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BRITISH FOSSIL CEPHALOPODS

A Monograph of the British Fossil Cephalopoda. Part I. Introduction and Silurian Species. By J. F. Blake, Esq., M.A., F.G.S., Professor of Natural Science in University College, Nottingham. (London: J. Van Voorst, 1882.)

FOR the first time has just appeared Part I. of a monograph upon the British Palæozoic Tetrabranchiate Cephalopoda, and important as this group of Mollusca has ever been regarded by all palæontologists and badly as such has been wanted by all students of British Palæozoic geology, no one has hitherto attempted any history of this group for Britain. Barrande has elaborately done so for Bohemia and De Koninck for Belgium, both have extensively written upon the older Cephalopoda [Cambrian, Silurian, Devonian, and Carboniferous]. Barrande in his exhaustive work illustrates no less than 1620 Silurian species. De Koninck in his last important work upon the Carboniferous Limestone of Belgium enumerates 170 species, amongst them many new forms and many common to British strata. Prof. J. F. Blake intends completing this history of the British Palæozoic Cephalopoda in two volumes. The part now issued, being part or vol. i., treats only of Silurian species. No less than 244 quarto pages and 31 plates are devoted to the description of 11 genera and 6 sub-genera, and 143 species. The great genus *Orthoceras* being illustrated by 76 species, and its 4 sub-genera by 6 species, *Cyrtoceras* 23 species, *Poterioceras* 2, *Gomphoceras* 11, *Phragmoceras* 7, *Ascoceras* 3, *Nautilus* 4, its sub-genus *Trochilites* 3, *Trochoceras* 12, *Lituites* 2, *Ophidioceras* 2, and *Goniatites* (?) 2 species. These 143 species range from the Tremadoc Rocks, of the Cambrian series, to the Tile-stones of the Upper Ludlow. Forty of the 145 species also occur in Europe and America, or 32 are common to Europe and 6 to America, thus showing the wide distribution of certain genera and species. Thirty-one plates accompany the letterpress or text, every species being figured, and more than 2000 specimens have been examined by the author having reference to the history and description of these 143 species. Prof. Blake has given on pp. 233-6 a table of the distribution in time of all the species, and on p. 237 a condensed table showing the "growth, culmination, and decay of the genera and group." These two tables are suggestive, and the outcome of their study shows that there were two maxima of individual abundance, one occurring in the older group of rocks, the Caradoc or Bala, and the other, in the Lower Ludlow, yet we feel assured that there was no real diminution or falling off in the variety of forms between these two deposits. The tables clearly show that the species in the Wenlock Limestone were (or are now found to be) comparatively few as compared with those in the shales above and below, and would indicate that the Cephalopoda of the Wenlock seas were not commonly frequenters of clear and shallow waters, but were partly pelagic and possibly gregarious in more or less turbid waters, as indicated by the impure sediments composing the Ludlow shales.

Prof. Blake has proposed a classification of the Nautiloidea based upon the general form of the shell, and having a variable siphuncle. He places all the Palæozoic forms under four groups: 1, the *Conici;* 2, the *Inflati;* 3, the *Spirales;* and 4, the *Irregulares.* The 18 genera being naturally distributed through these four groups.

Group 1. The Conici.—Receives the genus *Orthoceras*, with its 5 sub-genera: *Endoceras*, *Actinoceras*, *Tretoceras*, *Conoceras*, and *Gonioceras*, all having straight conical shells; also the curved genus *Cyrtoceras* with its sub-genus *Piloceras*.

Group 2. The Inflati.—Receives the well-known genera *Poterioceras*, *Gomphoceras*, *Phragmoceras*, *Ascoceras*, and *Glossoceras*, all possessing species with curved inflated shells, and contracted apertures.

Group 3. Spirales.—Those species with the whorls in contact, of simple form and considerable curvature, illustrate this group. The characteristic genera are *Trocholites* (Silurian), *Clymenia* (Devonian), *Aturia* (Tertiary and Cretaceous), *Discites* (Carboniferous), and *Nothoceras* (Silurian), a Bohemian form.

Group 4. Irregulares.—The genera comprising this group are all unsymmetrical in form, and greatly curved, the genus *Lituites*, *Trochoceras*, and *Ophidioceras* illustrate this division.

Prof. Blake does not lay much stress upon the contraction of the aperture in the shell classification, although it is important and recognised by Barrande as of much significance, doubtless other features in the general structure of the shell weigh equally in the determination of species. Such variations as are seen in rare or little known forms become matters of individual opinion to the species maker. As no Dibranchiate Cephalopod is known, or has no representative in the Palæozoic rocks, they may be dismissed as having no place or value amongst the Silurian species; therefore the whole group, whose entire history Prof. Blake has so ably described, belong to the Tetrabranchiata in its two great families, the *Nautilidæ* and *Orthoceratidæ*, especially the latter. Most, if not all, naturalists now agree in separating or excluding the *Bellerophons* from the Cephalopoda, although Prof. McCoy, Ferrussac, D'Orbigny, Latreille, and Sowerby formerly believed they belonged to the "Argonautidæ," and so placed them.

There is still difference of opinion as to the exact limits and sub-divisions of the order Orthocerata. Barrande has given all the known classifications, and the characters on which they have been founded by different authors. They are based (1) upon the position of the siphuncle; (2) the form of the suture; (3) the involutions of the shell; (4) the form of the aperture; (5) the symmetry or asymmetry of the shell; (6) the direction of the septa; (7) the simplicity or complexity of the siphuncle.

In Palæozoic forms the siphuncle played a very important part in the life and history of the species, being simple in one genus, complicated in another, dorsal in one, and ventral in another, and medial in some; the genera and species have been mostly founded on these changes and elements.

The earliest group to make its appearance in time was that of the Orthocerata, and out of it from the peculiarities of the siphuncle and shape of transverse sections, have been formed or established six genera, viz. *Gonioceras*, *Tretoceras*, *Endoceras*, *Actinoceras*, *Bathmoceras*, and *Bactrites*, all these constitute one natural group, placed

by Mr. Blake under the "*Conici*," diverging from this and more restricted in time, having variously shaped apertures, and singularly inflated, fusiform, pyriform, or flask-shaped shells, are the genera *Phragmoceras*, *Gomphoceras*, *Poterioceras*, and *Ascoceras*, and placed under the group "*Inflati*" by the author. The other two groups of the Nautiloidea—the *Spirales* and the *Irregulares*—possess so great a shell curvature that they assume the form of whorls, which may or may not be in contact. This fact appears of sufficient importance to justify Mr. Blake in regarding it as the basis for establishing the group "*Spirales*," in which is placed the genera *Nautilus*, *Gyroceras*, *Trochilites*, and *Clymenia*, &c., finally through peculiarity of form, such as want of symmetry, or loss of, or changes in curvature, are many of peculiar aspect, which Mr. Blake places under the group "*Irregulares*," the genera contained in which are *Trochoceras*, *Lituites*, *Ophidioceras*, and *Cryptoceras*. These researches have led to the construction of the table of classification above given.

Prof. Blake commences his systematic description of the species with the genus *Orthoceras*. No less than 70 species in this genus are described by the author, ranging from the Tremadoc rocks to the uppermost Ludlow beds (the Tile-stones). The species mostly abound in the Bala beds, the Wenlock shales, and the two Ludlows. The literature or bibliography of the species of the Orthocerata, their descriptions, and that of the 5 sub-genera is of the greatest value, and an addition to our knowledge of this oldest known genus in the British rocks; Cyrtoceras being its only associate in the Tremadoc beds. The sub-divisions of the genus by Quenstedt, M'Coy, De Koninck, and Barrande are given. Mr. Blake adopts Barrande's views and grouping of the Orthocerata into two groups: (1) the *Brevicones;* and (2) the *Longicones*. The latter, which is very numerously represented, Mr. Blake divides into the *Annulati*, the *Angulati*, the *Lineati*, the *Imbricati*, and lastly the group *Leves*. In this latter group is temporarily placed all species whose *external* surface is unknown. Then follows concise but clear descriptions of the five sub-genera—*Actinoceras*, *Endoceras*, *Tretoceras*, *Conoceras*, and *Gonioceras*. For the first time we now have the 70 British species of Orthocerata brought together, and most ably described and figured; 3 species belong to the group "*Brevicones*," and 67 to the group "*Longicones*." Of these, 20 species fall under the group *Annulati*, 6 under the *Angulati*, 13 under the *Lineati*, 7 under *Imbricati*, and 22 in the group *Leves*. We are now able to investigate all the known species of this extensive Palæozoic genus, and no student need be at a loss to determine, either through original description and drawing, or the reproduction of type species, any forms that he may meet with in the Silurian rocks of the British Islands. The author's plan of first describing in every instance the type of the species, is of extreme value, as it at once (if a known species) clears up its history; this with reference to the original figure and description by the author, and its reproduction in the monograph, ensures and affords every chance of right determination. Following the "type" is the general description, then its relation to other known forms, British or foreign, followed by its distribution in time or space; this plan is implicitly followed throughout the entire volume—it is clear, definite, and systematic. The next important group described by Mr. Blake are the Cyrtoceri, numbering 22 species. These curved Cyrtoceri Deshayes termed Campulites, restricting the term to those species having the siphuncle on the inner side. Goldfuss, however, regardless of the position of this organ, named them Cyrtoceras; Billings, De Koninck, Sandberger, Giebel, and Barrande have all proposed divisions for the classification of Cyrtoceras. Blake follows Barrande, who divides them into two series, according to the position of the siphuncle: (1) the *Exogastric*, in which that organ is external; and (2) *Endogastric*, in which it is internal. Prof. Blake proposes a third grouping for these species, in which the siphuncle is near the centre, calling it "Mediogastric." The Bala, Wenlock, and Lower Ludlow beds contain most species of Cyrtoceri. The species *C. precox*, from the Tremadoc beds of Garth, in North Wales, and from Llanerch in Pembrokeshire, with *Orthoceras sericeum* are probably the oldest forms known.

The singular genus Gomphoceras receives much careful analysis from Prof. Blake. Six of the 11 species are new, and there appears to be good reason for their establishment; with one exception the species are all (10) Upper Silurian, 8 of the 11 are in the Lower Ludlow beds, and 5 in the Wenlock Limestone. Two quarto plates are devoted to this remarkable genus. Four of the 7 species of Sowerby's genus Phragmoceras are also new, and for the first time figured. Like Gomphoceras this genus is chiefly Upper Silurian, the Wenlock and Ludlow strata being characterised by them. Mr. Blake adds much to our knowledge respecting the species of the genus Ascoceras of Barrande, hitherto little known or understood; the species in Britain are confined to the Ludlow rocks.

The group Spirales, illustrated by the genus Nautilus and its sub-genera, receives ample and critical notice, and shows how varied have been the views of naturalists upon the affinities of this old genus, established by Breynius in 1732. The value of the sub-genera in this as in all the large groups is of much significance in tracing the history of the obscure forms classed under the genus Nautilus or *Nautiloid* remains in the Lower Palæozoic rocks. Five of the so-named genera—Trocholites, Clymenia, Aturia, Discites, and Nothoceras are placed under the genus Nautilus as sub-genera. Mr. Blake gives Quenstedt's, D'Orbigny's, and De Koninck's classification or sub-divisions, and suggests one of his own. Quenstedt proposed to subdivide the genus Nautilus into 8 groups: (1) the Insecta, (2) *Clymenia simplices*, (3) *Clymenia angulosæ*, (4) the Moniliferi, (5) Bisiphites, (6) Simplices, (7) Undulati, (8) Aganides.

This and the classification by De Koninck ("Terr. Carb. de Belg."), in which he partly follows Quenstedt, are the only two hitherto recognised divisions of the genus. The Belgian Professor places his Palæozoic species under the following six heads: (1) Imperfecte, (2) the Striati, (3) the Radiati, (4) Lævigati, (5) *Clymeniæ simplices*, and (6) *Clymenia angulatæ*; four of the six being those of Quenstedt. Prof. Blake proposes or suggests a simpler grouping. No. 1, *Simplices*, illustrated by the sub-genus *Trocholites;* 2, the *Radiati*, those species having radiating, sigmoidal, or angular ribs; 3, the *Ornati*, variously ornamented, chiefly Carboniferous,

equivalent to M'Coy's sub-genus *Temnocheilus*; 4, the *Sinuosi*, those with sinuous sutures; and 5, those species with nummuloid siphuncles (Trias only).

Probably only three species of Nautilus occur in the Silurian rocks—*Nautilus quadrans*, *N. Holtianus*, and *N. Bohemicus*. This last-named species appears to be the *Lituites Biddulphi* of Sowerby (1838); but his insufficient description, in the "Sil. Syst." of Murchison, prevents true identification. They are all three Upper Silurian forms. The Lower Silurian rocks of Newfoundland and Canada have yielded eleven species. In the Carboniferous strata Nautilus attains through Discites its maximum development. In the Permian only one species is British, and three American, and is now the only living representative of the Tetrabranchiata. The sub-genus *Trocholites* (three species are Lower Silurian. These six forms are the only *true* Nautiloidea in the Silurian rocks.

The last group (4, the *Irregulares*) in Mr. Blake's classification receives three genera: *Trochoceras*, with 12 species; *Lituites*, 2; and *Ophidioceras*, 2 species. We have no representative of either the *Endogastric* or *Exogastric* group of Barraude in this country. American and Swedish Lower Silurian species are somewhat abundant, in Britain it is chiefly an Upper Silurian genus. Of the 12 species known 8 are Upper Silurian—Wenlock and Ludlow—and the Llandilo, Bala, and Llandovery beds yield the remaining *Trochoceri*. Five of the 12 species are *new* to Britain, described and figured by Prof. Blake for the first time. The two type species—*Trochoceras* (Lituites) *cornu arietes* (Sowerby), and *Trochoceras* (Lituites) *giganteum* (Sowerby)—are admirably refigured and described by Mr. Blake, the general descriptions adding to their specific value, and the determination of Bohemian forms of Lituites in Britain materially adds to the correlation of the two faunas. Barrande's genus Ophidioceras (*Lituites, auct.*) seems to have been recognised by Mr. Blake; it differs from typical Lituites by the whorls being accurately in contact. The *Lituites articulatum*, Sow., was long ago figured as Lituites in the "Sil. System," p. 622, t. 11, f. 5, and adopted by Salter. The straight ribbing and band distinguishes this genus from Lituites. This volume concludes with general observations, and highly suggestive many of them are. Prof. Blake endeavours to throw some light upon the laws which govern the appearance and disappearance of forms of life, and into the nature of those groups of individuals to which we assign the term species.

Mr. Blake prepares a table, condensed from the larger and preceding one on pp. 233-236. This condensed table shows the numerical value of the species occurring in the 11 genera, and ranging through the ten formations or horizons, thus showing their increment, decrement, and stratigraphical distribution. Both tables show three maxima in the Ludlow, Wenlock, and Bala beds—in the Ludlow 65 species, the Wenlock 43, and the Bala 39. Mr. Blake does not believe that there was a corresponding falling off between these epochs; he draws conclusions from the comparative fewness of species in the *Wenlock Limestone* as compared with the Ludlow shales above and Wenlock shales below that formation. Of the four groups given the *Conici* first appear, and constitute the bulk of the Lower Silurian fauna, 31 species occurring in the Bala rocks [the Tremadoc only yielding two species, the Llandeilo 9, and the Lower Llandovery 8, or 19 for the three horizons]. The *Conici* and *Spirales* are the only two groups which continue on in time or range into the higher divisions of the Palæozoic rocks (the *Devonian* and *Carboniferous*), the *Inflati* being represented by *Poterioceras*, &c., in the Carboniferous series.

Mr. Blake next considers the characters of the individual genera and their appearance in time, but somewhat begs the question to suit his particular view upon evolution; it surely can hardly be safe to speculate upon any particular curve or part of the curve in any particular genus, to argue for descent through evolution, other conditions not known. Neither *Cyrtoceras precox* or *Orthoceras sericeum*—which are the oldest species known in Britain—"are transitional forms, both being well characterised," and it is questionable whether the group which has been longest in existence in a given area, will there most abound, many physical conditions may tend to prevent that, "though we grant that possibly the greater the abundance of individuals, the greater is their chance of preservation in the rocks, the nature of the deposit admitted.

In the paragraph on p. 239, having reference to the genera Cyrtoceras, Phragmoceras, and Gomphoceras, more evidence is wanting before we can draw any conclusion as to priority of appearance, or show that those having the siphuncle internal (Endogastrica) appeared first or preceded the Exogastrica (with the siphuncle external); it is true we must take the evidence as it stands, or as we find it; it is, however, wiser not to theorise upon such slender materials.

Prof. Blake next notices and discusses the question of species (pp. 239-243), and has pronounced opinions upon this vexed, complicated, and philosophical question, naturally the old idea of the independence of species is rejected. Mr. Blake adopts all through his book the method of "actually describing a type-specimen around which the other forms designated by the same name may cluster." When the original type has not been seen or found, a type is selected to which others are compared. In attempting the explanation of the phenomenon of distinct species or specific groups, it is well known that two theories are now held: (1) that which considers each species a "special creation, though inexplicable"; or, (2) "that which asserts the development of one from the other by a process of evolution." Mr. Blake appeals to palæontology to show, through its researches, the gradations between one species and another. The result to Mr. Blake's investigation in this and other groups is against "fixity of species." He states, that "if species were such definite entities as they were once supposed to be, they ought to be much more easily distinguished than they are, and that the many variations of form which will be found included, and necessarily included under one specific title, whose 'general description' thereby becomes one of considerable latitude, show that different specimens are not so closely linked as that theory would imply." On the other hand, "Does this present study," asks Mr. Blake, "give any positive aid to the theory of evolution?" He fails to see any reasonable solution or answer. It is evident that among "the many forms which flourish in any one epoch, it must be impossible to say with certainty which was the descendant of any particular form in the preced-

ing epoch, especially as the intervening links are, in all probability, absent."

Mr. Blake selects certain species of Orthocerata which may have been produced by descent; at the least it is only supposition, and he states that there is no proof that they are actually so connected, but to the general theory of evolution—which merely states that every form of life has been developed from a preceding one nearly allied to it—the present study affords no contradiction or difficulty, but affords aid—which if not so great as could be desired, is yet as much as could be expected. In the present study of the Palæozoic Cephalopoda we have a fair representative of a successive fauna of the same class, and the species are grouped round a series of central types; and so long as the surrounding circumstances remain constant and the same, the process of evolution by indefinite variation and survival of the fittest should either be uniform, and leave relics having no special grouping, or it should cease when the best adaptation to the surrounding circumstances or conditions had been acquired. These views are expressed and carefully argued by Prof. Blake, in the concluding pages of his work. "The great defect," writes Mr. Blake, "of the theory of natural selection is that it leaves the original variation, which is the basis of the whole to chance; chance variations are not likely to lead to any law." "The part which it has effectually performed is to show how variations of the individual may produce permanent changes in the species, and thus break down the idea of the fixity and independence of the latter." "We are, perhaps," says the author, "as yet too dazzled by the brilliancy of the theory to perceive its inadequacy as a complete account of life or to place it as one link only in the chain of explanations."

The "General Observations" of Prof. Blake on pp. 237-44 are a fitting termination to the laborious part undertaken by him in describing the 145 Silurian species. The work has been most carefully and honestly done, and now for the first time we possess a complete monograph upon the Tetrabranchiate Cephalopoda of the oldest Palæozoic rocks; no less than 31 quarto plates illustrate the species, and all are drawn life-size. Mr. Blake has examined 2000 well-characterised specimens, and has visited all the museums and private collections in Britain likely to contain materials for his work, and as he remarks, the work includes a description of every known specimen so far as it presents any available characters.

The fragmentary state of nine-tenths of the specimens collected, demanded from the author the most careful examination, whether by comparison or through description of specimens, and those who know the condition of Silurian Cephalopoda as occurring in this country will indeed appreciate the critical labour of Prof. Blake; he has rendered great service to palæontology. The book was the one want, as a completion to the works of Murchison, McCoy, Salter, and Sowerby in Britain; a companion to the grand monographs by Barrande upon the Cephalopoda of the Silurian Rocks of Bohemia, also a fitting accompaniment to the monograph by De Koninck upon the same group for the Silurian and Carboniferous Rocks of Belgium. No library devoted to natural science should be without this first volume, and no student of Palæozoic species can do without it. No group of invertebrata are of such importance to the stratigraphical geologist as the Cephalopoda; in Britain alone the Palæozoic species number nearly 400, and in Bohemia the *Silurian Cephalopoda*, as described by Barrande, reach the great number of 1600, the Devonian species 500, and the Carboniferous species of Europe 350 species; these totals will at least give some idea of the life and distribution of this class of mollusca through time in Europe, and as Prof. Blake's first volume only treats of the Silurian of Britain, we wish him further success in his continued work upon the British Devonian and Carboniferous species, the fossil forms in which require the most minute, careful, and detailed study. R. E.

OUR BOOK SHELF

Social History of the Races of Mankind. Fifth Division: Aramæans. By A. Featherman. (London: Trübner, 1881.)

We do not like to discourage a student who has evidently a zeal for knowledge, and must have given great labour to compiling the comprehensive account of human society, of which this volume is the first instalment published. But we are bound to say he does not seem alive to the differences of value among the travellers' books of which he gives a list at the end of each section, and out of which he has pieced together extracts describing Jews, Arabs, Egyptians, &c. Thus some statement about the Copts may be out of Lane's "Modern Egyptians," or it may be out of Miss Lot's "Nights in the Harem," and the reader would rather like to know which is which. Mr. Featherman writes in his preface: "The facts have been selected with critical discernment, and no doubtful or incredible statements are admitted in the text, unless controverted in a footnote." Then follows an introduction, which begins: "The primæval man did not spring from a single stock, or from one ancestral type. He arose under varying conditions, and at different geological periods. The initiatory forces of nature which caused his primitive development, existed in the same degree in all the isothermal regions of the earth, and whenever the favourable circumstances were capable of producing and fostering into maturity the human animal, there he appeared," &c., &c. Putting preface and introduction together, it is plain that the author's critical discernment does not enable him to know a doubtful statement when he sees it, even when it is of his own making. In fact he does not quite know where he is, or a casual look into his volume would not show the ancient Egyptians classed among the Aramæan or Semitic nations without mention of their great physical difference from Jews and Arabs, nor would there be found in the account of the Egyptian religion a mention of Isis as being Ceres and Proserpine, mother and daughter at once. The book deserves a place on the library shelf, and will be useful to students, especially for its descriptions of Druses, Talmud Jews, and other little-known minor groups. It is doubtful if its reception by the public will justify the series being continued; but in case it goes on, the materials ought to be more carefully selected, and references given.

Commercial Organic Analysis. By A. H. Allen. Vol. II. (London: Churchill, 1882.)

The first volume of Mr. Allen's work treated of cyanogen compounds, alcohol derivatives, phenols and acids; in this second part the very useful and practical character of the work has been fully maintained in the description of the properties, tests and assay of the hydrocarbons, fixed oils, and fats, sugars, starch and its isomers, alkaloids and organic bases, &c. The author has omitted, as stated in his preface, all mention of dyes and colouring matters, coal-gas, and animal products, on the ground that their consideration would have inconveniently in-

creased the size of the work. This is somewhat to be regretted, as they are matters of quite as much importance as fixed oils, &c., to which a long chapter is devoted, and their inclusion would have certainly increased the value of the book for all general purposes.

The chapters on paraffins, terpines, and homologues of benzene are very clear, and in many cases detailed methods of assay, as, for instance, with benzene, anthracene, &c., are given that will be found of practical value.

A large chapter is devoted to the description of methods of examination of fatty oils and fats employed in the soap manufacture, and the same section also gives considerable general information respecting varieties of soap with methods in some cases improved by the author, for the analysis of soaps ; in particular a tabular arrangement of analysis of a soap on p. 242.

About 100 pages are devoted to the important subject of sugars, and in this space we find an admirable condensation of methods in use, both optical and chemical, for the detection and determination of the various varieties of sugars met with commercially. The optical portion is prefaced by some short remarks on construction, and varieties of polometers in use, which might with advantage have been somewhat extended.

All the methods given in this section are up to date, and cannot fail to be of use not only to the practical man, but to the student.

The chapter on the alkaloids is also a very complete compilation of methods of detection, &c., that have been proposed and found to be reliable up to date. No doubt the book will be found valuable as a reliable compilation of methods, &c., as such, saving much time and trouble in referring to the original publications. The author is an eminently practical chemist, and in his preface to the first volume seems to deride the teaching of "ultimate organic analysis" and the "ringing the changes on the everlasting-chloro-bromo and nitro derivatives of bodies of the aromatic series."

The quality of Mr. Allen's production atones somewhat for this ebullition, for his book requires a considerable amount of theoretical knowledge to be possessed by the user ; and it is very desirable, if we are to maintain a position as chemists at all, that the cant about "purely practical work" should cease, and a more thorough foundation in theoretical chemistry be imparted to students, so that they may become reliable practical men, and not mere machines for manipulating test-tubes.

Nordenskjöld's Arctic Voyage Round Asia and Europe. A Popular Account of the North-East Passage of the *Vega*, 1878-80. By Lieut. A. Hovgaard. Translated from the Danish by H. L. Brækstad. Maps and Illustrations. (London : Sampson Low and Co., 1882.)

LIEUT. HOVGAARD, of the Danish Navy, was one of the most efficient members of Baron Nordenskjöld's well-selected staff on board the *Vega*. When he returned from the remarkable voyage, he very naturally felt impelled to tell his countrymen how he had fared and what he had seen. This he has done in a pleasant and popular style, utilising to some extent the material collected by his chief. Lieut. Hovgaard, while dealing mainly with its lighter aspects, gives a fairly complete sketch of the voyage. The translation is well done, and the translator deserves special credit for the intellgible way in which he has rendered Russian names. The illustrations are not up to a very high mark.

The Sphygmograph; its History and Use as an Aid to Diagnosis in Ordinary Practice. By R. E. Dudgeon, M.D. 8vo., pp. 72. (London : Bailliére, Tyndall, and Cox).

THIS book may be of some service to beginners, as it gives rudimentary instruction in the use of the instrument, but this is all it does. The history is carelessly written, the account of the indications given by the sphygmogram is imperfect, and the deductions drawn are sometimes, we think, incorrect. From a curve in the upstroke the author concludes that the ventricular contraction is of a peristaltic character, a conclusion which would be most important if it were correct. But he does not at all take into consideration the great probability that this curve is due to instrumental error, inasmuch as it does not appear in the tracings obtained by Marey's sphygmograph, in which the connection of the writing-lever with the artery is more perfect than in Dr. Dudgeon's instrument. The chief value of the book consists in the description and directions for applying Dr. Dudgeon's sphygmograph, which certainly possesses the great advantage over other instruments, that it is much cheaper, and can be applied much more quickly, and with much less trouble.

A Great Mathematical Question. By T. Wakelin, B.A. (Melbourne : G. Robertson, 1881.)

A PAMPHLET of 16 pp., with a coloured diagram, the object of which is to show the fallacy of the *measure* of kinetic energy. It is an account of the old dispute originated by Leibnitz, and about seven pages are taken up with extracts from Whewell's "History of the Inductive Sciences" (vol. ii. pp. 68-70) ; *Penny Cyclopædia*, "Vis Viva" ; *Encycl. Brit.*, "Energy" ; Balfour Stewart, "Heat" (pp. 301-4) ; and Routh's "Rigid Dynamics" (pp. 260, 263, 270-1), with a reference to Todhunter's "Mechanics" (pp. 210, 211). We would suggest, as additional references, Clerk Maxwell, "Matter and Motion" (§ lxxvii.), and Tait's "Recent Advances in Physical Science." Mr. Wakelin concludes : "It will therefore be seen that the *distance* through which a body *falls* during the time of falling, is not a measure of the work of the force of gravity during that time. This, of course, means that the ordinary measure of the kinetic energy of a mass in motion is an erroneous one."

LETTERS TO THE EDITOR

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[*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 ensure the appearance even of communications containing interesting and novel facts.*]

The Existence of a Voice in Lizards

THE letters on the existence of a voice in lizards, by M. Pascoe and S. P. Oliver, in NATURE, vol. xxv. pp. 32, 174, gave me much pleasure, being a confirmation of observations first made and published by myself in 1874, but doubted in different quarters. In my paper, "Zoologische Studien auf Capri, II. Lacerta muralis coerulea, ein Beitrag zur Darwinschen Lehre, Leipzig, Engelmann, 1874" (p. 20), I have laid down the result of my observations, in the first instance, concerning the habits of the bluish-black wall-lizard, *Lacerta muralis cærulea*, discovered by me on the Faraglione rock near Capri, and subsequently on those of other wall-lizards. There, I say : "To the harmlessness (or fearlessness, mentioned previously) of the blue inhabitant of rocks—*Lacerta muralis cærulea*—I owe the discovery of the animal's intonating capacity, a peculiarity generally ascribed among reptiles to the geckoes and chamæleons, but never observed in wall-lizards till now."

One summer-day I heard in the room where I kept a cage of lizards a peculiar sound, similar to the piping of a nestling, only softer. Having listened attentively, I was surprised to find it proceeding from the throat of one of my male blue lizards. Leisurely resting on a stone, the animal repeated the sound a dozen times, perhaps at intervals of about a quarter of a minute, each time opening its mouth a little way. For several consecutive weeks I noticed the same kind of voice in other individuals of both sexes, after which period I did not hear it for months. A series of these calls were taken down by me from ear ; I give them here : "chri, bschi, riä, bi, bschiä."

Among these slightly protracted notes the ch, sch, i, and ä predominated. As to their possible meaning I am still in the dark; I was not even able to discern whether they were to express a sensation of pleasure or comfort, pain, or passion. The animals seemed to be in quite a normal condition. As I shall relate further on, I overheard afterwards a common wall-lizard of Capri, grown blind by conjunctivitis, in the act of producing the same sounds.

After it had been attempted to reject my statements, without any reasoning, indeed by declaring the voice described by me to have been the effect of a rheumatic affection of the mucous membranes, which the Italian lizards had contracted in our cold German climate, I happened to hear the same sounds from a lizard under circumstances wholly excluding every supposition as to its being an abnormal voice. I have shortly communicated the fact in my paper "Untersuchungen über das Varüren der Mauereidechse, ein Beitrag zur Theorie von der Entwicklung aus constitutionellen Ursachen, sowie zum Darwinismus," in Troschel's *Archiv für Naturgeschichte*, xlvii. Jahrgang, 1881, and separately in Nicolai's Library, Berlin, 1881 (pp. 66-68), I quote the following passage:—

"In 1877, having ordered a man to search the middle Faraglione rock for lizards, I waited for his return in a little boat at the foot of the rock. After a while, the man came down with a number of captured lizards tied up in his pocket-handkerchief. I was going to take a specimen of *Lacerta muralis cærulea—Cærulescens mihi*—which he had just released, in my own hand, when it uttered repeatedly, in swift succession, a series of very sharp tones, sounding like 'bschi,' and reminding me of the hoarse piping of a mouse or a young bird."

Moreover, I mentioned that Dugès already tells us of *Lacerta Edwardsii*, a little lizard peculiar to the shores of the Mediterranean, that it is apt to utter a sound resembling the creaking of a Cerambyx. And he further reports that *Lacerta ocellata*, a large lizard of the south, when angry, will expel its breath so vehemently that a sort of voice is produced. And M. H. Landois, of Münster, at my request, informed me last year that *Lacerta viridis* was able to utter a distinctly hissing or blowing sound. These reptiles on being approached on a hot summer day, would rush furiously at their enemy, at the same time making use of their voices, so that they were distinctly heard.

Excepting the few instances above mentioned, in which the existence of voices in lizards has been observed, I am not aware of any corroborative evidence preceding that discovery, a circumstance which is easily explained by the general taciturnity of the animal, which but rarely makes use of its voice.

On the other hand, the *Tapoya Douglasii*, a kind of lizard living near the Oregon Lake, when irritated, hisses very audibly. In like manner are the Iguanas reported to hiss and blow on being caught.

TH. EIMER,
Professor of Zoology in the University of Tübingen

Sea-shore Alluvion.—Langley Point

THIS spit of shingle, thrown up under the lee of Beachy Head and to the eastward of Eastbourne, is formed, like Dungeness, to windward of what was anciently a large tidal estuary forming Pemsey or Pevensey Haven. At the Roman period the mound on which stand the ruins of the castle, was washed by the sea. The windward supply of shingle forming this ness came from the beach at Brighthelmstone, a fortified town below the cliff, in Elizabeth's reign, on the site of the chain pier, gradually undermined by the sea, and not wholly destroyed until the end of the last and commencement of the present century, and the growing out of Langley Point is coincident in time with the destruction of the Brighton beach as its subsequent retreat and decline are coeval with the rapid increase of Dungeness to the leeward. In effect, Langley Point in 1736 projected three-quarters of a mile further into the sea than at present, and it is a curious fact that the breakwater proposed by the Harbour of Refuge Commission of 1840, parallel to, and one mile from the shore in Eastbourne Bay, opposite the "Wish Tower" site and the Grand Redoubt touched at the north-east end of its eastern *kant* the low-water line of 1736, as shown by the surveys of Desmaretz, the well-known ordnance surveyor of that period, but situate in three to four fathoms of water in 1840. This is a striking illustration of the amount of speculation respecting any increased area of anchorage to be obtained and maintained by artificial works in the vicinity of these shingle moles or inclosing recessions therein. In Desmaretz's time the bays west and east of this formation, viz. Eastbourne and Pevensey bays, like those now at Dungeness, must have afforded considerable shelter with three fathoms of water, now, however, reduced to one, and the area of shelter correspondingly curtailed.

Dummer's plan of 1698 shows that then the haven was open up to the castle, with the site of an old outfall about one mile west of the then entrance, which had been deflected eastward by the travelling shingle, and about this period, from its becoming constantly blocked up, the land-owners appear to have taken steps to render the drainage permanent by placing a sluice and trunk at the entrance, so that the haven has lapsed into a marsh sewer or drain.

A reference to well-known maps shows that this Ness must have advanced seaward up to a certain period, at the rate of ten yards per annum, when, however, the western supply became greatly diminished by the old Brighton beach being gradually used up, the subsequent diminution and retreat of this point afforded material for the continued increase of Dungeness to the leeward of it.

From 1724, downwards, the recession of the point has averaged over certain terms a rate of from seven to ten yards per annum, entailing the abandonment of several of the Martello Towers which fringe this portion of the coast, as well as the west fort at the Point, dismantled forty years back, also constant expenditure in heavier and deeper retaining walls in front of the fosse of the circular redoubt, at its western extremity, to check the repeated local encroachment of the sea.

It results from this continued recession of the shore that the works at the circular redoubt form an advanced point. In the early part of this century the shore in front of this work was much more seaward, and in front of particular Martello Towers in Eastbourne Bay it has retreated over certain terms of years at the rate of one yard per annum. This is shown by the known distance from the towers to high-water mark at the time of their construction. The waste since the erection of these towers has been mainly westward in Eastbourne Bay, accompanied by a certain local increase for a short distance to the eastward of the Point in Pevensey Bay, a similar result to that experienced at Dungeness.

From Dungeness to Langley Point, a stretch of thirty miles, except where intersected by harbour mouths, there is an uninterrupted belt of shingle. Over the last century an elongation of the east point (Dungeness) appears to have consumed the western surplus supply, as shown by the corresponding retreat of the western (Langley) point. The intermediate belt has with less fluctuation been driven more landward, showing that a littoral wasting away from wave action at one point is balanced by a corresponding increase at another.

The plan by Grenville Collins, 1693, shows Pemsey Haven clearly defined with two arms or branches, and a considerable entrance, but contains no notice of such a projection as Langley Point. The topographical survey by Yeakel and Gardner, 1778, a well-executed map to a scale of two inches to the mile, shows it stretching one and a quarter mile into the sea in a south-easterly direction. Of course the accuracy of the rates of progression and retrocession given above are based on a comparison of Desmaretz's surveys with those of recent date, and depend on the character of the former. The remarkable changes in the coast-line along Eastbourne Bay, its small depth, the little protection afforded by Beachy Head, and the eastward movement of Langley Point, are, as in the Dungeness case, arguments against artificial works in either of these bays.

J. B. REDMAN

6, Queen Anne's Gate, Westminster, S.W., April 29

Colour Perception

MR. HANNAY'S explanation of the colours observed in his dark rooms, seems quite in accordance with orthodox science. It is not the explanation I should myself offer, but as that would occupy too much space, and as I am conscious I should not carry the public with me, I refrain from entering on it.

What I do object to is the notion apparently entertained by Mr. Hannay, that his attempted explanation of this single phenomenon, explains also the experiments in the formation of colour I showed him. How can this explain the fact that I can show in the space of a few inches, from mixture of black and white alone, a dozen different colours side by side, mostly as clear and bright as if painted? And how does it explain the fact, that using the exact same proportion of black and white

and working at the same speed, the motion to the one hand will produce *red*, and when reversed, *blue?* Mr. Hannay also seems to imply that the colours of my experiments to be seen well, should be looked at passively or without keen attention. On the contrary, the more light thrown on them, and the keener, fresher, and younger the eyes of the observer, the more brilliant are the colours, and if a boy of ten or twelve years old, who never saw anything of the sort before, be called in, he will describe them better than grown people.

Scientific men have hitherto considered it a sufficient explanation of these experiments to say the effects are "physiological," as if colour were ever anything else. Newton says, speaking of *coloured rays*, that he uses the term merely to suit the understanding of the vulgar, as they are nothing but a certain power and disposition to stir up a sensation of this or that colour. Prof. Ogden Rood again classes these as *subjective* colours, a word which, if it has any meaning at all beyond a very limited one, can have none with reference to colours which remain permanent so long as the machine is in motion.

27, York Place, Manchester, April 22 NAPIER SMITH

How may Clouds consisting of Liquid or of Frozen Water be Distinguished?

IN NATURE, vol. xxv. p. 529, M. de Fonvielle asks my opinion as to what observations may be made in a balloon to discover whether in a cloud whose temperature is below zero the minute particles of water are liquid or solid.

There may be difficulties in the way of deciding by direct observation of the form of the particles, whether they are globules or crystals. But since H. B. de Saussure, a century ago ("Essai sur l'Hygrométrie), by means of a single lens, could distinguish in the air over heated water, globules of condensed water of different size, greater ones which appeared to him full, and smaller ones which he regarded as hollow; and when in more recent times A. Waller (*Philosoph. Transactions*, 1847) could make his "microscopic observations on the so-called vesicular vapour of water as existing in the vapours of steam and in clouds, &c.," with the result that he denied the existence of mist-vesicles, it seems possible that by means of a magnifying instrument the form of the particles suspended in the air can be recognised.

A sure evidence, but obtainable only under favourable circumstances, that the particles forming a cloud are ice-crystals would be the observation of the halos of 22° and 46° radius and of parahelions as produced by the cloud. HERMANN KOPP

Heidelberg, May 3

On the Conservation of Solar Energy

Dr. SIEMENS's theory of the constitution of the sun implies that there is an absorption of solar rays constantly going on in space. If this is so, space cannot be perfectly transparent.

An astronomer of the early part of the present century—I think it was Olbers—came to the same conclusion, though from different reasons. He found that as the space-penetrating powers of the telescope is increased, the number of stars that become visible does not increase so rapidly as it would if they were evenly scattered through space, and if space were perfectly transparent; and he concluded that most probably space is not perfectly transparent. This, however, is by no means conclusive, because it is possible that the reason why the number of stars that become visible does not increase as it ought to do on the supposition, is that the number of stars in the universe is limited.

JOSEPH JOHN MURPHY

Old Forge Dunmurry, co. Antrim, May 3

CYCLONES[1]

II.

IN our former article we dwelt on the deductions arrived at by the author from a consideration of the mechanical theory of cyclones. We will now proceed to examine how far such theoretical relations are corroborated by the results of observation. The results of observation utilised by the author comprise those of the Rev. W. Clement Ley, published in his "Laws of the Winds"; those of Prof. Loomis, deduced from a study of the U.S. Signal Service charts; those of Dr. Hildebrandsson, with regard to the upper currents from an examination of the Danish synoptic charts; those of Capt. Toynbee, from a study of the Atlantic storms; and lastly, some contained in a recent work on the hurricanes of the Antilles, by Padre Viñes of Habana. Mr. Ferrel at the outset pointedly remarks that for a mariner to be able to make use of the laws deduced from a study of the theory of cyclones, not only a knowledge of such laws is requisite, "but likewise of the *normal* states of the wind and of the barometric pressure in all parts of the ocean and at all seasons of the year, unaffected by the abnormal disturbances of these progressive cyclones; since with a knowledge of the normal conditions of the winds and of the barometric pressure at any time and place he can perceive the first indications of the abnormal disturbances which are the forerunners of these storms, and so can be on his guard, and then with a knowledge of these storms or cyclones, he can generally avoid at least their most dangerous part."

With regard to the first result from theory, viz. the general incurvature of the winds in a cyclone, which was formerly altogether denied by the cyclonists—so-called—Reid and Piddington (not Redfield), or inordinately magnified in every case by Espy, and other upholders of the radial theory, there seems to be no doubt from the results of observation here given, as well as from others not cited by the author, that the wind deviates to a considerable extent from the tangent to the isobars inwards towards the low centre. Moreover, in accordance with theory, this inclination is greater at inland stations where there is more surface friction than at or near the sea when it is less. Thus Ley found the inclination to be about 29° for inland stations, but only 13° for those on the coast. This difference between the inclination at sea and on land may perhaps account for the tenacity with which sea captains still cling to the notion that the wind blows in circles coincident with the isobars; since it is precisely at sea where the incurvature should theoretically be least. The increase in the inclination corresponding to a decrease in the latitude is likewise borne out by observation. Thus from Ley's observations, which embrace North and South Europe, the mean inclination to the isobar is about 25°, from those of Capt. Toynbee on latitude 50° it is 29°, from those of Loomis nearer the equator in America 47°,[1] from those of Padre Viñes in the Antilles 45°, and we may add from some in the Bay of Bengal, mentioned by Blanford, about 42°.

It is thus pretty evident, as the author remarks, that "though the horn-cards of Piddington based on the strictly circular theory of the winds may still be used at sea in high latitudes without great error, yet nearer the equator they must become more erroneous, and entirely fail at the equator if cyclones could exist there." Mr. Meldrum, of Mauritius, as far back as 1867 drew attention to the disasters which resulted in consequence of vessels having estimated the direction of the centres of cyclones according to the rules of the circular theory, and since the publication by M. Faye of his "Défense de la loi de tempêtes," has strenuously opposed the resuscitation of this exploded doctrine. He has also lately given an admirable proof of the truth of the incurvature, by publicly announcing when the wind, in a cyclone on March 21, 1878, was from the north-east in Mauritius, that the centre of the storm was not to the north-westward according to the circular theory, but to the west-south-westward, which was afterwards found to have been the case.

It is a manifest duty therefore which mankind owes itself, if the dangers of the sea are to be minimised, that the amount of inclination of the wind to the isobar should be determined by observation in different seas and for

[1] "Methods and Results of Meteorological Researches for the use of the Coast Pilot." Part II.—On Cyclones, Waterspouts, and Tornadoes. By William Ferrel. (Washington, 1880.) Continued from p. 12.

[1] Some of these included very gentle winds.

different latitudes, in order that the navigator may be able to modify his rules accordingly, and so avoid such a fatal error as that of running gradually into the centre of a storm, which a rigid adherence to Piddington's rules would be certain to entail.

So far we have not considered what effect is produced on the inclination by the progressive motion of a cyclone. Were a cyclone regular in form and stationary, the inclination should obviously be the same at every point on the surrounding isobars. When, as is generally the case, it has a progressive motion, this—on the supposition that it is mainly due to the general motions of the atmosphere—should, by a simple application of the parallelogram of velocities, alter not only the velocity but the direction of the inflowing winds, increasing their inclination in the rear, and diminishing it in the front part of the cyclone.

This conclusion tallies remarkably well with the observations of Padre Viñes in the Antilles, where the cyclones travel westwards, as well as with those of Prof. Loomis in North America, where they travel towards the east. When we come to Europe, however, a remarkable exception to this rule occurs, since here the inclination is much *greater* on the east or front side (especially south-east) of a cyclone than on the west or rear side.[1] The author attempts an explanation of this fact on p. 40, but a better one both of this and of the equally enormous though opposite difference found by Loomis between the inclination in the rear and front parts of cyclones in the United States, which can hardly be altogether due to the admittedly small velocity of the general motion of the air over America from west to east is given by Lieut. Spindler, of the Russian Navy, in a recent number of the *Repertorium*,[2] where he considers it to be mostly due to the friction encountered by the wind on the Continental side of cyclones, increasing the inclination in the west and therefore rear part of the American cyclones, and that in the east or front part of the European cyclones.

If the general truth of the difference between the inclination in the front and rear of cyclones at sea, due to their progressive motion, be admitted, the case of the poor navigator becomes still more complicated, as in addition to considering latitude, distance from the centre, and velocity of the wind, he must likewise consider in what quadrant of the cyclone he is situated, since the direction of the vortex with reference to that of the wind, is so different in different quadrants. Fortunately it is just in front of a cyclone—the most dangerous position for a ship to be in—where the old circular rules are least at fault, since it is precisely here where theoretically the inclination should be least.

With respect to upper currents, the results derived from theory are remarkably confirmed by those from observation. In general, since the air flows in towards the centre below, it must flow out from it above, and also somewhat across the current which flows below, so that if we stand facing the wind at the earth's surface, and at no very great distance from the low centre, the upper current should almost invariably flow from some point to our right. This agrees with observation, since, according to Clement Ley, the average direction of the upper currents is 44° to the right of the direction from which the surface-winds blow. The general conclusion arrived at by Mr. Ley regarding upper currents, that they "manifest a centrifugal tendency over areas of low pressure, and a centripetal over those of high," is identical with that arrived at by Dr. Hildebrandsson, and with the author's theory as far as it applies to ordinary, or as he calls them, warm-centred cyclones.

Cold-centred cyclones, to which we alluded in our previous article, do not seem to have been identified by the author except in a stationary form surrounding either pole. The observations of the upper currents hitherto made indeed argue powerfully against their existence at all in the progressive form, since in their case the upper currents should flow in towards the low centre, accompanied by a gentle outflow below, a state of things diametrically opposed to all present experience in connection with a central area of low barometer.

The author next discusses the effect of the general progressive motion of the atmosphere on the upper currents, which is similar to that on the lower currents, but larger in consequence of its increase with the altitude.[1] In winter when the progressive motion is theoretically larger than in summer (Part I.), the upper currents in our region should in nearly all cases move from some westerly point, acquiring their greatest velocity on the south side of the low centre. In summer the directions should be more variable, and the wind's velocity less. Observation verifies both these conclusions; thus Clement Ley found the greatest velocities of the upper currents, such as 120 miles an hour, to occur generally in the winter, when the cyclone centre was to the north or north-east, and it was travelling eastwards. On the other hand the cases in which the upper clouds were found to be stationary most commonly occurred in summer, and near the centre of areas of high pressure. These facts, both as regards the strength and direction of the upper currents, are confirmed by Prof. Loomis's observations of the winds on Mount Washington. The author then proceeds to show how the upper currents may be employed to indicate through the medium of their visible accompaniments—the cirrus clouds—the approach and direction of a distant cyclone; a point most valuable to the seaman, who cannot command a daily weather chart. He says: "The almost universal precursor of a distant storm is the appearance of more cirrus-clouds than usual, not only differing from those of the general currents in form, but also in the *direction* of the currents indicated by those clouds."

In low latitudes, where according to theory the upper and lower currents are more nearly radial to and from the centre respectively, the direction from which these clouds come, especially while the storm is still at some considerable distance, is found to indicate very nearly the direction of its vortex. In higher latitudes matters are more complicated, since the currents are more tangential, the upper currents flowing anticyclonically at great distances from the centre, but even here, the observer will not, as a rule, be far wrong according to the author's diagrams, and those of Clement Ley, if he places the centre of the approaching storm a little to the right of the direction from which the cirrus advances.

Regarding the existence of an anti-cyclone in connection with every cyclone, and the broad annulus of high barometer with its maximum at the dividing limit between them, the author finds ample confirmatory evidence; though from the fact that the depression at the centre is more marked than the rise of pressure near the border of the cyclone, the latter is often so masked by other irregularities as not to be readily discernible on a synoptic chart. In our own islands, where we frequently encounter a string of small cyclones travelling over us from the Atlantic, the barometer rises briskly after the passage of each low centre only to warn us of the approach of its successor, from whence no doubt arose the old maxim, "Quick rise after low foretells stronger blow." The author mentions that the approach of the hurricane of September, 1875, was indicated at Havana by a sudden rise of the barometer,

[1] In the north-west quadrant the inclination according to Ley is only 9°, while in the south-east quadrant it is 35°.

[2] Ueber die Abhängigkeit der Stärke und Richtung des Windes von der Grösse und Richtung des Gradienten an den Küsten des Baltischen Meeres. "Rep. für Met., tom. vii. No 5. St. Petersburg. 1880.

[1] This increase in the velocity of the general atmospheric drift with the altitude is shown in Part I. p. 45, to result from the relations between the velocity of the wind and the observed barometric pressures and temperatures in different parts of the world. For the latitude of the British Isles the eastward component of velocity at the elevation of five miles—the height of the cirrus-clouds—is estimated to average about sixty-three miles per hour in January, twenty-nine miles per hour in July, and throughout the year about fifty miles per hour. At the surface, the mean velocity is calculated to be four miles per hour in January, and two and a half miles in July.

while the cyclone was yet at the Windward Islands, about 1200 miles distant.

A sudden and abnormal rise of the barometer thus constitutes as important a warning to a navigator as a similar fall, or a band of cirrus-cloud, only to be able to make effective use of this danger-signal he ought accurately to know the normal height of the barometer where he is, and at the time of year. The author shows how this may be done in Part I., where he has constructed charts, based on a large series of observations in the northern hemisphere, showing not only the curves of mean annual pressure, but also those which represent the coefficient of annual inequality. From a simple equation involving these two elements, the normal pressure at any time and place can be approximately reckoned, and hence the amount of abnormality determined.

The author next applies the cyclone theory in explanation of the various inequalities of barometric pressure, which are observed on the same latitude in different longitudes. These inequalities he considers to be mainly dependent on the deviations of the mean temperature (annual or monthly) from the mean of all longitudes, which he gives in a tabular form for every fifth degree of latitude and every tenth degree of longitude in the northern hemisphere, by means of interpolation from the observations discussed in Part I. From these tables it appears that in addition to, and superimposed upon, the general system of two polar cyclones due to the normal differences of temperature between the Equator and the Poles, we have throughout the year, and more especially in the winter, the conditions for the existence of a large fixed warm-centred cyclone in the North Atlantic, with its centre near Iceland. The barometric pressure should consequently be lower here than the mean of the latitude taken round the globe. That this is the case is well-known, and also that the prevalence of south-west winds in these islands is due to our generally lying on the south-east edge of this nearly perpetual cyclone. A similar cyclone similarly produced lies in the North Pacific.

Two corresponding regions of abnormally low temperature lie one on the east side of Asia, and the other on the east side of America, which, according to the author's theory, should give rise to cyclones with cold centres. As a matter of fact, however, these conditions are found to be completely reversed; the pressure being above the average, especially in winter, when the temperature-gradients are steeper, and therefore, according to the author's views, the cyclonic conditions should be more developed; while the motion of the air at the surface is anticyclonic, and outwards from the region of greatest relative cold.

The least satisfactory part of the author's work is that which relates to these cyclones with cold centres. Their non-existence in the progressive form is admitted, and where they should occur according to theory in a stationary form, they are notably absent, except in the two circumpolar cyclones. It is possible, however, that they may be identified, though in a modified form, and lacking the central barometric depression *at the earth's surface*, with what are termed "winter anticyclones," which usually coincide with areas of great cold, and which, while they exhibit at the earth's surface an anticyclonic outflow of air, are fed above a certain level by a cyclonic inflow.

Finally, as regards rainfall, which is an almost unfailing accompaniment of cyclones, the author, while admitting its assistance in helping to maintain a cyclone when once started, by the forces which operate whenever vapour is condensed, is strongly opposed to its being a *primary* source of energy, and cites in favour of this notion the following conclusion, arrived at by Prof. Loomis, after a careful study of the U.S. Signal Service charts. "Rainfall is not essential to the formation of areas of low barometer, and is not the principal cause of their formation or of their progressive motion."

The last chapter of the author's work which relates to tornadoes, waterspouts, and hailstorms, has already been referred to in a special article in NATURE, and it only remains for us to observe in connection therewith, that while tornadoes differ specifically in many respects from cyclones, the condition of the atmosphere in the latter is eminently favourable to their production. To this circumstance, according to Ferrel, may be attributed the occurrence of sudden blasts of tornado violence in the middle of cyclones, accompanied by a rapid oscillation of the wind-vane. It is these sudden gusts which do the main damage in such cases, since, as might be expected, the velocity of the wind increases *per saltum* where the gyrations of the tornado and the cyclone coincide in direction. They are found to occur more on the cold or clearing-up side of a cyclone, which Ferrel explains to be due to the cold upper strata overlapping the warmer central part of the storm, and thus promoting a condition of vertical instability of equilibrium in which tornadoes are generated with facility. Viewing the work as a whole, Mr. Ferrel may be congratulated on having presented to the world a memoir of such luminous research as well as practical utility. When we compare it with the numerous other crude treatises and hypotheses evolved during the past half-century on the same subject, which have not only brought the science of meteorology into ridicule, but encumbered our libraries, we feel a deep sense of relief at finding the question dealt with by a mathematician of more than ordinary ability, and one who does not shrink from tackling the real difficulties of the subject. He has for some time been known by his writings on hydrodynamical questions of great importance, especially those applying to the general motions of the atmosphere. The present work will go far towards placing him in the very front rank of physical and theoretical meteorologists. The deductive method has been fairly applied throughout to the equations of motion, and its success will do much towards counteracting the too prevalent tendency at the present time to induct from every solitary phenomenon, or experiment, to some otherwise baseless hypothesis. If the author has not accounted for all the peculiarities of cyclones, he has at least shown that the views entertained by the leading meteorologists regarding their formation, characteristics, and general movements accord with their mechanical theory, and that the sources of energy ordinarily assumed to act, such as heat, gravitation, and terrestrial rotation, are sufficient, without having recourse to any wild hypothesis founded on some unknown function of electricity. The valuable practical hints and suggested modifications of existing rules will do much to avert disasters at sea, the main purpose, doubtless, for which the work was designed, while its thoroughness and comprehensive character will materially help to advance our knowledge of a meteor, which in one form or another comprises almost every condition of the atmosphere included under the term "weather." E. DOUGLAS ARCHIBALD

ON PHOTOGRAPHS OF THE SPECTRA OF THE NEBULA IN ORION[1]

FOR about eighteen months I have been giving attention to the nebula in Orion with two objects in view, first to ascertain whether any changes are taking place in that body by making a series of photographs to be compared in the future with a similar series; and second, to photograph the spectrum of the nebula in various parts so as to see whether any new lines could be found, and also whether the composition is uniform throughout.

As to the first of these objects I have recently suc-

[1] Read before the National Academy of Sciences, April, 1882, at Washington, U.S., by Henry Draper, M.D. Communicated by the author.

ceeded in taking a very fine and extensive photograph of the nebula containing most of the delicate outlying parts which were not in my earlier photographs. This is in the hands of the photolithographer now and will shortly be published. The experiments have been very difficult because an exposure of more than two hours in the telescope has been necessary, and an exceedingly minute motion of the stars relative to the sensitive plate will become apparent on account of the high magnifying power (180) employed.

In carrying out the second object two contrivances have been used; first, a direct-vision prism in the cone of rays from the objective before they had reached a focus, and second the two-prism spectroscope with which I have taken photographs of stellar spectra for some years past.

During the month of March I have made two good photographs with each of these arrangements. Those with the direct-vision prism, without a slit, have of course demanded that the image should be kept stationary on the sensitive plate throughout the exposure, viz. two hours, and they are as difficult to get as good photographs of the nebula itself. On the contrary, those obtained with the slit spectroscope do not require the same steadfast attention.

The results derived from these photographs are interesting partly from what they show and partly from what they promise in the future. A number of photographs, under various conditions, will be needed for the full elucidation of the subject.

The most striking feature is perhaps the discovery of two condensed portions of the nebula just preceding the trapezium, which give a continuous spectrum. At those places there is either gas under great pressure or liquid or solid. I have not been able to detect any stars of sufficient magnitude in these portions to produce this effect either in my photographs of the nebula or in any of the well-known drawings of this object. It seems to me also that the photographs show evidence of continuous spectrum in other parts of the nebula. In these respects the conclusions arrived at by Lord Rosse in his memoir (*Phil Trans.* Royal Society, June 20, 1867, p. 70) are to a certain extent borne out.

The hydrogen line near G, wave-length 4340, is strong and sharply defined; that at *h*, wave-length 4101, is more delicate, and there are faint traces of other lines in the violet. Among these lines there is one point of difference, especially well shown in a photograph where the slit was placed in a north and south direction across the trapezium; the Hγ line, λ 4340, is of the same length as the slit, and where it intersects the spectrum of the trapezium stars, a duplication of effect is visible. If this is not due to flickering motion in the atmosphere, it would indicate that hydrogen gas was present even between the eye and the trapezium. I think the same is true of the Hδ line, λ 4101. But in the case of two other faint lines in this vicinity, I think the lines are not of the length of the slit, one being quite short and the other discontinuous. If this observation should be confirmed by future photographs of greater strength, it might point to a non-homogeneous constitution of the nebula, though differences of intrinsic brightness would require to be eliminated.

The April number of the *American Journal of Science* contains an account of a photograph of the spectrum of this nebula taken by Dr. Huggins. I have not found the line at λ 3730, of which he speaks, though I have other lines which he does not appear to have photographed. This may be due to the fact that he had placed his slit on a different region of the nebula, or to his employment of a reflector and Iceland spar prism, or to the use of a different sensitive preparation. Nevertheless, my reference spectrum extends beyond the region in question.

As illustraring the delicacy of working required in this research, it may be mentioned that in one of these photographs the spectrum of a star of the tenth magnitude is easily discerned. It is only a short time since it was considered a feat to get the image of a ninth magnitude star, and now the light of a star of one magnitude less may be photographed, even when dispersed into a spectrum.

EPPING FOREST

ON Saturday last, May 6, the Queen declared free to the public the 5600 acres of open land to the north-east of London, known as Epping Forest. The history of the rescue of this magnificent tract, so long the favourite resort of London naturalists, has been told many times since the Corporation of London took up the question, and by their well-directed efforts not only checked the encroachment of rapacious land-owners, but restored to the people about 1000 acres of forest land that had been illegally inclosed. The total cost of this philanthropic movement may be estimated at nearly half a million of money, and the Corporation has deservedly earned the gratitude of all Londoners, and more especially of those lovers of nature who have for long been in the habit of regarding the Forest as a preserve from which they could obtain materials for their studies. It is a common complaint with our natural history students, that the open spaces around London are gradually being destroyed as the pressure of population necessitates increase of buildings in the suburbs, so that the preservation of this large area is really a matter of considerable scientific importance, and as such will be regarded with satisfaction by the readers of NATURE. Fortunately for naturalists, the Act of Parliament declares that the woodland tract under consideration shall be kept as far as possible "in its natural aspect." There has thus been secured to the public at large, and to the metropolitan field naturalists, a recreation-ground of a quite peculiar character, and one which will be looked upon as a great boon by botanists, zoologists, and microscopists.

The value of Epping Forest, from our point of view, lies chiefly in its wildness; by far the greater portion is primitive woodland, which has been but little interfered with by man in comparison with the heaths and commons to the north, west, and south of London. Such an expanse requires little in the way of "improvement." The Conservators have acquired a power of dealing with one of the few surviving remnants of primæval Britain, and in the interests of that continually increasing class of the public who devote themselves to the various branches of out-door natural history, it is to be hoped that this authority will be exerted judiciously. We are disposed to believe that the requirements of the ordinary holiday-maker and of the field naturalist are in this case identical. To be able to roam through many miles of wild forest is as truly a pleasure and novelty to the former as it is a necessity to the latter. From whichever side we view the question of the conservation of the forest, any attempts to destroy its natural features cannot but be deprecated, and in view of the fate of so many of the open spaces round London, this position cannot be too strongly emphasised by those to whom the preservation of our rapidly-disappearing natural history resorts is a matter of importance.

The problem of managing a tract of country which consists of a large proportion of primitive forest and a smaller proportion of land formerly under cultivation, so as to comply with the conditions of the Act and with the requirements of all classes of the public, is not so difficult as might appear at first sight. It is not as though the interests of field-naturalists in any way clashed with those of the general public. We have here a wide expanse *pro delectatione populi*, which is to be distinguished and to be kept distinct from all other public spaces in the vicinity of the metropolis by virtue of its forestal wildness,

and in order to maintain it in its "natural" condition it would have been better if the Conservators had taken counsel with some of the numerous scientific societies of London which are representative of the various classes of natural history students and investigators. This is indeed the only point—but it is a serious one—on which we feel compelled to express our disappointment at the line of management taken up by the Conservators. The Epping Forest Committee consists of twelve members of the Corporation and four Verderers chosen septennially by the commoners of the Forest parishes. Now a Committee appointed to deal with a scientific question—and as such we regard the management of a forest—cannot altogether ignore the claims of natural history without incurring the risk of having their proceedings compared with the tragedy of Hamlet with the Prince of Denmark left out. The present Verderers are Sir T. Fowell Buxton, Mr. E. N. Buxton, the Chairman of the London School Board, Mr. Andrew Johnston, late High Sheriff of Essex, and Mr. D. J. Morgan. The names of these gentlemen encourage us to think that it is no fault of theirs if the claims of natural history science are altogether ignored.

How to deal with those waste stretches of land formerly under cultivation is a question quite distinct from the management of the wooded portions of the forest. While for the latter a minimum of interference would in our opinion be most in accordance with the views of all parties, there are ample opportunities of "landscape gardening" the former. In face of this fact it is somewhat surprising that the energies of the Conservators should thus far have been chiefly directed to alterations in the *natural* portions of the area under their charge, and we are glad to see that the Essex Naturalist's Field Club has taken the initiative in inviting the co-operation of all natural history students interested in the preservation of open spaces in their natural condition, in signing a protest against the destruction of the natural features of Epping Forest. The form of petition has been forwarded to all the scientific societies of London most concerned in this question, and has already received many influential signatures. If the dedication ceremony of last Saturday makes the freeing of the Forest an event in the history of this country, it seems but just that in a period pre-eminently distinguished for its scientific culture, the naturalists of London should urge their claims ere it be too late. R. M.

THE WINTER OF 1881-2

THE fine winter months of 1881-2, from November to March, have been characterised by a mildness rarely equalled in our British climate. Nowhere in the British Islands, from Scilly to Shetland, or from Dover to Valentia, was the mean excess above the normals of the temperature of these five months less than 2°·0. This was the excess in the south of England; in central districts, such as Oxford and York, it rose to 3°·0; and the excess increased on advancing northward till it reached 4°·0 in the upper districts of the Tweed, Clyde, Tay, and Dee, and at Culloden, and Lairg. Everywhere on the coasts the temperature was from half a degree to a degree, relatively lower than in strictly inland situations.

In Scotland the mean temperature of each of the months exceeded its normal, except in a very few localities in December, when temperature was slightly under the average. Each of the other months had a temperature from 2°·5 to 6°·0 above the normal. In England, on the other hand, the temperature of January was pretty generally under the average, the deficiency amounting in some cases, as at Spurnhead, to nearly 2°·0; and in the central districts of Ireland the deficiency was even greater. In February, in a few districts of England, temperature fell slightly below the normal, whereas, over large districts of Scotland, in the same month, it rose to at least 5°·0 above the normal.

As regards atmospheric pressure, its geographical distribution during these months was strikingly abnormal. In each month, as regards departures from the normals, there was an excess in the south, whereas in the north there was a deficiency, or if there was an excess at all, it was much less than in the south. The averages of the five months give an excess above the normal of 0·188 inch at Torquay, and 0·171 inch at Greenwich; 0·116 inch at Llandudno; 0·063 inch at Lissan, Tyrone, and 0·088 inch at Silloth; 0·023 inch at Islay, and 0·061 inch in East Lothian; 0·011 inch at Monach, Outer Hebrides, and 0·045 inch at Aberdeen; but a deficiency from the normal of 0·019 inch at Kirkwall, 0·048 inch at North Unst, and 0·103 inch in Farö. It was to this unprecedentedly steep barometric gradient from south-east to north-west from the normals of these winter months, and the equally unprecedented predominance and force of south-westerly winds which resulted therefrom, that we owe the remarkable mildness of last winter. The extraordinarily high pressures which so frequently ruled on the Continent during the winter, and the all but rainless weather which accompanied these anti cyclones, and the low state of many of the rivers on the one hand, and on the other the almost unbroken succession of storms which swept the Atlantic with their low pressures and destructive tempests of wind, may be pointed to as the outstanding features of the great atmospheric disturbance which has signalised the winter of 1881-82, of which the mildness of the weather in the British islands was merely an accompaniment.

If the winters of the north-east of Scotland, from which there are temperature observations since 1764, be examined, it is seen that the mean temperature of the five months from November to March have been 2°·0, or more, above the normal during eighteen winters. These winters, with the amounts of the excess above the normal, are given in the following table, to which is added the excess or deficiency from the normals of each of the six summer months immediately following:—

Winters.	Excess above the normal.	April.	May.	June.	July.	Aug.	Sept.	Mean of six months.
	°	°	°	°	°	°	°	°
1772-73	+2·0	+1·2	−1·4	−0·7	−1·5	+1·4	−1·2	−0·4
1777-78	+2·0	−0·2	+3·8	+4·4	+3·6	+1·8	−1·2	+2·0
1778-79	+5·2	+2·9	+1·7	+3·4	+7·4	+6·8	+3·5	+4·3
1780-81	+2·0	+3·5	+2 6	+5·1	+1·4	+0·0	−1·1	+1·9
1789-90	+4·2	−2 0	+1·2	−1·2	−3·3	0·2	−3·3	−1·5
1793-94	+3·6	+4·2	−0·7	+2·6	+3·6	8	+0·5	+1 6
1795-96	+2·3	+7·9	−0·9	−1·3	−3·5	+0·5	−0·2	+0·4
1827-28	+2·7	+0·6	+1·5	+1 8	−0·5	0·2	+1·7	+0·8
1831-32	+2·5	+1·2	−1·0	+0·8	−0·4	+0·2	+1·3	+0·4
1833-34	+3·2	+0·5	+2·6	+1·8	+1.2	+1·2	+1·2	+1·4
1834-35	+2·4	+0·0	−0·7	−0·8	−0·5	+1·9	−0·6	−0·1
1843-44	+3·8	+5·1	−0·9	−0·0	−1·2	1·6	+0·4	+0·3
1845-46	+4·1	+0·1	+3·5	+6·5	+1·3	+2·7	+6·5	+3·4
1848-49	+2·3	−1·9	+1·3	−2·2	−1·3	0·2	−0·4	−0·8
1850-51	+2·1	−1·4	+0·2	−0·9	−1·3	0·7	−0·4	−0·7
1857-58	+2·8	+0·1	−0·3	+4·4	−2·8	+1·2	+0 8	+0·6
1868-69	+2·2	+2·5	−4·5	−2·0	+1·7	0 9	+0·5	−0·5
1881-82	+4·1							
Means ...	+3·0	+1·4	+0·5	+1·3	+0·2	+0 8	+0·5	+0 8

Thus, so far as the north-east of Scotland is concerned,

the mildness of the winter of 1881-82 has only been twice exceeded, viz. in 1789-90, when it was 4°·2, or 0°·1 more, and in 1778-79, when it was 5°·2, or 1°·1 more. The winter of 1845-46 showed the same excess as last winter.

We also gather from the table that these winters, which gave a mean excess of 3°·0, were immediately followed by summers warmer than usual, the mean six months' excess being about a degree (0°·8). Indeed, of the whole seventeen summers, only one, viz. the summer of 1790, can be considered as showing a deficiency of temperature sufficiently great and prolonged to be regarded as attended with serious consequences to agriculture. The table is a striking general confirmation of the prognostic long and widely entertained that a mild winter is the precursor of a fine warm summer.

SEVRES PORCELAIN AND SCIENCE

THAT the French should know better than any other nation how to enlist art in the service of science is just what might be expected. Such a service on the part of art to science is only a fair return for the immense resources which scientific research has been able to place at the disposal of art. Nowhere have the discoveries of science been more useful or more utilised than at the celebrated porcelain manufactory of Sèvres, and the illustrations which we give to day will afford some idea of the beautiful results which are thus produced. As a permanent record of successful scientific efforts, nothing could be more satisfactory and appropriate. In Fig. 1 the characteristic features of the Arctic regions are rendered with almost perfect success and truthfulness; while the allegorical representation in Fig. 2, in commemoration of the last transit of Venus, is happy in conception, and charming in effect. Of the artistic merits of the two vases our readers can judge for themselves. It may be interesting to give some idea of the difficulties attending the manufacture of such delicate productions, which we are able to do, from a lecture by M. Ch. Lauth, Administrator of the Sèvres manufactory, published in *La Nature*, to which journal also we are indebted for our illustrations.

Fig. 1 represents a vase which has been presented to King Oscar of Sweden, and is one-eighth of the original size. The splendid vase represented in Fig. 2 is still only in course of execution, and when complete will be placed in the Mazarin Gallery of the French National Library; it will be ten times the size of the illustration. M. Lauth thinks the national institution at Sèvres should be organised more as a school for the training of workers in the delicate art, than as a mere manufactory. The art of fixing colours on pottery, M. Lauth tells us, differs essentially from that which deals with the colouring of any other medium. There is required in the materials perfect adhesion, absolute resistance to atmospheric influences, and a brilliancy which will make the colours seem part of the object itself. As the colours must be subjected to a very high temperature, there must be eliminated from the palette of the ceramic artist all organic colouring matter, and all the unstable mineral colours; he must have recourse to oxides, metallic silicates, or to metals. And the fixation of these colours is always the result of a chemical action, of a combination which takes place at a high temperature between the body of the porcelain and the matters used in its decoration. Many different methods are used for the purpose, but they are divided into two great classes—decoration at great heat, and the decoration by muffle, an oven of a special kind.

The former consists in applying to the porcelain, colouring substances, which are fixed and developed at the same temperature as that at which the porcelain is baked; this is how the most valued results are attained; as the enamel covers the colour, it assumes an extreme brilliancy and depth—it becomes part and parcel of the object itself. This is how the magnificent blue of Sèvres is obtained, as well as certain browns and blacks, and a few other combinations. The colours may be either mixed on the paste, or put upon the object when moulded, before enamelling, or mixed on the object itself when complete; they may be also applied to porcelain already baked, which may be again baked at the higher tempera-

FIG. 1.—Sèvres Vase, commemorative of the North-East Voyage of Baron Nordenskjöld (¼).

ture. This is notably the process employed at Sèvres for their blues. One of the most brilliant varieties of decoration at high temperature consists in what is called the process of *pâtes d'application*. This method consists in painting by the brush on porcelain unbaked or heated; by successive and carefully adjusted applications, a very great thickness is attained, by sculpturing which the artist can give the decoration a re-

FIG. 2.—Vase, commemorative of the Transit of Venus in 1874, by M. Joseph Chéret ($\frac{1}{10}$).

markable finish and value. The object is then heated, enamelled, and baked.

It is different with the decoration accomplished by means of a muffle oven; in this method the painting is always made on baked porcelain, and consequently on enamel, and the heat employed is relatively low. In this process there is necessary, in order to make the colours on the metals adhere, a medium, which is called the *fondant;* it is generally a silicate, or silico-borate of lead. By raising the temperature, these bodies are fused, attack the object, combine with it, and at the same time determine by that reaction the adhesion of the colour. According to the nature of the *fondants* and colours, a greater or less heat may be applied; and as certain colours are more sensitive than others, it is frequently necessary to bake at successive fires of different temperatures. The baking of colours by this process requires very great experience; the absence of any instruments of precision is greatly felt, and there is no other means of ascertaining the temperature that prevails in the muffle, than to observe on samples of porcelain the changes of colour which are undergone by certain preparations very sensitive to differences of temperatures.

PHYLLOXERA

DR. MARION has recently published (Dupont, Paris, 1882) a *résumé* of the results attending the efforts of the Paris, Lyons, and Mediterranean Railway Company to stay the ravages of phylloxera. These efforts were inaugurated in 1876 at a time when the wine growers of Hérault were on the point of relinquishing the struggle. Dumas having demonstrated the great value of alkaline sulphocarbonates as insecticides, this company energetically planned and organised its distribution, with such success that in the period between 1877 and 1881 the number of barrels distributed through their agency rose from 1085 to 14149. The sulphocarbonate is injected twice a year in doses of 12 grammes into holes half a metre apart, being either administered in simple doses or double doses, with an interval of three or four days. The doses vary, however somewhat, according to the nature of the soil and condition of the vines, and much is therefore left to the intelligence of the operator. The remedy acts imperfectly in clayey or stiff soils, and when the ground is saturated.

The first injury manifested when vines are attacked is the loss of their finer radicles, which perish through the suction of the aphid. The consequent loss of nutrition next causes the partial death of old wood and feebleness in the young shoots, followed by a gradual diminution in the fruit. If badly attacked, old vines cannot be saved, as much of the woody stem is dead beyond recovery, but young vines almost always recover under the sulphocarbon treatment, when applied under favourable conditions; new radicles appear, then an increasing luxuriance in the foliary organs, and finally the renewed production of fruit. Dr. Marion strongly advocates the use of this remedy, and sustains his arguments by well selected examples which thoroughly demonstrate its efficacy. It is capable of a wide application, the prices realised for wines in most districts being well able to support its cost.

Other remedies found practicable, but not discussed in Dr. Marion's work, are submersion, and replacement by American stock, with or without grafting. The former can only be practised in comparatively flat or low-lying vineyards in proximity to rivers or canals. These are surrounded by strong embankments of from one to one and a half metres high; and the waters are either let in by mere difference of level at flood times or by centrifugal pumps. The water must not be less than 40 to 50 centimetres in depth, and remain forty to fifty days, and the process is repeated each year. Some waters help to fertilise the soil, and this treatment has invariably produced the best results.

The introduction of American vines has also in certain districts been attended with great success, both in clayey soils, and where the smallness of the vintage per acre precludes the sustained use of costly remedies. The species, however, possess most varying powers of resistance in different soils, and require to be selected with great care. In the vineyards of Medoc, and of high-class vines generally, American stocks are only used for grafting, a clever workman being able to operate on 100 to 200 vines per diem, 70 to 90 per cent. of which will be successful.

Among partly successful remedies may be mentioned the system *Garros*. This consists in uncovering the roots of the vines as far as possible, and treating them with a litre of powdered quicklime, sulphate of copper, and sea-salt. The remedy has been found efficacious, but seems to act, not fatally, on the insects, but in diminishing their number and stimulating the plants to overcome their ravages. The system *Sabaté* is directed towards the destruction of the winter egg, which produces the winged or reproducing stage of the phylloxera. The treatment consists in removing the dead bark from the trunk, and dusting with powdered quicklime, but, like the last, it is not fatal to the insect. A third remedy, that of *Dunay*, consists in exposing the roots of the vine, and coating them from the surface-roots to some 20 centimetres in depth with coal-tar.

I saw, while staying with Leland Cossart, in Madeira, a plan somewhat similar to this practised with great success. Mr. John Leacock, its inventor, removes after the first autumn rain, the soil to a depth of some 20 inches, so as to expose the upper roots, peels off the loose bark and paints the roots with resin dissolved in turpentine, at the same time manuring the vines. This mixture being unaffected by water remains viscid for three or four years, and destroys the insects on their passage up and down. Its cost is less than a halfpenny per vine, and while those so treated were luxuriant in bright green foliage, all around were yellowing and weak.

J. S. GARDNER

THE EXTENSION SEAWARD OF THE WATERS OF THE CHINESE RIVERS

THE following notes, on the extension seaward of the waters of the Yang-tse, were made in the months of September and October (1878), a period of the year when the river first commences to fall, after its waters have attained their maximum height. The four points to which I turned my attention were—the colour and general appearance of the water, the taste, the specific gravity, and the relative amount of chlorides in solution. Owing to the powerful revolving tides of the estuary of the Yang-tse, the river-water and sea-water are churned up together in such a manner that the patches of green and yellow water may be plainly observed, and their line of union as sharply defined. It is from this cause that the density of the water may fluctuate to a very marked degree in the limit of a single mile; and it was not an uncommon experience, on passing from a patch of yellow water into one of green colour, to observe a sudden increase in the density from 1·005 to 1·015. The specific gravity is never constant in the same locality; and it is only by taking all the four points into consideration that a reliable inference could be drawn: thus, the first evidence of the proximity of salt water, which was found at a distance varying from fifteen to thirty miles from Wusung, was not afforded by any marked increase of the density or by any alteration in the taste or colour of the water, but merely by a very perceptible increase in the amount of chlorides held in solution; whilst in the midst of the islands of the Chusan archipelago, which are removed

about a hundred miles to the southward, it was often necessary to depend more on the density of the water, on account of the subsidence of the sediment.

Without entering into the details it may be sufficent to state that, whilst the waters of the Yang-tse, according to my observations, became permanently free from sediment, and assumed the more marked characters of sea-water, with a minimum density of 1·018, at a distance of about forty miles east of Wusung, they still retained their yellow colour and turbid appearance, with a density varying between 1·005 and 1·011, on the outskirts of the Chusan archipelago, about a hundred miles to the southward. From these data the conclusion may very naturally be drawn that the main body of the water discharged by the Yang-tse flows comparatively undisturbed in a southerly direction across the Hang-chu Bay to the Chusan archipelago. The southerly extension of the muddy waters of the Yang-tse in the neighbourhood of Chusan[1] must have been a frequent subject of remark to any one approaching Shanghai from the southward, and should he at some subsequent period undertake the voyage from that port to Nagasaki, he will be very probably surprised to find himself, some four or five hours after leaving Wusung, surrounded by the green waters of the Eastern Sea. The situation of the Great Yang-tse bank, which extends one hundred and fifty miles to the north-east from the mouth of the river, would appear to negative the conclusion at which I have arrived; but I am inclined to view this bank—lying as it does rather off the entrances to the river, and composed as it is of fine grey sand—as rather the work of a past period, when perhaps the bulk of the waters found a passage to the north of the island of Tsung-ming, than as being in actual formation at present. That a vast amount of sediment is deposited to the southward of the estuary at the present time we have the most undoubted testimony in the rapid shoaling of the sea amongst the islands of the Chusan archipelago, and along the shores of the Hang-chu Bay, which has caused channels at one time navigable for junks to be now impassable.

With reference to the general effect of the water discharged by the Chinese rivers on the density of the Yellow Sea and of the Gulf of Pe-chili, I may observe that in the month of October I found the specific gravity to rise slowly from 1·019 at the base of the Great Yang-tse bank—a point between fifty and sixty miles east of Wusung—to 1·023 amongst the islands of the Corean archipelago; and that the maximum of 1·024 was attained at a point mid-way between this archipelago and the Shantung promontary. North of this cape the density does not vary in any marked degree, but after the Miau-tau Islands were passed—a group which separates the Gulf of Pe-chili from the Yellow Sea—there was a gradual diminution, until, at our nearest point of approach to the Yellow River, the mouth of which was forty-five miles distant, the specific gravity was 1·021. This slight fall in the density was the *only indication* of our proximity to such a large river as the Hoang-ho—a circumstance which has a particular bearing on the excessive amount of sediment which this river has been estimated to discharge (*vide* NATURE, vol. xxii. p. 487). From this point to the mouth of the Pei-ho the specific gravity continued to decrease, until at a point about twenty-three miles from the mouth of this river, where the discolouration from sediment was first observed, it was 1·020. Thence to the Taku forts the density rapidly fell.

We may thus place the specific gravity of the Gulf of Pe-chili at from 1·020 to 1·023, and that of the Yellow Sea at from 1·022 to 1·024, whilst the difference between these densities and that of oceanic water—1·027—will represent the combined effect of the discharge of the Pei-ho, the Yellow River, and to a less degree of the Yang-tse, on the specific gravities of the seas in question.

I must conclude with an observation on the erroneous notion which the appellation of "Yellow Sea" must convey to the minds of most men. For however much the Yellow Sea may have merited the epithet of "yellow" when it received the waters of the Hoang-ho about a quarter of a century ago—though if an inference is to be drawn from the present condition of the Gulf of Pe-chili it could scarcely have been entitled to it even at that period—it has no claim whatever to it now. Free from sediment and dark green in colour, except in the immediate vicinity of the estuary of the Yang-tse, the Yellow Sea has been more appropriately named by Chinese sailors—"The Black-water Ocean." H. B. GUPPY

H.M.S. *Lark*, Sydney

[1] I may take this opportunity of observing, that on one occasion when off the northern extremity of Chusan, I noticed several large medusæ floating on the surface of the water, which was not only muddy in appearance but had a density of 1·006.

PROFESSOR GEIKIE IN ARRAN

AMONG the many features which have lent attraction to the study of geology at Edinburgh University, Prof. Geikie's field demonstrations have always held a conspicuous place. Few favourable Saturdays have been allowed to pass, on which he might not be seen rambling with his class through some wooded glen, or climbing some rugged brae, with hammer, sketch-book, and map-case, and every now and then stopping to point out some striking rock section, or to examine a "find," made perchance by one of his students. But at the end of the session, when a week or ten days are devoted to the exploration of some district possessing an interesting geological structure, the "long excursion" is always looked forward to with the keenest delight by professor as well as by students. The first long class-excursion ten years ago was to Arran, and the Professor decided that his last should also be to that island—famous alike for the beauty of its scenery and for the interest attaching to its geological framework. Quarters were taken up at Corrie Hotel on Monday April 24, and that afternoon saw the whole party, numbering about a score, roaming with bags and hammers along the coast towards North Glen Sannox, and making the acquaintance of the coarse red sandstones and brecciated white quartz conglomerates of the Upper Old Red, or Lower Calciferous Sandstone series, which extend in a broad belt round that part of the island. Further inland, a coarse conglomerate made up of well-rounded pebbles of pinkish quartz interstratified with characteristic dark chocolate-coloured sandstones and occasional argillaceous beds, was ascertained some years ago by the Professor to belong to the Lower Old Red Sandstone, and to be brought down by a fault against the schists that fringe the mountainous granitic core of the northern half of the island. He had already made some progress with a geological map of the island on a scale of six inches to a mile, and he now purposes to continue this work with the co-operation of his students. Resuming his geological boundary-lines at Glen Sannox, the party was soon scouring the hillsides far and near, in search of rock-sections and exposures, while he, map in hand, remained within ear-shot, and superintended operations, marking down the lines of junction, and unravelling the geological structures with the skilful hand of one long acquainted with the art of geological mapping. In this way several miles of the boundary between the granite and schists were mapped. In the course of a walk along the steep craggy Suidhe Fearghus, on the north side of Glen Sannox, the trend of this remarkable ridge was found to coincide with that of the vertical joint in the granite, and the deep gashes which indent its profile were observed to be due sometimes to cross joints, sometimes to basalt dykes which, decomposing, have weathered down much faster than the surrounding granite. The view from Caisteal Abhail, the highest peak (2735 feet) of the ridge, was magnificent, extending

southwards to Ireland, and northwards to the mountains of Mull and Arrochar. On the way down a dyke much more vitreous and obsidian-like than the other Arran pitch-stone, was crossed on the ridge between Caisteal Abhail and Cir Mhor, at the head of Glen Sannox. Another day the steps of the party were turned southwards, and as the red rocks of Glen Shurig, which runs inland from Brodick, had hitherto yielded no organic remains capable of identifying their precise geological position, the Professor instituted a methodical search, which resulted in the discovery of numerous more or less distinct impressions of the lycopod *psilophyton*, clearly proving them to be, as he had inferred, of Lower Old Red Sandstone age. Striking southward into Glen Dubh, the geologists then crossed the very perfect series of moraines, left there by the last valley glacier, and returning by Glen Cloy, and the well-known pitchstone dyke behind the Brodick Schoolhouse. The fossiliferous limestones and shales of Corrie were also well explored, and the position of this strata far down in the heart of the red sandstone series was remarked.

The concluding ramble of the week brought the party to the celebrated dyke of pitchstone at Corriegills, and the quartz-porphyry of Dur Dubh, both possibly of Tertiary age.

The latter rock is alike remarkable for its petrographical characters and its geological structure and history. The quartz in it has crystallised into singularly perfect doubly-terminated pyramids, which can be picked up in handfuls from weathered crannies of the rock. Viewed from the north, the end of the quartz-porphyry ridge is seen to present a remarkable columnar arrangement, the columns radiating from a common centre like the ribs of a fan. The Professor pointed out the resemblance of this structure to that of the west end of the Scuir of Eigg, where a stream of vitreous lava has flowed into and filled up a narrow valley, the sides of which have disappeared, and where the radial structure of the pitchstone is due to the rock having cooled in an approximately semicylindrical gorge, perpendicular to whose sides the columns were formed. In each case the superior durability of the mass has enabled it to resist denudation better than the surrounding rocks, which have long ago been carried off, leaving the lava standing up as a prominent ridge. Most of the students left Brodick by the afternoon steamer on Saturday, after a most enjoyable week of geologising with Prof. Archibald Geikie on the last of the delightful long excursions with his Edinburgh class. H. M. C.

NOTES

THE following telegram from the Special Correspondent of the *Daily News* with the Eclipse Expedition to Egypt, appears in Tuesday's issue:—"Sohag, Monday, 7.20 p.m.: Every facility has been granted to the Eclipse Expedition by the Egyptian Government. The site chosen is close by the bank of the Nile. The instruments are being set up. The Khedive has shown great interest in the Expedition, and the English party, who are his guests, owe much to the arrangements made by the Governor. The officials and natives are everywhere civil and obliging. The weather apparently is quite settled." Under date of May 9 the *Times* correspondent telegraphs as follows:—"The various Eclipse expeditions arriving at Sohag are being entertained by the Khedive. Most important help has been given by Muktar Bey, the Colonel of the Staff representing the Khedive, and the Government, who have also provided a steamer and a military guard."

SINCE we noticed the pamphlet of Prof. Bloxam on the state of affairs at the Royal Military Academy, the subject has been brought before the House of Lords with some prominence; but the main points of complaint appear to have been ignored. If only a portion of the charges in Prof. Bloxam's pamphlet can be sustained, they reveal a very deplorable want of discipline in an important and expensive public establishment, and also a feeling on the part of the authorities that subjects like physics and chemistry are of such minor importance to the scientific soldier as to warrant the withholding of the moral support to maintain discipline that Prof. Bloxam complains of. Some of the statements in the pamphlet are so severe that we hesitated to repeat them, but they do not appear to have been controverted. The position of a professor of a subject that is only looked upon as a sort of useless "extra," deprived to a great extent of the moral support of the heads of the establishment, cannot be a satisfactory one, and if the late Professor's charges and statements are correct, his successor is not to be envied.

WE regret to record the sudden death of Mr. Charles Hockin, at the early age of forty-two, in the midst of an active career as a civil engineer and electrician, on Wednesday, April 26 last. C. Hockin entered St. John's College, Cambridge, in October, 1859, from Aldenham Grammar School, and was elected scholar in the following May. After a successful career in mathematical work at his college he graduated as Third Wrangler in 1863. Choosing engineering as a profession he became pupil to Messrs. Forde and Fleeming Jenkin, and devoted his attention mainly to submarine telegraphy, a province in which his great mathematical abilities found scope, and in which he did much good work. He made, however, opportunities for other purely scientific pursuits, and co-operated with the late Dr. Matthiessen in his researches on the reproduction of electrical standards by chemical means, and also with Sir William Thomson and Clerk-Maxwell in the determination of the B.A. units of electrical resistance and capacity, as well as in the design and construction of the large standard electro-dynamometer for the Committee of the British Association. He was one of the earliest investigators of the resistance of selenium, a material to which so much attention has lately been devoted. His researches on the subject are referred to in the B.A. Report for 1867. In 1872 he joined as a partner the firm of Clark, Forde, and Co., and in the execution of his professional work visited every quarter of the globe, winning the respect and esteem of all with whom he came in contact and the affection of the few he admitted to his intimacy. While there have been few scientific men less eager than he was for personal fame, it is seldom that equal powers have been placed so readily as his were at the service of others, and there was no one whose opinion on the subjects to which he devoted himself was held in greater respect by scientific men. He devoted much time to mathematical investigations chiefly in connection with electricity, but comparatively little of his work has been published by himself, and it is to be hoped that his executors will see their way to the editing and publication of his mathematical papers.

WE learn from Prof. Ray Lankester that another zoological laboratory is to be erected on the shores of the Mediterranean. The French Government has decided to establish at Villafranca near Nice a zoological station, the sole object of which will be to provide accommodation to the numerous naturalists who every year are attracted to this locality by its great reputation as a hunting ground for marine animals. Dr. Jules Barrois, the distinguished embryologist, has been appointed director of the zoological station of Villefranche-sur-Mer. The existence near Nice of a laboratory accessible to strangers, approved by the director, will be an immense boon to English naturalists especially, since the Riviera is not separated from us by a very long journey, is a favourite resort of our countrymen, and is on the whole salubrious. It is the most favourable spot for the study of the Mediterranean fauna by the naturalists of northern countries; and though the new laboratory will by no means compete with or diminish the value of that at Naples, yet it will render possible a short visit to the Mediterranean for the purpose of

zoological work, whereas a long sojourn is rendered almost necessary by the much longer journey to Naples. Further it is well known that forms occur at Villafranca which are not found at Naples, as also many occur at Naples not to be found at Villafranca.

AN interesting account has been lately furnished by M. Plateau, the eminent Belgian physicist (who has been blind nearly forty years), of the sensations he experiences in his eyes. He has no sense of objective light even when directing his eyes towards the sun. But his visual field is always divided into spaces, some of which are pretty bright and others sombre or nearly dark, and which merge into each other. Their general tint alternates, in time, between grey and reddish. The relative arrangement of those different spaces is always the same, but the intensity of their tints varies. The central space seems now rather bright, now very dark; above and below, and on the left to the limits of the field, there is sometimes brightness, sometimes darkness, but on the right there is generally a vertical band, nearly black, and beyond this a space which is nearly always bright and reddish. These appearances follow all the movements of the eyes, which probably do not participate in the same way in the tints, but M. Plateau cannot distinguish what belongs to one from what belongs to the other. No connection of the general tint with the work of digestion is observed. The author states that he became blind through looking fixedly at the sun for some time, with a view to observing his after-sensations; it was not till about fourteen years after this that inflammation of the choroid set in, destroying vision, but, during the interval, he often saw coloured and persistent halos round flames, &c., and he advises those who have such vision to consult an experienced oculist.

WITH the approval of the Treasury, Mr. P. Edward Dove, of Lincoln's Inn, has been appointed Secretary to the Transit of Venus Commission.

THE University of London have determined to prosecute with energy before the City of London Livery Companies Commission their claim to administer the funds of Gresham College. For reasons which are given, it is alleged that the founder, Sir Thomas Gresham, intended to found a University for London without limitation to the City proper; and it is urged that his bequest, as at present administered, does not subserve that purpose, being merely devoted to occasional lectures.

SEVERAL commissions have been appointed by the French Government to report on the advisability of undertaking to flood the Algerian Sahara on the plan proposed by M. Roudaire. It is believed, on good grounds, that the report will be in favour of M. Roudaire's great scheme, and that the objections laid before the Academy of Sciences will be put aside.

THE fate of Capt. De Long, the commander of the *Jeannette* Arctic Expedition is now only too certain; Mr. Melville telegraphs from the mouth of the Lena, March 24, that he has found the Captain's dead body and those of his companions, as well as all papers and books. Mr. Melville was to search for the party under Lieut. Chipp in the other cutter.

THE *Daily News* Naples Correspondent writes:—"The illustrious Italian travellers, Capt. Bianchi and Signor Licata, secretary of the Naples African Club, are about to undertake a new expedition, the plan of which is as follows:—From the Bay of Biafra, in Guinea, they will traverse the hitherto unexplored high levels of the Cameroon Mountains in the direction of the Labi Lakes, and study the country in which rise the Congo, Niger, Gazelle Rivers, and Lake Tsad, to find the key of the hydrographic system of tropical Africa. From the lakes they will descend to Lake Luta, which was partly explored by Signor Gassi. They will then traverse the Uganda territory, going north-east towards the Gallas country, already known to Capt. Bianchi, and return to Italy *viâ* Abyssinia and the Red Sea, having thus crossed Africa from west to east. They believe it will take four years to complete this immense journey, which will have principally a scientific aim."

THE *Natal Mercury* records the death of Mr. G. W. Stow, F.R.G.S. The telegram announcing his death reached Bloemfontein from Heilbron *viâ* Bethlehem. He was not only known by his geological surveys of Griqualand West and Natal, but he had been engaged for many years on a work on the Bushmen tribes, and another on the influx of the native races into the southern portion of Africa.

THE last news from Dr. O. Finsch, who has for the last two years and a half been exploring the Pacific Islands, is dated from Thursday Island, in Torres Straits, January 8, 1882. From September, 1880, to March, 1881, he had been in the little coral island of Matupi, near New Britain. After a visit to Sydney and New Zealand, he had gone to Thursday Island; thence he intended to visit North Australia and various islands in Torres Straits, after which he was to go to New Guinea, there to stay several months. Dr. Finsch has already sent to Berlin many boxes of collections in natural history and ethnology. He has already concluded from his researches, that all the Pacific races may be referred back to two stems—a straight-haired (Polynesians and Micronesians), and a crisp-haired (Melanesians and Papuans), and he is doubtful whether there do not exist connecting links between the two.

WE have already given such full details of the objects and methods of the International circumpolar observing stations, that we need only bring the record up to date by giving the list of the stations so far fixed upon, and the countries that are to occupy them:—(1) Point Barrow (north-west America), by the United States; (2) Great Slave Lake, England and Canada; (3) Lady Franklin Bay, United States; (4) Godthaab (West Greenland), Denmark; (5) Pendulum Islands, Germany (probably); (6) Jan Mayen, Austria; (7) Spitzbergen, Sweden; (8) Bossekop, Norway; (9) Sodankylä (67° 24′ N., 26° 36′ E.), Finland (probably); (10) Novaya Zemlya, Russia; (11) Dickson's Harbour, Holland; (12) Mouth of the Lena, Russia. Some of them are already occupied, and all of them will be during the summer.

PROF. ARTHUR GAMGEE will, on Tuesday next (May 16), give the first of a course of four lectures, at the Royal Institution, on Digestion; and Prof. David Masson will give the first of a course of four lectures on Poetry and its Literary Forms, on Saturday (May 20).

WE have received a report of the meeting of the Essex Naturalists' Field Club, held on February 25, when the preservation of Epping Forest in its natural condition was the subject of discussion. It was decided that the Conservators should be petitioned by the Club, on behalf of the natural history students of the metropolis, and a form of petition has been circulated among the various scientific societies and individual naturalists interested in this question. Those wishing to sign the memorial should communicate with the Hon. Sec., Mr. William Cole, Laurel Cottage, Buckhurst Hill, Essex.

APART from absence of soil and moisture, the height of the "timber line," according to Mr. Gannett (*Am. Jour. of Science*, April) is purely a question of temperatures, and he shows that in several parts of Western America the line rises rapidly as the latitude decreases. On the volcanic peaks of the Mexican plateau, *e.g.* it is higher by several thousands of feet than anywhere else in the United States. Even in the same latitude there are very marked differences in its height. The less the elevation of the surrounding country, other things equal, the lower is the limit of timber. Considering that this limit must

have approximately the same mean annual temperature everywhere, and that in abrupt ascent there is a decrease in mean annual temperature, of about 1° F. for every 300 feet, Mr. Gannett thought to determine the temperature at the timber line, from that of a station at or near the base (supposed, though not always correctly, to represent the average climate round the base), together with the height. The tabulated figures, for thirteen mountains, &c., yield the mean 30°·4, which is probably very near the true mean annual temperature of the timber line. Should the result hold good, after wider observation, it will afford, Mr. Gannett says, a very valuable and easily obtainable isothermal, and also enable one to estimate the height of the timber line from thermometric stations at the bases of mountain ranges.

On April 26 M. Broch, president, and the delegates of the Bureau International des Poids et Mesures, presented to M. Tirard, the Minister of Commerce, specimens of the facsimile reproductions of the standard metres and kilogrammes preserved since the beginning of the century in the French National Archives. These copies have been executed with an alloy of platinum and iridium, in compliance with the instructions given by MM. Henry Sainte Clair-Deville and Debray. This great work has taken not less than ten years. These facsimiles have been sent to the Bureau at Breteuil, where they will be used in executing the copies ordered by the several nations for their use.

A new edition of Kelland and Tait's "Introduction to Quaternions" has been published by Macmillan and Co. While refraining from making any changes in the late Prof. Kelland's part of the work, Prof. Tait has re-cast his own where he fancied he could improve it.

The Committee of the Sunday Society are more than usually active just now in connection with the motion for extending the opening of museums on Sundays, which Mr. George Howard is to propose in the House of Commons on the 19th inst. On the 17th inst. a National Conference of Delegates from Provincial Towns, Trade Societies, and other organisations, is to be held at the Westminster Palace Hotel under the presidency of Viscount Powerscourt, and in the evening of the same day a large meeting is to take place at St. James's Hall, when addresses are to be delivered by Lord Powerscroft, Lord Dunraven, Lord Dorchester, Mr. Thomas Burt, M.P., Mr. George Howard, M.P., Dr. Richardson, and others.

The additions to the Zoological Society's Gardens during the past week include Six Northern Marsh Tits (*Parus borealis*) from Russia, presented by Mr. A. H. Jamrach; four Pigmy Pigs (*Porcula salviana* ♂ ♀ ♀ ♀) from Nepaul, a Burmese Tortoise (*Testudo elongata*), a —— Terrapin (*Clemmys*, sp. inc.) from Burmah, received on approval; two Green Monkeys (*Cercopithecus callitrichus*) from West Africa, a Grey-headed Love Bird (*Agapornis cana*) from Madagascar, received in exchange; a Water Chevrotain (*Hyomoschus aquaticus*), a Golden-haired Tiger Cat (*Felis chrysothrix*) from West Africa, a Mercenary Amazon (*Chrysotis mercenaria*) from Columbia, three Chiloe Wigeon (*Mareca chiloensis* ♂ ♀ ♀) from Chili, a Silky Bower Bird (*Ptilonorhynchus violaceus*), two Blue-faced Honey-Eaters (*Entomyza cyanotis*) from Australia, a Red-handed Tamarin (*Midas rufimanus*) from Brazil, a Wild Duck (*Anas boscas* ♀), British, four Yellow-billed Cardinals (*Paroaria capitata* ♂ ♂ ♀ ♀) from South America, purchased.

OUR ASTRONOMICAL COLUMN

Anthelm's Nova of 1670.—The vicinity of this object will soon be in a favourable position for observation, and we may once more direct attention to the small star which occupies very nearly the place given by the observations of Hevelius and Picard in 1670. By a recent careful reduction of Picard's observations, the mean place of the object for the beginning of 1670 was found to be in R.A. 19h. 34m. 5s.·3, Decl. + 26° 31′ 42″, which, accurately brought up to 1880, give, R.A. 19h. 42m. 41s.·3, Decl + 27° 0′ 56″. Near this point we find a telescopic star, which is No. 1814 of the Greenwich catalogue of 1872, the place there assigned differing from that reduced to the year from Picard's observations by + 3s.·8 in R.A., and 33″ in declination, and the right ascension for 1670 is open to an error of quite two seconds, and in greater uncertainty than the declination. The small star is followed by one (*b*) 12s.·6, about 4′·9 N., and a second (*c*) at 22s.·4, about 2′·0 N. Its magnitude has been noted as follows:—1852, April 24, 10·11 m.; 1861, May 24, 12 m.; 1872, August 23, = *b*; 1874, November 13, 0·5 m. less than *b*, decidedly less at first view. Another star (*d*) follows the one nearly in the position of *Nova*, 32s.·6, and is N. 1′.7. Prof. Schönfeld found from the observations of Hevelius and Picard combined, a place differing from that given above by − 2s.·8 in R.A., and + 0′·3 in declination.

Variable Stars.—It is known that U Cephei had long been indicated as a probable variable star by the discordant magnitudes given by Schwerd's estimates 1827-28, as arranged by Oeltzen, and when taken in hand for regular examination, its short period was soon detected by Ceraski. Schwerd's estimates were from 6·7 to 10m. It appears by no means improbable that if several other stars for which the magnitudes in the various catalogues are very discordant, were systematically examined, similar cases might be found. For instance, we have 17 *i* Andromedæ noted from 3½ to 7m., 16 Leonis Minoris 5 to 8m., 41 *i* Aquilæ 3½ to 6m., and 35 Camelopardi 5½ to 8m.; the last, a double star, has already been found to be variable, as regards one component at least; but we have no approximation to the period.

The Comet 1882 *a*.—The following places are derived from the same elements that were employed last week, and are for Greenwich midnight:—

1882.	R.A. h. m.	Decl. ° ′	Log. distance from Earth.	Sun.
May 13	0 41·0	+74 5		
14	1 4·7	73 33	9·9571	9·9715
15	1 26·9	72 51		
16	1 47·5	72 0	9·9539	9·9481
17	2 6·3	71 1		
18	2 23·4	69 54	9·9518	9·9227
19	2 38·7	68 40		
20	2 52·5	+67 23	9·9508	9·8949

Next week we may probably be in possession of elements which will allow of a close prediction of the comet's track as it approaches the sun. All the later orbits assign for the date of perihelion passage June 10.

BIOLOGICAL NOTES

Fauna of the Suez Canal.—Dr. C. Keller, who is engaged upon a zoological investigation of the Suez Canal, with a special view to determining what exchange of animals may have taken place between the Red Sea and the Mediterranean, has recently sent his first report from Ismailia to the St. Gall Society for Commercial Geography. He states that the exchange is proceeding slowly, owing no doubt to the presence of the lakes of bitter-water through which the canal was traced. The inhabitants of these very lakes seem to have been the first to commence migrations. This fact Dr. Keller has unquestionably ascertained with regard to several species of the lower animals; a particularly interesting case being that of a violet species of sponges, belonging to the fauna of the bitter lakes. This is now migrating in the canal towards the Mediterranean. He named this form *Lessepsia violacea*. Several larger species of fishes, which are now caught in plentiful quantities in the Timsah lake, have migrated there from the Mediterranean; amongst these are *Anarrhichas lupus*, *Solea vulgaris*, and *Polyprion cernium*. Other species have migrated from the Red Sea to the Timsah lake, perhaps to Port Said; amongst these Dr. Keller mentions a large dark green mackerel and several brightly coloured but small Acanthopteri. The canal itself, in the direction from the Timsah lake towards Port Said shows but a poor fauna; that of the bitter lakes is also poor with regard to different species, while the representatives of the few species that are there are excessively abundant.

THE COMPARATIVE ACTION OF ISOMERIC AND METAMERIC COMPOUNDS ON THE GROWTH OF PLANTS.—In an interesting paper on this subject, lately laid before the Royal Irish Academy by Prof. Emerson Reynolds, F.R.S., he calls attention to an apparently neglected subject, and he shows that well-marked differences in physiological activity can be detected with the aid of plants, even in cases of metameric bodies of comparatively simple constitution. The bodies he selected for experiment were ammonium sulphocyanate and its metamer, theocarbamide or sulpho-urea. Both compounds are rich in nitrogen, and therefore capable of supplying a highly important element of plant food; they are easily soluble in water. The experiments were made in the summer of 1881 on plants of *Nicotiana longiflora*. They lasted over three months—August to end of November; a certain number of the plants were watered with rain-water—a certain number with the compounds in solution, otherwise all the plants were exposed to the like conditions. The following were among the chief results:—

	Water-rain.	Theocarbamide.	Sulphocyanate.
Total height in inches ...	31	23	12
Number of leaves	15	14	13
Maximum length of leaves in inches	9·5	15·25	8
Maximum breadth ditto ...	4·25	6	2·5
Number of seed pods ...	9	15	0
Ditto well developed ...	1	11	0

It would then seem (1) that the particular elements of which a body is composed exert less influence on the physiological activity of the compound than the intra-molecular grouping of the component atoms; (2) that in some instances at least differences of physiological activity between metameric bodies can be easily detected by the aid of plants.

CAUCASIAN MILK FERMENT.—The inhabitants of the high-lying lands in the Caucasus prepare, by fermentation of cows' milk, a drink which they call kephir. Kephir is used by the inhabitants of the mountains not only as an article of food, but also as a remedy against different diseases. As a ferment in the preparation of this drink, strange white lumps are used, which have a spherical or elliptical shape, and attain the size of from 1 m. to 5 cm. On a microscopical examination of these lumps, they showed that they consisted of two different substances—yeast cells and bacteria. The yeast cells may be regarded as the ordinary form, produced by cultivation, of *Saccharomyces cerevisiæ*, but Kern was unable to get these to the spore-bearing stage. As to the bacteria, they composed the chief part of the little lumps, and were in the Zoogloea state. The vegetative bacteria cells were 3·2 m. to 8m. in length, and ·8 broad. In preparations put up by drying, a distinct cell membrane could be distinguished. Treated after Koch's method, the vegetative cells show at one end a locomotive organ, which resembles a cat-and-nine-tails, of threads. When exposed to the action of acids or a high temperature, the vegetative cells grow out [probably through progressive cell-divisions] into long Leptothrix threads, which change generally precedes the spore-formation stage. The spores are round, always formed in twos in each vegetable cell, and are always placed standing on their ends; even by making use of Hartnack's immersion X, no partition wall could be discovered between the spores. In the Leptothrix-threads rows of spores could be observed, which are, however, always so situated that two spores belong to each cell. The spores while still in the cells are ·8 m. in size; those lying free attain the size of 1 m.; the germinating spores swell up 1·6 m. The germination of the spores generally takes place in such a manner that an exosporium and an endosporium can always be distinguished in them. The thinner endosporium arises out of the thicker exosporium, first as a small excrescence, which gradually increases, developing more and more into a long cylindrical tube, and then begins by cell-division to form vegetative cells. The whole course of the development to the spore-formation, beginning with the vegetative cell to the formation of a similar new cell, was followed. This newly described form of Bacteria, which undoubtedly belongs to the Desmobacteria of Cohn, is in its vegetative state not unlike the *Bacillus subtilis* of Cohn; it is, however, clearly distinguished not only from it, but also from all other kinds of Bacteria hitherto described by its spore-formation, since it always forms in each cell two round spores placed end to end, while in the species of Bacteria hitherto described, only one spore has been noticed in each cell. On account of this sharply-marked feature Kern places this form of Bacteria in a new genus, next to the genus Bacillus, and calls it *Dispora caucasica*, nov. g. et nov. sp. A more exhaustive essay on this subject, with explanatory plates, Kern promises in the next number of the *Bulletin de la Société Impérial des Naturalistes de Moscow*.—Prof. Dr. J. N. Goroschankin assisted Kern by kindly furnishing him with the necessary materials for his work, for which Kern expresses his deepest thanks.—*Botanische Zeitung*, April 21, 1882, p. 264.

NEW FRESHWATER SPONGES.—Mr. Edward Potts describes three more curious freshwater sponges in the *Proceedings* of the Academy of Natural Sciences of Philadelphia (January 10, 1882, p. 12). One found in September, 1881, near Chadd's Ford, is of a very delicate structure; its framework of skeleton spicules is exceedingly meagre, and slightly bound together, scarcely amounting to a mesh system, and the numerous small white statospheres are found in recesses far larger than themselves. This sponge has been called *Meyenia crateriforma*. Another, forming beautiful green masses, often four to five inches in diameter, and about a quarter of an inch in thickness, was found in Cobb's Creek, near Philadelphia. The surface is irregular, occasionally rising into rounded lobes; the efferent canals are deeply channeled in the upper surface of the sponge, five or six sometimes converging to a common orifice. The statospheres are numerous—rather small. There are two series of birotulate spicules, and it has been called *Heteromeyenia ryderii*. The third species was found at Lehigh Gap, Pa., in November, 1881, and belongs to the genus Tubella. This genus, established by Carter, contained only four species, all from the Amazon River. The new species is small, encrusting, and has been called *P. pennsylvanica*. The skeleton spicules are arranged in a simple series of single non-fasciculated spicules, in the interspaces of which the statospheres are abundant. These spicules are very variable in size and shape, but all are entirely and coarsely spined. The dermal spicules seem absent.

MOLLUSCOUS FAUNA OF MOSCOW.—The molluscous fauna of the neighbourhood of Moscow was very little known until now, the two former works dealing with this subject, by M. Ratchinsky and M. Madéjine, giving only fifty-one species of Gasteropods, that is, only a half of this class of Molluscs which are to be found in the neighbourhood of Moscow. M. Milachevitch fills up this gap (*Bull. de la Soc. des Naturalistes de Moscou*, No. 2) by giving a list of the Molluscs of this region, his determinations of species having been made with the help of, or revised by M. Clessin and Dr. Böttger. It is worthy of notice that of the 109 species described, 11 belong to the region of the Alps, and 17 to the boreal region, 7 of them being common to both regions, and all the Alpine species having been widely spread in Germany during the Quaternary period. A remarkable feature of the Moscow molluscous fauna is the absence of the larger species of *Helix* (*H. pomatia*, *H. nemoralis*, *H. arbustorum*, *H. hortensis*, &c.), whilst they are frequent in other parts of the boreal region—to which the Moscow molluscous fauna belongs too—nearer to the sea. As to the southernlimits of the boreal region in Russia, it is difficult to determine it, but M. Milachevitch supposes it to follow a line drawn from Riga to Tamboff and Saratoff.

PERISTALTIC INTESTINAL MOVEMENTS.—The movements of the intestine have been recently studied by the graphic method, by Signori Mosso and Pelicani (*Reale Ist. Lomb.*), experimenting both on man and the dog. Among other results it appears that at every movement of respiration there occur strong contractions of the rectum. Emotions and cerebral activity have a very manifest influence on the muscular fibres of the intestine, causing strong contraction. Besides so-called spontaneous undulations in the tracings, the direct cause of which is not known, it is possible, the authors prove, to contract at will portions of the intestine that are a considerable distance from the sphimeter muscle. The authors study the influence of changes of temperature on the tonicity of the intestinal walls, indicate the variations of the latter in sleep, digestion, and under influence of medicaments, &c., and show how intestinal movements are related to changes of volume in the forearm and blood-pressure in the carotid.

ON THE OCCURRENCE OF ROOT-FLORETS IN CATANANCHE LUTEA.—A paper on this subject by B. Daydon Jackson, Sec. L.S., was read before the Linnean Society on May 4.—M. J. A. Battandier, in writing to Sir John Lubbock, pointed out the occurrence of certain large single florets produced directly from the roots of this yellow-flowered composite. Examination of the large series of specimens of this species contained in the herbaria at Kew and the British Museum, showed that these

florets were to be found in almost every instance, frequently in great numbers, but usually overlooked from their great resemblance to scales of the root-stock. M. Battandier further stated that the fruit was twice the size of those contained in the normal capitula; also that the root-florets were not cleistogamic, a fact confirmed by finding specimens showing the anther-tubes and stigmata projecting. Similar instances were also recorded as occurring in two species of Scuipus and a Myosotis.

CHEMICAL NOTES

THE formulæ deduced by Guldberg and Waage in their general theory of action of mass have been recently applied, with satisfactory results, by R. Warder (*Amer. Chem. Journ.* iii. No. 5) to the case of saponification of ethylic acetate. W. Ostwald continues his work in the same field; he has recently studied the actions which occur when certain pairs of salts are fused together in equivalent quantities. His general result is that those salts which have the greatest heats of formation are always produced in greatest quantity. Berthelot's so-called "law of maximum work," viz. that of several possible products of a reaction that salt, in the formation of which most heat is evolved, is alone produced, is regarded by Ostwald as erroneous; if it were true, chemical equilibrium would be established only in those exceptional reactions wherein some of the reacting bodies underwent dissociation. Berthelot's statement is a return to the old hard and fast ideas on which "tables of affinity" were constructed, ideas long ago overthrown by C. L. Berthollet (*Journ. Pract. Chem.* xxv. 1).

DATA continue to be accumulated showing more definitely that there exists a close connection between the structure of molecules and the physical properties of the substances composed of these molecules. Pawlewski has recently published a short account of his researches on the "critical temperatures" of liquid compounds: he states that the critical temperatures of isomeric ethers are identical or very nearly so, that isomers containing "doubly linked" carbon atoms have a higher critical temperature than those in the molecule of which the carbon atoms are singly linked, &c. (*Berichte*, xv. 460).

IN an important paper bearing on the same general subject, E. Wilson states, as a result of his collation of many determinations of specific gravities of solids, that it is not justifiable to assign, as is usually done, a certain definite volume to each elementary atom in a compound molecule, but that the volume to be assigned to each atom in a compound molecule depends on the nature of all the atoms in the molecule (*Proc. R. S.*, 32, 457).

IN continuance of his experiments on the effects of pressure on chemical changes—before referred to in these notes, Spring states that he has prepared Wood's alloy (melting at 65°) by compressing, at 7500 atmospheres, iron filings, with bismuth, cadmium, and tin, in proper proportions. He has also obtained Rose's alloy (lead, bismuth, and tin), and also brass, by pressure of the constituent metals (*Berichte*, 15, 595).

AS the results of an extended series of observations on the structure of metals, Kalischer (*Berichte*, 15, 702) concludes that most of the metals are naturally crystalline, and that when the crystalline structure has been lost by mechanical treatment it can, in most cases, be restored by the action of heat.

PHYSICAL NOTES

AN important contribution to physico-mechanical science has been made by M. Berthelot in a memoir communicated to the Académie des Sciences of Paris, upon the rapidity of propagation of a wave of explosion. An explosion in a gaseous compound propagates itself, it would appear far more rapidly than a sound wave could travel in the medium. For example, the velocity of sound in mixed oxygen and hydrogen gases is 514 metres per second, while the explosion propagates itself at 2814 metres per second. M. Berthelot concludes that the wave is therefore not an acoustic wave at all, but a wave of chemical action. The characteristics of this new mode of propagation appear to be the following: uniform velocity of propagation (through tubes); independence of this velocity of the material of the tubes; tubes of lead and gutta-percha of equal calibre conveying the explosion at equal rates. The velocity in a capillary tube is slightly less than in a wide one, being 2390 metres per second for oxyhydric gas as against 2840 metres. The velocity differs in different mixtures, being 1080 metres per second in a mixture of oxygen and carbonic oxide. The velocity is independent of pressure which, in the experiments varied from 1 to 3 atmospheres. M. Berthelot attempts to identify this velocity with that of the translation of the gaseous molecules at the temperature attained in the explosion, as calculated from the formula of Clausius—

$$v = 29{\cdot}354 \sqrt{\frac{T}{\rho}} \text{ (metres per second)};$$

where T is the absolute temperature and ρ the density at 0° of the gas relatively to the air. He *assumes* T as 3000° in each case, which would give for the oxyhydric mixture a velocity of 2000 to 2500 metres per second and 1300 for carbonic acid. M. Berthelot therefore propounds the following view as to the way in which explosive action is propagated. In the film of gas first kindled a certain number of molecules are urged forward with a velocity corresponding to the maximum temperature of the chemical combination. Their shock against the neighbouring films determines there the commencement of chemical action, and so the movement proceeds, a uniform rate being observed except for those molecules which are close to the walls of the tube which give up in the form of heat a portion of their kinetic energy to the solid matter of the tube. A comparison with certain properties of sound waves leads one to doubt the finality of Berthelot's conclusion that these waves are not sound waves; for Regnault formed a similar retardation of sound-waves in narrow tubes, and it is known that their velocity is independent of pressure, and that it increases with an increase of temperature, and that the temperature which determines the velocity is not the temperature of the mass as a whole but the temperature of the molecules in the actual wave for the time being. The recent experiments of Galloway and of Abel on the propagation of an explosion in air charged with dust and contaminated with gas appear to deal with quite another phenomenon, namely, the velocity of spread of combustion in a space containing particles of solid matter floating in the air, and which has no more direct relation to the velocity of sound than has the velocity with which combustion is propagated along a train of gunpowder or a piece of slow-match.

ANOTHER contribution to experimental acoustics we owe to Mr. John Le Conte of California, who has published in the *American Journal of Science* some observations on sound-shadows in water. More than fifty years ago, when Colladon and Sturm were measuring the velocity of sound in the waters of the Lake of Geneva, Colladon remarked on the extreme sharpness with which an acoustic shadow was cast by a projecting wall that ran out into the lake. The greater sharpness of shadows might be expected from the mathematical theory of undulations, for waves of higher pitch than for those of lower, as the wave-lengths of the former are shorter, and therefore less liable to diffraction at the edges of acoustically opaque objects. Mr. Le Conte's experiments were almost all made with the waves produced by the explosion of cartridges of nitroglycerine, each containing 15 lbs. of the explosive stuff. These cartridges were being used in blasting a shallow reef in the harbour of San Francisco, and the means taken to observe the propagation of the shock consisted in sinking soda-water bottles and glass tubes filled with air, so as to be wholly or partially concealed behind solid objects such as wooden piles. A cartridge was exploded about 40 feet away from a pile about 12 inches in thickness; behind this obstacle, and for a distance of 12 feet behind it, a sharply-defined sound-shadow could be traced. Another instance is given in the singular preservation of buildings on the occurrence of an explosion at San Francisco when situated within the geometrical shadow of other buildings. Mr. Le Conte seeks to explain the relative sharpness of shadows of explosive sounds by supposing that in this case the very short impulse gives rise to a disturbance whose wave-length is exceedingly short. In connection with the subject, it may be worth while to recall Lord Rayleigh's beautiful experiment on the sound-shadow behind an opaque circular disk, where (as in the case of light for which, as predicted by Poisson and verified by Arago, there is a luminous point at the centre of the shadow), at the centre of the acoustic shadow, a perceptible augmentation of the shrill note of a bird-whistle was observed.

THE old device of exploring the vibrating column of air in an organ-pipe to ascertain the position of nodes and loops, by letting down into it a membrane of tissue paper on a wire frame, is

familiar. König's method of introducing a small tube communicating with a manometric capsule and a flame indicator, was recently described in our Physical Notes. The latest device for a similar purpose is that of M. Serra-Carpi, who introduces a small microphone supported on an elastic membrane stretched over a wire ring. The microphone is connected by wires to a telephone and a battery. Hardly any sound is heard except when the exploring microphone is at a node, when it causes a buzzing sound to be heard in the telephone. The objection to all these methods is that the pressure of the explorer alters the position of the nodes in the tube. König's apparatus is probably least open to this objection, but it requires a special piece of apparatus of an expensive kind.

THE JOINTING OF ROCKS AND THE CHANNEL TUNNEL[1]

THE writer, referring in the first instance to his "Report" on Jointing, published in vol. xxv. (1875) of the *Transactions* of the Royal Irish Academy, in which the subject is treated of in its purely geological aspect,[2] remarks that his investigations in connection with it entitle him to take a part in the discussion of a question in engineering, which public enterprise has of late elevated to one of international importance.

At the outset, however, he feels himself compelled to express his doubts that rock-jointing has been sufficiently attended to by the active promoters of the proposed Channel Tunnel.

The remarkable divisional structure under consideration, often taken to be analogous to ordinary cracks or fractures due to rock-disruption, is, in the opinion of Prof. King, a phenomenon having only a distant relation in its origin to the latter.

In its normal state, jointing is a fissured condition of rocks—the fissures presenting even, smooth, regular, and close-fitting conjunctive planes, often standing vertically, or in an inclined position. Where the fissures have been affected by stratic disturbances, or have been acted on by water and other erosive agencies, they are more or less open, thereby converted into "crevices." It divides both sedimentary beds and igneous masses; and is separable into two or more series or systems, each having its respective fissures running in parallelism, also in a definite and an independent direction, over areas hundreds of miles in extent; and descending to considerable depths below the earth's surface. The fissures vary in their distance from one another from under half an inch to two or more feet.

That jointing demands the closest attention on the part of engineers engaged in sub-aqueous works requires no other proof than the fact of the utter failure which attended the scheme for opening out, during the famine of 1845-48, a water communication, about four miles in length, between Lough Corrib and Lough Mask, in the west of Ireland. After an expenditure of 40,000*l.* it was found that the jointing in the carboniferous limestone, through which the excavation had been made, carried off all the water. The work had, therefore, to be abandoned; thus resulting in nothing more than a dry ditch!

As regards the chalk and other rocks to be penetrated for the Channel Tunnel, Prof. King admits that they may not be so highly jointed as the much older carboniferous limestone; nevertheless, he shows that the former deposits are not altogether free from dangers, which, to be overcome, require the closest attention.

From the numerous occurrences, noticed by writers, and observed by himself, of faults, true jointing,[3] ordinary disruptive fractures, inclined bedding openings, dry submarine swallow-holes of Pliocene age (now filled with clay, sand, gravel, in some cases containing sub-fossil sea-shells) and rock porosity in the chalk formations of Kent, Prof. King infers that these detriments are equally present in the same deposits, well known to exist at the bottom of the Channel; where some of them cannot but turn out to be sources of water-leakage, greatly interfering with the success of the proposed Channel Tunnel.

Precisely similar detriments, giving rise to the same apprehensions are to be met with on the opposite seaboard of France. Reference may be made to the great lines of fracture which have moulded the river-drainage system of the Bas Boulonnais; and especially to the marvellous jointing (represented by the distinguished geologist, M. Daubrée, in his "Etudes Synthétiques de Géologie," parte prem.), which vertically intersects the chalk cliffs near Tréport, north of Dieppe.

Still, such serious drawbacks Prof. King admits must not be held as unsurmountable. He is fully satisfied that engineering in the present day is quite able to cope with them; but only by an enormous expenditure. It has been proposed to line the Tunnel with concrete; but in his opinion it is absolutely necessary that nothing short of lining it, and in its entire length, with the most resisting, impervious, and endurable stone, should be attempted.

[1] Abstract of a paper "On the Jointing of Rocks, in Relation to Engineering, especially the Tunnelling of the Strait of Dover," by William King, D.Sc., Professor of Mineralogy and Geology, Queen's College, Galway, read April 24 at the Royal Irish Academy, Dublin.

[2] Jointing in its relation to Physical Geography has been lately treated of by the author in "Thalassa and Xera in the Permian Period," appended to the work—An Old Chapter of the Geological Record, &c., by Professors King and Rowney.

[3] The "many small faults" and "very marked and constant joints"—the latter sometimes containing infiltrated flint—which characterise the chalk "cliffs in many places near Margate" (Whitaker) must be familiar to numbers of the citizens of the metropolis. "Numerous vertical crevices," doubtless originally jointing, intersect a bed of chalk fifty feet thick, close to Dover, at the base of Shakespeare's Cliff.—(W. Phillips.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The accommodation recently provided for practical biological work has already proved seriously deficient, owing to the rapid growth of the classes in physiology and comparative morphology. The class-room for practical morphology was built to accommodate thirty students working at the same time, and the room for histology, 36. Additional temporary accommodation has been made for an increased number of students, but there are grave inconveniences in consequence. This year there are about fifty-five students in elementary morphology, and twenty in the advanced class; seventy students attend elementary physiology, and about fifteen the advanced course. The only possible alternative to the provision of new rooms, is the division of classes into sections, and repeating the practical work with each section; rendering a large increase in teaching power necessary. Moreover, such an arrangement will interfere with the rule that the practical work belonging to the lecture is gone through immediately after. Under these circumstances it is recommended by the Museums and Lecture Rooms Syndicate that a third floor should be added to the New Museum Building in its central portion, giving a new class-room sixty feet long, and new private rooms for Mr. Balfour's classes, while Mr. Balfour's present class-room could be added to Dr. Foster's department. The cost is estimated at about 1500*l.*

The increasing need for a new lecture-room for biology has not been lost sight of; and it is suggested that it will be advisable to adapt the present bird-room to the purposes of a lecture-room; while the Museum of Comparative Anatomy should be extended so as to be capable of accommodating the birds. This alteration would necessarily involve considerable expense, and it is postponed for the present.

Part I. of the Natural Science Tripos will begin on May 22; Part II. on June 1.

SCIENTIFIC SERIALS

Annalen der Physik und Chemie, No. 3.—Photometric researches, by E. Ketteler and C. Pulfrich.—Theory of elliptical double refraction, by E. Lommel.—On differences of tension between a metal and liquids of different concentration, by E. Ketteler.—On galvanic conbinations consisting only of elements, and on the electric conductivity of bromine and iodine, by F. Exner.—Reply to an observation by Herr F. Exner, on Volta's fundamental experiment, by F. Schulze-Berge.—Vaporisation, fusion, and sublimation, by M. Planck.—On new electric figures, and on the gliding of electric sparks, by K. Antolik.—Representation of longitudinal and transversal waves by projection, by R. Weber.—On the theory of stationary motion, by S. Oppenheim.

No. 4.—On the relation of transverse contraction to longitudinal dilatation in bars of isotropic glass, by W. Voigt.—On the electric resistance of vacuum, by E. Edlund.—Transportable instruments for measurement of variations of intensity of terrestrial magnetism, by F. Kohlrausch.—Tangent-compass for absolute measurements, mirror-galvanometer, electro-dynamometer, and magnetometer free of metal, by the same.—Remarks on the mechanical bases of the laws of Ohm and Joule, by E.

Budde.—Experimental researches on the intensity of diffracted light, II., by J. Fröhlich.—Some observations on the works of Herren Lommel, Glazebrook, and Mathieu, by E. Ketteler.—On the condensation of gases on surfaces, by H. Kayser.—Researches on the dependence of the molecular refraction of liquid combinations on their chemical composition, by H. Schröder.—On Legrange's equations of motion, by B. Weinstein.

Journal of the Franklin Institute, April.—A new theory of the suspension system with stiffening truss, by A. J. du Bois (concluded).—Adaptation of Euler's formula to American long column experiments, by W. H. Barr.—The Flannery boiler-setting for the prevention of smoke, by C. A. Ashburner.—Milk, by F. Haines.—The fire-underwriters' regulations respecting the use of the electric light.—On the filtration of water for industrial purposes, by P. Barnes.—The sugar-beet industry, by L. S. Ware and R. Grimshaw.—The Hudson River tunnel, by S. H. Finch.

Bulletins de la Société d'Anthropologie de Paris, tom. iv. fasc. iv. Paris, 1881.—This, the latest quarterly number of the *Bulletins*, contains the concluding part of M. Topinard's paper on his facial goniometer.—Observations by L. Manouvrier on the relations between the weight of the cranium and that of the maxillaries and the femur, with a view of trying to determine the relations between the several parts of the body connected with the cerebral, digestive, and motor functions.—Reports by M. Leboucle of a case of variation in the clavicular trapezius; and on the occurrence in man of the abnormal muscle named by Wood, the supercostalis"; a case of atavism in the occurrence, in a woman, of the flexor profundus digitorum of the ourang-outang, by M. Chuzinski.—On the crania of criminals preserved at Brest, by M. Corre.—On the craniology of criminals, by Dr. Ardouin, who also contributes an interesting paper on the results of the Medical Statistical Tables of Japan, published at Tokio in 1880.—M. Leon Metchnikoff gives the result of his ethnological observations while in Japan on the different races occupying the country, and his views as to their probable origin.—M. Verneau considers the type and origin of the ancient inhabitants of the Canaries; and M. Manouvrier describes at great length the result of his observations on eleven natives of Tierra del Fuego, in the Jardin d'Acclimatation, at Paris. His remarks gave rise to prolonged discussions among the Members of the Society, and were supplemented by a communication from M. Topinard, based on personal observation of these savages, and by a *résumé* by M. Hovelacque of all that is known of the people and their country, through the reports of English and French travellers.—M. Magitot describes the abnormal characters of a dwarf, presented last October by Baron Larrey to the Académie de Médecine; and M. de Quatrefages reports the case of a dwarf smaller than Tom Thumb, and in whom, he believed, that the disproportionally large size of the head was due to hydrocephalus.—M. Parrot brought forward a case of megaloglossis, combined with idiocy, in a child of two years of age.—M. Laborde presented to the Society his essay on the experimental and morphological function of the semi-circular canals in animals, in which he believes we may discover that of a "sensitvo-motor" apparatus, intended to render the sense of hearing more complete. M. Delaunay, in summing up the conclusions he has arrived at in his labours in the field of general pathology, considered the various degrees of liability towards certain diseases shown at different ages, by either sex, and among different races. The only contributions towards palæontological inquiry contained in this number are: M. Hamy's report of the progress of the excavations at Bollwiller, whose deposits would appear to belong to the latest neolithic age; Prof. Carl Vogt's communication of the discovery by M. Roth, in the Pampas of La Plata, of a human skeleton lying below the carapace of a fossil glyptodon; and the presentation, by M. Vinson, of a chromolithographic reproduction of a celto-iberian inscription, found near Siguenza. M. Vinson is of opinion that we have as yet no authority for accepting the theory of any close affinity of the Basques with the ancient Iberians.

Memorie della Società degli Spettroscopisti Italiani, March.—Solar observations made at the Royal Observatory of Palermo in the fourth quarter of 1881, by Prof. Ricco.

SOCIETIES AND ACADEMIES

LONDON

Zoological Society, May 2.—Prof. W. H. Flower, LL.D., F.R.S., president, in the chair.—Before commencing the usual proceedings, the president called attention to the fact that one of the communications made to the previous meeting was from the pen of Mr. Charles Darwin; and took the opportunity of referring to the labours and character of the illustrious naturalist, whose work had so profoundly modified not only zoological science, but so many other departments of human thought.—Mr. Sclater exhibited a drawing of a Tapir presented to the Society by Mr. Fritz Zurcher in August last, which had been captured on the Yuruari River in Venezuela. Mr. Sclater observed that in form and colour this animal seemed to agree better with *Tapirus dowii* than with the ordinary *T. americanus*, and suggested that it was quite likely that the former species might be the Tapir of the northern coast-region of Columbia and Venezuela.—Mr. J. E. Harting, F.Z.S., made some remarks on the desirability of adopting a standard of nomenclature when describing the colours of natural objects.—Dr. Hans Gadow, C.M.Z.S., read a paper on the structure of feathers in relation to their colour, in the course of which he endeavoured to show how the optical appearances of the various colours met with in the feathers of birds were produced.—Prof. Flower, F.R.S., gave an account of the cranium of a Cetacean of the genus *Hyperoodon* from the Australian Seas, upon which he proposed to found a new species, *H. planifrons*.—A communication was read from Dr. O. Staudinger containing the description of some new and interesting species of Rhopalocera from the New World.—A communication was read from Mr. H. J. Elwes, F.Z.S., containing a description of a collection of butterflies made on the Tibetan side of the frontier of Sikkim, amongst which were examples of several species new to science.—A communication was read from Mr. Edgar L. Layard, F.Z.S., describing a new species of Parrot of the genus *Nymphicus* from Uvéa, one of the Loyalty group, which he proposed to call *Nymphicus uvæensis*.

Geological Society, April 16.—J. W. Hulke, F.R.S., president, in the chair.—The President remarked that it would argue a degree of indifference with which the Society could not be charged, if the meeting were to proceed to the transaction of the ordinary business, without some reference to the sad loss sustained by the whole scientific world within the last few days, in the death of that illustrious naturalist, whose remains had been consigned that morning to their last resting-place at Westminster. He added that the spectacle presented by the vast assemblage of people who came together to witness the obsequies of Mr. Darwin, was of the most soul-stirring kind, and constituted the grandest conceivable testimony of respect for the memory of the distinguished philosopher who had just passed from among us.—S. S. Buckman, Hugh Salvin Holme, Collet Homersham, and Joseph B. Tyrrell were elected Fellows of the Society.—The following communications were read:—On fossil Chilostomatous Bryozoa from Mount Gambier, South Australia, by Arthur W. Waters, F.L.S., F.G.S.—*Thamniscus*: Permian, Carboniferous, and Silurian, by George W. Shrubsole, F.G.S.—On the occurrence of a new species of *Phyllopora* in the Permian limestones, by George W. Shrubsole, F.G.S.—On the relations of the Eocene and Oligocene strata in the Hampshire Basin, by Prof. John W. Judd, F.R.S., Sec.G.S. The section at Whitecliff Bay, in the Isle of Wight, affords us the means of determining the true order of succession of nearly 2000 feet of Tertiary strata, and is therefore employed as a standard to which to refer the strata seen in sections where the order of succession is not so clear. The author supported the views of Prof. Prestwich as to the limits of the Bracklesham series, as opposed to the opinions expressed on the subject by the Rev. O. Fisher. He pointed out the confusion which has arisen from the correlation of certain strata in the Hampshire basin with the barren Lower and Upper Bagshots of the London area, in which fossils are so rare as to render their geological age somewhat doubtful. To the Lower Bagshot some authors have referred 660 feet of the strata seen at Alum Bay; while other authors have restricted that name to about 73 feet of the same section. The age of the Upper Bagshot of the London basin is admitted by all authors to be very doubtful. The only way to avoid the confusion unavoidable from using the same names for strata, the correlation of which was so hypothetical, was to employ local names for both sets of beds. He proposed to refer to the freshwater sands below the Bracklesham and Bournemouth strata, containing a distinctive flora, as "the Studland beds," and the sands above the Barton clay by the old name of "the Headon Hill Sands." Above these sands are a series of clays only about 40 feet thick at Whitecliff Bay, but much thicker at Headon Hill and Hord-

well Cliff. These sands and clays form the Headon group; they consist of freshwater strata with bands of limestone and lignite, but including numerous inconstant intercalations of layers containing marine shells, for the most part much dwarfed. The age of the Headon group, as shown by the fossils which it contains, is that of "the zone of *Cerithium concavum* of continental authors. The brackish-water Headon group is succeeded at Whitecliff Bay by nearly 100 feet of purely marine strata. These marine beds, which had been shown to rest on an eroded surface of the Headon beds, contain the remarkable fauna which had been recognised by many British and foreign geologists as that of the Lower Oligocene. Similar strata with the same fossils are found in the New Forest, at Lyndhurst, Brockenhurst, Roydon, and other points, and there also attain a considerable thickness. It was pointed out that this marine series is quite distinct from the Headon, or zone of *Cerithium concavum*, with which it had been confounded. The author had been very severely criticised for the views which he had put forward in a former paper as to the manner in which the Brockenhurst series is represented in the section at the west end of the Isle of Wight. There was much difficulty in these variable estuarine beds in correlating the beds seen in Colwell Bay with those exposed in the cliffs of Headon Hill. With several previous authors on the subject, he maintained that the great series of sandstones and limestones forming Warden Point and How Ledge are continuous with those exposed in the face of Headon Hill, and, consequently, that the marine beds of Colwell Bay, overlying those limestone series are younger than the brackish-water bands interstratified with the Headon beds of Headon Hill. His critics, however, insisted that these two beds agreed with one another in such a manner that they must be regarded as parts of the same bed, separated by denudation. In opposition to this view, it was pointed out that the Colwell Bay bed is of the most inconstant character, and long before reaching Headon Hill is seen to be on the point of thinning out and disappearing altogether. In conclusion, the author pointed out that his own interpretation of the succession and correlation of the strata in the Hampshire basin brings them into complete harmony with that which is maintained by the great majority of continental geologists, while that of his critics appeared to be hopelessly irreconcileable with their views.

Chemical Society, May 4.—Dr. Gilbert, president, in the chair.—Prof. J. Dewar, F.R.S., delivered a lecture on the recent development of the theory of dissociation. The lecturer, after referring to the earlier work of Black on "Physical Chemistry," pointed out the origin of the term dissociation, and the experiments made thereon by Deville. Troost proved that dissociation is a function of the temperature, that it is independent of mass, and that the action is reversible; the process resembles in many respects the condensation and volatilisation of a vapour. The experiments in which vapours are conducted along heated porous tubes, only prove that dissociation takes place, but do not tell us the extent of the dissociation. Exact determinations of the partial pressures obtained by heating various substances, as ammoniochloride of silver, water, &c., to certain temperatures have been made, and thus curves have been drawn, which, by inspection, show the pressure necessary to prevent the decomposition of a substance at any particular temperature. Recent investigations have shown that solid substances have a temperature analogous to the "critical point" of gases, above which they cannot exist; thus, when hydrogen sulphide and water are subjected to great pressure at low temperatures, a crystalline hydrate is formed, but above 40° C. this substance cannot be shown to exist, however great the pressure may be. If a mixture of hydrogen and iodine be heated to about 300° C., some hydriodic acid is formed; if hydriodic acid be heated to 300° C., free hydrogen and iodine are formed, and the resulting mixture of hydrogen, iodine, and hydriodic acid has in each case the same composition. The lecturer then explained the cycle of Carnot, and showed how a formula could be deduced from it, by which the latent heat of a chemical compound could be calculated. The importance of the researches of Andrews on the liquefaction of carbon-dioxide was insisted upon, and the analogy of some of the results with the dissociation of chemical bodies pointed out. In conclusion, the author discussed the probability of the dissociation of elements in the sun's atmosphere, and reasoning from a legitimate extension of the known laws of dissociation, inferred that if hydrogen be considered as the elementary form of matter, the sun's atmosphere is most unfavourable to dissociation.

Anthropological Institute, April 25.—Hyde Clarke, vice-president, in the chair. It was announced that Alfred Morrison, F.G.S., and Frederick Harold had been elected Members of the Institute.—The Chairman referred at some length to the great loss that anthropological science had suffered by the death of Mr. Darwin, an Honorary Member of the Institute; Prof. Flower, F.R.S., also offered a tribute to Mr. Darwin's memory. Mr. E. H. Man read a second paper on the aboriginal inhabitants of the Andaman Islands. He touched first upon the important subject of language, and pointed out certain peculiarities connected with the varying use of several sets of possessive pronominal adjectives with particular classes of nouns: in expectation at an early date of a paper on the South Andaman language by the president of the Philological Society, this subject was but briefly dealt with by the author, who next proceeded to describe the Andamanese system of adoption and the recognised degrees of affinity, especially as bearing on the question of marriage, bringing to notice at the same time the erroneous opinions hitherto held on this latter point, as also anent their death and burial customs. Numerous superstitions, beliefs, and traditions were related, the latter treating of the account given by the aborigines regarding the Creation, Deluge, and Dispersion. Mr. Man was careful to state that he had taken the precaution to obtain his information from members of distant tribes who had had no opportunity of intercourse with Europeans or other aliens residing at Port Blair, and added that it was extremely improbable, for the reasons noted in his paper, that any previous generations of these islanders, within historic times, by whom these traditions had been handed down, could have obtained their versions from strangers.

Royal Horticultural Society, April 25.—Sir J. D. Hooker, in the chair.—*Larches attacked by larvæ:* Mr. Maclachlan reported upon some specimens of larch twigs received from Mr. R. Clutton, of Hartwood, Reigate, who stated that thousands of young larches were attacked by larvæ at Box Hill—"the affected trees swarm with little grubs which move about in their cocoons, and seem to suck the juices from the young foliage, leaving it dead, and so kill the trees." They proved to be the larvæ of a minute moth, *Coleophora laricella*, which lays its eggs on the twigs or buds. The larvæ hatched in autumn construct cases of cuticle, &c. The young *autumn* larvæ attach their cases to the young leaves in spring, which they soon mine and destroy. Mr. Maclachlan is of opinion that the damage done by this insect is not likely to seriously injure larches. He remarked that Box Hill being chalk and dry, was not well suited for the growth of larches.—*Fertilisation of Hoya:* Mr. W. G. Smith referred to this subject, and exhibited flowers with flies attached to the glutinous disks of the pollen-masses. The Hoya is highly fragrant. This fragrance is very attractive to insects, which are necessary for fertilisation of this plant. The pollinia are concealed, excepting the dark viscid disks, which are exposed. When an insect alights on the flowers, one foot at least slips and gets caught by one of the fine little glutinous disks. In its effort to escape two, three, or even four other feet are almost sure to get similarly caught. The insect then tries with all its power to free its limbs. If successful the pollen-masses are withdrawn out of the pouches by the feet. The basal appendages of each pair of pollinia are elastic, and when in the pouch they are like an extended spring, but the instant the masses are drawn out, the spring closes, and the two pollen masses quickly cross each other and hold tightly on to the insect's little claws. If the insect is weak, it cannot withdraw its legs at all, and so perishes on the flower; but if strong, it flies away with one to five pairs of pollinia clasped round its feet. Sometimes an insect breaks part of its leg off in trying to withdraw it. The five stigmas are not ready to receive the pollen at the time the pollen is mature; so that it is only when the insect realights on some neighbouring Hoya-flower in a more advanced stage of growth that cross-fertilisation takes place by its treading on the exposed stigmas.

EDINBURGH

Royal Society, May 1.—Mr. Milne Home, vice-president, in the chair.—Prof. Piazzi Smyth, Astronomer-Royal for Scotland, read a paper on some points in the meteorology of Madeira, both absolute and comparative. By a careful comparison of the mean monthly temperatures, the maximum temperatures, and the mean daily range, during the months of June and July at Madeira and Lisbon, it appeared that the temperature at the

former was markedly more equable. A like comparison was also instituted for the corresponding *annual* variations at Madeira, Lisbon, Jerusalem, and Scotland, and the same wonderful equableness was shown to exist. Observations with the wet- and dry-bulb thermometer, and spectroscopic indications of the "rain-band" proved the climate of Madeira to be at the same time remarkably humid, which at once explains its cold summers and warm winters. This striking humidity the author traced to the influence of the Gulf Stream, a branch of which trends south from the Bay of Biscay past the coast of Portugal. That the ocean waters around Madeira are peculiarly warm, was demonstrated by the late Sir Wyville Thomson in the *Challenger* Expedition. The abundant presence of watery vapour in the atmosphere also seems to have a marked influence upon the flora and fauna, which are very different from what would be expected when latitude alone is considered.—Mr. P. Geddes communicated a paper by Mr. F. E. Beddard, B.A., on the anatomy and histology of *Pleurochacta Moseleyi*, a new genus and species of earthworms, which had been brought home by Prof. Moseley from Ceylon. The chief characteristics of this species noted were, that the setæ are not arranged in continuous lines round the body, but in two lateral groups, that there are no segmented organs, and that the capillaries extend into the hypoderm, as in the leech.—Prof. Heddle, in the first of three notes, described a leaf-bed which he had discovered at the base of a high precipice at the north-west corner of the island of Canna. The bed consists of a highly laminated brown clay, easily split by tapping or by inserting the edge of a knife. This clay, when it comes down to the water's edge, is acted upon by the waves to form the so-called Fuller's earth. In the second note, the author intimated that the inner Hyskier—a group of skerries some nine miles from Canna—was formed of the pitchstone porphyry of the Scuir of Eigg, which is about twenty-two miles distant. The third note related to a supposed organism from the marble of Sutherland, which the author, from his intimate acquaintance with the structure and mode of occurrence of minerals, was certain was not a mineral. A specimen had been sent to Dr. Carpenter, who, without any knowledge as to where it had been got, described it as being very Eozoic.—Mr. J. Aitkin communicated a brief note on the selective absorption of sea-water for light, on which he had made some spectroscopic observations.

PARIS

Academy of Sciences, May 1.—M. Jamin in the chair.—The death of Mr. Darwin was commented upon by the President and by M. de Quatrefages.—On some reactions of bichloride of mercury, by M. Debray.—On the employment of liquefied gases, and particularly ethylene, for production of low temperatures, by M. Cailletet. A thermometer immersed in liquid ethylene indicated about −105°; whereas protoxide of nitrogen boils at −88°. In utilisation the liquid was, on opening an orifice in the receiver, projected through a glass tube on the apparatus to be cooled. Suddenly diminishing the pressure of compressed oxygen cooled to at least −105°, one observes tumultuous ebullition for a little; (at −88° oxygen gave merely a fine mist). Ethylene has the property of remaining liquid and transparent at temperatures where protoxide of nitrogen and carbonic acid become solid and opaque.—Separation of gallium, by M. Lecoq de Boisbaudran.—Report on a memoir of M. C. Stephanos, entitled "Memoir on Groups of Binary Forms having the same Jacobian."—Determination of the difference of longitude between Paris and Besançon, by MM. Barnaud and Leygue. A chronometric observatory is being founded at Besançon, for the benefit of the watchmaking industry there, and the difference of longitude between the site chosen and the Montsouris Observatory is found to be 14m. 36·267s.—Developments in series of a holomorphous function in an area limited by arcs of the circle, by M. Appell.—On certain ternary quadratic forms, by M. Picard.—On photographs of the spectrum of the nebula of Orion, by Prof. Draper.—On the polarisation of electrodes and on the conductivity of liquids, by M. Bouty. From experiments in which the electromotive method of M. Lippmann was applied to measuring the conductivity of acidulated water with a very weak electromotive force (*e.g.* that of a zinc-cadmium element), he concludes that a liquid has only one way of conducting electricity (not *two*, an *electrolytic* and a *metallic*, as some physicists suppose), whatever the special phenomena of the electrodes.—Influence of a metal on the nature of the surface of another metal placed at a very small distance, by M. Pellat. Two metal surfaces placed opposite each other at an interval of a few millimetres or tenths of a millimetre, have their superficial layers temporarily altered (as one finds on measuring the difference of potential); after separation the change gradually disappears. The author regards the action as not electric, but purely material, and depending on the nature of the influencing metal (it is great with lead, less with copper, *nil* with zinc). Metals seem to emit, at ordinary temperature, a volatile substance, which, deposited on the surface of objects, chemically modifies their nature.—On the liquefaction of ozone, by MM. Hautefeuille and Chappuis. By compressing, at about 125 atm., a mixture of oxygen and ozone in a bent tube, part of which was cooled with a jet of liquid ethylene (see above), they obtained ozone in liquid drops of a dark indigo blue colour. The vaporisation of the liquid is not very rapid, even at atmospheric pressure.—Action of insoluble metallic sulphides on a solution of acid sulphate of nickel in presence of sulphuretted hydrogen, by M. Baubigny.—Oxidation of pyrogallol in presence of gum arabic, by MM. de Clermont and Chautard.—Chemical study of various products of Uruguay, by M. Sace. This relates to caoutchouc from various fig trees, the camphor tree, a blue-flowered vetch, and chickweed.—Observations relative to a group of fossil Suidæ, whose dentition has some Simian characters, by M. Filhol. These fossils are from the upper eocene. Other points of similarity are the shortening of the skull and the form of the temporo-maxillary articulation.—Researches on the anatomy of some Echinida, by M. Kahler.—The Grotto Lympia, by M. Riviere. He finds evidence of the contemporaneity of the brecciform deposits of this grotto (discovered at Nice in 1878, and containing remains of *Elephas*, *Lagomys*, *Capraprimigenia*, *Cervus*, *Bos*, &c.), with quaternary man.—On the reptiles found in the gault of the east of France, by M. Sauvage. Eleven have been discovered. *Inter alia*, crocodiles existed of much larger size than those of the Cambridge strata. The principal Dinosaurian was a *Megalosaurus* (*superbus*) of gigantic size, differing in several features from the *M. Bucklandi* of the oolite in England.—A hypsometric map of the rivers of European Russia, by Col. de Tillo, was presented by M. Daubrée. It is observed that the principal water-courses of that country change pretty abruptly in general direction. M. Holtz noted several observations relative to intermittent springs.

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