Ash	4·8
Water lost at 100° C....	15·0
Undetermined...	12·6

The flowers analysed had a slight smell of fermented saccharine matter and a distinct acid reaction. But it is not at all probable that they could have contained any large proportion of cane-sugar even when quite fresh, and that 15/16ths of that sugar had been inverted during the process of desiccation. We cannot argue from analogy in this case. For while the nectar of many flowers contains no sugar except sucrose, invert-sugar occurs in some blossoms, as well as in many other parts of plants. Even the unripe and growing stems of the sugar-cane and of many grasses contain much invert-sugar. It must, however, on the other hand, be remembered that cut sugar-canes imported into this country contain a large amount of invert-sugar, and that if they be kept a week only after the harvest the invert-sugar naturally present in the juice shows a marked increase and the cane-sugar a corresponding diminution. On the whole, then, so far as the materials at my disposal enable me to judge, I believe that the saccharine matter of fresh Mahwa flowers will be found to consist mainly of dextrose and levulose, and that consequently they will not be available as a material for the economic production of sucrose.

I have to thank Mr. W. T. Thiselton Dyer, C.M.G., Director of the Royal Gardens, Kew, for drawing my attention to this subject, and for a supply of the material on which I have worked. A. H. CHURCH

THE UNIVERSITY EXTENSION MOVEMENT[1]

THIS "movement" is one of the most significant of the present day, and provides a most useful step in that ladder of learning which it is desirable to see reaching from the elementary school up to the University degree.

Under the University Extension system, knowledge of the highest character is offered by its acknowledged possessors to all classes alike, yet with the very popular qualities of cheapness and attractiveness. The contents of this paper fall naturally into two heads: first, the advantages offered and the objects aimed at by those engaged in the work; and, secondly, hints and instructions as to the methods by which the work may be successfully carried on. Mr. Moulton vigorously urges the former, and has ten years' experience in the latter.

The ideal aimed at is, that a University education should be placed within the reach of any "person" in any grade of society, and that large bodies of students all over the country should be attached to the University as associates, of whom, if few ever became full members, yet any might do so, and all have started on the road. The Universities have set themselves to meet the wants of classes who have been long debarred from such privileges; and an ample page of knowledge will be spread before the eyes of all whom partial education may lead to seek it yet further.

The desire has long been felt both among middle and lower classes. The old Literary and Philosophical Society on behalf of the one, and the old Mechanics' Institute of the other, were both anxious attempts to do, by voluntary effort and amateur work, what the University now offers to undertake as a special business, by means of an itinerant system of authorised teachers taken from their most highly-trained and successful graduates. Under the eye of the Syndicate, and not making popularity their end, they will have a power at their back and a guarantee of their quality and of its permanency which the old lecturers could never give.

The great difference, accordingly, from the single desultory lectures given at the old institutions is the thoroughness of the instruction aimed at under this new system rising by stages to the full studies of the University. No subject is undertaken in a set of less than twelve lectures; notes are expected to be taken, the books recommended by the lecturer are expected to be read, and a class is held before or after the next lecture to incite and help the students. An examination takes place at the end of the course requiring a higher standard than the ordinary college examination, and not a lower one on account of the student's difficulties, for such students are allowed eventually to take a University degree, and it is correctly felt that it would be exceedingly mischievous in any way to lower the standard now required for that. This may seem a high one for candidates often consisting of a large proportion of working men, but nevertheless, in many cases where comparison could be made with young men resident at college, the former have proved to have the advantage over the latter. This again is not incredible; persons attending these lectures are drawn from all classes alike, yet all are volunteers, who have felt their want and chosen their subject—the best soil for any seed of knowledge to fall upon. It is not the upper classes only who are found to appreciate higher education, but it has proved to be a cause which can rouse passionate effort among working men placed in the most unfavourable conditions.

The Universities thoroughly sympathise with the demand in these days for knowledge in the lines of science and of modern history. There is perfect freedom from holding up classics and ancient languages, and abstruse mathematics as the *summum bonum*. The principal supporters of the movement are clearly divided into favourers of science, and favourers of literature and art, and an effort is made to thoroughly meet either demand. Indeed, nothing is more striking in reading this publication than the elasticity with which the University sets itself to fit its syllabus of subjects, and its arrangements for teaching them, to the various wants of the different bodies who wish to avail themselves thereof—whether colleges, philosophical societies and institutes, free libraries, subscription libraries, or special societies or companies for the purpose. Instances are given of the lectures being carried on by all these various bodies, and to all who would make use of this means of increasing knowledge, practical advice is here given upon matters down to those of the smallest range, and we may quote the following experiences:—

Ladies more than gentlemen are glad of the educa-

[1] "The University Extension Movement." By R. G. Moulton, M.A. With an Introduction by Prof. Stuart, M.P. (London: Bemrose and Sons, 1886.)

tion here offered, and ladies accordingly should always form part of the committee; young people also who have lately left school and can attract their companions to continue whatever study they have liked or felt the value of; pupil teachers—often, hereafter we hope, as at Hull now, the School Board paying the fee—attending as a matter of business; and artisans who feel their deficiencies. The trades unions of the latter already, some of them, spend 1000*l.* a year in education, and if men can also be attracted here to increased knowledge, lay in a solid foundation of some science at a course of lectures, and get their intelligence awakened to what is going on in the world around them, public-houses will to them be no great temptation, and much of their work will be carried on more intelligently.

Where, as is generally the case, from three to five towns at no great distance apart can agree upon a course of lectures to be given, and audiences can be drawn to both afternoon and evening deliveries, it is found that the charge made to one of the courses need not exceed three shillings for the set of twelve lectures. Nevertheless the financial difficulty is described as the greatest both to lecturers with the rich University at their back, and to hearers, who certainly may lose working-hours and perhaps feel the attendant small expenses of books, &c. It is one of the most curious characteristics of this movement that the lectures are assiduously attended by all classes of society alike, and yet the seekers after knowledge themselves do not value it at its cost price, even when offered on so liberal and economical terms. However, higher education always did require the help of the patron of letters and of the founder of the college, and he who assists these classes may rest satisfied that he is carrying on their work in a modest way.

Prof. Stuart in his Introduction hopes, and cannot doubt, that the University or some other competent body may realise the vast influence and noble position here to be attained. The compressed population of England possesses great economical advantages over the scattered townships of America. It cannot be believed that financial difficulties will be suffered to stand in the way of this movement, and we may look forward to seeing our Universities literally worthy of their name through offering all knowledge to all sorts and conditions of men.

W. ODELL

THE NEW NATURAL HISTORY MUSEUM IN VIENNA

THE two magnificent palaces in the Ringstrasse, opposite the old Kaiserburg, designed, the one for the conservation and exhibition of the art history, the other of the natural history, collections of the Imperial Court, are rapidly approaching completion. Completely alike as they are in their decorations and their style of architecture generally, their interior arrangement does of course in each case conform with the special requirements of the collections each is intended to receive. The lateral front, 69·38 metres long, faces the Ringstrasse; the main fronts, at right angles to the Ringstrasse, run, with a length of 169 metres, parallel to each other, separated by a square which is laid out in garden plots, and is to be crowned in the centre by the monument of Maria Theresia. The design and execution of the two buildings emanate from one of the most eminent architects of Vienna, Karl Baron Hasenauer, who is at present directing likewise the erection of the Court Theatre, and the reconstruction of the Hofburg.

The building occupying the more western site, and destined to receive the Natural History Museum, is somewhat further advanced as a whole than its eastern compeer. A few particulars regarding this Institute will be acceptable to the readers of NATURE.

The collections hitherto kept apart, and now about to be united into one grand and indivisible whole in the new building, are under the supreme direction of the Royal and Imperial Chief Staff of Stewards of the Court (*Obersthofmeisteramt*), the present head of which, Prince Constantine Hohenlohe, takes a most lively interest in this branch of his administration. They embrace:—

(1) The Mineralogical Court Collection, hitherto distributed in four rooms of the Hofburg and some smaller underground compartments there. These comprise the mineralogical, geological, and palæontological treasures.

(2) The Zoological Court Museum, popularly known as the "Naturalien Cabinet," hitherto exhibited in a quarter of the Hofburg, in Josephsplatz, adjoining the Court library.

(3) The Botanical Court Museum, which, along with the herbarium of the University, found its accommodation in a structure situated in the Botanical Gardens, and belonging to the University.

(4) The Prehistoric, Anthropological, and Ethnographical collections, hitherto not exhibited, but kept packed in various depots.

The new building destined for the accommodation of these collections possesses four stories. The lowest, elevated but a few feet above the level of the street, and distinguished as the "*Tiefparterre*," is arranged as a storehouse, with assorting rooms for the different divisions of the Museum, and here, too, the chemical laboratory for the mineralogical department is to be fitted up. The next two stories, distinguished as the "*Hochparterre*" and "First Floor," are designed for the exhibition of the various objects that will be arranged for general view. Each of them consists of a suite of nineteen halls, ranging from 200 to 260 square metres in area, disposed all round the exterior face of the building, which stands on free and open ground, in such order that, entering from the staircase, visitors will be enabled to pass through them in a continuous series, re-issuing into the staircase at a place opposite to that by which they entered. Inside this exterior suite of rooms, and looking down into the two large courts, are ranged a series of smaller compartments in a line parallel to that of the large halls, destined in part likewise for purposes of exhibition, but mainly for the libraries of the different departments and the laboratories of the various divisions.

The plan for the distribution of the different collections in the halls, and for the general arrangement of the whole, was drawn up by my predecessor, Intendant Hofrath von Hochstetter, who, unhappily, was called away in the midst of his ardent activities in the summer of 1884; and, except in the case of a few quite subordinate alterations, this plan has been completely maintained.

The former Mineralogical Court Collection is divided into two assortments: a mineralogical-petrographical and a geological-palæontological. The first, which is under the care of the custodian, Dr. A. Brezina, assistant to Dr. Friedrich Berwerth, has the Halls I. to V. inclusive in the *Hochparterre* (see figure) assigned to it. In the central repositories of the Halls I. to III. will be shown the finest specimens of our long-celebrated collection of minerals, arranged in the main according to the system of Groth. The wall-cases, having higher frames, will exhibit in part the larger specimens, and in part local series of minerals. In the window recesses in Hall III. will be disposed a collection of polished precious stones.

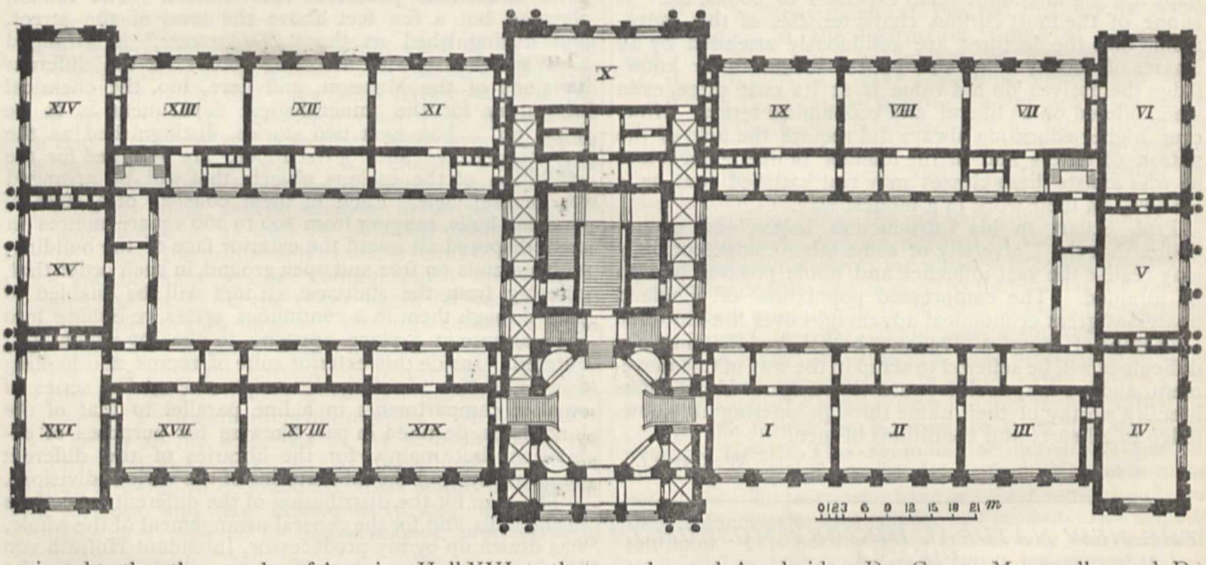
Hall IV. will display in its wall-repositories a collection representing the paragenetic relations of minerals, as also smelting processes.

The central cases of Hall V. are intended to accommodate the meteorites. These will constitute the most brilliant point in the whole division. According to the last inventory of Dr. Brezina ("Year-Book of the Royal and Imperial Geological Institute," 1885, p. 151), this collection, on May 1, 1885, represented no less than 358 localities in 1197 specimens, having a total weight of 1,134,836 grammes. The wall-repositories of this hall will contain the collection of stone species, as also the beautiful and instructive collection of building materials amassed by a voluntary fellow-labourer, Herr Felix Karrer.

The Halls VI. to X. are destined for the Geological Division. At the head of this department is Herr Theodor Fuchs, with his assistants, Herren E. Kittl and F. Wähner. In Hall VI. will be displayed the rich phyto-palæontological collection acquired for the Museum in largest part by purchase from Baron von Ettingshausen, and containing the types enumerated in his many descriptive works, a collection which has already been exhibited by himself. In the wall-repositories of this hall a collection of instructive specimens is to be presented, illustrating the dynamic processes in the formation and transformation of stones. The Halls VII. to IX. will present to view the collection of petrifactions classified, in the first place, according to the grand orders of the different ages and, within this classification, according to the zoological system. Hall X., finally, is destined for the exhibition of the skeletons of the larger Mammalia of the Cænozoic age, as also of the numerous and beautiful moa skeletons we possess.

The treasures of this last hall will enable the student to pass now, without break of continuity, into the prehistoric series of specimens under the direction of Herr F. J. Szombathy, with Herr N. Wang as his assistant. This collection will extend through the Halls XI. to XIII. Sorted into great groups, there will be displayed in these spaces the accumulations of the Palæolithic and Neolithic periods, the Bronze period, the Hallstätter period, the Latèn period, then of the Roman and Merovingian periods. Within these large groups the distribution will be of a geographical character, so that each locality will have its own treasures of the prehistoric age grouped by themselves. The most prominent section in this division will be formed by the excavations from the celebrated burying-field on the Hallstätter Salzberg, and hardly less interest will be excited by the disentombments from the caves of Moravia and Krain, from the settlements and burying-grounds in Carinthia, in Krain, in Northern Bohemia, &c.

The remaining spaces of the *Hochparterre* are allotted to the ethnographical collections under the supervision of the Custodian, Herr Franz Heger, with his assistant, Dr. M. Haberlandt. Here, too, the arrangement will be of a geographical nature, Halls XIV. and XV. being



assigned to the ethnography of America, Hall XVI. to that of Australia and Oceania, and Hall XVII. to that of Africa, while Halls XVIII. and XIX., along with some smaller adjoining compartments, will represent the ethnography of Asia. In this division, which will have all the charm of novelty for our Viennese public, the richest collections are those from Brazil, and, next to these, from the regions of the Upper White Nile.

In complete accordance with the structural arrangement of the *Hochparterre* is that of the "First Floor," in which the Halls XXI., XXII., and so on, will range themselves exactly above the Halls I., II., &c., the intermediate number of XX. being borne by the vestibule in the *Hochparterre*. The whole of this "First Floor" is devoted to the exhibition of the zoological collections. This division falls under the supervision of the Director, F. Steindachner, who has, in addition, specially reserved to himself the care of the collections of Fishes, Amphibia, and Reptiles. Other officials of this division are Herr A. von Pelzeln and Friedrich Kohl for the Mammalia and Birds; Profs. Brauer and Dr. E. Becher for the Mollusca; Herr A. Rogenhofer for the Lepidoptera, Hemiptera, and Hymenoptera; Herr L. Ganglbauer, for the Coleoptera and Orthoptera; Prof. F. Brauer, for the Diptera and Neuroptera; Herr C. Kölbl, for the Crustacea, Myriapoda, and Arachnida; Dr. G. von Marenzeller and Dr. von Lorenz, for the other divisions of the invertebrate animals.

Most richly represented in the zoological division are,—the group of birds, in respect of which, and more particularly the types from Brazil—thanks to the collections of Natterer, formed in his time—our Museum still, perhaps, takes the first rank among the Museums of Europe; the group of fishes, which recalls to mind the labours of a Heckel, a Kner, and recently our excellent Steindachner; the group of insects in general, and, in particular, that of the Diptera, in which are incorporated, among other collections, the celebrated ones of Meigen and Schiener, &c.

In Hall XXI. are exhibited the Protozoa, Cœlenterata, Echinodermata, and Vermes; in Hall XXII., the Arthropoda; in Hall XXIII., the Mollusca; in Halls XXIV. to XXVI., the Fishes; in Halls XXVII. and XXVIII., the Amphibia and Reptiles; in Hall XXIX., a special collection of the Birds of Austria-Hungary; in Halls XXX. to XXXIII., the systematic collection of Birds; and in Halls XXXIV. to XXXIX., the Mammalia.

In some adjoining rooms on this floor will be exhibited the very rich and magnificently prepared collection of fish skeletons presented to the Museum by the Director, Steindachner.

The highest story of all, the so-called "Second Floor," presents the same distribution of halls and adjoining rooms as do the *Hochparterre* and the "First Floor." The halls distinguished by the numbers from XLI. to LIX. correspond with the Halls I. to XIX. in our sketch.

The spaces on this floor will, as a rule, not be admissible to the public at large, but will be mostly appropriated as workrooms for the officials of the establishment and for experts to whom the use of the collections and other appliances is to be granted on the most favourable conditions possible.

One half of the second floor, comprising the halls from XLI. to XLIX. inclusive, will be set apart for the zoological division. Here the main collections of the invertebrate animals, only a small part of which can be exhibited on the first floor, will be kept in closed cases. Two halls will accommodate the skeletons of the Mammalia and birds, and one hall will lend itself as a library to the accommodation of periodical literature of general interest, while all publications of special departments will be distributed in the workrooms of the respective divisions.

Hall L. is destined for the collection, already very rich, of human skulls and skeletons.

Halls LI. to LIV., inclusive, are devoted to the botanical division. On the death, last summer, of the custodian of this department, Dr. Reichardt, the charge of it was committed to Dr. G. Beck, with whom is associated as assistant, Dr. Szyszylovic. The first three halls contain the herbarium, very valuable for the numerous original types it possesses; the last comprises the collections of woods, fruits, &c.

Halls LV. and LVI. form the reserve rooms for the geological division, in which the particularly rich chief collection of Tertiary Conchylia and the more subordinate collections of Foraminifera and Bryozoa are to be bestowed.

The Halls LVII. to LXIX., finally, are to be appropriated, as reserve rooms for the ethnographical collection, which is growing at an extraordinarily rapid rate.

Be a few words still allowed me respecting the state of the works yet needing to be completed before our Museum can be opened for public entertainment and instruction.

The building of the palace and its decoration in all exterior parts is finished. All the halls, workrooms, and dwelling-rooms are ready for use and in large part already occupied. The cases and stand apparatus destined to receive the collections are also in large part already set up or in process of being set up. Building operations of any serious extent yet remaining to be done are confined to the interior, and more particularly the central axis of the building in which the staircase stands. This work, however, is of such compass that, according to the declaration of the superintendent of the building, it will yet claim nearly two years before it is ended. So far as the collections themselves are concerned, they are all, with the exception of the large Mammalia, already transferred into the new building, and a beginning has also been made in arranging and disposing them. With the final completion of the building, this latter work will likewise be completed, and then will this new establishment for scientific labour and for the instruction of the public be at once opened. FRANZ VON HAUER

Vienna

NOTES

THE Council of the Royal Meteorological Society have arranged to hold at 25, Great George Street, S.W., on the evenings of March 16 and 17 next, an exhibition of barometers. The Exhibition Committee invite co-operation, as they are anxious to obtain as large a collection as possible of such instruments. A list of some of the principal patterns of which the Committee desire specimens has been prepared, and may be had by applying to Mr. William Marriott, Assistant Secretary. The Committee will also be glad to show any new meteorological apparatus invented or first constructed since last March, as well as photographs and drawings possessing meteorological interest not previously exhibited.

THE appointment of Sir Lyon Playfair to be Vice-President of the Council will be welcomed by all friends of education and of science. Sir Lyon's recent utterances on the duty of the State as to the promotion of scientific research must be fresh in the memories of our readers; and it will be interesting to watch to what extent the Minister's practice accords with his creed.

THE inauguration of the statue of Claude Bernard by Guillaume took place on Sunday last, at the entrance of the Collège de France. Speeches were delivered by MM. Paul Bert, Berthelot, Chauveau, Dastre, Fremy, and Renan. The audience was large, in spite of the very cold weather. The statue of Bernard stands near a table on which has been placed a dog undergoing dissection. The animal is partly concealed by a large bronze sheet on which are written these words—"Glycogenie Diabete—Nerfs vasomoteurs—Substances toniques—Liquides digestifs," which may be considered as giving a summary of the extent of Claude Bernard's disquisitions and discoveries.

THE death is announced of Dr. Arnold Konstantin Peter Franz von Lasaulx, Professor of Mineralogy and Geology at Bonn University. He died at Bonn on January 25, aged forty-six years.

AT the last sitting of the Paris Academy of Sciences M. Paul Bert took leave of his colleagues. He said that his academical qualifications were the principal cause of his appointment to his mission. He will be brought into contact with the *savants* of the East, and he is hoping to convert them to the principles of the West merely by persuasion and without being obliged to resort to coercion.

THE Académie des Sciences, in awarding the Prix Montyon to M. Girard, the director of the laboratory opened in Paris seven years ago for testing the quality of the food and drink sold by the tradesmen of the capital, has issued a report which shows how much good this laboratory has done. The laboratory was first opened in 1878, and specimens of wine, beer, cider, milk, chocolate, coffee, tea, &c., are examined daily; so, too, are the colours used for toys, sweetmeats, and liqueurs, as well as pork suspected of containing trichinosis, and tinned meats. Some of these samples are brought by the public, and the analysis is made free of cost when all that is asked is whether they are free from adulteration. If, however, an analysis of their proportionate composition is required, the laboaatory makes a small charge, and this brings in an annual income of about 1200*l.* a year. A larger number of samples are, however, brought in by the twenty inspectors who are attached to the laboratory, and whose duty it is to visit the different taverns and grocers' shops, and examine the articles offered for sale. These inspectors are provided with a microscope and with acids, which enable them to test a good deal of merchandise on the spot, and they only bring back to the laboratory specimens of the articles which they have reason to suspect are adulterated. There are twenty-five chemists attached to the laboratory, each of whom has his own special department, one taking milk, another wine, and so on. Each sample is divided into two parts, one of which is kept as evidence in case it should be found to be adulterated. The municipal laboratory analyses about 25,000 samples per annum at a cost of about 8000*l.*

THE total rainfall at the Ben Nevis Observatory during 1885 was 146·50 inches, the largest monthly fall being 24·33 inches in

December, and the least 4·97 inches. On December 12 there fell 5·34 inches, and on the following day 3·52 inches, or 8·86 inches on these two days.

AMONGST the objects which will be exhibited in the Ceylon Section of the forthcoming Indian and Colonial Exhibition will be a large ethnological collection from the Maldive Islands.

THE discovery of a portion of the vertebral column of a specimen of *Mosasaurus gracilis*, Ow., is announced to have been made in the hard white limestone or chalk of Whitewell, near Belfast.

DR. ARCHIBALD GEIKIE, Director-General of the Geological Survey, has now completed his "Class-Book of Geology," and the work will be published during next week by Messrs. Macmillan and Co. This volume completes the series of educational works on physical geography and geology projected by Dr. Geikie.

IT is interesting to note that the trout and salmon reared in February last year by the National Fish Culture Association have achieved the growth of 6½ inches, which is remarkable considering they have been subjected to an artificial existence. The whitefish hatched in 1885 have reached the size of 5 inches.

THE iris of the eye of Italians is most commonly chestnut; according to M. Mantegazza, the proportion of such is 64 per cent., the black eyes number 22 per cent., the blue 11, and the gray 3. Piedmont and Lombardy have the largest proportion of gray eyes; Venetia, of blue. In general the chestnut colour of hair amounts to 71 per cent.; then comes the black hair, 26 per cent.; then the blond, 3 per cent. (though in Venetia it is 8). Black hair is rare in Venetia. More than three-fourths of the Italians have abundant hair. Southern Italy excels Northern in this respect; in Tuscany the poor heads of hair preponderate (58 against 42 per cent.). As to beards, the colour does not always coincide with that of the locks. While chestnut preponderates, this preponderance is less marked; and one sometimes finds chestnut locks with blonde, and more often brown, beards. Bushy beards with abundant locks are most common in the South of Italy. In two-thirds of Italy, the natives wear the beard short or are clean shaven. This practice dominates especially in Tuscany (82 per cent.); the Sardinians have most long beards (50 per cent.). Red hair in Italy has been a subject of discussion among anthropologists; some think red-haired persons are remnants of a race almost extinct, and which extended to the banks of the Rhine and into England; others think red hair a mere physiological accident, from which no conclusion can be drawn. In Italy throughout one finds a few cases of red hair. In one commune, Sant' Agata di Puglia, red hair is predominant. No explanation has been given of the fact. Baldness is most common in Tuscany. In Italy generally, of 10,000 young men examined for military service 20 were rejected for premature baldness, and 52 for diseases of the scalp.

MR. CHARLES T. NEWTON, C.B., will on Tuesday next (February 16) give the first of three lectures at the Royal Institution on "The Unexhibited Portion of the Greek and Roman Sculptures in the British Museum" (illustrated by drawings and casts).

IT has been recently pointed out that the number of births in France per 10,000 inhabitants has diminished more than one-third in a century. It was 380 in 1771-80, 289 in 1831-40, and only 241 in 1871-80.

SEVERAL Continental geologists have been lately engaged in tracing the marks of the Ice Age on the Northern Alpine slopes. According to Dr. Brückner (in *Naturforscher*), the decrease of size in the diluvial ice-streams from west to east, corresponding to a decrease in the glaciers of the present, and due, no doubt, to the lowering of the region eastwards, is a noteworthy feature. Then it is becoming even more clear that there were at least two ice-periods, separated by a long interglacial period. The number of geological profiles containing two moraines (an older and a younger) deposited by glaciers, and separated by a layer which cannot have arisen under the ice, is considerable; in the region indicated nineteen such are known. The separating layer is in some cases loam (from weathering); in others it contains diluvial coal; in others it is formed of river deposits, &c. The position of these profiles shows that the ice-masses must have shrunk to the highest parts of the range after the first ice-period. The climate of that interval was probably much like the present; this is inferred from examination of the interglacial coal of Innsbruck, &c. The second glaciation was not so extensive as the first; for to the north of the moraines of the later glaciers appears a projecting strip, of more or less breadth, of the older moraines. This outer zone of moraine has also some special features in composition. In the interglacial period the rivers cut valleys in the masses deposited by the older glacier-streams; and these were filled again when the later glaciers came. Between the Rhine and the Traun there is evidence of a still earlier period of glaciation. Again, the coincidence of limits of the lake-region in the northern border of the Alps with those of the diluvial glaciers is significant. While some geologists attribute these lake-basins to erosion by glaciers, others think they were preglacial, and only prevented by the glaciers which occupied them in the Ice Age from being filled with earthy matter, &c. Dr. Brückner notes the fact that most of the geologists who have studied the features of the Bavarian lakes, take the former view, while those who have studied the Swiss lakes (where the relations are more complicated) take the latter.

THE London Stereoscopic Company's second annual International Amateur Photographic Exhibition, 1886, will be held at the Art Galleries, 103, New Bond Street, W., from April 15 to May 24.

THERE were (according to Dr. Dujardin-Beaumetz) 19 deaths from hydrophobia in Paris last year—a number higher than in previous years; and yet the number of stray dogs destroyed was also higher (viz. 5060). Of these 19 persons, 15 were males and 4 females. The youngest was a little girl of 5½ years; the oldest, a man of 63. The time of incubation varied from 19 months (in the case of a young man of 26) to 29 days (a child of 11). In only one case was the time of the bite unknown. Excluding that, and the exceptional case of 19 months, an average of about 2 months is arrived at for the time of incubation. As to duration of the disease, the extreme limits were 1 day and 8 days; average 3½ days. In no case were the lower limbs bitten. In 12 cases out of 18, the upper members were bitten, especially the hand (9 times out of 12), the wrist twice; in the 6 other cases it was the face (5 times) and the skull (once) that were attacked. Lastly, in 17 cases of the 18, the bite was that of a dog; in the remaining case, it was that of a cat. It will be noted that these statistics relate only to *deaths* from hydrophobia.

FERMENTATION can be utilised (as was shown by Roberts in 1861) for quantitative determination of sugar in urine. The method has been recently developed by Herr Einhorn (*Virchow's Archiv*), and he claims that the test will indicate one-tenth per cent., or even, if the fermenting liquid be previously boiled ten minutes, one-twentieth per cent. of sugar (the common reduction and polarisation-tests are exact to about 3 per cent.). Herr Einhorn uses three tubes of special shape: one with normal urine having no sugar, another with the urine to be examined, and the third with urine having sugar added to it. The urine, whether containing sugar, or normal, is boiled and diluted with boiled water to the amount of the original volume. Compressed yeast is added to the liquid in the proportion 10 per cent. Acetic acid is of no use for the fermentation, and may be prejudicial.

A SWEDISH naturalist has collected some remarkable statistics of the important part natural history and certain other branches of science have played in the names assumed by the Swedish nobility when elevated to that rank. As regards zoology, five names begin with Lejon (lion), and six with the German equivalent Löwen, Lewen, or Len. Only one name begins with Örn (eagle), but six with the German form, Adler. The mythical animals Grip (griffin) and Drake (dragon) have been appropriated by six and three families respectively. Of other animals and birds of prey, Tiger (tiger) is represented by four families, Ulf (wolf) by three, Björn (bear) by three, Falk (falcon) by three, Geijer (hawk) by two, and Räf (fox) by one. There are, further, two families whose names begin with Oxe (ox), one with Häst (horse), two with Elg (elk), one with Hjort (stag), one with Rålamb (doe), one with Get (goat), one with Svin (swine), one with Bäfver (beaver), one with Dufva (dove), one with Reiher (heron), one with Stork, one with Gädda (pike), three with Rud (carp), one with Ödla (lizard), and one with Brämo (gadfly). Many more names have been taken from trees and plants. Thus, fourteen begin with Lilje (lily) and Ros (rose) respectively, eleven with Lager (laurel), nine with Ceder (cedar), seven with Ek (oak), six with Lind (lime), and so on. If we turn to astronomy, numerous stars form the prefixes of names, but in no case the sun or the moon. Fourteen begin, and eleven end, with Stjerna (star). It is mentioned that the famous name, Oxenstjerna, is a corruption of the German word Stirn (forehead), which is proved by the family escutcheon, and is not derived from the above word.

A CORRESPONDENT gives some interesting particulars to a Norwegian journal of the habits of herring jumping out of the water when frightened. He states that he has observed whole shoals of this fish, in their anxiety to escape when pursued by whales, piled up above the surface of the sea to a height of from three to six feet. On one occasion the fish formed a mass even with the top of the mast of a fishing-boat, viz. about fifteen feet, and had part of the same fallen into the boat it would doubtless have sunk.

THE following are the results of a very elaborate mathematical inquiry which Prof. N. Joukowsky has recently made into the laws of motion of a solid body having hollows filled up with a homogeneous liquid. Various shapes of hollows filled with liquid have been considered, as also the case of a vortex-motion of the liquid having interior friction. Some phenomena of the interior motion of the liquid itself, in the case of the solid body when caused to rotate, were verified by experiments which proved conformable to the theory; they have shown that in a body whose rotation-velocity is decreasing from its surface to its centre (*e.g.* a glass sphere filled with water, and which is brought into motion), the molecules flow from the poles to the equator, and *vice versâ* where, the rotation being suddenly stopped, the speed of rotation is on the decrease from the centre to the circumference. The general conclusion of the inquiry is, that if we have a hollow body filled with a liquid, and this system be brought into motion, its motion will tend to reach a limit characterised by one of the chief axes of inertia of the body taking the direction of the chief momentum of the communicated motion, and the whole system will rotate around this axis as a single body—the speed of rotation being constant, and equal to the quotient obtained from the division of the force applied by the momentum of inertia of the system with regard to this axis. M. Joukowsky asks,—Does it not explain the circumstance that our planets, notwithstanding the variety of their occasional primary velocities, all rotate around their axes of inertia?

IT is stated in Paris that the telegraph now extends to Langson in Tonquin, on the Chinese border. As already mentioned in NATURE, on the Chinese side the telegraph was carried during the recent military operations in Tonquin from Canton to Lungchow, about thirty miles from Langson. Hence, with the exception of this short gap of thirty miles, the telegraph extends in an unbroken line from Saigon in the south of the Indo-Chinese peninsula to Pekin, where five years ago there was no telegraph whatever. The rapidity with which, since 1881, it has spread all over China, and has come into general use, is one of the wonders of modern days.

THE "binding" effect of intense cold and a fierce wind on snow is remarkably illustrated by a photograph, in *Science*, of a large mass of snow formed on one side of a telegraph pole (at the top) near the summit of Mount Washington. Lieut. Schwatka notes this in relation to the building of snow houses by the Eskimo. While the cohesion of snow in our latitudes (and the early Arctic snow) is of a plastic, wet, or "pasty" nature, the snow used in building, packed by high wind and cold, is dry and almost stone-like. Cutting a thin portion gives a shower of fine powder as from loaf-sugar. Blocks of this snow ring like a well-burnt brick, or a bar of suspended steel struck with the hand. Lieut. Schwatka remembers a block rolling down hill 15 or 20 feet, and says, "I doubt if a rolling guitar would have given forth many more confused musical tones than the bumping block as it struck and bounded down the hard stone-like bank of snow." The least quantity of ice in the snow, however, makes it more or less worthless for building. To produce this snow, it may not be necessary that the wind and the low temperature have occurred together, but both must have happened before the Eskimo will use the snow for building.

A STRONG shock of earthquake took place in the Island of Lemnos in the night of January 17-18. There was no subterranean noise.

AN earthquake is reported from Jaska and Samobor (Croatia) on January 23. Two violent shocks were felt at 9.35 a.m. on that day. No considerable damage was done, although many walls show fissures.

AN International Exhibition will be held at Madrid in 1888.

THE Calcutta Correspondent of the *Times* telegraphs, under date the 7th inst., that Mr. Ney Elias, the new British Consul to Kashgar, has made a successful journey down the Upper Oxus, through Shignan and Koshan, to Badakshan. He was everywhere well received.

THE Calcutta *Englishman* states that, shortly after the last cyclone suddenly burst over Madras, the local Government wrote to the Government of India, suggesting that telegraphic communication should be established between Madras and either Sumatra or the Nicobars for the despatch of storm-warnings. The Indian Government, however, considers that the value of meteorological stations in these localities in relation to the Storm Signal Service on the Madras coast is by no means established. Experience has shown that the storms which reach Madras are in most cases formed on the east or the north-east coast of Ceylon, and that therefore telegrams from the opposite side of the bay would give little or no help in forecasting the approach of storms. The Government of India, therefore, suggests that the telegraphic reports from Pondicherry and Negapatam, as well as from Jaffna and Trincomalee in Ceylon, would be more likely to give the required information.

A REMARKABLY strong Artesian spring has been struck, at a depth of 155 feet below the surface, at Alnwick, in a boring which the Local Board are having sunk for the supply of the town. This spring, which was met with in a bed of sandstone, rises to no less than 30 feet above the surface, and is flowing with increasing volume at the rate of 115,000 gallons per diem. The site of this boring is at an elevation of some 200 feet above the level of the town, from which it is about two miles distant

The additions to the Zoological Society's Gardens during the past week include two Maholi Galagos (*Galago maholi*) from West Africa, presented by Mrs. Max Michaelis; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. Corbet; an Indian Otter (*Lutra nair* ♂) from Ceylon, presented by Capt. J. C. Withers; a Ring-tailed Coati (*Nasua rufa* ♂) from South America, presented by Lieut. J. H. N. Theed, R.N.; a Red-bellied Waxbill (*Estrelda rubriventris*) from West Africa, presented by Mrs. T. Johnson; two Alligators (*Alligator mississippiensis*) from the Mississippi, presented by Mr. F. J. Dawe; a Malbrouck Monkey (*Cercopithecus cynosurus* ♀) from West Africa, two —— Lemurs (*Lemur* —— ♂ ♂) from Madagascar, a Common Boa (*Boa constrictor*), an Anaconda (*Eunectes murinus*) from South America, deposited; a Great Kangaroo (*Macropus giganteus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

The Double-Star 61 Cygni.—The determination of the orbit of this double-star has hitherto baffled those astronomers who have attempted to deduce it from the numerous measures which have been made. Thus one computer finds the relative motion of the components to be rectilinear, another hyperbolic, and another circular, but in no case have the determinations been altogether satisfactory. Recently, however, Dr. C. W. Peters, of Kiel, has succeeded in obtaining elliptic elements, with a periodic time of 782·6 years and angle of eccentricity = 10°, which appear to represent the great mass of observations which have been made from the earliest times down to 1883, with considerable accuracy. Herr Peters has computed the following ephemeris from his elements:—

Epoch ...	1885·0 ...	1886·0 ...	1887·0 ...	1888·0
Position ...	119° 44′ ...	120° 7′ ...	120° 31′ ...	120° 55′
Distance ...	20″·60 ...	20″·71 ...	20″·81 ...	20″·92

Taking the parallax of 61 Cygni to be 0″·45, it appears from these elements that the combined mass of the system is about one-half of the sun's mass, whilst the mean distance between the components is about 70 times that of the earth from the sun.

The Zodiacal Light.—In October 1883 Prof. Arthur Searle presented to the American Academy of Arts and Sciences a very valuable paper on the zodiacal light, in which he had collected and reduced on a uniform system the evening observations of all the principal observers. The principal points then brought out were that in all probability the apparent changes in the latitude of the zodiacal light were due mainly, if not entirely, to the effect of atmospheric absorption, and that the method of observation by drawing outlines must be replaced by careful photometric observations if definite knowledge was to be substituted for the vague information we now possessed as to the "Gegenschein," the "zodiacal bands," &c.; and Prof. Searle concluded with the suggestion that the ordinary meteoric theory would gain greatly in simplicity by the substitution of meteoric dust scattered generally throughout the solar system for the meteoric rings that have been usually imagined. Prof. Searle has continued his investigations in a recent memoir, in which he corrects, for the effect of atmospheric absorption, Jones's observations of what the latter called the "stronger light" at the elongation 60°, whether made in the morning or evening. The result of the inquiry is to confirm the view arrived at previously, that atmospheric absorption largely affects the apparent position of the zodiacal light, and Prof. Searle again lays stress on the need for photometric observations. Prof. Searle concludes that, after correcting for atmospheric absorption, there seems reason to think that the zodical light has had, during the present half-century, a more northern latitude near the longitude 180° than near the longitude 0°. He also shows, from a careful study of the distribution of the stars in the *Durchmusterung*, that "upon the meteoric theory of the zodiacal light it is to be expected that a continuous zodiacal band should be present; but the question of its actual visibility is complicated by the slight maxima of stellar density which are situated along those parts of the ecliptic most readily accessible to observation from stations in the northern hemisphere." An interesting result is obtained from an examination of the elements of the 237 asteroids first discovered, from which it would seem that "the belt of sky occupied by the projections of the orbits of" these asteroids "presents certain peculiarities which correspond to those of the zodiacal light, and suggest the hypothesis that the light may be partly due to minute objects circulating in orbits like those of the smaller planets."

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 FEBRUARY 14-20

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

At Greenwich on February 14

Sun rises, 7h. 18m.; souths, 12h. 14m. 23·7s.; sets, 17h. 11m.; decl. on meridian, 12° 56′ S.: Sidereal Time at Sunset, 2h. 50m.

Moon (Full on February 18) rises, 12h. 34m.; souths, 20h. 27m.; sets, 4h. 21m.*; decl. on meridian, 18° 22′ N.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury ...	7 15 ...	11 46 ...	16 17 ...	17 29 S.
Venus ...	6 39 ...	12 29 ...	18 19 ...	2 51 S.
Mars ...	19 27* ...	2 4 ...	8 41 ...	6 32 N.
Jupiter ...	20 44* ...	2 45 ...	8 46 ...	0 37 S.
Saturn ...	12 17 ...	20 28 ...	4 39* ...	22 43 N.

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

Occultations of Stars by the Moon (visible at Greenwich)

Feb.	Star	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image ° °
14 ...	111 Tauri ...	... 5½ ...	1 51 ...	2 34 ...	164 273
14 ...	117 Tauri ...	... 6 ...	3 10 ...	3 59 ...	130 297
18 ...	ξ Leonis ...	... 6 ...	2 19 ...	3 21 ...	95 296
19 ...	48 Leonis ...	... 6 ...	3 44 ...	4 43 ...	87 301
20 ...	τ Leonis ...	... 5 ...	1 5 ...	2 0 ...	23 293
20 ...	13 Virginis	... 6 ...	21 36 ...	22 23 ...	72 176

Feb.	h.	
18 ...	19 ...	Venus at inferior conjunction with the Sun.
19 ...	4 ...	Mercury in conjunction with and 11° 22′ south of Venus.

Variable-Stars

Star	R.A. h. m.	Decl. ° ′		h. m.
U Cephei	0 52·2 ...	81 16 N. ...	Feb. 16,	21 58 *m*
λ Tauri	3 54·4 ...	12 10 N. ...	,, 14,	22 43 *m*
			,, 18,	21 35 *m*
W Virginis	13 20·2 ...	2 47 S. ...	,, 17,	0 0 *m*
δ Libræ	14 54·9 ...	8 4 S. ...	,, 18,	23 28 *m*
U Coronæ	15 13·6 ...	32 4 N. ...	,, 20,	0 48 *m*
U Ophiuchi	17 10·8 ...	1 20 N. ...	,, 16,	3 9 *m*
		and at intervals of		20 8
β Lyræ	18 45·9 ...	33 14 N. ...	Feb. 14,	14 30 *m*
			,, 17,	7 0 *M*
δ Cephei	22 24·9 ...	57 50 N. ...	,, 14,	21 30 *M*

M signifies maximum; *m* minimum.

CHEMICAL NOTES

We have already mentioned M. Konovaloff's researches into contact actions, published in the *Journal* of the Russian Chemical Society (1885, vii. and viii.) The following conclusions of his inquiry are worthy of being noticed:—The capacity of solid bodies for condensing gases on their surfaces is generally recognised, but their capacity of dissociating them under certain conditions must also be recognised now as a property of all solid bodies, although shared in by them in different degrees. Platinum enjoys this property to a high degree, but also many other solid bodies, glass among them, the intensity of its contact action obviously depending upon several circumstances: its chemical composition, the structure of its surface, and its temperature, as also upon the density of the gas it is brought in contact with. It being so, it appears possible, in the author's opinion, that in the dissociation phenomena studied by Sainte-Claire Deville (and having so great an importance for the theoretical discussions upon the dynamics of chemical reactions), the dissociation observed was a consequence of the contact action of the solid body. Contact action seems also to have played its part in the researches of M. Lemoine on the dissociation of hydrogen iodide. On the whole, in all those cases where the process of chemical transformation in a gaseous medium offers an uninterrupted character, there is reason to suppose that a contact action has been taking place. But if this supposition proved to be correct, we should be compelled to admit that the chemical transformation, even in its simplest shape in a gaseous medium, is intimately connected with the action of molecular forces—that is, with such actions which do not have the characters of determinated chemical combinations. Molecular forces ought to be taken into account even in the transformations going on in a gaseous medium ; both factors—tbe chemical affinity and the cohesion—appear so intimately connected that it would be impossible to delimitate them : the chemical reaction would appear as a result of both the forces which unite atoms in molecules and those which are at work between the molecules.

The last issue of the *Journal* of the Russian Chemical Society (xvii. 7) contains the first part of a most valuable inquiry, by M. Konovaloff, into the part played by contact actions in dissociation. Without undertaking to deal with this immense subject in full, the author, taking advantage of observations he had made together with Prof. Menschutkin during their experiments as to the dissociation of compound ethers, has submitted to a closer investigation the contact phenomena when gases are brought into contact with solids. The want of cohesion between the gaseous molecules, and the great difference of densities of both the gas and the solid, give better conditions under which to study the influence of the solid. Summing up the researches of Sainte-Claire Deville, Würtz, Faraday, Ramsay, Berthelot, and many others who have devoted attention to the subject, the author shows that capillary structure and porosity are not necessary conditions in a solid body for producing dissociation ; smooth surfaces may also condense vapours and gases, and sometimes retain them with such a force as to make the disengagement of the absorbed gas quite correspond to the dissociation of a chemical compound. The character of the surface, having of course a great importance, M. Konovaloff has carried on his experiments so as to study the influence of the character of the surface. The first part of his inquiry contains the experiments made as to the dissociation of the tertiary amylacetate, the method of inquiry being successive determinations of the density of its vapours on W. Meyer's method. The result arrived at is obviously that the structure of the surface of the glass which is brought into contact with amylacetate vapours is of great importance ; but it is worthy of notice that the rough surface of the glass-powder condenses the vapour without producing a notable dissociation, while the smooth surface of the glass-cotton dissociates it.

THE INSTITUTION OF MECHANICAL ENGINEERS

THIS Institution held its annual meeting at the theatre of the Institution of Civil Engineers on Thursday and Friday last under the presidency of Mr. Jeremiah Head, who was re-elected for the ensuing year.

A paper was read by Mr. J. H. Wicksteed descriptive of an autographic test-recording apparatus of a very ingenious character. It is designed to obviate both the labour of observation and that of hand-plotting. But, beside the saving of time and labour, there is the further gain, in obtaining the diagrams autographically, that the progress of the test is continuous ; and as time is a factor in the behaviour of a test-piece, it is important in making tests for comparison that there should be no irregularity in this factor.

The sample is held between an upper and lower gripping-box. The upper box is suspended from the back centre of a steelyard, which, by the adjustment of its poise-weight, weighs whatever pull is put upon the sample. The lower box is connected with a hydraulic cylinder, which puts the pull upon the sample, and extends it until it breaks. Thus while the hydraulic cylinder is doing the mechanical work of breaking the sample, the steelyard is measuring the load it sustains. The object of the indicator is to record simultaneously the amount of the load and the extension due to it. To get this simultaneous record the horizontal ram of the indicator, which carries the tracing pencil, is in fluid connection with the hydraulic cylinder which puts the load upon the sample, and the indicator therefore partakes of that load. Round the outer end of the ram is coiled a spiral spring, which is compressed as the pressure on the ram increases, and expands as the fluid pressure on the ram decreases ; the pencil records the point of equilibrium between the two. The friction of the leathers in the hydraulic cylinder and that of the indicator ram are both eliminated from the diagram, the first by putting on to the piston of the hydraulic cylinder a gross pressure equal to the effective pressure on the sample and the friction of the hydraulic leathers, and the second by revolving the indicator ram by belt power and gearing ; the driving power being applied in a plane at right angles to the longitudinal travel of the ram has no effect upon that travel, but entirely overcomes the obstruction which the friction of the leather would otherwise offer to the free travel of the ram, so that the ram becomes sensitive enough to respond to the very smallest want of balance between the opposite forces of the water pressure and the spring. For recording the extension of the sample simultaneously with the load upon it, the metallic paper on which the pencil travels is mounted on a brass barrel like that of an ordinary steam indicator ; and in accordance with the extension of the sample the barrel is made to revolve by means of an arrangement which eliminates any general movement of the sample, recording that only which is due to its extension.

The author summarises the autobiography of every specimen strained to the breaking-point in the testing machine. Entering the machine in a state of internal equilibrium, its first stage is what is called in the paper one of unyielding elasticity ; it extends about 1/10,000 of its length per ton of load, but on removal of the load remains unstrained. In its second stage the strains and stresses fluctuate, the bar yielding about 2 per cent. of its length, the strain being beyond recovery. The pencil of the indicator hesitates and almost trembles. There would seem to be a succession of local extensions in the bar, as was lately pointed out by Prof. Kennedy in this journal (NATURE, vol. xxxi. p. 504). These local extensions reduce the area locally in a higher ratio than the cohesive force increases ; fracture would at once occur were it not that after a short critical interval the bar sets up increased resistance, thus entering its third stage. Stable equilibrium is restored, but the permanent strain increases in its ratio with every additional ton, and the bar may stretch 20 per cent. During the last stage the equilibrium is again unstable ; the pencil steadily records a rapidly-decreasing resistance, accompanied by a local strain which, over the part where it occurs, is very much greater than in any preceding stage. The author concludes by drawing attention to the circumstance that the apparatus records definitely the elastic limit of the material, the diagram traced gives the gross mechanical work put upon the sample, as it enables the local extension about the breaking-point to be separated from the general, thus affording a means of comparing samples of different shapes ; and lastly the apparatus makes its record quite independently of the manipulation of the poise upon the steelyard.

A paper descriptive of tensile tests of iron and steel bars was read, prepared by the late Mr. Peter D. Bennett. His principal object in making these tests was to ascertain the relative effect produced on the tensile strength of a flat bar of iron or mild steel : (1) by a hole drilled out of the bar to the required size ; (2) by a hole punched $\frac{1}{8}$ inch smaller in diameter, and then drilled out to the size of the first hole ; and (3) by a hole punched in the bar to the size of the drilled hole. In each of the former cases the average strength was increased per square inch of the original area across the fracture ; in the third case there was a falling off in strength of nearly 20 per cent. owing to the method of perforation. The results in the first two cases were alike both for iron and mild steel, but in the third case the diminution in strength of mild steel was only 6 per cent. In another series of tests the perforated hole was filled with a rivet put in by a hydraulic machine with a pressure of thirty-one tons on the head, the results being relatively as before. The author considers these results to be due to the fact that in the drilled bar the slightly greater strain indicated was reached only along the transverse diameter of the hole, and that the strain on the metal decreased along the longitudinal diameter of the hole until it was distributed over the whole width of the bar. Thus, at the point where it was most severely strained the metal would receive some support from the less severely strained parts adjoining.

The tests go to prove that the elongation of different test-bars, all of the same length, is greatly affected by their diameter, those of larger diameter elongating more than those of smaller diameter, and that as the specimens decrease in length the contraction of area at the point of fracture decreases also; and, in consequence, the tensile strength increases when reckoned on the original area, and decreases when reckoned on the fractured area. The elongation in percentage of the original length is also very much increased in the shorter specimens, owing to the fact that the greater part of the elongation then takes place much nearer to the point of fracture, instead of being more equally distributed, as it is along the length of the longer bars.

A paper was read by Mr. A. A. Langley, descriptive of a hydraulic buffer-stop for railways, the chief advantages of which are absence of recoil after collision, continuous uniform resistance for bringing a train to rest, and absence of shock or breakage either in train or in buffer. The chief feature is the application of hydraulic resistance by the use of pistons working in horizontal cylinders filled with water, and fixed in line with the buffers of the rolling-stock.

THE VALUE OF THE REFRACTION GONIOMETER IN CHEMICAL WORK[1]

IMPORTANT advances in chemistry have often been the result of new methods of research, and these have generally involved the use of new apparatus. The introduction of the balance made the greatest of revolutions in chemistry; but the thermometer, the blowpipe, the polariscope, and the spectroscope in its multifarious applications may also be cited as examples.

My object is to speak of the refraction goniometer or spectrometer, by which the refraction and dispersion of bodies can be measured. The construction of this instrument, and the use of it, which ought to be a part of the regular training of chemical students, may be learned from many works on physics, but it is very fully described in Glazebrook's "Optics," together with the manner in which the angular measurements are reduced to refractive indices. By means of this instrument the index of refraction is easily obtained for liquid bodies; solids or gases require a more complicated apparatus, but those of them which can be readily dissolved in any liquid can be determined from their solutions.

The index of refraction (μ) of a body is a definite physical property, like its boiling-point, specific gravity, or solubility, and ought to form part of our knowledge of any substance. I have generally determined it for the line A of the spectrum of the sun; but Continental observers have usually adopted the red line of hydrogen, which is coincident with the solar line C.

The length of the spectrum—that is, the difference between the indices of refraction of extreme rays, say the lines H and A, which may be taken as the measure of dispersion—is another physical property, and an equally important one.

If the index of refraction and the dispersion of a substance be accurately known, we have a double test of the purity of any specimen that may have to be examined.

As, however, the refraction varies with temperature and other circumstances, it is better to deal with the specific refraction, that is, the index, minus unity, divided by the density $\left(\frac{\mu - 1}{d}\right)$. This is little, if at all, affected by pressure, heat, change of aggregate condition, mixture, solution, or, generally speaking, by chemical combination. Thus the specific refraction of water under different circumstances has been determined as follows, the observations being reduced for the line A of the spectrum:—

Water	Specific refraction
Liquid, at 1° C.	0·329
,, at 48° C.	0·329
Solid	0·331 [2]
Gas	0·324
Mixture with alcohol	0·330 [3]
Water of crystallisation	0·330 [4]
,, ,,	0·327 [5]

The identity of the specific refraction of a body in the solid state or in solution has been frequently proved; the last instances determined were as follows, the observations on the crystals being made by M. Soret, and on the solutions by myself:—

Substance	Solution	Crystallisation
Ammonia alum	0·2780	0·2784
Soda alum	0·2613	0·2604

For the purpose of calculation, however, it is more convenient to adopt what Landolt denominated the refraction equivalent, that is, the specific refraction multiplied by the atomic weight $\left(p\frac{\mu - 1}{d}\right)$. The refraction equivalent of water may be taken, therefore, as $0·3295 \times 18 = 5·93$. Of this, the two atoms of hydrogen may be assumed from observations on other bodies to represent 2·6, leaving for the atom of oxygen 3·33.

The specific refraction and dispersion of a body not merely gives an indication as to its purity or otherwise, but tells the quantity of the substance with which it may be mixed, if that substance is known. Thus Landolt has applied it to the quantitative analysis of mixtures, and gives examples, such as ethyl alcohol and fousel oil, ethyl alcohol and ether. I have applied it myself in the estimation of carbolic acid in disinfecting powders, by dissolving the acid out in a known quantity of alcohol, and determining the refraction and density of the solution.

In chemical investigations among organic compounds the determination of the specific refraction of the products is very valuable. Thus, in a recent investigation on the action of the copper-zinc couple on bromide of benzyl by Mr. Tribe and myself, there were three different ways in which it led us to results which we should not otherwise have arrived at.

(1) The viscid mass which resulted from the action appeared very unpromising, but, on examining it with the prism, its specific refraction and dispersion were so high that we determined to purify it, and this led to the discovery of the new hydrocarbon benzylene.

(2) When the reaction was performed in the presence of alcohol, it seemed probable that toluene would be produced; but the liquid, when heated, distilled off at 78°, which is the boiling-point of pure alcohol. Instead, however, of throwing the distillate away, it was examined in a hollow prism, and seen at once to be something very different. Indeed, the increased refraction and dispersion led to the belief that one-fifth of it was toluene, though that boils at 110°. On adding water, a liquid separated, which was proved to be toluene by its boiling-point and density, as well as by its specific refraction and dispersion, 0·5604 and 0·0474, agreeing sufficiently well with the known figures.

(3) On another occasion, among products of fractional distillation was a liquid which had too small a refraction to allow of its being considered a hydrocarbon. It was suspected that the low refraction might be due to oxygen or bromine; and this led to a further examination and the discovery that the liquid contained a new bromine compound.

But another important application of these physical properties is to the elucidation of the chemical structure of various bodies. A very large amount of information as to specific refraction is now at our disposal through the labours of different experimenters, not only in this country, but in Germany, Italy, Russia, Holland, and Sweden; and the whole course of recent investigations goes to show (1) that the specific refraction of a body depends essentially on its ultimate atomic constitution; but (2) that this is modified in certain definite ways by the molecular arrangement or structure. Thus, to take an instance: sugar, $C_{12}H_{22}O_{11}$, whether crystallised or dissolved, has the refraction equivalent of 119·3. If, however, we take each atom of carbon at 5·0, and water at 5·93, we should obtain the figure 125·1 as the calculated value. The discrepancy is far too great to be attributed to errors of experiment, and points to the fact that sugar is not, strictly speaking, a carbohydrate; that really it does not contain water, but that the hydrogen and oxygen are otherwise arranged, as chemists have concluded on other grounds. The oxygen in all hydroxyl compounds is 2·8, according to Brühl, and this would give for sugar the theoretical value 119·5, which is almost identical with the experimental number.

In a similar way it has been very fully substantiated that carbon, whenever it is in the condition which is termed "double-linked," has the value, not of 5·0, but of about 6·1. Hence in any compound the constitution of which is doubtful, we can tell how many carbon atoms are in this condition. Thus, to take terpene, $C_{10}H_{16}$. This has been the subject of much discussion among chemists, one considering it to have one pair of carbon

[1] Communicated to Section B of the British Association, at the Aberdeen meeting, September 1885.
[2] Rausch.
[3] Landolt; mean of three observations.
[4] In ammonia alum; Charles Soret.
[5] In double sulphates; Topsoe and Christiansen.

atoms double-linked, others two pair, and another as many as three pair. On these three suppositions its refraction equivalent would be 73·0, 75·2, and 77·4 respectively. Now the various isomeric terpenes have a refraction equivalent of about 72·9, leading to the belief that only one pair of carbon atoms is in that condition. This conclusion is enforced by the specific dispersion, which averages 0·0299. From the analogy of other compounds containing ten atoms of carbon and which are of known constitution, about this amount of dispersion might be expected to occur in a $C_{10}H_{16}$ having one pair of carbon atoms double-linked.

I do not know how far chemists may be disposed to accept these optical properties as the arbiter between rival theories of constitution; but their value as helps will not be denied.

With reference to this mode of experimenting, it should be borne in mind that a very small quantity of a substance suffices for the purpose of observation; and whereas chemical processes use up material, the refraction of a liquid can be taken with no other loss than the small amount which unavoidably clings to the vessels employed. This even may be recovered if it is worth the trouble.

A table of the approximate refraction equivalents of forty-six of the elements was drawn up for my paper in the *Phil. Trans.* of 1869. Many of these have since been re-determined, either by myself or other observers, and a new edition of the table was prepared for the Montreal Meeting of the British Association, and appears in the *American Journal of Science* of January 1885. Carbon, oxygen, nitrogen, sulphur, phosphorus, iron, chromium, silicon, and doubtless other elements have two or three different values; and the special circumstances under which these different effects upon the rays of light occur offers a most promising field for any future investigator.

J. H. GLADSTONE

THE RAINFALL OF THE BRITISH ISLANDS[1]

CLIMATE may be defined as that peculiar state of the atmosphere in regard to heat, moisture, and rainfall which prevails in any particular place, together with its meteorological conditions generally, in so far as these influence animal and vegetable life. The diversified characters which climate displays may be referred chiefly to the combined operation of these four different causes, viz., distance from the equator, height above the sea, distance from the sea, and prevailing winds.

The greatest differences, however, in the local climates of places situated at no great distance from each other arise from differences in the rainfall. The arid plains of the North-Western Provinces of India as compared with the fertile higher slopes of the Himalayas contiguous to them, and the widely contrasted climates of the western and eastern slopes of Scandinavia respectively, may be cited as illustrations. In the British Islands there are perhaps no stronger contrasts of climate than those pre ented by Skye and the Laigh of Moray. The mean temperature of these two regions in no month of the year differ so much as two degrees, and for several of the months they are nearly identical. But the rainfall of Skye rises towards, and in many places exceeds, 100 inches annually, whereas over the Laigh of Moray it is only about 26 inches. Now it is this difference in the rainfall, with the clear skies and strong sunshine that accompany it, which on the one hand renders the south shores of the Moray Firth one of the earliest and finest grain-producing districts of Scotland; and, on the other, renders the island of Skye quite unsuitable for the remunerative cultivation of cereal crops. It is this aspect of the rainfall which gives it so paramount a place in the climatology of a country.

Of all meteorological data, the rainfall is the most difficult to represent cartographically; and there is no other way to arrive at even a tolerable approximation to the average rainfall of a district than by numerous rain-observing stations well distributed over its surface. Hence in this inquiry all available statistics of the rainfall for the period of years selected have been used,—the number of stations being 1080 in England and Wales, 547 in Scotland, and 213 in Ireland—in all, 1840 stations. Notwithstanding this comparatively large number of rain-gauges, very extensive districts remain wholly, or all but wholly, unrepresented.

The period selected for the investigation is the twenty-four years ending 1883, and the principal sources from which the information has been obtained are the returns published by the Meteorological Societies of England and Scotland and by Mr. Symons. For the method of discussing the results we refer to the recently published Part of the *Transactions* of the Scottish Meteorological Society, pp. 131-33. It may be here enough to say that the whole of the averages have been calculated for, or reduced to, the same term of twenty-four years beginning with 1860 and ending with 1883.

The 1840 averages were then transferred to large maps of England, Scotland, and Ireland, and from the results thus shown the British Islands were shaded into six divisions, these shadings showing the districts where the mean annual rainfall

1st does not amount to 25 inches
2nd is from 25 to 30 ,,
3rd ,, 30 ,, 40 ,,
4th ,, 40 ,, 60 ,,
5th ,, 60 ,, 80 ,, and
6th above 80 inches.

On the map exhibited on the wall these divisions are shown by three tints of blue and three of red,—the blue showing a rainfall exceeding forty inches annually, and the deepest tinted blue the regions of largest rainfall; and the red a rainfall less than 40 inches, the lightest tint marking off those parts of England where the rainfall is least, or where it is less than 25 inches annually.

The regions of heaviest rainfall, marked off by 80 inches annually, or upwards, are these four:—

(1) The greater part of Skye, and a large portion of the mainland to the south-east, as far as Luss.

(2) The greater part of the Lake District.

(3) A longish strip including the more mountainous portion of North Wales, and

(4) The mountainous district of the south-east of Wales.

The rainfall is also heavy on Dartmoor, and certain portions of the west of Ireland; but in these parts it does not appear quite to reach 80 inches.

The West Highlands present the most extensive region of heaviest rainfall in the British Islands. The mountain-masses along whose slopes and plateaus the rainfall is precipitated, offer a practically unbroken face of Highlands directly in the course of the rain-bringing winds from the Atlantic. Particular attention is drawn to the circumstance that these mountain-masses present many lochs and valleys directly in the course of these winds, up which therefore the winds are borne, and these cooling as they ascend pour down the deluges of rain which deeply trench the sides of the mountains in the lines of their water-courses.

This region of heaviest rainfall lies so far to the north of Ireland that the rainfall is not lessened by a previous partial drying of the Atlantic winds in their passage thither. To southward, however, it is quite different. Over the whole of the extensive tract of Great Britain from Luss to the Lake District there is not a single rain-gauge whose annual average reaches 80 inches, even although a number of rain-gauges have been planted in the higher districts, and in positions likely to furnish approximately the maximum rainfall of these districts. The diminished rainfall is no doubt due to the partial drying of the Atlantic winds in their passage across Ireland before they reach Southern Scotland.

St. George's Channel and the Irish Sea open a free passage to the south-westerly winds, here diverted into a more southerly course, to the north of England and to Wales, and accordingly where the mountain masses of the Lake District and of North and South Wales oppose their course the rainfall over large portions of these high districts exceeds 80 inches.

The maximum falls in these four districts respectively are 185·96 inches at The Styx, in the Lake District; 128·50 inches at Glencroe, Argyllshire; 116·90 inches at Beddgelert, North Wales; and 96·18 inches at Ty-Draw-Treherbert, South Wales.

The largest region of 60 to 80 inches rainfall is in the West Highlands, surrounding the region of still larger rainfall of 80 inches and upwards, and it extends from the Crinan Canal to beyond Loch Assynt in Sutherland. Then follow the hills to the north of Galloway, the hills to the north and east of Dumfriesshire, large portions of the Lake District, of North and South Wales, of West Galway, the mountainous districts of Kerry, and Dartmoor in Devonshire.

[1] An Address delivered to the Philosophical Society of Glasgow on December 16, 1885, at the request of the Council, by Alexander Buchan.

An annual rainfall of 40 to 60 inches covers extensive tracts of the British Islands; a rainfall of at least 40 inches characterising the climates of about a fourth part of the surface of England, of about the half of Ireland, and considerably more than the half of Scotland, the latter taken as a whole being by far the rainiest of the three divisions of the United Kingdom. It is to be noted that nowhere along the east coast of Great Britain, or for some considerable distance inland, does the average rainfall anywhere reach 40 inches. In the east of Ireland, on the contrary, the rainfall exceeds 40 inches in Wicklow, the south of Down, and the middle districts of Antrim, which is probably due to the south-westerly winds being diverted into a more southerly direction in their passage through the Irish Sea.

Over the whole of the west of Great Britain the rainfall exceeds 40 inches annually, except from St. Bees' Head to Dumfries, and from Holyhead to Lancaster, these districts being largely protected from the rain-bringing winds by the Cumberland and the Welsh mountains respectively. It may also be stated that the rainfall of the Orkney and the Shetland Islands falls short of 40 inches, whereas in the Hebrides it exceeds that amount.

The shadings of blue on the map show in a striking manner the extension eastwards of the areas of the 40 inches and upwards annual rainfall by the mountains of Sutherland, the Grampians, the Cheviots, the Pennine Range, and the hilly ground of the south-western counties of England.

On the other hand, the breakdown at various intervals of the mountainous or hilly plateau which may be regarded as extending along the west of Great Britain from Cape Wrath to the Land's End has an equally striking influence on the distribution of the rainfall, and as regards man's material interests is even more important. Thus the opening of the Bristol Channel, between Wales and the Cornish Peninsula, is the avenue through which is spread a more generous rainfall over a large portion of Central England than would otherwise have been the case. Through the breakdown of the plateau between the Pennine Range and North Wales another large portion of England, extending from Cheshire round by Derbyshire, and thence northward through Yorkshire, has its rainfall also very materially increased.

But the most remarkable of these breakdowns is the great lowering of the water-parting between the Firths of Forth and Clyde. Through the opening thus formed the south-westerly winds pass freely, and overspread Dumbartonshire, Stirlingshire, and the whole of Western Perthshire, precipitating over these regions a rainfall truly western as regards its copiousness and the direction of the winds with which it falls; and through the same breakdown there is extended, even eastward through Kinross-shire, a rainfall of fully 40 inches—an amount which occurs nowhere else over comparatively level plains so far to the east of the water-parting between eastern and western districts.

Of the greatest importance is it to note the rainfall of Clydesdale, lying to the south of this breakdown. The amounts are, in inches, 29·98 at Bothwell Castle, 30·54 at Dalziel House, 31·66 at Auchinraith, and 32·37 at Murdostoun. Now it is simply the *southerly* element of the rain-bringing winds which makes the rainfall of the Hamilton district of Clydesdale so essentially different, both as respects its amount and the times of its occurrence, from that of the Clyde below Glasgow. It may be noticed here that when the rainfall of the west is in excess of the average the rainfall of West Perthshire is also in excess; and on the other hand, when there is an excessive rainfall over the Hamilton district, it generally occurs that the rainfall of eastern districts is also in excess. The peculiarity of the rainfall of Glasgow consists in this—that it lies midway between those districts which are so differently circumstanced.

The valleys of the counties of Kirkcudbright with Dumfries and the intervening ridges lie awthart the course of the rain-bringing winds, and show the inevitable result of a rainfall successively diminishing on advancing eastward. But on arriving in Eskdale, the most easterly of these valleys, we meet with a rainfall considerably in excess of that of any of the valleys to westward at the same elevations. The larger rainfall of Eskdale is due to its lying more in the line of the Solway, and having immediately to eastward a high mountainous region which the south-westerly winds must cross in their passage to eastward.

The distribution of the rainfall over this hilly region and over the valleys on each side of it is instructive. Thus at Kirkconnel Hall, near Ecclefechan, it is, in inches, 39·64; Canonbie, 49·72; Carlesgill, 58·00; Eskdalemuir, 63·30; Tudhope (on the ridge, 1961 feet high), 76·43; and on the east of the watershed at Teviothead, 54·86; Borthwickbrae, 44·36; Hawick, 33·55; and thence continues diminishing in descending the valley to 26·50 at Springwood Park, near Kelso. The reason why the rainfall of this region is thus distributed is that the air on the windward side of the ridge being suddenly raised to a greater height in crossing the range its temperature is continually reduced by mere expansion, and copious precipitation follows; whereas on the leeward side, as the air descends to lower levels, its pressure (or density) being increased, and its temperature also thereby increased, it gradually becomes drier, and accordingly the rainfall diminishes rapidly with the descent of the aërial current to the lower plains. A similar distribution of the rainfall is seen in crossing the Downs from Brighton to London, and over all other regions similarly situated.

It is the rapid increase of the temperature and drying of the air as the wind passes from high and wide plateaus into lower levels which determines the areas of least rainfall of the British Islands. Accordingly the smallest average annual rainfall, varying from about 22½ to 25 inches, occurs in England, and overspreads a large portion of the south-eastern counties extending from the Humber to the estuary of the Thames, exclusive of the higher grounds of Lincoln and Norfolk, where the rainfall rises above 25 inches. In every other part of the British Islands the rainfall is above 25 inches. The influence of the higher grounds of Norfolk and Lincoln in swelling the rainfall, most probably by increased falls with easterly winds, is very striking. Similarly the rainfall of the Yorkshire Wolds is in excess of surrounding districts. Between the valley of the Thames and the Humber the rainfall nowhere exceeds 30 inches, except near the Chiltern Hills.

It will be observed that the northern limit of the region marking off a rainfall under 25 inches annually is at the Humber, or near where Great Britain suddenly shrinks in breadth. It is, however, probable that the larger rainfall of the eastern part of Yorkshire, as compared with what obtains further south, may also, in part, be occasioned by causes analogous to those which give Western Perthshire its large rainfall.

In Scotland no rain-gauge gives an annual average under 25 inches. In three districts, however, the averages are only slightly in excess of 25 inches, and less than 27 inches: these districts being (1) Lower Tweeddale from about Coldstream to Jedburgh; (2) the low-lying parts of East Lothian; (3) the shores of the Moray Firth from the mouth of the Spey round to Tain. It will be seen that these districts are not only well protected by extensive highlands from the rains of the south-westerly winds, but also from the, in many cases, torrential downpours of south-easterly winds. It is this double protection which gives the driest of its climates to these parts of Scotland.

In Ireland, on the contrary, only a small district round Dublin shows a rainfall less than 30 inches, this district being well protected by the Wicklow mountains from the rain-bringing winds; and as in that island there is no continuous mountain-mass stretching north and south there is no such great difference of rainfall and temperature shown between the eastern and western climates of Ireland as in the case of Scotland and England.

The narrowness of the strip round the east of Scotland where the rainfall does not exceed 30 inches a year is an interesting feature, of which the rain-maps constructed for individual months suggest the explanation. Of the rainfall of eastern districts the larger proportion is due to easterly winds, and by much the larger portion of these falls usually takes place neither on the low-lying coasts, nor at any great distance inland, but in the intermediate region at heights from about 250 feet and upwards. The falls are also very heavy in low-lying valleys that open out so as to face these rain-bringing easterly winds. Of these rains the weather of October 1880 afforded an excellent illustration. The rains of that month fell with strong north-easterly winds, and the foreshores, looking to the north-east, of the Firth of Forth, the Moray Firth, and the Pentland Firth, had a monthly rainfall above the average, being in some places more than double the average; whereas over the rest of Scotland the rainfall was under the average, being over very extensive breadths from 70 to 98 per cent. less than the mean rainfall for October.

One of the most marked features of the climates of the south of England, to which many of our invalids are sent, is due to the influence of the Downs on the rainfall. Over the whole of the somewhat broad region occupied by the Downs the rainfall exceeds 30 inches, rising near Petersfield to 40 inches. Along the south coast, and for a varying distance inland as determined by the physical configuration, the average is less than 30 inches from Dover westward as far as the east shores of the Isle of Wight. On proceeding still farther westward, the annual rainfall slowly but steadily rises, till on rounding Prawle Point in Devonshire it begins to exceed 40 inches, and with this increase of the rainfall there is a still more striking increase of temperature in the winter months.

The whole of the results arrrived at in this inquiry show conclusively that the key to the distribution of the rainfall of the British Islands is the direction of the rain-bringing winds in their relation to the physical configuration of the surface.

Looked at broadly, there are four very distinct causes of rain, viz. (1) the moist south-westerly winds; (2) rains, often very heavy rains, from the east, extending but a little way inland; (3) the annual fall of temperature from August to January; and (4) those peculiar influences that have their fullest development in the thunderstorms of summer over low-lying extensive plains.

The rainfall of the British Islands has been examined with reference to its seasonal distribution in relation to the physical configuration of the surface. The mean amount of each place for the past twenty years has been calculated for the twelve months, these being reduced to thirty days each. The mean of these twelve months being taken, the mean monthly rainfall of the year was then ascertained, and with this latter mean each monthly mean was compared, and its excess, or defect, entered in percentages on twelve maps.

The moist south-westerly winds acquire their maximum anuual predominance in December and January, and as these winds come loaded with the vapour of the Atlantic the rainfall rises above its monthly mean over nearly the whole of Scotland. Two patches, however, are to a great extent exempt, these being the districts lying on the lee side of the greatest stretch of mountainous land, viz. to the north-east of the Grampians and to the east of the Moffat and Lead Hills. Similarly, in England, during these months, the rainfall is considerably above the average over the whole of the dry districts extending from the Tweed southwards, and bounded on the west by the water-partings of the Mersey and the Severn, and on the south by the Thames, including the northern slopes of Kent.

During the great annual fall of temperature from August to January the greatest excess over the mean monthly rainfall occurs in September and October, when the fall of temperature is most rapid, south-westerly winds very prevalent, and heavy rains with easterly winds, chiefly the easterly winds of cyclones, of most frequent occurrence. In these months the rainfall reaches the annual maximum over large districts in the east of Scotland, and over all but the whole of England.

In northern and extreme western districts nearly all thunderstorms occur during the winter months, whereas few occur in eastern and central districts at this season; but nearly all occur in the summer months—a remark which applies with greatest force to the more extensive level, or comparatively level, portions of the country. Now, from the frequent occurrence of the thunderstorms and thunder-showers, the annual rainfall of these districts approaches to, and in not a few cases reaches, the annual maximum in the summer months. The local excess begins to show in June, and is extended in July much more decidedly over the agricultural districts of England and Scotland that are best suited for the ripening of wheat and barley. In August there is shown a still further development and extension of the summer rains over these and adjoining districts. It is to be noted, however, that during this time the rainfall remains under the average over the extreme south-western, southern, and south-eastern districts of England. In these characteristics of the summer rainfall these important agricultural centres resemble the climates of Central Europe, where the rainfall rises to the maximum during the summer months.

The following are the annual amounts of the rainfall, in inches, in certain districts and along certain lines radiating from Glasgow:—Glasgow 40·20, Bresley Hill 37·33, Bothwell Castle 29·98, Dalziel House 30·50, Lanark 35·66, Wiston 45·33; Queen Park 36·24, Newton Mearns 52·63, Black Loch 57·60; Paisley 45.37, Castle Semple 52·10, Blair 53·62, Ardrossan 41·03; Kilbarchan 57·28, Kilmalcolm 57·28, Greenock 64·25, Overton 71·45; New Kilpatrick 48·05, Dumbarton 48·25, Cameron House 62·95, Luss 80·45, Firkin 96·05, and Ardlui 115·46. These figures show in a striking manner the extraordinary variations of climates there are in the immediate neighbourhood, or within easy reach, of Glasgow. Quite recently an inquiry was set on foot in Berlin, where numerous rain-gauges were planted with the view of arriving at some clear understanding as to the amount of observational information required in order to state definitely what the actual rainfall of a district is. Might I suggest to the Mathematical and Physical Section of the Philosophical Society that a similar investigation be taken in hand, and forty or more rain-gauges be added to those already in use. In a few years not only would they be able to answer the question proposed by the Berlin meteorologists, but in answering it they would state with satisfactory precision the character and limits of the various local climates which differ so widely from each other in the neighbourhood of Glasgow.

THE AUSTRALIAN MUSEUM, SYDNEY[1]

(1) THE Museum has been, during the year 1884, as in previous years, open to the public daily, except on Mondays, when it is necessarily closed for the purpose of cleaning. The largest attendance on any one day was on December 26, when 1643 persons were registered at the doorway. The greatest Sunday attendance was 1315, on April 13. The average daily number of visitors throughout the year was 262 on week-days and 853 on Sundays. The total for the year is 126,040.

(2) The collections are still being increased by means of purchases, exchanges, collecting expeditions, and donations. A list of these additions, under their separate heads, will be found in Appendices V., VI., VII., VIII. Among these may be specially mentioned several pairs of large antelopes from South Africa, a full-grown ourang-outang of the larger species (*Simia satyrus*), and several of the smaller species (*S. morio*): a fine specimen of the Chimpanzee (*Troglodytes niger*); two whales, one from Kiama (*Physeter macrocephalus*), and one from the coast of England, belonging to the extremely rare species known as Rudolf's Whale (*Balænoptera borealis*); casts of gigantic fossil remains from the British Museum, including *Elephas ganesa*, *Mastodon andium*, *Toxodon platensis*, *Sivatherium giganteum*, *Megalania prisca*, &c.; and large and important ethnological collections.

(3) Great alterations and improvements have been effected by the erection of additional wall-cases, constructed upon the best principles and at considerable cost, for the reception of large collections of skeletons and Australian fossil remains; and for groups of Birds of Paradise, and other exhibits of great interest from New Guinea and elsewhere. Additional cases and cabinets have been provided for the mineral collections, and others are in course of construction for similar purposes.

(4) Want of sufficient space in the present building is still felt as a serious drawback to the usefulness of the Museum. The Trustees nevertheless gladly express their obligation to the Government for the provision now made for further accommodation. An additional shed has been erected, which is used as a store for timber and other material. A large iron workshop has also been provided, and another of similar dimensions is in course of erection. These are to be used for the storage of spirits and bottles, and for workrooms in connection with spirit specimens.

(5) Catalogues, not only of the various collections in the Museum, but also of all branches of Australian Zoology, are still in course of preparation; but no new publications have been issued during the past year.

(6) Mr. Ramsay's visit to Europe in connection with the International Fisheries Exhibition enabled him to examine various Museums, Zoological Stations, and Aquaria, and has been productive of much advantage to this Museum. A report, with particulars of his proceedings and details of his arrangements for purchase and exchange of specimens, will be found in Appendix XI.

(7) The exhibits which are sent to the Calcutta Exhibition have been presented by the Trustees to the Government of India.

(8) The Teaching Collection, consisting of skeletons, models, and specimens illustrative of comparative anatomy and natural history, which for some years past occupied the north room in the upper floor of the Museum, has been transferred to the University. This collection was specially prepared for teaching purposes, and, as most of the specimens were already represented in the Museum, and it occupied space which could be better used for the display of other objects of interest, the

[1] Report of the Trustees for 1884.

Trustees felt themselves justified in making the transfer. Although this collection is now at the University, its ownership remains with the Trustees.

9. There has been no change in the Board during the year, by death or otherwise.

10. Annexed to this Report are the following Appendices:—

I.—Annual Balance-sheet.
II.—Attendance of Visitors.
III.—Attendance of the Trustees.
IV.—Work done by Taxidermist and Articulator.
V.—Specimens collected.
VI.—Specimens purchased.
VII.—Exchanges.
VIII.—Donations.
IX.—Books acquired.
X.—Duplicate Books.
XI.—Mr. Ramsay's Report.

(Signed) ALFRED STEPHEN,
Crown Trustee and Chairman

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The Special Board for Medicine have presented to the Vice-Chancellor the following Report with a view to its communication to the Senate:—"The Board have considered the requirements of the Previous Examination from the point of view of its suitability as a preliminary examination for students entering on the study of medicine, and have come to the conclusion that in the interests of mental training these requirements may with advantage be modified. They would desire to see introduced an adequate examination in the elementary mechanical principles of Physics, meaning thereby—the fundamental notions of matter, motion, and energy, and the simple laws which govern their relations; the physical properties of matter in the solid, liquid, and gaseous states; and the application of these properties and laws in the case of simple instruments and machines. An examination in these principles need not involve any but the most elementary mathematics, yet it could be made to exercise the student in clearness of conception, in accuracy of statement, and in soundness of reasoning. These qualities are in a special degree essential to students of medicine, but from our Report of November 11, 1885, it would appear that in these respects the preliminary training of many who propose to become students of medicine has not been satisfactory. The subject we propose is already well taught and appreciated in many good schools, and it appears to us extremely desirable that the University should encourage all schools to improve themselves in this direction by including the subject in its Previous Examination. It is not for the Board to say whether the subject should form part of the Previous Examination proper (though many considerations might be urged for this plan), or be required as an additional subject in place of the present examination in Elementary Mechanics. They are, however, persuaded that, if introduced in some form, the examination would be for all students at least of equal value to the present examination in additional subjects, and for students whose work at the University is to consist largely in the study of nature it would be of considerably greater value."

Mr. H. D. Rolleston, of St. John's College, has been appointed Assistant Demonstrator of Physiology, in succession to Mr. Green. Mr. Rolleston was placed in the First Class in the Natural Sciences Tripos, Part I., in the Easter Term, 1885.

SCIENTIFIC SERIALS

Annalen der Physik und Chemie, No. 12, December 1885.—J. Fink, on the influence of pressure on the electric resistance of electrolytes. Cailletet's apparatus was used for producing compression, Kohlrausch's induction apparatus for the electric measurements. A solution of hydrochloric acid (5·02 per cent.), having a resistance of 7·490 Siemens' units at 1 atmo., fell to 7·335 at 200, and to 7·126 at 500 atmos. A weaker solution (0·98 per cent.) showed a diminution of 7·39 per cent. in its resistance at 500 atmos. A similar solution of zincic sulphate showed a diminution of 11·74 per cent. The diminution is proportional up to 300 atmos.—E. Edlund, on the transition-resistance in the voltaic arc. The conclusion is against the existence of such a resistance.—K. Wesendonck, on the fluorescence of naphthalin-red.—H. W. Vogel, on the relation between absorption by colouring matters and their sensitising action on bromide of silver.—G. Kötschau, studies on fluid motions. Some very extraordinary figures are produced by careful introduction of a coloured liquid into an uncoloured one.—F. Himstedt, a determination of the ohm. This paper describes the method, depending on a knowledge of the coefficient of mutual induction of two coils, which has already been discussed by Lord Rayleigh, and which is similar to that of Roiti. The final result gives as equivalent to the ohm a column of mercury of 1 square millimetre section and 105·98 centimetres length.—W. B. Brace, on the magnetic rotation of the plane of polarisation, and some special cases of refraction. It is shown that there may be in a calc-spar crystal three rays which suffer no double refraction. Experiments are also described concerning prisms of heavy glass in a magnetic field.—G. Stern, position of the commutator in electro-dynamic machines. A discussion of Clausius' formulæ with respect to the relation of the current to the angle of lead.—E. Mach and J. Wenzel, a contribution to the mechanics of explosions.—K. L. Bauer, apparatus for demonstrating that electricity resides only on the surface of a conductor. This is a modification of Biot's apparatus, consisting of two concentric hemispheres, and convenient means of insulating and discharging.

Journal of the Russian Chemical and Physical Society, vol. xvii. fasc. 7.—On the part played by contact actions in the phenomena of dissociation, by D. Konovaloff.—Thermic data for some combinations of the aromatic series, by E. Werner, being numerical data as to the heat of neutralisation of saligenin and oxybenzoic aldehydes and acids, and mellic acid.—On the oxidation of oleic and elaidic acids by permanganate of potassium, by A. Saytzeff.—Notes by MM. Albitzky, Nikolsky, and Ustinoff.—On the motion of a solid body having cavities filled with a homogeneous liquid, by M. Joukowsky, being the second part of a mathematical inquiry into ellipsoidal, cylindrical, and such other cavities as have the shape of a rotation-body, and also several cavities connected together.—On the collision of absolutely solid bodies, by M. Schiller, second part, being a further mathematical development of the theory, together with answers to Prof. Joukowsky's observations.—On the influence of an electric current on the resistance of selenium and its sensibility to light, by N. Hesehus, being an explanation of the experiments of Fritts by the theory of allotropic dissociation.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 17, 1885.—"On the Formation of Vortex-Rings by Drops falling into Liquids." By Prof. J. J. Thomson, M.A., F.R.S., and H. F. Newall, M.A.

When a drop of ink falls into water from not too great a height, it descends through the water as a ring, in which there is considerable rotation about the circular axis passing through the centres of its cross-sections; as the ring travels downwards, inequalities appear, and the ring breaks up into a number of smaller rings, which in turn may again subdivide.

It is shown that capillarity plays no essential part in the formation of the rings; in fact, it may be said that, with very few exceptions, rings are formed only when a liquid is dropped into one with which it can thoroughly mix. There are very many cases in which rings are formed when there is no possibility of capillary action, such as when the liquid into which the drop falls is the same as the drop itself.

The drops were observed by instantaneous illumination; and it was seen that the drop enters the liquid as a sphere, becomes flattened as it descends, and finally breaks into a ring more than half an inch below the surface.

When a sphere moves through a liquid, the tangential velocity of the liquid is different from that of the sphere. If the sphere be a liquid drop, there is no absolute discontinuity in the motion, but only a very rapid change, so that there is a finite alteration in a very small distance. This is equivalent to a vortex-film covering the sphere, the lines of vortex-motion being horizontal circles. If the liquid be viscous, the vorticity will diffuse inwards and outwards. The drop, as it falls, becomes flattened, on account of the resistance to its fall; and if by the time it becomes disk-shaped the drop is full of vortex-motion, the disk must break up—for it is an unstable arrangement of vortex-motion—and assume the stable arrangement, namely, that of the anchor-ring. Then the most important property of the liquid involved is its viscosity. If this is too small, the vortex-motion will not have time to spread far by the time the drop has become disk-shaped; whilst if the viscosity is too great, the vortex-motion will all be dissipated before the drop becomes disk-shaped.

To avoid complication, experiments were made in which drops were let fall into liquid of the same kind as that composing the drop. Liquids so treated were found to arrange themselves into four classes, distinguishable by the character of the ring formed. The quotient μ/ρ was determined for each of the liquids—μ being the coefficient of viscosity found by Poiseuille's capillary tube method, and ρ the density, water being the standard in both cases. It was then found that the four classes were also distinguishable by the value for μ/ρ.

Thus in Class I. ether, chloroform, and carbon bisulphide give rings only very uncertainly, the drop breaking up and spreading irregularly through the column of liquid. For these μ/ρ is not greater than 0·7.

To Class II. belong water, alcohol, turpentine, paraffin, and other liquids; these give the best rings: and for them the value of μ/ρ is between 1 and 3.

For Class III. μ/ρ is between 3 and probably 8 or 10: and this class includes moderately viscous liquids, such as butyl-alcohol, amyl-alcohol, fairly strong sulphuric acid, and diluted glycerine. In these cases the rings form very slowly.

Class IV. includes all the most viscous liquids, like strong solutions of sugar, potash, sulphuric acid, glycerine. The value of μ/ρ is much larger (about 15 to 30), and no ring is formed at all, unless special precautions are taken to get very large drops.

It is pointed out that nothing can depend on the absolute value of μ/ρ, since it has the dimensions of the product of a length and a velocity. The naturally comparable length in the system is the size of the drop. It is shown that diminishing the size of the drop has the same effect as increasing the value of μ/ρ. The velocity of the drop is probably the comparable velocity; but this cannot be varied much without introducing large disturbances.

The more complicated problem of a drop of one liquid falling into a vessel of a different liquid is treated briefly, and the analogy of the diffusion of vortex-motion with the conduction of heat is referred to; μ/ρ, in the present problem, corresponding with the diffusivity in the conduction of heat.

The breaking up and subdivision of the rings is shown to depend on (1) motion in the column, which brings about irregularities in the ring, when the vortex-motion has nearly or quite died out; (2) the difference of density of the liquids composing the drop and the column, on account of which the parts of the ring, in which most of the liquid is gathered, fall most quickly, and give rise to rings in the same way as that in which the original ring was formed. Strong evidence is adduced to show that capillarity is not concerned in the subdivision.

Instances in which a small surface tension exists are also referred to, and figures of some curious cases are given.

The paper closes with a section in which it is shown that a connection exists between the depth to which a ring travels in the column and the form of the drop at the moment of impact at the surface of the column.

January 14.—Abstract of a Paper "On the Action of Sunlight on Micro-organisms, &c." By Arthur Downes, M.D.

In previous memoirs (*Proc. Roy. Soc.*, 1877–8–9), of which preliminary notes appeared in NATURE, Dr. Downes, with the collaboration of Mr. T. Blunt, showed that sunlight was fatal to Microsaprophytes by a process of hyper-oxidation thereby induced.

In this process the more refrangible rays were the most active. In the course of the induction which led to this conclusion two other facts of importance were elicited. The molecule of oxalic acid was speedily resolved into water and carbonic acid by the combined effect of light and free oxygen, and a typical representative of the diastases, the invertive ferment of cane-sugar, had its qualities completely destroyed by sunlight, which was, however, without effect in a vacuum or a neutral atmosphere.

During the past eight years evidence confirmatory of these conclusions has accumulated from various sources, and the principal facts are reviewed by the author.

After referring to the observations of Warington and others on the nitrifying ferment, of Tyndall in regard to the insolation of putrefiable infusions under an Alpine sun, and to others, Dr. Downes summarises the recent results of Duclaux, who finds, from an examination of several species, that *Micrococci* are apparently far more sensitive to sunlight than the more resistant *spore-forming Bacilli*. Duclaux, who has likewise observed the destructive effect of sunlight on a diastase, agrees that this injurious action on germs is an affair of oxidation. In his previous papers the author had noted the different powers of resistance of various organisms to sunlight, notably of *Saccharomycetes* or *Mucedines*, as compared with *Bacteria*. He now describes a specially resistant *Bacterium*, roughly resembling, but not identical with, the *Ascobacterium* of van Tieghem, of which he finds no previous record.

In refuting the conclusion of Jamieson, an Australian observer, that both he and Prof. Tyndall had mistaken effects of heat for effects of radiant energy distinct from heat, Dr. Downes describes recent experiments of his own, which indicate that a similar action, though of course in a less degree, is exercised by diffused light. He concludes with a reference to the well-known observations of Pringsheim on the destruction of vegetable protoplasm by the more refrangible rays, and claims them as evidence of the truth of his former generalisation that the hyperoxidation of protoplasm by light is a general law from the action of which living organisms require to be shielded by a variety of protective developments of cell-wall, aggregation of tissue or colouring matter, and in other ways.

January 21.—"On the Clark Cell as a Standard of Electromotive Force." By Lord Rayleigh, M.A., D.C.L., Sec.R.S.

This paper, supplementary to that "On the Electrochemical Equivalent of Silver, and on the Absolute Electromotive Force of Clark Cells" (*Phil. Trans.*, part 2, 1884), gives the further history of the cells there spoken of, and discusses the relative advantages of various modes of preparation. The greatest errors arise from the liquid failing to be saturated with zinc sulphate, in which case the electromotive force is too high. The opposite error of *super*-saturation is met with in certain cases, especially when the cells have been heated during or after charging. Experiments are detailed describing how cells originally supersaturated have been corrected, and how in others the electromotive force has been reduced by the occurrence of supersaturation consequent on heating. If these errors be avoided, as may easily be done; if the mercury be pure (preferably distilled *in vacuo*); and if either the paste be originally neutralised (with zinc carbonate), or a few weeks be allowed to elapse (during which the solution is supposed to neutralise itself), the electromotive force appears to be trustworthy to 1/1000 part. This conclusion is founded upon the comparison of a large number of cells prepared by the author and by other physicists, including Dr. Alder Wright, Mr. M. Evans, Dr. Fleming, Prof. Forbes, and Mr. Threlfall.

As regards temperature coefficient, no important variation has been discovered in saturated cells, whether prepared by the author or by others. In all cases we may take with abundant accuracy for ordinary applications—

$$E = 1{\cdot}435\{1 - 0{\cdot}00077(t - 15^\circ)\},$$

the temperature being reckoned in Centigrade degrees. For purposes of great delicacy it is advisable to protect the standards from large fluctuations of temperature. Under favourable circumstances two cells will retain their relative values to 1/10,000 for weeks or months together.

Unless carefully sealed up, the cells lose liquid by exudation and evaporation, and then the electromotive force gradually falls. Marine glue appears to afford a better protection than paraffin-wax, and there seems to be no reason why cells thus secured should not remain in good order for several years.

In cells of the H-construction (§ 29 of former paper), the leg containing the amalgam (but not the one containing pure mercury) is liable to burst, apparently in consequence of a tendency to alloy with the platinum. Protection with cement of the part of the platinum next the glass has been tried, but no decisive judgment as to the adequacy of this plan can as yet be given.

Recent cells, intended for solid zincs, have been made of a simplified pattern—nothing more, in fact, than a small tube with a platinum wire sealed through its closed end. The zincs are not re-cast, and the paste is prepared from (unwashed) mercurous sulphate rubbed up in a mortar with *saturated* solution of zinc sulphate and a little zinc carbonate. A stock of paste may be prepared and retained for use in a bottle.

Experiments are described tending to prove that the irregularities observed during the first few weeks of the life of a cell prepared with acid materials have their origin principally at the mercury electrode.

Cells prepared with dilute solutions have a lower temperature coefficient (about 0·00038), but would be more difficult to use as standards whose value is to be inferred from the mode of preparation.

Details are given of H-cells charged with amalgams of zinc and mercury in both legs, without mercurous sulphate. A very small proportion of zinc is sufficient to produce the maximum effect. Pure mercury, neither alloyed with zinc nor in contact with mercurous sulphate, has an uncertain electromotive value.

Since the comparison of cells does not absolutely exclude a small general alteration of electromotive force with age, further determinations of the standard cell (No. 1) have been effected by means of the silver voltameter. The results—

TABLE XVIII.

Date	E.M.F. of No. 1 at 15° C. in B.A. volts.
October 1883 to April 1884	1·4542
November 1884	1·4540
August 1885	1·4537

are very satisfactory, and indicate a constancy sufficient for almost all practical purposes.

Finally, some comparisons are given between Clark cells and Daniells, with equi-dense solutions, both of Raoult's pattern and of that described recently by Dr. Fleming.

Entomological Society, January 20.—Fifty-third Anniversary Meeting.—Mr. R. McLachlan, F.R.S., President, in the chair.—An abstract of the Treasurer's accounts was read by Mr. H. T. Stainton, F.R.S., one of the auditors, and the Secretary read the report of the Council.—The following gentlemen were then elected as the Council for 1886:—President: Robert McLachlan, F.R.S.; Treasurer: Edward Saunders, F.L.S.; Secretaries: Herbert Goss, F.L.S., and the Rev. W. W. Fowler, M.A., F.L.S.; Librarian: Ferdinand Grut, F.L.S.; other Members of Council: T. R. Billups, Edward A. Fitch, F.L.S., F. Du Cane Godman, M.A., F.R.S., W. F. Kirby, E. B. Poulton, M.A., F.G.S., H. T. Stainton, F.R.S., S. Stevens, F.L.S., and J. Jenner Weir, F.L.S.—The President then delivered an address, and a vote of thanks to him was moved by Mr. Stainton, and seconded by Mr. F. Pascoe, and the President then replied. A vote of thanks to the officers was then moved by Mr. J. W. Dunning, and seconded by Mr. Distant, and Messrs. Saunders, Fitch, Kirby, and Grut replied. This was the first annual meeting since the incorporation of the Society by Royal Charter.

Zoological Society, February 2.—Prof. W. H. Flower, V.P.R.S., President, in the chair.—Mr. W. B. Tegetmeier, F.Z.S., exhibited and made remarks on a Pheasant from the Persian borders of Transcaucasia.—Mr. C. A. Wright, F.Z.S., exhibited a Dove of the genus *Turtur* from Malta, and identified it as a semi-albino variety of *Turtur auritus*.—Mr. Sclater exhibited, on behalf of Mr. W. H. Dobie, a young specimen of Sabine's Gull (*Xema sabinii*), which had been obtained at Mostyn, on the coast of Flintshire.—Mr. Seebohm exhibited a specimen of Ross's Sea-Gull (*Larus rossi*) obtained in June last in the neighbourhood of Christianhaab, Disco Bay, Greenland.—Capt. R. G. Wardlaw Ramsay exhibited and remarked on a specimen of a new bird of the genus *Copsychus* obtained by Mr. H. Pryer in North-Eastern Borneo, which he proposed to call *C. niger*.—A communication was read from Prof. R. Collett, C.M.Z.S., containing an account of the external characters of the Northern Fin-Whale (*Balænoptera borealis*), based upon the examination of numerous specimens of this whale killed on the coast of Norway during the past summer.—A communication was read from Dr. G. Stewardson Brady, F.R.S., containing descriptions of some new freshwater Entomostracous Crustaceans from South Australia.—Dr. H. Woodward, F.Z.S., communicated, on behalf of Dr. Monticelli, a catalogue of the species of Bats found in South Italy.—Mr. R. B. Sharpe, F.Z.S., read the first of a series of notes on birds in the Hume Collection. The present communication treated of the specimens supposed to belong to the Hawfinch of Europe, which had been collected at Attock, and showed that they belong to a different species, which Mr. Sharpe proposed to call *Coccothraustes humii*.—Mr. F. E. Beddard read the third of his series of notes on the Isopoda collected during the voyage of H.M.S. *Challenger*. The present paper completed the preliminary description of the new species of this group collected during the voyage, which amounted altogether to about forty-five in number.—Mr. J. H. Leech, F.Z.S., exhibited and described specimens of a Butterfly from Mogador, which he referred to a variety of *Anthocharis eupheno*.

Geological Society, January 27.—Prof. T. G. Bonney, F.R.S., President, in the chair.—H. Kirby Atkinson was elected a Fellow, and Prof. Gustav Tschermak, of Vienna, a Foreign Member of the Society.—The following communications were read:—On the fossil Mammalia of Maragha, in North-Western Persia, by R. Lydekker, F.G.S.—On the Pliocene of Maragha, Persia, and its resemblance to that of Pikermi, in Greece; on fossil elephant-remains of Caucasia and Persia; and on the results of a monograph of the fossil elephants of Germany and Italy, by Dr. H. Pohlig. Communicated by Dr. G. J. Hinde, F.G.S.—The Thames Valley surface-deposits of the Ealing district and their associated Palæothic floors, by John Allen Brown. Communicated by A. Ramsay, F.G.S.

Victoria (Philosophical) Institute, January 18.—Rev. Dr. Thornton in the chair.—A paper upon "A Samoan Tradition of Creation and the Deluge" was read by the Rev. T. Powell, F.L.S. Mr. Powell said he thought the Samoans were of Semitic origin; and if Hebrew characters had been used instead of the Roman alphabet for the writing of their language, the triliteral, Semitic nature of the language, in which hundreds of words were identical with Hebrew, would have been obvious.

MANCHESTER

Literary and Philosophical Society, November 3, 1885.—Prof. W. C. Williamson, LL.D., F.R.S., President, in the chair.—On the different arrangements in a state of maximum density of equal spherical granules, by R. F. Gwyther, M.A.—Note on the velocity with which air rushes into a vacuum, and on some phenomena attending the discharge of atmospheres of higher, into atmospheres of lower, density, by Mr. Henry Wilde. Since the reading of my paper before the Society on the efflux of air, I have thought that it might be useful to recapitulate, briefly, the fundamental grounds upon which my experiments and the general reasoning thereon were based. This appears to me to be further necessary, from the dual sense in which the term "velocity" may be considered in the discharge of elastic fluids: the term, as I have already pointed out, has been applied by some, indifferently, to express the rate of increase of volume after leaving the aperture, and the velocity of the stream through the aperture before expansion. It is in the latter sense that the term is used in my paper, and the velocities shown in the several tables have been calculated on this basis. The application of the laws of discharge of inelastic fluids to those which are elastic is a natural principle of reasoning sufficient for us to assume a theoretic velocity for air rushing into a vacuum of 1332 feet per second; and the corollary to this proposition, that the velocity of efflux through the aperture into a vacuum is the same for all pressures above and below that of the atmosphere also follows, naturally and directly, from the reciprocal relations of the elasticity and density of the homogeneous atmosphere. But, just as the theoretic velocity of discharge of water and other inelastic fluids is diminished by the opposing motions and friction of the issuing stream of particles, so that the amount of discharge is only ·62 of that required by theory; so from the varied mobility of different gases there was an antecedent probability that an ideal law would not prevail for the velocity with which air has been assumed to flow into a vacuum. Hence, just as the hydraulic coefficient ·62, expressing the actual amount of efflux through a hole in a thin plate, could only be arrived at by experiment; so by experiment only could the actual velocity with which the atmosphere rushes into a vacuum be ascertained. This velocity, therefore, as determined by experiment, may be represented by the coefficient ·77 for the contracted vein. Or, $V = \cdot 77 \times 1332 = 1025$ feet per second. From Tables I. and II. it appears that the corollary of the equality of the velocities for all pressures, when air flows into a vacuum, is not strictly applicable for the lower pressures, but is approximately true for pressures above 120 lbs. That air of lower density acts as a vacuum to the discharge into it of air of higher density, under certain conditions, is a truth so well established from the experiments described as to require no further proof, but, that the reduction of temperature at the orifice of the discharging vessel did not sensibly affect the velocity of the air through the orifice under such conditions, was evident from an inspection of the tables, and more particularly of Table V., where a pressure of six atmospheres acts as a vacuum to a pressure of nine atmospheres. In this experiment it will also be seen that 21·22 cubic inches of air, of a constant density of nine atmospheres (the equivalent of 5 lbs. of pressure), were discharged successively into a vacuum and into atmospheres of increasing densities up to six atmospheres, when the several discharges were made in equal times, viz. 7·5 seconds. Now, the velocity for this time, as shown in Table I., is 1210 feet per second for the contracted vein, and as the times were equal, so were the velocities equal, for the successive discharges up to six atmospheres. The velocity for low pressures, as I have shown in Table III., is compounded of the rate of discharge into a vacuum and the resistance of the atmosphere, and approximates to the square roots of the pressures. For effective pressures below 1 lb. above the atmosphere the rates of discharge are as the square roots of the pressures, as has been shown by Dr. Joule in the paper previously referred to. That the phenomenal rates of discharge which I have described are manifested whenever slight differences of pressure exist between the discharging and receiving atmospheres, may be inferred from the familiar experiment of fixing a perforated disk of cardboard by its centre to the end of a small metal tube or a piece of tobacco-pipe; when a similar plain disk, placed on, or against the other, instead of being driven off by a jet of air blown through the pipe, is attracted to it.

SYDNEY

Linnean Society of New South Wales, October 28, 1885.—Mr. C. S. Wilkinson, F.L.S., Vice-President, in the chair.—The following papers were read:—Notes from the Australian Museum, by R. von Lendenfeld, Ph.D. Note 1.—The vestibule space of *Dendrilla cavernosa*. In this note a very remarkable structure is described; the sponge forms wide ramified tubes with thin walls; and the terminations of these tubes are closed by sieves, as in *Euplectella*. Rings of sensitive and ganglia cells are described round the pores in this membrane. Gland cells similar to those of other *Aplysillidæ* are also described. Note 2.—*Raphyrus hixonii*, a new gigantic sponge from Port Jackson. A sponge, weighing over 400 lbs., was recently dredged in Port Jackson. A detailed description of it is given in this note. The author wishes to keep the two genera *Papillina* and *Raphyrus*, combined by O. Schmidt and Norman, distinct. He has found, besides the spicules known of the European species, two other kinds in this Australian sponge. The structure of the whole sponge is reticulate, as in the Aulenìnæ. Remarkable, very granular, amœboid cells, which are very abundant around the inhalant lacanes, are described as digestive cells. Note 3.—*Halme tingens*, n.sp. A sponge with peculiar staining qualities. This is a sponge from Thursday Island, which becomes blue after some time, and stains paper, &c., placed in the same spirit with it a remarkably dark blue. The spirit remains light yellow. The author thinks that this colour might be turned to practical account. Note 4.—A case of mimicry. Four sponges are described and photographed in this note. Two are *Ceraospongiæ*, and two are *Monactinellæ*. The two former belong to the genus *Chalinopsis*, R. von L.; the two latter to the genus *Dactylochalina*. The author agrees with Vosmaer that the horny sponges have descended from the *Monactinellid* siliceous sponges. Forms like those described connect the two groups. Their similarity in external appearance is considered a case of mimicry. Whilst the internal structure changed, and the sponge lost its spicules, it kept up a close resemblance to the ancestral siliceous sponge which was defended by its spicules. The case is a very interesting one.—Descriptions of some new or rare Australian fishes, by E. P. Ramsay, F.R.S.E., and J. Douglas-Ogilby. The species here described are *Pteroplatea australis*, *Sebastes scaber*, and *Platycephalus arenarius*, all new species, and *Cirrhitichthys graphidopterum* and *Lepidotrigla pleuracanthica*, species previously known.—On the genus *Trachichthys*, by J. Douglas-Ogilby. A full description and synonymy of the genus is here given, the author expressing an opinion that the *T. australis*, Shaw, and *T. jacksonensis*, Macleay, are the same species.—Catalogue of Australian Coleoptera, part ii., by George Masters. The families catalogued in this part are the *Dytiscidæ*, *Gyrinidæ*, *Staphylinidæ*, *Pselaphidæ*, *Paussidæ*, *Scydmænidæ*, *Silphidæ*, *Trichopterygidæ*, *Scaphididæ*, *Histeridæ*, *Phalacridæ*, *Nitidulidæ*, *Trogositidæ*, *Colydidæ*, *Rhysodidæ*, *Cucujidæ*, *Cryptophagidæ*, *Latrididæ*, *Mycetophagidæ*, *Dermestidæ*, *Byrrhidæ*, *Georyssidæ*, *Parnidæ*, *Heteroceridæ*—in all, 970 species.—The Plagiostomata of the Pacific, part iii., by N. de Miklouho-Maclay and William Macleay, F.L.S. Three fishes are here described: (1) A *Heterodontus* from the Chinese Seas, identified as the true *Heterodontus zebra* of Gray, hitherto looked upon as a synonym of *H. phillippi*; (2) a species of ray (*Myliobatis punctatus*), taken in 1879 in the Lub or Hermit Islands, north of the Admiralty Group; and (3) a ray from Sorry Island, north-west of the Admiralties, which is placed in a new genus of the *Trygonidæ*, and named *Discobatis marginipinnis*.—Fourth addendum to the Monograph of the Australian Hydromedusæ, by R. von Lendenfeld, Ph.D. In this paper a new species of Hydra is described, which possesses six arms, and on them cells, which the author considers more nearly allied to the Palpocils of Sarsia (Schulze) than the ganglia cells of Hydra.—Prof. Selenka's researches into the development of the American opossum, by R. von Lendenfeld, Ph.D. Prof. E. Selenka's most important discoveries regarding the concupiscence and the commencement of the development of the embryo of this marsupial are enumerated in this short preliminary report.—Second note on Macrodontism, by N. de Miklouho-Maclay. The author states his opinion about the very large teeth which he has observed in natives of different islands of Melanesia. The results of observations during his last two trips (1879 and 1882) to the Admiralty and Lub Islands is the conclusion that the enlargement of the teeth is nothing but an *excessive accumulation of a special kind of tartar* deposited on the incisors and canines of the upper and lower jaw.—Note on the "Kéu" of the Maclay Coast, New Guinea, by N. de Miklouho-Maclay. On the authority of the late Dr. R. Scheffer, Director of the Botanical Garden of Buitenzorg, Java, the author states that *two* species of *Piper*, allied to *Piper methysticum*, but different from it, were brought by him in 1873 from the Maclay Coast. The author gives a full description of the preparation of the "Kéu"-drink on the Maclay Coast, as well as of the effects of the same, which are more soporific than intoxicating. He adds further some remarks about the general use of the "Kava" root (*Piper methysticum*) throughout the islands of the Pacific.

PARIS

Academy of Sciences, February 1.—M. Jurien de la Gravière, President, in the chair.—On the theory of Mitchell's screw-pile, and on the "vrille," a small apparatus terminating in a sort of conic screw, used for making the scarfs of borings with the screw-pile, by M. H. Resal.—On the measurement of the velocity with which vibrations are propagated in the ground, by MM. F. Fouqué and Michel Lévy. They describe an instrument which they have invented for the purpose of automatically recording the velocity of propagation, as well as the intensity and duration of vibrations such as those produced by the blow of a Nasmyth hammer.—Note on some hyperelliptical formulas, by M. Brioschi.—Report on M. Romieu's work entitled "Essai sur les décans égyptiens," by M. Jules Oppert. In this work the author has endeavoured with partial success to determine the names of the thirty-six so-called "decans," stars which played such a large part in ancient Egyptian astronomy.—Determination of the constant of astronomic refraction by meridian observations (continued), by M. A. Gaillot.—On the integrals of total differentials of the second species, by M. E. Picard.—Geometrical theory of the articulated hyperboloid, by M. A. Mannheim.—Experimental verification of a new geometrical representation of the colour-sensations, by M. R. Feret. After establishing certain properties of the colour-sensations, and founding on them the principles of a new diagram representing these sensations, the author proceeds to show that the results furnished by experience harmonise at all points with those anticipated theoretically. But although the theory leads to the same equations as those already determined by Maxwell, it differs essentially from them in so far as it is founded on the rule of the parallelogram, and is independent of the notion of the three fundamental colours.—Thermic researches on hypophosphoric acid, by M. A. Joly. The thermic properties of the two hydrates of phosphoric acid already determined are compared with those of the various hydrates of phosphoric and arsenic acid, the study of which the author has now completed. Hypophosphoric acid is further compared with the other acids of phosphorus and arsenic by studying its saturation with an alkaline base, and two metallic bases, the oxide of manganese and the oxide of silver.—Note on the indicators of the different energies of the polybasic acids, by M. R. Engel.—A study of chlorophyll, in connection with M. Regnard's induction that the chlorophyll function, that is, the property of decomposing carbonic acid in the light, is of a purely chemical order, inherent to chlorophyll, and continuing to act apart from the physiological conditions, by M. Victor Jodin. Without denying this conclusion the author recalls certain former experiments, which apparently point at a different result, and which should be taken into consideration in order to establish a general theory of chlorophyll based on all the known facts.—On the morphology of the ovary in insects, by M. Armand Sabatier.—A contribution to the anatomy of the Chloræmidæ, by M. Et. Jourdan.—Observations in connection with M. Köhler's recent note on a new species of Balanoglossus, by M. G. Pouchet. It is shown that this species is identical with that which MM. de Guerne and Barrois found in abundance in 1880 in the Island of Loch (Glenans Archipelago), and is also probably the same as that found in 1879 by M. de Lacaze-Duthiers at Frez-Hir, Finisterre.—On the optical properties of some fibrous minerals, and on some critical species (arseniosiderite, wawellite, vadiscite, davreuxite, hydrated anthophyllite, hydrotephroite of Langlan, Sweden), by M. A. Lacroix.

BERLIN

Physiological Society, November 27, 1885.—Dr. Benda spoke on mammalian spermatogenesis. The results recently communicated to the Society by Dr. Biondi (NATURE, vol. xxxii. p. 544), of his investigation into the genesis of spermatozoa, had, in view of their divergence from the ideas of earlier observers, induced Dr. Benda to examine the subject more closely. By application of the best hardening and staining methods he had obtained precisely the same figures as had all earlier observers. In particular, through the preparations he had made from rats, bulls, and dogs, he had convinced himself of the actual existence of Ebner's spermatoblasts. Upon a large cell arising from the wall of the canal, the foot-cell, a thin stalk projects, on which was situated an oval formation consisting of small flaps. In his interpretation of this stalk, however, Dr. Benda differed from Ebner, taking the spermatoblasts as he (Dr. Benda) did, for a heap of daughter-cells connected by the stalk with the foot-cell. He further deviated from earlier observers in assuming that the foot-cell originated from a large wall-cell provided with a quiescent nucleus, which interiorly developed a process with which the daughter-cell then united into the spermoblasts. Not till later on did the spermatozoa appear. Examinations of a large series of different kinds of animals would enable a plan to be taken of all the stages of spermatogenesis.—In the discussion which followed the address, Prof. Waldeyer urged that the type of the spermatogenesis, as described by Dr. Biondi, namely, that of cell-columns with progressive development from the interior outwards of the spermatozoa out of cell-nuclei, proved conclusively in the case of the rat, might possibly not hold good for all kinds of animals. It was possible that in other kinds of animals the several stages passed, not successively, but simultaneously and less distinctly, one from another, so that whole knots of cells may be involved in the same stage of development. A subsequent conjunction of daughter-cells with the process of a foreign cell seemed to him improbable.—Dr. Müllenhof presented a series of photographs of horses in movement, prepared by Herr Anschütz in execution of a commission from the Royal Ministry of War. One series exhibited the successive positions of the horse in the act of springing; another in the act of trotting. Dr. Müllenhof followed this up with some observations on the way in which these images were obtained, and drew special attention to certain positions in the body of the animal.—Dr. Wolffberg described a case of abnormal single vision which had recently come under his observation. A man of sound health in every respect complained that for some time he was constantly seeing two objects of the same kind, or very similar to each other, as a single object when they were lying beside each other. It made no difference what was the form of the objects, whether they were letters of the alphabet, numbers, strokes, crosses, and so on. In all these cases he saw the two objects constantly as a single object when they stood at a short distance from each other. In a horizontal position the two objects might be placed at a greater interval from each other than in a vertical position, in order to be seen by him as a single object. The position of the singly seen image was always that of the fixed object. The single seeing of two objects was confined to the macula lutea. If the objects were not entirely alike, but only very similar to one another, then did they likewise appear as one. If they had different colours, then were they likewise seen as one object with rivalry of colours. In the eyes of the patient the existence of no objective anomaly could be established. By way of explanation of this hitherto unobserved phenomenon, Dr. Wolffberg called to mind the physiological phenomena of normal single seeing in the case of two images striking identical spots of the retina, and of abnormal single seeing in the case of objects in the circle of vision which did not indeed hit identical spots of the retina, but yet appeared as single. The physiological abnormal single seeing in this latter case respected, however, only objects to which attention was not turned, which were not fixed, and in such contingency the images appeared always between the two objects. If, then, the physiological single seeing, in the case of non-identical spots of the retina being hit, distinguished itself so far from the above-mentioned pathological condition, it yet had in common with the pathological condition the rivalry of the colours, the single seeing of similar objects, and the greater interval in horizontal than in vertical directions. In the opinion of the speaker, the observed pathological condition was due to a psychical cause, and was to be classed in the category of illusions.

BOOKS AND PAMPHLETS RECEIVED

"Le Sens des Couleurs chez Homère": Dr. de Keersmaecker (Lebèque, Brussels).—"Die Lebendige Kraft und ihr Mass": Dr. Max Zewerger (J. Lindauer, München).—"Widerstand und Maschinenleistung der Dampfschiffe": E. Rauchfuss (Lipsius und Tischer, Kiel).—Electro-Deposition": A. Watt (Lockwood and Co.)—"A Guide to the Examination of the Nose": E. C. Baber (Lewis).—"Alkali Tables," 2nd Edition: O. Bell (Lockwood and Co.).—"Practical Introduction to Chemistry": W. A. Shenstone (Rivingtons).—"Attack and Defence as Agents in Animal Evolution": C. Morris (Philadelphia)—"Les Orages en Russie": A. Klossovsky (Odessa).—"On a New Zealand Fungus that has of late become a Valuable Article of Commerce" W. Colenso.—"The Apparent Movements of the Planets"; W. Peck (Archibald and Peck, Edinburgh).—"Beobachtungen über die Dämmerung insbesondere über das Purpurlicht und seine Beziehungen zum Bishop'schen Sonnenring": Dr. A. Riggenbach (Georg's Verlag, Basel).

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