Nature

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE

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VOLUME XXXVIII

MAY 1888 to OCTOBER 1888

"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH

London and New York

MACMILLAN AND CO.

1888

RICHARD CLAY AND SONS, LIMITED,
LONDON AND BUNGAY.

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A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

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Of Nature trusts the mind which builds for aye."—WORDSWORTH.

THURSDAY, MAY 3, 1888.

VOLAPÜK, PASILINGUA, SPELIN, LINGUALUMINA.

Volapük or Universal Language. By Alfred Kirchhoff. (London: Swan Sonnenschein and Co., 1888.)

Key to the Volapük Grammar. By Alfred Kirchhoff. (London: Swan Sonnenschein and Co., 1888.)

Elementar Grammatik zur Weltsprache (*Pasilingua*). By P. Steiner. (Berlin: Louis Heuser, 1887.)

Spelin, Eine Allsprache. By G. Bauer. (Agram: Franz Suppan, 1888.)

Lingualumina, or Language of Light. By F. W. Dyer. (London: Industrial Press, 1875.)

"IF only we had been consulted at the creation of the world, good as the general working of the machine is, how many little improvements might have been introduced!" This remark, not meant to be irreverent, is often heard when people suffer from toothache either at the arrival or at the departure of their molars, or when a sudden frost sets in and destroys the blossoms on all the fruit-trees in their garden. Volapük seems suggested by the same kind of sentiment. Languages, the adherents of Volapük seem to say, are all wonderful machines, but, if we could only have been consulted by the original framers of human speech, how many little irregularities might have been eliminated, how much might the whole working of the machine have been simplified, and what a saving of fuel might have been effected if instead of a thousand of these linguistic machines, each having its own gauge, there had been one engine only, taking us from Fireland to Iceland without any change of carriages.

Those who lament the imperfections of human speech may claim, however, this advantage over the grumblers at the world at large, that they are quite prepared to produce a better article. Again and again has the world been presented, not only with new alphabets and new systems of spelling, but with brand-new languages. Of late, however, there has been quite a good measure of them pressed down and running over. At the head of our article we have mentioned four only, called respectively *Volapük*, *Spelin*, *Pasilingua*, and *Lingualumina*. But there have been several more proposals for a universal language sent to us lately from various quarters of the world, all equally ingenious, though we are sorry we cannot disinter them from beneath that mighty cairn of pamphlets which is growing up from week to week in our library.

All these proposals have one thing in common. They start from a fact which cannot be disputed, that life is too short to learn more than four or five languages well, and that it is perfectly wicked to write books on scientific subjects in any language but English, French, German, or Latin. They then go off into raptures about the days when "the whole earth was of one language and one speech," and they even appeal to prophecy that it has been promised "that a pure language will be turned to the people, that they may all call upon the name of the Lord, to serve him with *one* consent."

And how is that prophecy to be fulfilled? Here the answers begin to vary a little. Some people say, Let everyone learn English, and the problem is solved at once. So it would be, so perhaps it will be, when the leopard shall lie down with the kid. But till that comes to pass different kinds of compromise are suggested. First of all, as to grammar, there is no excuse for any irregular nouns or irregular verbs, for gender as different from sex, for obsolete degrees of comparison, or for any involved syntactical constructions. These ought all to be abolished. Secondly, as to the dictionary, it is quite clear that if 15,000 words sufficed for Shakespeare, a dictionary of 250,000, like the English dictionary now being published by the University of Oxford, is the most fearful extravagance ever known. Here all inventors of a new language insist on retrenchment. The inventor of Volapük was satisfied at first with a dictionary of 10,000 words, but we are now promised a new one of 20,000.

There is a great difference of opinion, however, when the question arises from what source these words ought to be derived. Some draw their words at random from a number of the best-known languages, others confine themselves, as much as possible, to words common to German, French, and English. *Volapük* draws on several banks, chiefly on English, but it clips its coins fearfully. Thus, its very name, *Volapük*, is taken from German and English. *Vol* represents the German *Volk*, *pük* the English speech, so that *vola-pük* means originally folk-speech. In the same manner *appetite* has been replaced by *potit*, *abundance* by *bundan*, *silver* by *silef*, *Jew* by *yudel*, *house* by *dom*. In many cases these borrowed words have been so much changed that it is difficult to recognize them. Here *Pasilingua* has a great advantage. All its words remind us of a Teutonic or Romanic prototype, or of English, which has amalgamated these two elements in its dictionary. Volapük often requires a commentary, where Pasilingua allows us to guess with a good chance of success. Thus—

What o'clock is it? is in Volapük *Düp kimid binos?* in Pasilingua *Quota hora er al?*

Where do you live? is in Volapük *Kiplace lödens?* in Pasilingua *Ubi habitirs tüs?*

The sentence, Advertisements are to the man of business what steam is to industry, has been rendered in Volapük by *Lenunc binoms jafaman otos kelos stem plo dustor;* in Pasilingua by *Annóncius ers pro tos affäriros qua ta vapora pro ta industriu.*

After Volapük has once chosen what may be called its stems, which consist mostly of a consonant, a vowel, and a consonant only, everything else becomes easy enough Thus if *fat* stands for father, we get a simple declension:—

Singular.	Plural.
N. *fat*, father	*fats*
G. *fata*	*fatas*
D. *fate*	*fates*
A. *fati*	*fatis*

Pasilingua declines:—

Singular.	Plural.
N. *mortu*, the death	*mortas*
G. *mortude*	*mortasde*
D. *mortuby*	*mortasby*
A. *mortun*	*mortan*

Spelin declines:—

Singular.	Plural.
N. *mik*, a friend	*mikoes*
G. *doe mik*	*doe mikoes*
D. *tu mik*	*tu mikoes*
A. *mik*	*mikoes*

It is clear that there are ever so many ways by which the same result might be obtained, so long as the principle is strictly adhered to that each case shall have but one sign, and that the same sign is to be used in the plural and the singular, while the plural again is indicated by a sign of its own. In Bengali and many other languages the same principle is carried out with considerable consistency. What applies to declension applies to conjugation, to degrees of comparison, and to derivation. All becomes regular, simple, intelligible, whatever set of suffixes, prefixes, or infixes we adopt. Thus, to have is *lab* in Volapük. Hence:—

Singular.	Plural.
labob, I have	*labobs*, we have
labol, thou hast	*labols*, you have
labom, he has	*laboms*, they have
labof, she has	
labos, it has	
labon, one has	

By assigning to each suffix one peculiar power, Pasilingua distinguishes: *mortu*, death, *morto*, dead, *morte*, dead (fem.), *morta*, dead (neut.), *mortiro*, dying, *mortaro*, murderer, *mortamenta*, instrument of murder, *mortana*, poison, *mortarea*, battle-field, *mortitarea*, churchyard, *mortiblo*, mortal, *mortablo*, fatal, *mortoblo*, easy to kill, *morter*, to be dead, *mortir*, to die, *mortar*, to kill, *mortor*, to be killed, &c.

These few extracts will give our readers an idea of what they have to expect from *Volapük*, *Pasilingua*, and *Spelin*. *Spelin* has nothing to do with spelling. It is derived from *lin*, the abbreviated stem of *lingua*. *Pe* (from Greek *pas*) means all, *s* on account of its continuous buzzing sound is used to form collective nouns; hence *s-pe-lin* means all-language, or *Pasilingua*.

The study of these systems is by no means without interest and advantage. It will help to clear people's ideas about the great complexity of language, and show how simple a process grammar really is. If more generally adopted, as Volapük seems likely to be, such a system of writing may become even practically useful, particularly for telegraphic communication. That it could ever supplant our spoken language is out of the question, and Dr. Schleyer, the inventor of Volapük, distinctly disclaims any such intention ("Hauptgedanken," p. 10, note). One protest only we have to enter before leaving the subject. Nothing could be a greater mistake than to imagine that these clever and amusing experiments have anything in common with Leibniz's conception of a philosophical language. What Leibniz had in his mind may be guessed from the "Essay towards a Real Character and a Philosophical Language," by Bishop Wilkins, London, 1668, of which an abstract is given in Max Müller's "Lectures on the Science of Language" (vol. ii. p. 50). This is as different from Volapük as the *Kriegspiel* is from real warfare. For spending a dreary afternoon pleasantly, an experimental study of *Volapük*, *Pasilingua*, or *Spelin*, may safely be recommended. *Lingualumina* is a more serious matter. It is built on an exhaustive analysis of the notions that have to be expressed, and thus approaches nearer to the ideal which Leibniz had conceived of a perfect and universal language.

BRIDGE CONSTRUCTION.

A Practical Treatise on Bridge Construction: being a Text-book on the Design and Construction of Bridges in Iron and Steel. For the Use of Students, Draughtsmen, and Engineers. By T. Claxton Fidler, M.Inst. C.E. (London: Charles Griffin and Co., 1887.)

THIS book is principally intended for practical use by engineers and draughtsmen, who are now being called upon to design and construct bridges of unprecedented magnitude, like the Forth Bridge, which the introduction of iron, and latterly more especially of steel, has rendered possible. The execution of these requirements has brought forward a number of new problems to be solved in Statics, and the Elasticity and Strength of Materials, and has invested old problems with an importance which they did not before possess. Evolution in this branch of creation has gone on so rapidly that the Darwinian student of the "survival of the fittest" might turn to this book for striking exemplifications of his theories, which he would find in the classification of bridges, described and illustrated in the second section of the work. But while in the animate kingdom the mammoth animals have become extinct from insufficient mobility and relative strength to carry their own weight, the converse operation is observable in engineering construction. Bone and muscle are of the same strength as formerly, but the improved manufacture of steel has placed in the hands of the engineer a material with which he can safely attempt his mammoth creations; and should metallurgical science provide commercially for the engineer a new metal, as strong as, or stronger than, steel, but of less weight—say, aluminium—then we may expect to see still more marvellous developments in bridge building.

The bridge, on a large scale, resembles the mammoth or giant in requiring its whole strength to keep itself upright; and one of the most interesting theoretical questions discussed in the present treatise is the consideration of the maximum span possible with the material in hand—say, steel. When the span is large, the greatest economy in details must be practised, as the chief stress is due to the dead weight of the bridge, and not to the relatively insignificant weight of the moving load. Thus in the Forth Bridge a weight of 20,000 tons of steel is required in a single span to provide it with the necessary strength to hold itself up, so that the stresses due to a train of 200 tons running across may be left out of account.

The weight of metal worked into a bridge is at once a measure of the stresses in the material, and also of the quantity, and consequently the cost, of the material used. The author employs the customary units of engineers, the pound or ton as a measure of force and of weigh, and measures stresses in pounds or tons per square inch. He does not find it necessary to express his stresses in poundals per square foot, nor does he measure quantity of material in units of mass, which are *g* pounds or tons, as we are taught in theoretical text-books.

The mathematical student, to whom the book is partially addressed, will find it, while valuable as a handbook for a practical engineer, at the same time stimulating to his imagination in the realms of pure Abstract Mechanics, which at present run the risk of wandering away from reality, because the writers of modern text-books of mathematics do not look to the wonderful creations of modern engineering science for illustrations of theory. Thus the methods of Graphic Statics, largely employed in this treatise, arose out of the requirements of an engineer's office: a draughtsman was found using the method, and Prof. Maxwell seized upon it and elevated it to the rank of a new method in Mechanics.

Scientific treatises on Practical Mechanics are more common in America, where the requirements of opening up a vast continent have given great employment to the engineer and the bridge-builder; and it must be owned that these treatises are far superior to our own. But we hope the present treatise will do something to take away this reproach.

We may flatter ourselves that the Forth Bridge now in progress is the greatest thing of the kind in the world, but a rival in the Poughkeepsie Bridge is projected. These two bridges will exemplify the difference of practice of the Old World and the New. In our practice the whole bridge is riveted up into a rigid structure as much as possible; while in America the articulated system of triangular cells, with pin joints permitting rotation, is adopted, the stress in individual members being thus a simple pull or thrust. So far the American system has scored one in securing the contract for the Hawkesbury Bridge in Australia. This system affords the best theoretical illustrations of elementary Statics—the subject of Part I. of the present treatise—until the question of the bending moment (it is gratifying to find the term "tendency to break" of the abstract treatises discarded) comes into consideration, when the Old World bridge affords the requisite illustrations.

In Part III., on the "Strength of Materials," the author begins with the resistance of columns and struts to flexure, and here theory and practice have long worked together almost in harmony. The expression "breaking load" of a column—to mean the load which just starts flexure of the column—is apparently usual, but like the expression "tendency to break" should now be discarded for something more suitable. The theoretical strength of a column, according to Euler, which requires the assumption that the column is initially *perfectly* straight, and the actual strength against flexure, are represented in a diagram (p. 160); and the author has shown very ingeniously how the actual state of things encountered in practice can be imitated theoretically by a strut composed of two flanges of unequal elasticity (p. 163). Such a strut will begin to curve immediately as the load is gradually applied, and will thus represent very closely the actual behaviour of a continuous column, as great variations are found experimentally in the elasticity of iron or steel in specimens cut from one piece of metal (p. 167). When crushing or tearing takes place from continually applied pressure or tension, only empirical formulæ are suitable; but, as in actual structures the stress is kept by Board of Trade rules much below the elastic limit, the theoretical equations depending essentially on Hooke's law, that Tension and Extension are in the ratio of the Elasticity of the material, may be employed. Even with the low stresses permissible by law, Wöhler's researches on the fatigue of metals show that permanent deformation may keep on accumulating, and, in consequence, modern engineering practice is in some respects not so daring as formerly. Gordon's empirical rules (§ 124) (originally due to Tredgold) have been shown by Prof. J. H. Cotterill to rest on a theoretical basis, if the compression of the material due to the thrust previous to flexure is taken into account.

For very long spans, the only two rival methods of construction are the cantilever and the suspension principles, of which the Forth Bridge and the Brooklyn Bridge are the great respective examples. In the Cantilever method we build out equally on each side of a pier, so as always to preserve stable equilibrium, while in the suspension method the roadway is suspended from the chains or steel ropes. The chief drawbacks of the suspension principle, its defect of stiffness and great sensibility to changes of temperature, are shown by the author to be avoidable by the system of bracing in his "rigid suspension bridge" (Fig. 22).

The disastrous fall of the Tay Bridge Viaduct in a hurricane has forcibly redirected the attention of engineers to the importance of the theory of wind-pressure and wind-bracing (Chapter XXIV.), and now we may feel secure that in the new Tay Bridge of Mr. Barlow, as well as in all recent structures, ample allowance of strength is provided for against the effect of wind.

The book is copiously illustrated with excellent diagrams of real practice in the construction of bridges, based on the theories of the text, and should prove not only an indispensable hand-book of the practical engineer, but also a stimulating treatise to the student of mathematical mechanics and elasticity.

A. G. GREENHILL.

TWO FRENCH BOOKS.

Les Pygmées. Par A. de Quatrefages.

Les Ancêtres de nos Animaux, dans les Temps Géologiques. Par Albert Gaudry. (Paris: J. B. Baillière et Fils, 1887-88.)

THESE two works form two volumes of Baillière et Fils' "Bibliothèque Scientifique Contemporaine." The first, by the eminent Professor of Anthropology at the Jardin des Plantes at Paris, treats of the Pygmies, a diminutive race of mankind known to the ancients, alluded to by Homer, insisted upon as really existing by Aristotle, next believed to be but myths, and now established as a veritable race of the human kind. The author accepts for them the terms, suggested by Hamy, of Negritos and Negrilles, the latter being confined to the African Pygmies, and the former to those of the Asiatic Isles.

Avowedly a compilation, this little volume has all the peculiar charm that distinguishes Prof. Quatrefages' writings, and abounds with much curious and interesting details. The first chapter treats of the Pygmies from an historic point of view; the second, third, and fourth, of the Negritos, they being exclusively insular. The Negritos are to be found in New Guinea, and all over the Melanesian Archipelago, as far as Fiji; but, while the typical Negrito is confined to this area, conquest, emigration, and slavery have spread the race to Timor, Ceram, Bouro, Gilolo, to the western shores of Borneo, and so to other islands of the Pacific Ocean. Northwards they can be traced to the Carolines, and southwards to New Zealand where they preceded the Maoris. Mr. Ten Kate reports a Melanesian skull found in the little Isle of Santo Spiritu, off the coast of California. To the northwards they can be traced to the Loochoo Isles, Formosa, &c., while their western limits seem to be the Nicobar and Andaman Islands.

The question of the mixing of races on the borders of their distribution is discussed, and a good deal of recent information on this subject is given. The various modifications dependent on the wide range of distribution are also investigated, and the manners and habits of the several groups are described at some length. Good copies of photographs of native heads and figures are appended.

Chapter VI. treats of the Negrilles, or African Pygmies, the details of the Akkas, Tobbo and Chairallah, reared in Italy by Count Miniscalchi Erizzo being full of interest. The last chapter is devoted to the Bushmen of the Cape, and in connection with them there is an account of the Hottentots. The volume has thirty-one figures intercalated with the text.

The second work is by an equally well-known writer, —though of a very different school from that of Prof. Quatrefages—Prof. Albert Gaudry, also a Member of the Institute, and the Professor of Palæontology at the Museum. Well known for his able writings, and for his liberal and modern views on science, he has in this little volume given us a most delightful account of his ideas on the origin and development of the Mammalia during geological time. The volume begins with a chapter on the history of the progress of palæontology, followed by one on evolution and Darwinism. Though a disciple of D'Archiac, who was a strong opponent of Darwin's views, Prof. Gaudry read "The Origin of Species" with the most passionate admiration, and his labours since then have very materially helped to complete the palæontological record. The third chapter is devoted to the subject of the evolution of the Mammalia in geologic time; the fourth introduces us to the author's researches at Pikermi, where, as he tells us, he spent some of the most pleasurable moments of his life, engaged in excavating the remains of the quadrupeds which in times long ago roamed at liberty over the plains of Greece. Here were found an assemblage of animals of large size, such as has never been found before within so limited an area. Beautiful figures of many of these are given, and their relations to existing forms are explained. In another chapter we find an account of similar researches carried on at Léberon, near Cucuron (Vaucluse), where the remains were chiefly those of Herbivores, and an interesting table is added of the succession of the terrestrial Mammalia in France during the Tertiary period. In a concluding chapter there are some short sketches of the well-known palæontologists of the Museum: Alcide D'Orbigny, D'Archiac, Edouard Lartet, followed by a description of the fine new gallery for fossil forms at the Museum.

OUR BOOK SHELF.

The Elements of Graphical Arithmetic and Graphical Statics. By John Y. Gray and George Lowson, M.A. (London and Glasgow: W. Collins, Sons, and Co., 1888.)

IN the year 1871, Prof. Crofton, F.R.S., explained before the London Mathematical Society his diagrams illustrative of the stresses in Warren and lattice girders, and in the course of his remarks said that he had not found anything to help him in English text-books, and referred to papers by Profs. Rankine and Clerk-Maxwell. It was at this meeting (April 13) that Prof. Henrici drew attention to a work then little known in this country, viz. Culmann's "Graphische Statik"—"l'excellente 'Graphische Statik' de M. Culmann" (Prof. Cremona)—and showed that Prof. Crofton's constructions had been anticipated and the methods applied to a very wide range of subjects. On this occasion also Prof. Henrici illustrated the subject by a simple and ingenious notation. He subsequently drew up an abstract of Culmann's work (1866), which was printed in the Appendix to vol. iii. of the above-named Society's Proceedings (pp. 320-22). The work is now well known, and its methods are very generally employed by engineers, and are the subject of lectures in more than one of our Colleges.

The object of the book before us is to give an elementary account of the fundamental principles of the subject in a handy and cheap form, as well as to discuss some simple examples of their application.

The first part—which gives an explanation of graphical methods, illustrates graphical arithmetic, and shows how to represent areas and volumes by lines—is very carefully and clearly worked out, and leads one to see that this part of the subject might well come in at a fairly early date in school-work. Our idea is that the second part, "Graphical Statics," would be improved by more fullness of detail. It comprises an account of the following matters: kinematics, forces in one plane acting at a point, the funicular polygon, resolution of forces, moments, couples, bending moment and shearing force in a simple beam, rolling loads, framed structures, effects of wind-pressure on roofs, bridge-girders, and centres of gravity.

We have noted only two or three typographical errors. The notation employed is one most frequently termed "Bow's notation" in this book, from its having "been brought into use by Robert H. Bow, Esq., C.E.," but a note states that "the method seems, however, to have been first suggested by Prof. Henrici." We presume that Prof. Henrici's notation was the one we have referred to in the opening paragraphs of this notice. The immediate object of the book is to furnish help to students preparing for the South Kensington Examinations and for those of the City and Guilds of London Institute.

The Manual Training School. By C. M. Woodward. (Boston: D. C. Heath and Co., 1887.)

MR. WOODWARD has by no means a high opinion of the results of the efforts that have hitherto been made in European countries to promote technical education. In 1885 he spent five months in examining "trade schools" on this side of the Atlantic, and all the schools visited by him, with the exception of the French Government school at Châlons, disappointed him. He admits that they have "many excellent features"; but their manual training is generally, he holds, "very narrow," and he condemns "their long daily sessions, their long terms, and the conventional nature of their curricula." Manual training, according to Mr. Woodward, is in a much more flourishing condition in America. There it has been introduced "not for a trade or a profession, but for the healthy growth and vigour of all the faculties, for general robustness of life and character"; and he is of opinion that it has been developed in a way that places it "far in advance of any model in a foreign land." Whether or not this comparative estimate is accurate, no one who reads Mr. Woodward's book will dispute that the Americans have begun to understand thoroughly the importance of technical instruction, and that the leaders of opinion on the subject have done much to diffuse enlightened ideas as to the true aims and methods of manual training. Unfortunately, Mr. Woodward has not the art of presenting facts and arguments in an attractive style. He has, however, brought together a great mass of useful information about a subject of pressing importance, and his work, although relating chiefly to institutions founded in his own country, ought to find readers in England as well as in the United States. He does not enter, in detail, into the theory and practice of manual training in primary and grammar schools. He limits himself to the training of pupils beyond the age of fourteen. The value of the work is increased by a number of good woodcuts illustrating shop exercises in woods and metals.

The Method of Creation. By Henry W. Crosskey. (London: The Sunday School Association, 1888.)

THIS little volume belongs to a series of "Biblical Manuals," edited by Prof. J. Estlin Carpenter. With the polemical parts of the book we have, of course, nothing to do. In the chapters in which Mr. Crosskey devotes himself simply to the exposition of scientific truths he writes with full knowledge of his subject and in a clear and pleasant style. "How 'dry land' was formed" is the subject of an excellent chapter, in which the writer brings together some of the more striking of the facts which prove that rocks have been formed by various agencies, that there is no single period at which any kind of rock has been specially produced, that the crust of the earth consists of rocks in ordered succession, and that there has been an unvarying order in the succession of rocks. There are also good chapters on the history of plants and animals, and on the antiquity of the human race.

LETTERS TO THE EDITOR.

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

"Coral Formations."

DR. GUPPY's letter shows that I have not been sufficiently explicit on the subject of the formation of atolls, yet I cannot well understand that I have been obscure on the subject of his first question. Surely it is a sufficient reason for rejecting the theory of subsidence as applied to the Chagos Group that I fancy myself, in conjunction with M. Spurs, to have detected evidences of elevation in Diego Garcia. Darwin laid great stress on the character of the Great Chagos Bank as affording evidence of his theory of subsidence; he considers it to be an atoll drowned by a too rapid act of subsidence; but, as I have pointed out, if this were so it is impossible to understand how two atolls such as the Great Chagos Bank and Centurion's Bank could have been thus destroyed without Six Islands or Egmont's Atoll, which lies directly between them, being involved in their destruction. Further, the raised atolls north of Madagascar are unquestionable proofs of upheaval in this region, yet in the same region are low-lying atolls, atoll-shaped reefs awash, and submerged atoll-shaped banks. Clearly the theory of subsidence does not apply to these groups, and I do not see any reason for supposing that the Laccadive and Maldive Islands have been formed differently to the other atolls in the Indian Ocean, though I am unable to bring forward any fresh arguments with regard to them.

Secondly, because I do not agree with Mr. Murray in thinking that lagoons are due largely to the solvent action of sea-water, it is no reason that I should disagree with other parts of his theory. Indeed, after Dr. Guppy's striking observations at Santa Anna and other islands, it would be idle to deny that organic deposits have formed the bases of many atolls, perhaps of all. It did not seem to me necessary to deal with this part of the subject, because as a resident on an atoll without the means of making sectional soundings I had nothing new to say on the subject.

Perhaps you will allow me space to add that before reading my paper I had not had the advantage of meeting Mr. Murray. I have since had that advantage, and on comparing notes with him I find that I am much more in accord with him than my paper would seem to show. I still maintain my point that the rate of organic growth in the lagoon of Diego Garcia is sufficient to counterbalance the solvent action of the sea-water. In other points I agree with him, and believe that my observations confirm his view that atolls tend to spread outwards like a fairy-ring. Mr. Murray has convinced me that I laid undue stress on the direct influence of currents in determining the growth of corals, and this section of my paper was in consequence omitted in the account which appeared in the columns of NATURE. Judging from the local effects which I observed at Diego Garcia, where currents often swept through narrow channels with great force, and from Prof. Moseley's account of the oceanic currents sweeping past St. Paul's rocks, I was led to an exaggerated estimate of the rate of oceanic currents. No doubt a current running at the rate of some thirty-five miles in the day would modify or retard coral growth, but such currents are only found in narrow passages. G. C. BOURNE.

I LATELY discussed Murray's theory of coral formation with a class of boys and girls (fourteen to sixteen years of age), and *they* raised two questions which I am unable to answer. (1) If sea water dissolves the coral near the surface at such a rate as to form a lagoon, why does it not dissolve the limestone foundation even more rapidly? (2) After a reef has progressed a considerable distance from the shore, and a channel of open water is formed between, why should not the reef extend back again shorewards? How could such a channel as exists between Australia and its Great Barrier Reef ever have been kept open? These seem to be valid and serious objections: will some expert be kind enough to answer them? CHARLES R. DRYER.

Fort Wayne, Indiana, U.S.A., April 16.

Density and Specific Gravity.

THE point raised by Mr. Cumming in last week's NATURE (vol. xxxvii. p. 584), as to the use of the words density and specific gravity is, it seems to me, of some importance. For many years past I have, in my lectures, taken the law into my own hands in this matter, and, defining density as the mass of unit volume, I have defined specific gravity, in the way Mr. Cumming suggests in the last paragraph of his letter, as the weight of unit volume (or rather, lest I should cause any to offend against the examiner, I have thus defined *absolute* specific gravity, or specific gravity proper, and have pointed out that the definition commonly given was the definition of *relative* specific gravity). We thus get the parallel relations—

$$M = \rho V \text{ and } W = sV,$$

also

$$W = gM \text{ and } s = g\rho.$$

Thus regarded, specific gravity is to density just what weight is to mass. When force is expressed in absolute units of any kind, specific gravity and density must of course have different numerical values, just as weight and mass have. But in the very large number of cases in which weights are the only forces that have to be considered, and in which it is not needful to take account of the small changes of weight dependent on changes of geographical position, the local weight of the unit of mass may be conveniently taken as the practical unit of force—that is, we may take $g = 1$. In all such cases we have, *numerically*, weight = mass, and specific gravity = density, though the idea of weight is essentially different from that of mass, and the idea of specific gravity from that of density.

Of course, as Mr. Cumming points out, when specific gravity is defined as weight of unit volume, its numerical value for a given substance depends on what is taken as unit of weight and what as unit of volume. With the weight of 1 pound avoirdupois and the cubic foot as units, the specific gravity of water becomes 62·5, and that of platinum 1312·5, instead of 1 and 21 as given in the ordinary tables of (relative) specific gravities. If, on the other hand, we take as unit of weight the weight of unit volume of the standard substance, as is done when weights are expressed in grammes and volumes in cubic centimetres, or weights in kilogrammes and volumes in litres, absolute specific gravities and relative specific gravities become equal, and the ordinary specific gravity tables can be used for practical purposes, which is *one* of the great advantages to be gained by using the metrical system of weights and measures. With any other system, the numbers given in the tables require to be multiplied by the specific gravity of water—that is, they must be translated into absolute specific gravities—before they are of use for almost any real calculation, such as occurs either in experimental physics or in engineering practice. For instance, we weigh a measured length of copper wire and want to know its diameter, or we weigh the quantity of mercury that fills a glass bulb of which we require the capacity, or that fills a measured length of a tube of which we require the bore; or an engineer compares his pressure-gauge against a mercury-manometer in order to convert its indications into pounds-weight per square inch; or he has to calculate the pressure exerted by a brick wall so many feet high, or the weight of a mass of rock of so many cubic feet. In all these cases it is the absolute specific gravity that comes into account; it is no use to tell us that copper is 8·9 times as heavy as water, and mercury 13·6 times as heavy, unless we are told how heavy the unit volume of water itself is.

I maintain, in short, that the weight of unit volume of a substance is a quantity of very great practical importance, for which specific gravity is a very suitable name, whereas the ratio usually defined as specific gravity is of little or no use outside examination questions, and that if it needs a name it should be called relative density.

Further, my experience is that the definition here advocated presents considerable advantages from the point of view of systematic teaching. G. CAREY FOSTER.

University College, London, April 21.

JE crois que la notion de *specific gravity* donnée par M. Cumming dans NATURE du 19 avril (vol. xxxvii. p. 584) est de nature à puzzler les étudiants plus encore que la *vraie* définition physique de la densité.

La densité d'un corps est le rapport de sa masse à son volume—

$$\rho = \frac{M}{V}.$$

Dans le système C.G.S. la densité doit donc être exprimée en *grammes masse par centimètre cube* (voy. Everett, "Units and Physical Constants"). Le poids spécifique est le rapport du poids d'un corps à son volume et devrait être exprimé, dans le système C.G.S. en *dynes par centimètre cube*. Mais il y aurait alors le grave inconvénient pratique à cette définition *rigoureuse* que le poids spécifique varierait avec g, accélération due à la pesanteur, tandis que la densité resterait constante.

La confusion provient de ce que le mot *weight*, comme le mot *poids* en français, s'applique indistinctement à la *masse* d'un corps en grammes-masse et à la force qu'exerce la pesanteur sur le corps exprimée en grammes.

La solution logique est de supprimer le mot *poids* du langage, à cause de son double sens, et de ne parler que de la *masse* ou de la *force* exercée par la pesanteur, suivant que l'un ou l'autre facteur intervient dans les calculs.

En tout cas, exprimer le poids spécifique en livres ou en grammes est aussi absurde que d'exprimer les vitesses en mètres, et la puissance (*power*) d'une machine en ergs ou en *foot-pounds*. Le respect de l'homogénéité des formules est la condition essentielle des définitions des quantités physiques, et cette homogénéité n'est pas respectée dans la définition donnée par M. Cumming. E. HOSPITALIER.

Paris, le 23 avril.

The Ignition of Platinum in Different Gases.

AN abstract appeared a few weeks ago in NATURE relating to the "Occlusion of Gases by Platinum and their Expulsion by Ignition," which induces me to mention some curious results obtained by Mr. Lowndes and myself by the ignition of platinum in different gases. We were led to the experiments by another investigation on the behaviour of carbon at high temperatures in various gases. We find that when a platinum wire is heated to nearly melting by a current in an atmosphere of chlorine, the walls of the glass vessel become covered with a yellow deposit, which is insoluble in water, but dissolves in hydrochloric acid, and then, after addition of a little nitric acid, gives all the reactions of platinic chloride. The yellow deposit is in fact platinous chloride. At the same time the thick part of the platinum wire conveying the current, and which was not heated very highly, became incrusted with very fine long crystals of platinum. Some of these were more than the sixteenth of an inch in length, and apparently considerably more were located on that end of the thick wire leading to the negative pole than on the other.

There was also a very decided but lambent flame playing around the ignited and part of the cooler wire during the passage of the current. The arrangement used was a wide-necked flask, stopped with a glass bulb, through which a delivery-tube for the chlorine, and the two No. 12 platinum wires leading the current, passed. The ignited parts of the wire are little coils of No. 24 wire separated by a 1-inch piece of No. 12. On heating the flask externally up to the softening of the glass, the appearance of a flame around the wire increased slightly.

On repeating the experiment with bromine, very nearly the same effects were observed. The amount of platinous bromide was much less than in the case of the chloride, but the flame appearance was very much more pronounced. On passing chlorine into the bromine, so as to form chloride of bromine, both the flame appearance and the action on the platinum were largely increased. With iodine in the flask, vaporized by heating externally, little chemical action on the platinum was observed, only the slightest deposit being formed of a platinum-iodine compound on the glass; but, on passing chlorine into this also, a still more vigorous action on the metal took place, the deposit containing only chlorine and platinum. The flame appearance filled the entire flask. The spectrum of these flames shows no lines in any case. They are all continuous. The largest crystals of platinum were obtained with the ICl_3. Bromide of iodine behaved like iodine.

We have tried a number of other substances in a similar manner. Oxygen, sulphur, sulphur dioxide, nitric oxide, mercury vapour gave negative results as far as we could see. With hydrochloric acid some $PtCl_2$ was formed, but no flame appearance. Phosphoric chloride gave a slight flame, and some $PtCl_2$; but phosphorus is liberated, and then unites with the platinum, melting it. A current of very dry hydrogen fluoride was passed through the flask; before the wire was ignited no action on the glass of the flask was apparent, but almost immediately on passing the current the glass became much corroded by, probably, liberated fluorine. Owing to the flask breaking, we cannot say if platinous fluoride was formed.

With silicon fluoride a singular action took place, the wire, especially the negative half, becoming covered with long semi-transparent crystals of, we think, silicon. The silicon fluoride was very dry, and passed for a long time through the flask without any action until the wire was ignited, when simultaneously with the production of these crystals the glass vessel became much corroded. A small quantity of a soluble platinum salt was formed at the same time. We are continuing these experiments.

We do not think the platinum salts formed in this way are simply shot out by "volcanic" action, as they are quite uniformly spread over the sides of the glass vessel, and seem to be really volatile at the temperature and under the conditions. We have failed to find any record of platinum salts being volatile when heated under ordinary conditions, but it is probable that in the presence of free halogen they would be volatile.

Whether there be any true electrolytic action in these cases we are not at the moment prepared to say.

Royal Military Academy. W. R. HODGKINSON.

"The Nervous System and the Mind."

WILL you allow me to account for one or two of the discrepancies in my book which your very able reviewer points out in the current issue of NATURE?

He cannot reconcile the statement that "everyone nowadays admits that the evolution of mind and the evolution of the nervous system have proceeded *pari passu*, and are indeed but two aspects of the same process," with the further statement that "this way of studying them is so greatly neglected, is indeed derided and scouted." It is pointed out, however, in the passage from which he quotes, that the latter charge is laid at the door of my brother alienists only; while the former statement applies to psychologists at large.

Were it worth while, I could substantiate my charge by chapter and verse, but as the general movement is at last beginning in the direction I advocate, to do so would be to cause the cry from the wilderness to approximate too much to the character of the voice of chanticleer.

Your reviewer states, as if in controversion of my doctrine, that "experienced alienists tell us they find it necessary to admit a moral insanity with an average amount of intelligence." This I have never denied. My position is not that in "moral insanity" intelligence is deficient in amount. What I say is, that in "moral insanity" intelligence is always *disordered*. Disorder of intelligence is very different from deficiency of intelligence. CHAS. MERCIER.

Catford, S.E., April 23.

I AM glad that Dr. Mercier has found so little to complain of in the review of his recent work. I am bound to accept his explanation of the discrepancy I ventured to point out, although, on re-reading the two apparently antagonistic passages again, I do not find the distinction between psychologists and alienists, to which he now refers, clearly stated. The expression "everyone" (p. 4) appears to include both. Dr. Mercier's "brother alienists" are, it seems, excluded from the class that can grasp the truth that the evolution of mind and the nervous system are but two aspects of the same process, and belong to that uninformed class that "deride and scout" it. I certainly should have hesitated to understand this to be the author's meaning, but, being so, I must leave his benighted *confrères* to settle their account with him. They may perchance think that in this reading of the passage, "the voice of chanticleer" has already become associated with the *vox clamantis* in the wilderness!

In regard to the association of moral insanity with an average amount of intellect, I would only observe that the brother alienists of Dr. Mercier, including Dr. Maudsley, contend that, not only may this be met with, but that moral insanity may co-exist with an undisordered intelligence. Dr. Mercier's contention that "in moral insanity intelligence is always disordered" would therefore be still in conflict with the experience of some experienced alienists, which was the position I took.

Both these points, however, are only small matters compared with the general subject-matter of the work under review, and I repeat that it is gratifying to find there does not appear to have been any important mis-statement of Dr. Mercier's views in the friendly criticism of THE REVIEWER.

April 24.

Nose-Blackening as Preventive of Snow-Blindness.

MY friend Mr. Edmund J. Power sends me the following account of what appears to me to be an interesting fact. I should like to obtain suggestions from physiologists as to the possible explanation of the phenomenon, on the assumption that the blackening of the nose and eyelids really does prevent the injurious action of sunlight on the eyes; and further, I should like to know whether (quite apart from the fact of its utility or futility) the custom has possibly a remote origin in some ceremony or ritual. E. RAY LANKESTER.

"Can you or some of your friends explain the following?

"When in Colorado shooting the end of last year, my friend had a very bad attack of snow-blindness, caused by a long march on snow with bright sun. My eyes also were very bad the next day and caused much pain.

"Some days after I was under similar circumstances, when my guide stopped, and taking some burnt wood from a stump blackened his nose and under the eyes well down on the cheek-bone.

"On asking him the reason, he told me it stopped snow-blindness, and as the glare was very strong I did the same, and found immediate relief.

"I did this all the time I was out, and never found the snow affect my eyes in any way.

"Everyone I spoke to about it could give no reason for it, but all used it on the march. Some use glasses, but, as my man remarked, 'glasses cost dollars, dirt nothing.'

"Perhaps some of your friends can enlarge on the subject, as it is of great interest to me, and may be so to Alpine people, as glasses are hot to climb in, and from my own experience it is not easy to stalk in glasses and then take them off and shoot."

"Antagonism."

THE author of "The Correlation of the Physical Forces" has, I am sure, our sympathy when he relates how he has been forestalled by Prof. Huxley.

As Sir William Grove subsequently says that "it is always useful to know the truth," he will, perhaps, excuse my suggesting that his views upon antagonism as pervading the universe have been anticipated in a work published more than a quarter of a century ago. I allude to "First Principles," and more especially to the chapter in it upon "The Rhythm of Motion," in which the effects of antagonist forces are shown to be everywhere present, and are copiously illustrated and expounded from the stand-points of astronomy, geology, biology, psychology, and sociology. After reading this chapter, and especially its concluding sentence—"Given the co-existence everywhere of antagonist forces, a postulate which, as we have seen, is necessitated by the form of our experience"—we cannot, I think, but add another eminent name to that of Prof. Huxley as anticipating Sir W. Grove: it is that of Mr. Herbert Spencer.

F. HOWARD COLLINS.

Churchfield, Edgbaston, April 29.

Sense of Taste.

THE curious difference between male and female observers in detecting feeble traces of quinine, sugar, acid, &c., in water as mentioned in NATURE on p. 557 (vol. xxxvii.), is possibly owing to the sense of taste being injured in the males by the use of tobacco.

I have had occasion to apply delicate tests of smell and taste, and I find that even moderate smokers are unable to detect odours and tastes that are quite distinct to non-smokers.

Dunstable. W. G. S.

SUGGESTIONS ON THE CLASSIFICATION OF THE VARIOUS SPECIES OF HEAVENLY BODIES.[1]

III.

III.—SUB-GROUPS AND SPECIES OF GROUP I.

I. SUB-GROUP. NEBULÆ.

HAVING, in the preceding part of this memoir, attempted to give a general idea of that grouping of celestial bodies which in my opinion best accords with our present knowledge, and which has been based upon the assumed meteoric origin of all of them, I now proceed to test the hypothesis further by showing how it bears the strain put upon it when, in addition to furnishing us with a general grouping, it is used to indicate how the groups should be still further divided, and what specific differences may be expected.

The presence or absence of carbon will divide this group into two main sub-groups.

The first will contain the nebulæ, in which only the spectrum of the meteoric constituents is observed with or without the spectrum of hydrogen added.

It will also contain those bodies in which the nebula spectrum gets almost masked by a continuous one, such as Comets 1866 and 1867, and the great nebula in Andromeda.

In the second sub-groups will be more condensed swarms still, in which, one by one, new lines are added to the spectra, and carbon makes its appearance; while probably the last species in this sub group would be bodies represented by γ Cassiopeiæ.

Species of Nebulæ.

I have elsewhere referred to the extreme difficulty of the spectroscopic discrimination in the case of the meteor-swarms which are just passing from the first stage of condensation, and it may well be that we shall have to wait for many years before a true spectroscopic classification of the various aggregations which I have indicated, can be made.

It is clear, then, from what has gone before that in each stage of evolution there will be very various surfaces and loci of collisions in certain parts of all the swarms, and we have already seen that even in the nebulosities discovered by Sir Wm. Herschel, which represent possibly a very inchoate condition, there are bright portions here and there.

If the conditions are such in the highly elaborated swarms and in the nebulosity that the number of collisions in any region per cubic million miles is identical, the spectroscope will give us the same result. In the classification of the nebulæ, therefore, the spectroscope must cede to the telescope when the dynamical laws, which must influence the interior movements of meteoric swarms, have been fully worked out. The spectroscope, however, is certainly at one with the telescope in pointing out that so-called planetary nebulæ are among the very earliest forms—those in which the collisions are most restricted in the colliding regions. The colour of these bodies is blue tinged with green; they do not appear to have that milkiness which generally attaches to nebulæ, and the bright nebulous lines are seen in some cases absolutely without any trace of continuous spectrum. In higher stages the continuous spectrum comes in, and in higher stages still possibly also the bands of carbon; for in many cases Dr. Huggins in his important observations has recorded the weakness of the spectrum in the red, or in other words the strengthening of the spectrum in the green and blue exactly where the carbon bands lie.

But in all the bodies of Group I. which possess forms visible to us in the telescope, it would seem proper that their classification should depend mainly—at present at all events—upon their telescopic appearance, and there is very little doubt that a few years' labour with the new point of view in the mind of observers armed with sufficient optical power, will enable us to make a tremendous stride in this direction; but it seems already that this must not be done without spectroscopic aid. For instance, if what I have previously suggested as to the possible origin of the planetary nebulæ be accepted, it is clear that in those which give us the purest spectrum of lines, one in which there is the minimum of continuous spectrum, we find the starting-point of the combined telescopic and spectroscopic classification, and the line to be followed will be that in which, *cæteris paribus*, we get proofs of more and more condensation, and therefore more and more collisions, and therefore higher and higher temperatures, and therefore greater complexity in the spectrum until at length true stars are reached.

When true stars are reached those of the cluster appear nebulous in the telescope in consequence of its distance; the spectroscope must give us indications by absorption.

It is not necessary in this connection, therefore, to refer to undoubted star clusters, as the presence of absorption will place them in another group; but the remark may be made that it is not likely that future research will indicate that new groupings of stars, such as Sir Wm. Herschel suggests in his paper on the breaking up of the Milky Way, will differ in any essential particular from the successive groupings of meteorites which are watched in the nebulæ. Space and gravitation being as they are, it is not necessary to assume that any difference of kind need exist in the method of grouping formed stars and meteoric dust; indeed there is much evidence to the contrary.

II. SUB-GROUP. BRIGHT-LINE STARS.

It might appear at first sight that the distribution of bright-line stars among various species should be very easy, since a constant rise of temperature should bring out more and more lines, so that the species might be based upon complexity of spectrum merely.

But this is not so, for the reason that the few observations already recorded, although they point to the existence of carbon bands, do not enable us to say exactly how far the masking process is valid. Hence in the present communication I content myself by giving some details relating to maskings, and the results of the discussions, so far as they have gone, in the case of each star. I shall return to the line of evolution in a later paper.

Masking of Radiation Effects produced by Variations of Interspacing.

I have already stated that carbon bands are apt to mask the appearance of other spectral phenomena in the region of the spectrum in which they lie. In this way we can not only account for the apparent absence of the first manganese fluting, while the second one is visible, but it is even possible to use this method to determine which bands of carbon are actually present. There is another kind of masking effect produced in a different way, and this shows itself in connection with sodium. It is well known that when the temperature is low, D is seen alone, and if seen in connection with continuous spectrum the continuous spectrum is crossed by either dark or bright D, according to the existing circumstances.

I showed some years ago that the green line of sodium, not the red one, is really visible when sodium is burned in the bunsen burner. It is, however, very much brighter when higher temperatures are used, although when bright it does not absorb in the way the line D does.

Now, if we imagine a swarm of meteorites such that in the line of sight the areas of meteorite and interspace are

[1] The Bakerian Lecture, delivered at the Royal Society on April 12, by J. Norman Lockyer, F.R.S. Continued from vol. xxxvii. p. 609.

equal, half the area will show D absorbed, and the other half D bright; and in the resulting spectrum D will have disappeared, on account of the equality, or nearly equality, of the radiation added to the absorption of the continuous spectrum. The light from the interspace just fills up and obliterates the absorption.

But if the temperature is such that the green line is seen as well as D; in consequence of its poor absorbing effect there will be no dark line corresponding to it in the resulting spectrum, but the bright green line from the interspace will be superposed on the continuous spectrum, and we shall get the apparently paradoxical result of the green line of sodium visible while D is absent. This condition can easily be reproduced in the laboratory by volatilizing a small piece of sodium—between the poles of an electric lamp. The green line will be seen bright, while D is very dark.

In the bodies in which these phenomena apparently occur—for so far I have found no other origin for the lines recorded 569, 570, and 571—the wave-length of the green sodium line being 5687, such as Wolf and Rayet's three stars in Cygnus and in γ Argûs, the continuous variability of D is one of the facts most clearly demonstrated by the observations, and it is obvious that this should follow if from any cause any variation takes place in the distance between the meteorites.

In all meteoric glows which have been observed in the laboratory, not only D but the green line have been seen constantly bright, while we know in Comet Wells most of the luminosity at a certain stage of the comet's history was produced by sodium. It is therefore extremely probable that the view above put forward must be taken as an explanation of the absence of D when not seen, rather than an abnormal chemical constitution of the meteorites—that is to say, one in which sodium is absent. This may even explain the fact that up to the present time the D line of sodium has not been recorded in the spectrum of any nebula.[1]

Detailed Discussion of the Spectra of some Bright-Line Stars.

These things then being premised, I now submit some maps illustrating this part of the inquiry, although it will be some time before my investigations on the bright-line stars are finished. These maps will indicate the way in which the problem is being attacked, and the results already obtained. To help us in the work we have first of all those lines of substances known to exist in meteorites which are visible at the lowest temperatures which we can command in the laboratory. We have also the results of the carbon work to which reference was made in the previous paper; and then we have the lines which have been seen, although their wave-lengths have in no case been absolutely determined, in consequence of the extreme difficulty of the observation, both in stars and in comets, which I hold to be almost identical in structure.

In the case of each star the lines which have been recorded in its spectrum are plotted in the way indicated in the maps. The general result is that when we take into account the low temperature radiation, which we learn from the laboratory work, not only can we account for the existence of the lines which have been observed, but apparent absorptions in many cases are shown to be coincident with the part of the spectrum in front of a bright carbon fluting.

[1] In the lecture the author here referred to the spectrum of *o* Ceti, as photographed by Prof. Pickering for the Henry Draper Memorial, the slide having been kindly placed at his disposal by the Council of the Royal Astronomical Society. All the bright hydrogen lines in the violet and ultra-violet are shown in the photograph; with the exception of the one which is nearly coincident with H. The apparent absence of this line is in all probability due to the masking effect of the absorption-line of calcium. In this case, then, it appears that the calcium vapour is outside the hot hydrogen, and this therefore was being given off by the meteorites at the time.

A continuation of this line of thought shows us also that, when in these stars the spectrum is seen far into the blue, the luminosity really proceeds first from the carbon fluting, and in the hotter stars, from the hydrocarbon one in addition, which is still more refrangible. In the stars which have been examined so far, the dark parts of the spectrum, which at first sight appear due to absorption, are shown to be most likely caused by the gap in the radiation in that part of the spectrum where there is no continuous spectrum from the meteorites, and no bright band of carbon.

All the observations, it would appear, can be explained on the assumption of low temperature.

Notes on the Maps.

Lalande 13412.—Both Vogel and Pickering have observed the spectrum of this star and have measured the wave-lengths of the bright lines.

Vogel gives a sketch of the spectrum as well as a list of wave-lengths.

Vogel mentions a dark band at the blue end of the spectrum, and gives the wave-length in his sketch as from 486 to 473.

Both observers measure the bright 486 hydrogen (F) line.

Vogel measures a bright line at 540, while Pickering's measure is 545; but Pickering in another star, Arg.-Oeltzen 17681, has measured this line at 540, so there can be little doubt that is the correct wave-length.

Vogel measures a line at 581, but this has not been noticed by Pickering.

The bright part of the spectrum extending from 473 towards the blue with its maximum at 468 is, I would suggest, the carbon band appearing beyond the continuous spectrum, the rest of the carbon being cut out by the continuous spectrum, although 564 asserts itself by a brightening of the spectrum at that wave-length in Vogel's sketch, and by a rise in his light-curve.

The line at 540 is the only line of manganese visible at the temperature of the bunsen burner, while the 581 measurement of Vogel is in all probability the 579 line, the strongest line of iron visible at low temperatures.

In this star therefore we have continuous spectrum from the meteorites, and carbon bands, one of them appearing beyond the continuous spectrum in the blue as a bright band; bright lines of hydrogen, manganese, and iron being superposed on both. There is no absorption of any kind, the apparent dark band being due to defect of radiation.

Vogel's results are given in the ***Publicationen des Astrophysikalischen Observatoriums zu Potsdam***, vol. iv. No. 14, p. 17.

Pickering's are published in the *Astronomische Nachrichten*, No. 2376; *Science*, No. 41; and quoted in *Copernicus*, vol. i. p. 140.

2nd Cygnus.—B.D. + 35°, No. 4013.—Messrs. Wolf and Rayet, in 1867, first observed the spectrum of this star, and measured the positions of the bright lines. Micrometer readings and reference lines are given by them from which a wave-length curve has been constructed. The wave-lengths of the bright lines in the star thus ascertained are: 581 (γ), 573 (β), 540 (δ), and 470 (α); the relative intensities being shown by the Greek letters.

"La ligne β est suivie d'un espace obscur; un autre espace très-sombre précède α."

Vogel afterwards examined the spectrum, measured the positions and ascertained the wave-lengths of the bright lines, drew a sketch of the spectrum as it appeared to him, and a curve showing the variation of intensity of the light throughout the spectrum.

The wave-lengths given by Vogel are 582 and 570, and of a band with its brightest part at 464, fading off in both directions and according to the sketch having its red limit at 473. In the light curve Vogel not only shows the 582 and 570 lines, but also bright lines in positions which by a curve have been found to correspond to wave-lengths 540 and 636. Vogel indicates in his sketch a dark band extending from 486 to the bright band 473, and an apparent absorption on the blue side of the 570 line, this absorption being ended at 564. These two bands agree in position with the dark spaces observed by Messrs. Wolf and Rayet. The bright band in the blue at 473 is most probably the carbon band appearing bright upon a faint continuous spectrum, this producing the apparent absorption from 486 to 473. If the bright carbon really

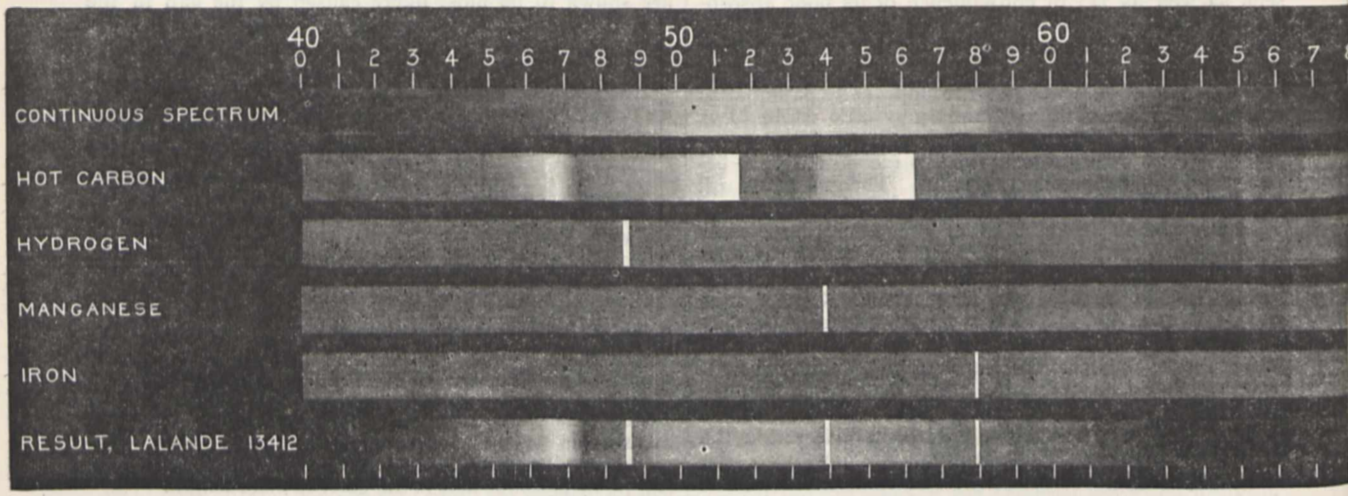


FIG. 4.—Map showing the probable origin of the spectrum of Lalande 13412.

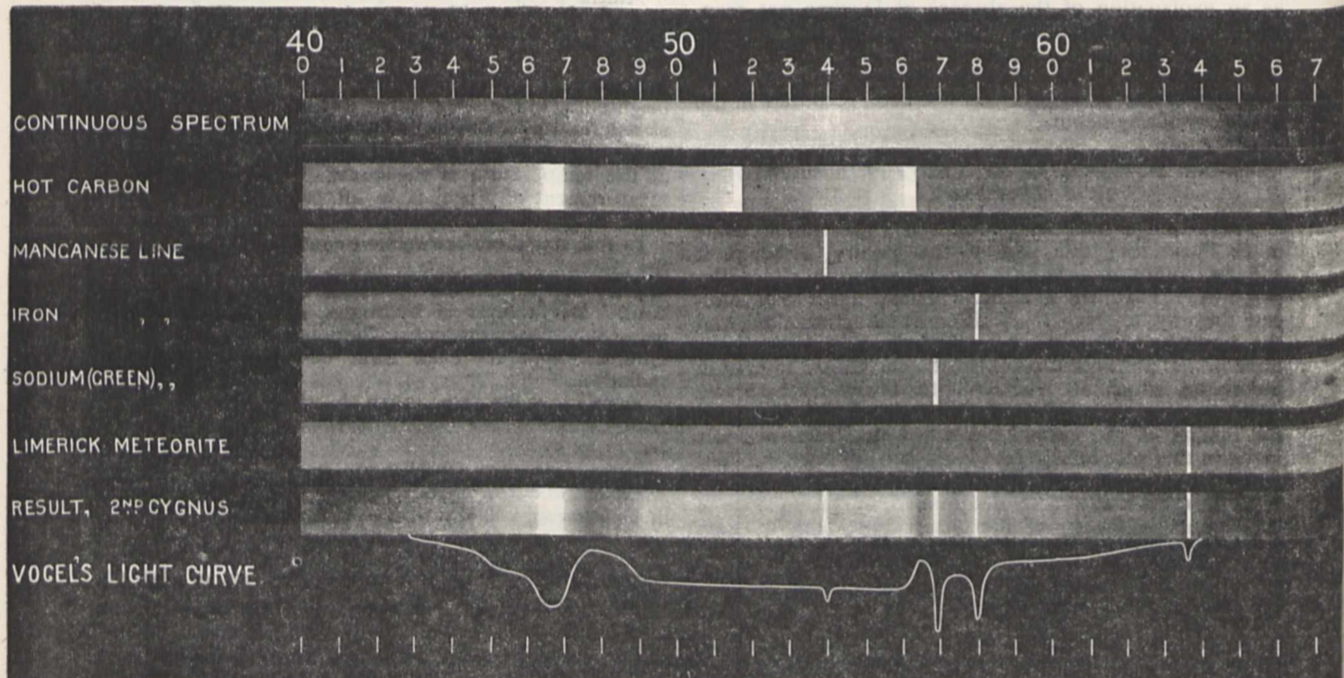


FIG. 5.—Map showing the probable origin of the spectrum of Wolf and Rayet's 2nd star in Cygnus.

accounts for the appearance of a dark band between the bright 570 and 564 in this star, all the apparent absorption is explained as due to contrast of bright bands on a fainter continuous spectrum due to red-hot meteorites.

The line at 540 is the only line of manganese visible in the bunsen burner, and the 580 line is the strongest low-temperature iron line. The 570 line is most probably the green sodium line 569, the absence of the yellow sodium being explained by the half-and-half absorption and radiation mentioned in the discussion of the causes which mask and prevent the appearance of the lines in a spectrum.

The line at 636 is in the red just at the end of the continuous spectrum, and as yet no origin has been found for it, although it has been observed as a bright line in the Limerick meteorite at the temperature of the oxyhydrogen blow-pipe.

This star therefore gives a continuous spectrum due to radiation from meteorites, and on this we get bright carbon (with one carbon band appearing separate in the blue), with bright lines of iron, manganese, sodium, and some as yet undetermined substance giving a line at 636 in the oxyhydrogen blow-pipe.

Wolf and Rayet's results are given in the *Comptes rendus*, vol. lxv. p. 292.

Dr. Vogel's are from the *Publicationen des Astrophysikalischen Observatoriums zu Potsdam*, vol. iv. No. 14, p. 19.

The above are only given as examples of the seven bright-line stars explained in the lecture.

(*To be continued.*)

THE ROYAL SOCIETY SELECTED CANDIDATES.

THE following fifteen candidates were selected on Thursday last by the Council of the Royal Society to be recommended for election into the Society. The ballot will take place on June 7, at 4 p.m. We print with the name of each candidate the statement of his qualifications:—

THOMAS ANDREWS, F.R.S.E.,

F.C.S., Assoc.M.Inst.C.E. Ironmaster and Metallurgist. Awarded by the Institution of Civil Engineers, for original metallurgical and physical researches, a Telford Medal and a Telford Premium, Session 1884; again a Telford Premium, Session 1885; and another Telford Premium, Session 1886. Author of the following eighteen papers:—In Proc. Roy. Soc. Lond. (four papers), "Electromotive Force from difference of Salinity in Tidal Streams," "Action of Tidal Streams on Metals during diffusion of Salt and Fresh Water," "Reversals of Electromotive Force between Metals of High Temperatures in Fused Salts," "Observations on Pure Ice and Snow" (a determination of their relative conductivity for heat, and the great contraction of ice at extremely low temperatures, &c.); Trans. and Proc. Roy. Soc. Edin. (four papers), "On Relative Electro-chemical Positions of Iron, Steels, and Metals in Sea Water," "Apparent Lines of Force on passing a Current through Water," "Resistance of Fused Halogen Salts," "Electromotive Force between Metals at High Temperatures"; Proc. Inst. Civ. Eng. (four papers), "On Galvanic Action between Metals long exposed in Sea Water," "Corrosion of Metals long exposed in Sea Water." Author of an investigation on "Effects of Temperature on Strength of Railway Axles," Part I., II., and III., conducted by the author at a cost of nearly £800, to determine on a large scale the resistance of metals to a sudden concussion at varying temperatures down to zero F. Author also of papers "On Variations of Composition of River Waters" (Chem. Soc., 1875), and "On Curious Concretion Balls from Colliery Mineral Waters" (Brit. Assoc. Rep., Chemical Section, 1879), and "On Strength of Wrought Iron Railway Axles" (Trans. Soc. Eng., 1879; a premium of books awarded for this paper). At present engaged on a research "On some Novel Magneto-Chemical Effects on Magnetizing Iron," and "On the Construction of Iron, Steels, and Cast Metals at Low Temperatures, – 50° F.," and "On the Viscosity of Pure Ice at – 50° F., &c."

JAMES THOMSON BOTTOMLEY, M.A.,

Demonstrator of Experimental Physics in the University of Glasgow. After being several years with Dr. Andrews in Belfast, as pupil, and as assistant afterwards, he acted as Demonstrator in Chemistry in King's College, London, under Dr. W. A. Miller, and subsequently as Demonstrator and Lecturer in Natural Science, under Prof. W. G. Adams, till 1870, when he came to his present post in the University of Glasgow. Author of "Dynamics," for the Science and Art Department; "Hydrostatics," ditto; "Mathematical Tables for Physical Calculations;" Essay on the Progress of Science since 1833 ("Conversations-Lexicon"); all the articles on Electricity and Magnetism in Moxon's "Dictionary of Science." Also of many scientific articles describing his own experimental researches, including "Thermal Conductivity of Water" (Phil. Trans., 1881); "Permanent Temperature of Conductors, &c." (Proc. Roy. Soc. Edin.), &c.

CHARLES VERNON BOYS,

A.R.S.M. Demonstrator of Physics, Normal School of Science and Royal School of Mines. Author and joint-author of the following:—"Magneto-Electric Induction" (Proc. Phys. Soc., 1879 and 1880); "An Integrating Machine" (Proc. Phys. Soc., 1881); "Integrating and other Apparatus for the Measurement of Mechanical and Electrical Forces" (Proc. Phys. Soc., 1882); "Apparatus for Calculating Efficiency" (Proc. Phys. Soc., 1882); "Measurement of Curvature and Refractive Index" (Proc. Phys. Soc., 1882); "Vibrating Electric Meter" (Proc. Roy. Inst. 1883); "New Driving Gear" (Soc. Art. Lect., 1884); and other papers.

ARTHUR HERBERT CHURCH, M.A. (Oxon.),

F.C.S., F.I.C. Professor of Chemistry in the Royal Academy of Arts. Sometime Professor of Chemistry in the Royal Agricultural College, Cirencester. Researches in Animal, Vegetable, and Mineral Chemistry, *e.g.* Turacin, an animal pigment containing copper (Phil. Trans., 1869); Colein, the pigment of *Coleus Verschaffeltii* (Journ. Chem. Soc, 1877); Aluminium in certain Cryptogams (*Chemical News*, 1874); Vegetable Albinism (Journ. Chem. Soc., 1879, 1880, 1886, Pts. I.-III.); New Mineral Species, Churchite, Tavistockite, Bayldonite (*ibid.*, 1865); Namaqualite (*ibid.*, 1870); Analysis of Mineral Phosphates and Arseniates (*ibid.*, 1868, 1870, 1873, 1875, &c., Proc. Roy. Irish Acad., 1882), &c.

ALFRED GEORGE GREENHILL, M.A.,

Professor of Mathematics for the Advanced Class of Artillery Officers at Woolwich. Was Second Wrangler and bracketed Smith's Prizeman in 1870. Has been Moderator and Examiner for the Mathematical Tripos, University of Cambridge, in 1875, '77, '78, '81, '83, '84. Author of "Differential and Integral Calculus" (1886); Article on Hydromechanics in the "Encyclopædia Britannica." Also of the following papers, in the Proceedings of the Royal Artillery Institute:—"Rotation required for Stability of Elongated Projectiles" (vol. x); "Motion in Resisting Medium" (*ibid.*); "Trajectory for Cubic Law of Resistance" (vol. xiv.); "Reduction of Bashforth's Experiments" (vol. xv.); "Siacci's Method for solving Ballistic Problems" (vol. xiv.). In the *Journal de Physique*:—"Sur le Magnétisme induit d'un Ellipsoide creux" (1881). *American Journal of Mathematics*:—"Wave Motion in Hydrodynamics" (vol. ix.). In the *Engineer*:—"Screw-propeller Efficiency" (1886). In the *Quarterly Journal of Mathematics*:—"Precession and Nutation" (vol. xiv.); "Plane Vortex Motion" (vol. xv.); "Motion of Top" (*ibid.*); "Motion of Water in Rotating Parallelopiped" (*ibid.*); "Fluid Motion between Confocal Ellipsoids" (vol. xvi.); "Solution by Elliptic Functions of Problems in Heat and Electricity" (vol. xvii.); "Functional Images in Cartesians" (vol. xviii.); "Complex Multiplication of Elliptic Functions" (vol. xxii.), and others. In *Messenger of Mathematics*:—"Fluid Motion" (vols. viii.-x.); "Lord Rayleigh's Theory of Tennis Ball" (vol. ix.); "Period Equation of Lateral Vibrations" (vol. xvi.); "Sumner lines on Mercator's Chart" (*ibid.*); "Solution of Cubic and Quartic" (vol. xvii.). In the Proceedings of the Cambridge Philosophical Society:—"Rotation of Liquid Ellipsoid" (vols. iii., iv.); "Green's Function for Rectangular Parallelopiped" (vol. iii.); "Integrals expressed by Inverse Elliptic Functions (*ibid.*); "Conjugate Functions of Cartesians" (vol. iv.); "Greatest Height a Tree can grow" (*ibid.*); "Complex Multiplication of Elliptic Functions" (vols. iv., v.). In Proceedings Institution Mechanical Engineers:—"Stability of Shafting" (1883).

LIEUT.-GENERAL SIR WILLIAM FRANCIS DRUMMOND JERVOIS, R.E., G.C.M.G.,

Governor and Commander-in-Chief of New Zealand. Distinguished as a Military Engineer. From 1841 to 1848 employed in South Africa, during which time he erected important military works, and added largely to the topographical knowledge of that part of the world, discovering the true feature of the Quathlamba Mountains, and making a minute topographical survey of Kaffraria; his map, published by E. Stanford, being a wonderful delineation of most difficult and rugged country. For nearly twenty years, from 1856 to 1875, employed in the designing and execution of the fortifications of the Empire at a most critical period, when, owing to the introduction of iron armour, a complete revolution took place in matters relating to ships, forts, and artillery. Was a member of the Scientific Commission (1861-62, &c.) appointed to investigate the subject of the application of iron armour to ships and forts. Governor of Straits Settlements, 1875-77. In 1877 selected to advise the Governments of Australia on the defence of their principal harbours. His recommendations have been adopted and carried out. In 1877 appointed Governor of South Australia, and in that capacity, as also in that of Governor of New Zealand (since 1882), has promoted the progress of Science in various ways.

CHARLES LAPWORTH,

Professor of Geology in the Mason Science College, Birmingham; Hon. LL.D. (St. Andr.). Most important contributions to the right understanding of the stratigraphy of the North-West Highlands and the Southern Uplands of Scotland, and investigations of the Palæozoic and other strata, as published in his papers on "The Moffat Series," "The Girvan Succession," "The Stratigraphy and Metamorphism of the Duness and Eriboll District," the "Secret of the Highlands," the "Close of the Highland Controversy," "Discovery of the Cambrian Rocks in the Neighbourhood of Birmingham," and on "The Classification of the Lower Palæozoic Rocks," &c.,—papers published between 1878 and 1887 in the Quart. Journ. Geol. Soc, and the *Geol. Mag.* Also for his Palæontological work, especially among the Rhabdophora, mainly published in six papers between 1873 and 1887. Recipient of the Murchison and of the Lyell Funds, and of the Bigsby Medal of the Geological Society.

T. JEFFREY PARKER,

Professor of Biology. Author of the Memoirs enumerated below. Distinguished as a Comparative Anatomist and as a Teacher. Has introduced an important new method of preserving the skeletons of cartilaginous fishes for museum purposes, and has rendered service to the cause of Science in the Colonies by his creation of the Otago Museum, and by his popular lectures and addresses. He has published thirty-three original papers on Biological subjects in the Proceedings and Transactions of various Societies—Royal, Zoological, Royal Microscopical, &c. Amongst these may be mentioned the following, viz.:—"On the Stomach of the Fresh-water Cray-fish," "On the Stridulating Organ of *Palinurus vulgaris*," "On the Intestinal Spiral Valve in the Genus *Raia*," "On the Histology of *Hydra fusca*," "On the Venous System of the Skate," "On the Osteology of *Regalecus argenteus*," "On the Blood-vessels of *Mustelus antarcticus*," &c.

JOHN HENRY POYNTING, M.A., B.Sc.

Professor of Physics in the Mason College, Birmingham. Author of the following papers:—"On a Method of Using the Balance with great Delicacy" (Proc. Roy. Soc., vol. xxviii.); "On the Graduation of the Sonometer" (*Phil. Mag.*, 1880); "On a Simple Form of Saccharimeter" (*ibid.*, 1880); "On Change of State: Solid-Liquid" (*ibid.*, 1881); "On the Connection between Electric Current and the Electric and Magnetic Inductions in the surrounding Field" (Proc. Roy. Soc., vol. xxxviii.); "On the Transfer of Energy in the Electro-magnetic Field" (Phil. Trans., 1884, Part II.).

WILLIAM RAMSAY,

Ph.D. (Tüb.). F.C.S., F.I.C. Professor of Chemistry, University College, London. President of the Bristol Society of Naturalists, and of the Bristol Section of the Society of Chemical Industry. Distinguished as a Chemist, and especially for his researches in Chemical Physics. Author of the following papers:—"Orthotoluic Acid and its Derivatives" (*Liebig's Annalen*, 1872); "Picoline and its Derivatives" (*Phil. Mag.*, 1876-78); "The Oxidation Products of Quinine and allied Alkaloids" (Journ. Chem. Soc., 1878-79); "Specific Volumes" (*ibid.*, 1879-81); "The Volatilization of Solids" (Phil. Trans., Pt. I., 1884); "The Vapour Pressures of Solids and Liquids" (Phil. Trans., Pt. II., 1884); "A Study of the Thermal Properties of Alcohol" (Proc. Roy. Soc., vol. xxxviii., p. 329); "On Evaporation and Dissociation" (Preliminary Notice, Rep. Brit. Assoc., 1884).

THOMAS PRIDGIN TEALE, M.A. (Oxon.),

F.R.C.S., 1857. Surgeon to the Leeds General Infirmary. Late Lecturer on Surgery, Leeds School of Medicine. Member of the General Medical Council. Eminent as a Sanitary Reformer, and Surgeon and Ophthalmologist. Author of—(*a*) various Papers and Lectures bearing upon Public Health and Sanitary Reforms, among which are:—(1) "Dangers to Health in our own Houses," a Lecture at the Leeds Lit. and Phil. Soc., 1877; (2) "Dangers to Health: a Pictorial Guide to Domestic Sanitary Defects," 4th ed., 1883 (also in French and German); (3) "Economy of Coal in House Fires," 1882; (4) "Address on Health" (dealing with the effects of Modern Educational Systems upon Health), delivered as President of the Health Section of the Social Science Congress at Huddersfield, 1883. (*b*) Papers of value in Surgery and Ophthalmology, extending from 1850 to 1885—(1) "On the Treatment of Lachrymal Obstructions, with suggestions to use Bulbed Probes" (*Med. Times and Gaz.*, 1860); (2) "On the Relief of Symblepharon by the Transplantation of Conjunctiva" (Ophth. Hosp. Rep., vol. iii., and Report of the International Ophthalmic Congress in London, 1872); (3) "On Extraction of Soft Cataract by Suction" (Ophth. Hosp. Rep., vol. iv.); (4) "The Relative Value of Atropine and Mercury in Acute Iritis" (*ibid.*, vol. v.); (5) "Enucleation of Nævus" (Trans. Med. and Chir. Soc., 1867); (6) "On Atrophy induced by Cicatrix" (*Brit. Med. Journ.*, 1867); (7) "On the Stimulation of Hip Disease by Suppuration of the Bursa over the Trochanter major" (Clin. Essay, No. 2, *Lancet*, 1870); (8) "Ovariotomy during Acute Inflammation of the Cyst" (*Lancet*, 1873); (9) "Ovariotomy in extremis" (Clin. Essay, No. 4, *Lancet*, 1874); (10) "Exploration of the Abdomen in cases of Obstruction of the Bowel" (Clin. Essay, No. 5, *Lancet*, 1875); (11) "On the Treatment of Vesical Irritability and Incontinence in the Female, by Dilatation of the Neck of the Bladder" (Clin. Essay, No. 6, *Lancet*, 1875); (12) "The Surgery of Scrofulous Glands" (*Med. Times and Gazette*, 1885).

WILLIAM TOPLEY,

F.G.S., Assoc.Inst.C.E. Student of the Royal School of Mines, 1858-61. For twenty years engaged in the Geological Survey; and has mapped parts of Kent, Surrey, Durham, Northumberland, &c., with illustrative sections and memoirs. Author of a general Memoir on the Geology of the Weald of Kent and Sussex. Author of various papers in Quart. Journ. Geol. Soc.; of a paper on the Relation of Geology to Agriculture, in Journ. Roy. Agric. Soc.; and on the Channel Tunnel, in *Quart. Journ. Sci.* Assisted Dr. Buchanan in a Report to the Privy Council Medical Officer, on the Distribution of Phthisis as affected by dampness of soil. Secretary (1872-81) of the Geol. Section of Brit. Assoc. Member for England of the Committee for preparing an International Geological Map of Europe. Editor of the *Geological Record*. President, Geologists' Association. Author of Report on "The National Geological Surveys of Europe" (Brit. Assoc., 1884).

HENRY TRIMEN, M.B. (Lond.),

F.L.S. Director of the Royal Botanic Gardens, Ceylon. Devoted to the study of Botany, systematic, descriptive, economic, geographical, and historical. Editor of the *Journal of Botany*, 1872-79. Author (in conjunction with Mr. W. T. Thiselton Dyer, F.R.S.) of "Flora of Middlesex" (1869); of the Botanical portion of Bentley and Trimen's "Medicinal Plants" (1875-80); and of more than sixty papers on botanical subjects, including:—"Descriptions and Critical Observations on the Successive Additions to the British Flora" (*Journ. of Bot.*, 1866-79); "The *Juncaceæ* of Portugal" (*ibid.*, 1872); "*Spenceria*, a new genus of *Rosaceæ*" (*ibid.*, 1879); "*Phyllorachis*, a new genus of *Gramineæ*" (*ibid.*); "Notes on *Oudneya* and *Boea*" (Linn. Soc. Journ., 1877-79); "Systematic Catalogue of the Phanerogams and Ferns of Ceylon" (Journ. Asiat. Soc. Ceylon, 1885); "Notes on the Flora of Ceylon, with Descriptions of many new species" (*Journ. of Bot.*, 1885); "Hermann's Ceylon Herbarium and Linnæus's 'Flora Zeylonica,'" being a critical examination of the plants of Hermann described by Linnæus (Linn. Soc. Journ., 1887); "Report to the Madras Government on the Cinchona Plantations of that Presidency" (1883); "Annual Reports of the Botanic Gardens, Ceylon" (1880-85).

HENRY MARSHALL WARD, M.A.,

F.L.S. Fellow of Christ's College, Cambridge. Professor of Botany, Royal Indian Engineering College, Cooper's Hill (Forestry Branch.) Distinguished for his researches in Histological and Cryptogamic Botany. Appointed by the Secretary of State for the Colonies to visit Ceylon, 1879-81, to investigate the Coffee-Leaf Disease. Has published numerous researches, of which the following are the more important:—"On the Embryo-sac and Development of *Gymnodenia conopsea*" (*Quart. Journ. Micros. Sci.*, 1880, pls. 3); "A Contribution to our knowledge of the Embryo-sac in Angiosperms" (Journ. Linn. Soc., 1880, pls. 9); First, second, and third Reports on the Coffee-Leaf Disease, Ceylon, 1880-81 (*ibid.*); "Researches on the Morphology and Life-history of a tropical Pyrenomycetous Fungus (*Asterina*)" (*Quart. Journ. Micros. Sci.*, 1882, pls. 2); "Observations on the genus *Pythueni*" (*Quart. Journ. Micros. Sci.*, 1884, pls. 3); "On the Structure, Development, and Life-history of a tropical Epiphyllous Lichen (*Strigula complanata*)" (Trans. Linn. Soc., 1883, pls. 4); "On the Morphology and the Development of the Perithecium of *Meliola*, a genus of tropical Epiphyllous Fungi" (Phil. Trans., 1883, Pls. 3); "On the Structure and Life-history of *Entyloma Ranunculi*" (Phil. Trans. 1887, pls. 4); "On some points in the Histology and Physiology of the Fruits and Seeds of the genus *Rhamnus*" (*Annals of Botany*, 1887, pls. 2). Translator of "Lectures on the Physiology of Plants," by Julius von Sachs (Clarendon Press, 1887).

WILLIAM HENRY WHITE,

Assistant Controller and Director of Naval Construction. Charged with principal responsibility for design and construction of all ships of the Royal Navy. Author of a "Manual of Naval Architecture," adopted as a Text-book in the Royal Naval College, issued to the Royal Navy, translated into German and Italian, and officially issued to both fleets. Author of numerous papers on the science and practice of Shipbuilding, most of these being published in the Transactions of the Inst. of Naval Architects, of which he is a Member of Council. In these papers there is a large amount of original scientific work, notably in "Calculations for the Stability of Ships," 1871 (written jointly with Mr. M. John); The Geometry of Metacentric Diagrams," 1878; "The Rolling of Sailing Ships," 1881; "The Course of Study at the Roy. Nav. College," 1877. Engaged in extensive theoretical investigations and experiments on the Structural Strength of Ships, and the Strains to which they are subjected at sea. Many of the results published in the "Manual of Naval Architecture" and Trans. Inst. Nav. Architects. Has had much to do with the extension of systematic observations of rolling, pitching, and general behaviour of H.M. ships at sea, from which much good has resulted to Ship-design, and valuable additions have been made to trustworthy information on Ocean Waves. Has also been able to render good service to the general extension of scientific methods of observing and analyzing the steam trials and turning trials of H.M. ships. Was closely associated for some years with the late Mr. Froude, and with the practical development in the designs of H.M. ships of the principles deduced from model experiments originated and conducted by Mr. Froude, which experiments are now superintended by the late Mr. Froude's son, Mr. R. G. Froude. Is the designer of some of the swiftest ships afloat, both armoured and unarmoured, in which designs wide departures were made from previous practice. Is a member of the Inst. Civ. Eng.; of the Council of the Inst. Naval Architects; Hon. Mem. of the N.E. Coast Inst. of Engineers and Shipbuilders; Member of the Roy. Unit. Serv. Inst. Has diploma as Fellow of the Royal School of Naval Architecture (highest class). Professor of Naval Architecture at South Kensington, 1871-73, and at Royal Naval College, 1873-81.

THE ISLANDS OF VULCANO AND STROMBOLI.

IN the spring of last year, accompanied by my friend Signor Gaetano Platania, I passed a month in a geological ramble through the Æolian Islands. In consequence of such a short stay, no observations were carried out with sufficient detail and accuracy to be worthy of publishing, especially after the many important observations that we already possess from Spallanzani to Judd. Unfortunately, the isolated position of the group, and the absence of any sufficiently qualified local observer, render it impossible to have continuous records of the vulcanological and seismological phenomena of the islands; in fact, what little is known has come from the few scientific travellers who from time to time visit this out-of-the-way locality. It is for that reason, therefore, that the following notes have been written, in the hope of saving a few of the links in the broken chain of the record of the two active volcanoes of Stromboli and Vulcano.

We arrived at Vulcano on May 24, 1887, and left the island on May 28. The erruption that had occurred during February and two following months of 1886 had drilled out the bottom of the crater, so that the lower half of the path (on the west side) leading down to the bottom of the crater had been removed, and its lower end terminated abruptly in a cliff sheer down to the crater bottom. In consequence we were unable to descend, but we could on two days get a good view of the crater bottom. Much hissing and blowing off of steam was going on from the fissures of the floor of the crater, which was covered by a layer of purplish-gray ash washed down from the sloping sides. The edges of the fissures in the bottom and lower part of the crater sides were covered by a yellow crust of what was no doubt sulphur, boric acid, &c.

On the somewhat flattened ridge forming the northern lip of the crater, and not very far from the head of the celebrated obsidian lava stream, was a very large fumarole emitting a strong and large jet of steam under pressure, having about the size and force of that of the *bocca grande* of the Solfatara. With our sticks we removed some of the stones choking the hole, which on their cooler parts were covered with deposits of sulphur and realgar. When this was exposed to the full jet of steam, the minerals were melted, and blown away or over the surface of the blocks, forming a kind of reddish varnish or patina, whilst a rain of drops was thrown into the air, so that our clothes and hats were bespattered with beads of a variable mixture of sulphur and realgar. To the east side, where are distinguishable three crater rings, a considerable number of fumaroles exist, depositing chiefly sulphur, but also boric acid where hottest. Mr. Narlian, a resident in the island, says that not since the 1886 eruption "has the crater entered into its former quiescent condition."

On the upper portion of the northern slopes of the cone, to the east of the obsidian stream, all the ground is fumarolic, and choked with sulphur, where that mineral is extensively quarried.

Vulcanello seems on the verge of extinction, it being possible to find only slightly warm exhalations of watery vapour in a few fissures.

During the days we were at Vulcano we noticed that the apparent quantity of vapour emitted had a very marked relationship to the moisture of the atmosphere, and therefore, indirectly, to the winds. The same we also observed to be the case at Vulcano as we saw it from time to time during our stay on the Island of Lipari.

June 1, 2, and 3 were spent at Stromboli. In ascending the volcano, we, on leaving the town, skirted the northern coast of the island, and after passing the Punta Labronzo commenced the ascent, gradually approaching the north-east limit of the Sciarra. It is a track that passes chiefly over hard rock, and to be strongly recommended in preference to any other paths, which are mostly over loose materials. Skirting the crater, one walks along the ridge of the mountain which overhangs and partly hides the crater; we commenced to descend a little on the south side of the volcanic mouth, until we arrived at a small pinnacle of rock, where a good view of the crater was obtainable. Here, under very great difficulties, from the looseness of the ground of about two square metres upon which we stood, an attempt was made to take two instantaneous photographs of the crater as we looked down into it. Unfortunately, both of these were useless, as we foresaw, from the vapour blowing towards us.

The crater was very quiet, only throwing out a very few fragments of pasty lava cake, with about four or five explosions during the four hours we remained near by. There were other explosions, but too weak to eject anything. I descended to the crater edge, but could not remain long, on account of the heat of the ground and the acid fumes, which seemed to be in great part composed of HCl with a good dash of SO_2.

On returning from the crater edge and descending a little lower on the south-west of the Sciarra, a good view is obtainable of that slope and the crater. Here two successful photographs were taken, which show very well the crater with its relative position to the summit of the mountain and to the Sciarra. On the following day the tour of the island was made in a boat, and, as only a few stones were being ejected, we were able to land on the narrow ledge or beach at the foot of the Sciarra. Two successful photographs were taken from the Scoglio dei Cavassi, from which a fine view is obtainable of the Sciarra and the crater.

During our residence on the island, and our stay at Salina and Panaria, we always noticed that the amount of visible vapour issuing was in direct proportion to the humidity of the atmosphere. On account of the great quietness of the volcano, it was impossible to form any judgment as to whether there was any relation of increased or diminished activity to the barometric pressure, and so, indirectly, to the winds.

Since leaving the island, correspondence has been kept up between Signor Giuseppe Rende, the post and telegraph master, and myself. The following information I have been able to glean from that gentleman's letters. From June to November 1887 the volcano remained in its normal state. On November 18, a moderate eruption (*eruzione mediocre*), and the wind blowing from the west, a shower of scoria (? fragments) (*aride pietre*), fell amongst the vines near the village. This was accompanied by explosions (*botti*), which, it appears, considerably frightened the people. Later, the scoria (*pomice*) fell into the sea, which it covered as far as the eye could see. Unfortunately, Signor Rende did not preserve any of the *ejectamenta*, but, judging from what one sees composing recent deposits of the island, the material was a pumiceous scoria, or a light scoria, as it appears to have floated on the sea.

In answer to further inquiries, Signor G. Rende tells me that the floating scoria extended *eastwards* as far as the eye could reach. No lava appeared, but a small mouth opened at the edge of the crater, but in a very few days disappeared. He then goes on to say:—

"I draw your attention in this letter to a very remarkable fact. On the 25th of last February (*i.e.* 1888), at 4.21 p.m., occurred two little shocks of earthquake of *undulatory* character, followed by a *subsultory* one, so that we thought it would be the end of the world for us. Never had a *subsultory* earthquake been felt. It split various houses, overturned walls, and made earth-banks slip. Those who had their eyes fixed on the mountain seemed to see the summit of it fall over from south to north. People who were working amongst the vines fell on their faces. No victims. Neither Panaria, Lipari, nor the other islands noticed the shock. The volcano (*i.e.* Stromboli) was in no way affected (*non fece mossa alcuna*)."

Prof. Mercalli has collected together what is known of the history of Vulcano and Stromboli. He also published accounts of the state of these volcanoes during the years 1882–86 inclusive ("Natura delle eruzione dello Stromboli," *Atti della Soc. Ital. di Sc. Nat.* vol. xxiv.; "Notizie sullo stato attuale dei vulcani attivi Italiani," *ibid.* vol. xxvii.; "La fossa di Vulcano e lo Stromboli dal 1884 al 1886," *ibid.* vol. xxix.).

The eruption of November 18, 1887, is curiously near the date of November 17, 1882, when one of the strongest modern eruptions of Stromboli occurred, and when five lateral mouths opened on the Sciarra about 100 metres below the crater edge, but without the ejection of a lava stream. As on one or two other occasions, the last eruption extensively covered the sea with scoria, a fact of no small importance when we take into consideration that Stromboli is a very basic volcano, in a unique state of chronic activity, and is yet able to produce scoria or pumiceous scoria, sufficiently vesicular to float on the sea, and so be transported to great distances.

With regard to the position of lateral eruptions of this mountain, the only situation in which dykes are visible is on the north-west side and near the Sciarra, where a considerable number are to be seen. One of these is visible in section near La Serra, showing it continuous with a lava flow that oozed from it only a few metres above sea-level, indicating that not very long since a lateral eruption gave rise to a lava stream; another, close to the crater, stands out as a great wall at right angles to the present eruptive axis of Stromboli, and certainly must have been formed when the crater was at a very much higher level. No less than three dykes at Stromboli are *hollow* ones, with their interspace filled in from above by loose materials, showing that they must also have been drained below present sea-level, as they reach—as hollow dykes—down to the beach. I believe I was the first to draw attention to this peculiar variety of dyke, in describing the eruption of Vesuvius of May 2, 1885, where it was possible to watch the process of formation ("L'Eruzione del Vesuvio nel 2 Maggio, 1885," *Ann. d. Accad. O. Costa d'Asp. Naturalisti*, Era 3, vol. i.; and "Lo Spettatore del Vesuvio," Napoli, 1887). These hollow dykes of Stromboli may be seen at La Serra, the northern limit of La Sciarra, and at Punta Labronzo. I expected them to be rare, as there is no mention of them made in any literature known to me; but as it is also well shown near the Punta del Corno, at Vulcano, it can hardly be the case.

In conclusion, I take this opportunity of thanking Signor Narlian, of Vulcano, and Signor Rende for their past kindness, and for the promise of further notes on these two isolated, neglected, but interesting volcanoes.

H. J. JOHNSTON LAVIS.

HEAD GROWTH IN STUDENTS AT THE UNIVERSITY OF CAMBRIDGE.[1]

IN the memoir read by Dr. Venn, on April 24, at the Anthropological Institute, upon the measurements made, during the last three years, of the students of Cambridge, one column is assigned to what he terms "Head Products," and which may fairly be interpreted as "Relative Brain Volumes." The entries in it are obtained by multiplying together the maximum length and breadth of the head and its height above a specified plane. The product of the three determines the contents of a rectangular box that would just include the portion of the head referred to. The capacity of this box would be only rudely proportionate to that of the skull in individual cases, but ought to be closely proportionate in the average of many cases. The relation they bear to one another affords, as it seems to me, a trustworthy basis for the following discussion, especially as all the measurements were made not only on a uniform plan, but by the same operator.

[1] Read at the Anthropological Institute, on April 24, by Francis Galton, F.R.S.

It will be convenient to reproduce Dr. Venn's figures in a separate table, neglecting the second decimal:—

Head Products.

Ages.	Class A. "High honour" men.	Number of measures.	Class B. The remaining "honour" men.	Number of measures.	Class C. "Poll" men.	Number of measures.
19	241·9	17	237·1	70	229·1	52
20	244·2	54	237·9	149	235·1	102
21	241·0	52	236·4	117	240·2	79
22	248·1	50	241·7	73	240·0	66
23	244·6	27	239·0	33	235·0	23
24	245·8	25	251·2	14	244·4	13
25 and upwards.	248·9	33	239·1	20	243·5	26
		258		476		361

The figures in the table are thrown into diagrams in Figs. I., II., and III., in which curves are also drawn to interpret what seems to be their significance. The great irregularity in Fig. II., corresponding to the age of twenty-four, may be fairly ascribed to the smallness of observations, only thirteen in number, on which it is founded. The three resultant curves are shown by themselves in Fig. IV., where they can be easily compared. It will then be seen that the A and C curves are markedly different, and that the B curve is intermediate. Accepting these curves as a true statement of the case—and they are beyond doubt an approximately true statement—we find that a "high honour" man possesses at the age of nineteen a distinctly larger brain than a "poll" man in the proportion of 241 to 230·5, or one that is almost 5 per cent. larger. By the end of his College career, the brain of the "high honour" man has increased from 241 to 249; that is by 3 per cent. of its size, while the brain of the "poll" man has increased from 230·5 to 244·5, or 6 per cent.

Four conclusions follow from all this:—

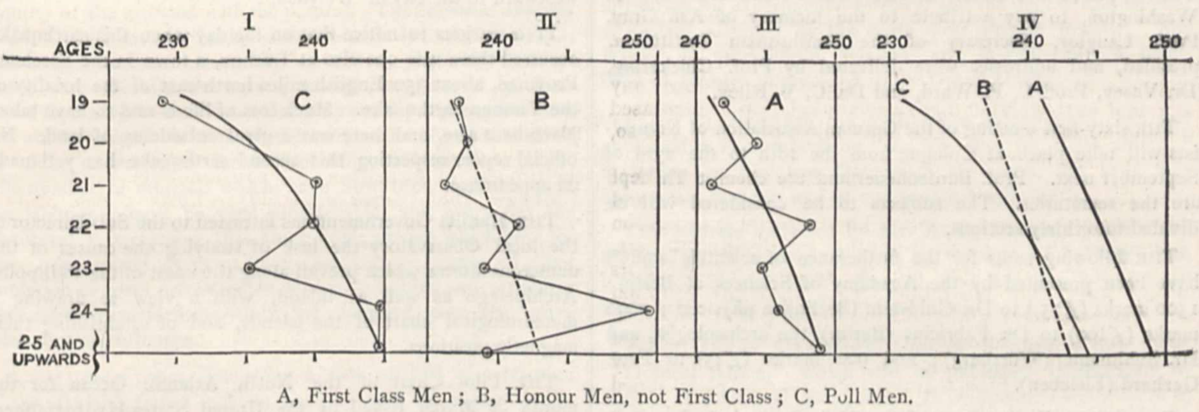
(1) Although it is pretty well ascertained that in the masses of the population the brain ceases to grow after the age of nineteen, or even earlier, it is by no means so with University students.

(2) That men who obtain high honours have had considerably larger brains than others at the age of nineteen.

(3) That they have larger brains than others, but not to the same extent, at the age of twenty-five; in fact their predominance is by that time diminished to one-half of what it was.

(4) Consequently "high honour" men are presumably, as a class, both more precocious and more gifted throughout than others. We must therefore look upon eminent University success as a fortunate combination of these two helpful conditions.

Length × Breadth × Height of Head, in inches, of Cambridge University Men at different Ages (from Dr. Venn's Tabes).



A, First Class Men; B, Honour Men, not First Class; C, Poll Men.

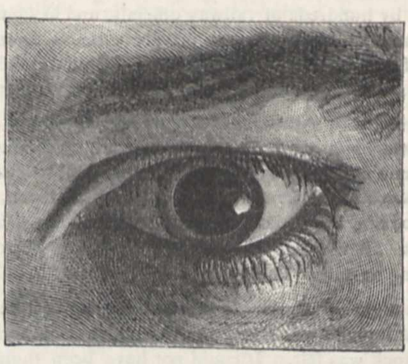
PHOTOGRAPH OF THE EYE BY FLASH OF MAGNESIUM.

THE effect of complete obscurity on the normal pupil has hitherto been seen only by the light of electric discharges, which allowed of no measurements.

MM. Miethe and Gaedicke, by their invention of the well-known explosive magnesium mixture, have furnished us with a simpler method. A photograph of the eye can be taken in a perfectly dark room, showing the pupil fully dilated, as its reaction does not begin until after exposure.

Mr. Miethe, astronomer at the Potsdam Observatory, himself at my suggestion undertook to execute the accompanying photograph of a normal eye, life-size, after a quarter of an hour's rest in a carefully darkened room. The pupil was found to measure 10 mm. horizontally (the breadth of the cornea being 13 mm.). A reflection of the flash is seen on the cornea.

This kind of photography may prove a new and valuable method for many other branches of scientific research, but it is of especial utility to ophthalmology, as the eye, by its mobility and sensitiveness, has hitherto been a most difficult subject for the camera.



CLAUDE DU BOIS-REYMOND.

NOTES.

THE Council of the British Association has nominated Prof. Flower for the Presidency of the meeting to be held next year at Newcastle.

THE annual *conversazione* of the Royal Society will be held on Wednesday, May 9.

THE Council of the Marine Biological Association has appointed Mr. Gilbert C. Bourne, M.A., F.L.S., Fellow of New College, Oxford, to be Director and Secretary of the Plymouth Laboratory. Mr. Bourne began the study of biology under Dr. P. Herbert Carpenter at Eton College, and in 1881 obtained an exhibition in natural science at New College. After studying under Prof. Moseley at Oxford and Prof. Aug. Weismann at Freiburg in Baden, Mr. Bourne was placed in the first class in the honour school of natural science at Oxford in 1885. Immediately after taking his degree he proceeded to Diego Garcia in the Indian Ocean, with the purpose of investigating the fauna and flora of that island. On his return to England he became assistant to Prof. Moseley at Oxford, and has performed the duties of Lecturer and Demonstrator in Animal Morphology for the last two years. In October last Mr. Bourne was elected to an open Fellowship at New College.

ON the evening of April 5, about one hundred and fifty persons interested in science met in the hall of the Columbian University, Washington, to pay a tribute to the memory of Asa Gray. Prof. Langley, Secretary of the Smithsonian Institution, presided, and addresses were delivered by Prof. Chickering, Dr. Vasey, Prof. L. F. Ward, and Dr. C. V. Riley.

THE sixty-first meeting of the German Association of Naturalists will take place at Cologne from the 18th to the 23rd of September next. Prof. Bardenheuer and the chemist Th. Kyll are the secretaries. The subjects to be considered will be divided into thirty sections.

THE following sums for the furtherance of scientific studies have been presented by the Academy of Sciences at Berlin: 1500 marks (£75,) to Dr. Goldstein (Berlin), a physicist; 2000 marks (£100) to Dr. Fabricius (Berlin), the archæologist, and Dr. Suhlmann (Würzburg); and 900 marks (£45) to Prof. Gerhard (Eisleben).

CAPTAIN C. E. DUTTON, of the U.S. Geological Survey, is writing his monograph on the Charleston earthquake. The reports on which it will be based are complete, and in shape for the printer. *Science* is of opinion that no earthquake of ancient or modern times has been observed with such care and fulness of detail. Besides the observations made by Professors in several Colleges, by hundreds of railway officials, and at signal stations, a large number of intelligent private citizens have given an account of their own experiences. The volume which Mr. Dutton is editing will also contain a report on the Sonora earthquake.

ON the night of April 17 a magnificent display of the aurora borealis was observed at Motala, in Sweden, in the northern sky. On the same night at 9.5 p.m. a phenomenon was seen in the north-western sky at Örebro, also in Central Sweden, having the appearance of a bright horizontal flash of lightning, but without any report. It was followed by the appearance of an unsteady and varying aurora. The thermometer stood at 21° C.

ON the night of March 27 a rumbling noise like that of a distant earthquake was heard at Aaseral, in Southern Norway, but no shock was felt. It could not have been thunder, as the weather was clear and intensely cold.

ACCORDING to the official report of the recent great earthquake in Yunnan Province of China, the shocks commenced between 5 and 6 p.m. on January 14, and lasted till 4 o'clock the following morning. During this period about ten serious shocks were counted, all being accompanied by a noise like thunder. In district cities in the south of the province, the town walls were either thrown down or cracked, while public offices and temples shared the same fate. In the city of Shih-ping large numbers of private houses were destroyed, those in the south and east quarters suffering most, while those which remained standing had cracked or slanting walls. Two hundred persons were killed in this town alone, and 3000 were injured. In and around this single city about 5000 persons were killed and injured. Most of the people were left without homes, and were starving, as the provisions were buried in the ruins of the houses. In one town the gaol was thrown down by the shocks, and all the prisoners escaped. The earthquake is said to be the most destructive ever recorded in China. The locality in which it was most violent is mountainous, and produces copper and a particular kind of tea for which Yunnan is famous. The area of disturbance is said to be about 770 miles from east to west, and 60 from north to south, Shih-ping being near the centre. The direction of the shocks appears to have been at right angles to the prevailing direction of the valleys, lakes, and rivers of the region. This, at least, is how the Pekin correspondent of a Shanghai newspaper reads the report; and he adds that from the centre of intensity, a little to the west of the city of Shih-ping, there was a decided extension of the earthquake-wave northward in the direction of the Yunnan lake Tienchih, as well as westward to the city of Weiyuen.

IT is curious to notice that on the day when this earthquake occurred there was one also at Luchon, a town in the Szechuen Province, about 350 English miles north-east of the locality of the Yunnan earthquake. Much loss of life is said to have taken place here also, and there was a great subsidence of land. No official report respecting this second earthquake has yet made its appearance.

THE Manilla Government has intrusted to the Sub-Director of the local Observatory the task of studying the causes of the numerous storms which prevail along the coast of the Philippine Archipelago as well as inland, with a view to drawing a meteorological chart of the islands, and of establishing their magnetic positions.

THE Pilot Chart of the North Atlantic Ocean for the month of March, issued by the United States Hydrographer, contains the following interesting facts. Three pronounced cyclonic storms passed over the North Atlantic during the month. One of these was in some respects one of the most remarkable and destructive storms ever experienced along the Atlantic coast of the United States. After traversing the entire American continent from west to east without any noteworthy energy, it gained terrific force on reaching the coast to the southward of Hatteras on the 11th. Its progress eastward was delayed from the 11th to the 15th by an area of high barometer, and it then resumed its course easterly with renewed energy, crossing the 40th meridian in about 50° N. latitude. Much less fog was experienced off the Grand Banks than usual during March. Field ice was encountered as far south as 43° N., and between 46° and 60° W., but the amount reported was not great. Earthquakes were experienced by the United States store-ship at Coquimbo on January 4, and by the British ship *Diadem* in latitude 26° 2′ N., longitude 63° 19′ W, on March 1. The sensation in the latter case was as though the vessel had grounded upon a reef.

IN the storm to which reference is made in the preceding note, oil seems to have been freely used off the coast of the United States for the calming of the waves. According to *Science*, more than a dozen captains and sailing-masters caught in the tempest when at its worst believe their vessels were saved by this expedient. The sailing-master of the yacht *Iroquois* reports that when furious waves with an immense comb were approaching they were deprived of their power to do harm by "a patch of oil no larger than a dining-room table."

ANOTHER interesting mineral synthesis has just been effected by M. Dufet. Native di-calcium arsenate, pharmacolite, occurs very sparingly upon the known parts of the surface of our globe, and is so rarely found in well-defined crystals that M. Des Cloizeaux has only just completed his investigation of its mineralogical and optical properties. Generally it is found in the form of silky fibres, but is at times met with in perfect monoclinic prisms of pearly lustre and frequently possessing a pink tint. M. Dufet has succeeded in producing these beautiful crystals by a very ingenious method. Two concentric vases, the outer containing nitrate of lime and the inner di-sodium arsenate, were filled with water, and so arranged that very slow diffusion occurred between the two liquids. The conditions of Nature were evidently very closely imitated, for the very gradual precipitation thus brought about resulted in the formation of groups of crystals, exactly resembling those of pharmacolite. Goniometrical measurements showed that they belonged to the monoclinic system; and the close approximation of the fundamental angles to those of the mineral given by Haidinger and Schrauf, and especially the still more remarkable closeness to the values just arrived at by M. Des Cloizeaux, leave no doubt as to the identity of the artificial with the natural. The chemical analysis of M. Dufet's crystals leads to the formula $HCaAsO_4 + 2H_2O$, and it thus becomes chemically as well as physically isomorphous with brushite, the corresponding phosphate of calcium, $HCaPO_4 + 2H_2O$. This result clears up the discrepancy between the acknowledged formula of the latter mineral and that given by older mineralogists for pharmacolite, $2HCaAsO_4 + 5H_2O$. The number of minerals which have now been reproduced in the laboratory must be very considerable, and every day the likelihood is increasing that those noble species which have for ages been prized as gems may discover the secret of their formation to some indefatigable worker. Rubies and sapphires have already yielded, possibly the diamond may not prove refractory much longer.

A VALUABLE paper, describing a new method of extraction of the alkaloids from Cinchona bark by cold oil, as used at the Government Cinchona Factory in Sikkim, was lately drawn up by order of the Lieutenant-Governor of Bengal, and has now been issued. Dr. King, the Superintendent of the Sikkim Plantation, carried on a long series of experiments on an acid and alkali process of manufacture, by which he succeeded in producing an excellent quinine. He never, however, succeeded in recovering much more than half of the amount contained in the bark on which he operated. The acid and alkali process had, therefore, to be abandoned, as wasteful and inefficient. A process depending on the maceration of the bark in spirit was next tried, but, after much experiment, it was in turn abandoned. During a visit which Dr. King paid to Holland in 1884, he obtained some hints as to a process of extraction by means of oil. Benefiting by the advice of some chemical friends, Mr. Gammie, the resident manager in Sikkim, has been able to perfect this process, with the result that the whole of the quinine in yellow bark can be extracted in a form indistinguishable, either chemically or physically, from the best brands of European manufacture. This can be done cheaply, and the Bengal Government has caused an account of the matter to be printed, in order that private growers of Cinchona may be enabled to take full advantage of the process, and that a permanent reduction in the price of quinine may ensue.

THE Trustees of the Indian Museum, Calcutta, have issued a circular announcing that they have had under their consideration the means whereby a useful scientific examination of the insect-pests of India can be best effected. Bearing in view the great economic importance of the investigation, they have directed the first assistant, Mr. E. C. Cotes, to consider it an essential portion of his duties, and have instructed him to communicate with persons interested in the subject, and likely to aid the inquiry, in order to collect materials which may form a sufficient basis for really scientific conclusions. Mr. Cotes will gradually record the entire life-histories and practical methods of dealing with the principal insect-pests, publishing from time to time, as materials accumulate, the information collected, and distributing it to those interested. Those who live in the districts where the insects occur, and have actual experience of the pests, are invited to send to Mr. Cotes accounts of facts they have observed; and the circular includes a full statement of the points upon which information is wanted.

READERS interested in the science and practice of forestry will be interested in the perusal of a Report by the American Consul at Mayence, on Forest-Culture in Hesse, contained in the January issue of the Consular Reports of the United States. The writer discusses the organizations and functions of the department having the care of forests, the duties of the various classes of officials employed in forest-cultivation, the economical results of the system pursued, the course of instruction followed in the schools of forestry, the organization and methods of the institution for experimental forestry, and the degree and amount of control assumed by the State over private forests. The Report is exceedingly detailed, and is practically a handbook of forestry as practised in the Grand Duchy.

PROF. BLANCHARD, the well-known entomologist, has just published in Paris a book on "La Vie chez les Êtres animés," in which he discusses Darwinism at length, but in a very incomplete manner, and of course in a hostile spirit.

THE address delivered by Mr. A. D. Michael, President of the Quekett Microscopical Club, on the 24th of February last, is printed in the Club's Journal, and has also been issued separately. The subject is "Parasitism."

PROF. HENRY DRUMMOND has in the press a new book, "Tropical Africa," which will be published immediately by Messrs. Hodder and Stoughton. It will contain an account of the author's recent travels in Central Africa, with one or two chapters of natural history.

MR. LEWIS, of Gower Street, will publish immediately a volume of "Physiological and Pathological Researches," by the late T. R. Lewis, F.R.S. (elect). The work is edited by Sir William Aitken, F.R.S., G. E. Dobson, F.R.S., and A. E. Brown, and contains five maps, forty-three plates, including chromo-lithographs, and sixty seven wood engravings.

AT the meeting of the Institution of Civil Engineers on Tuesday, April 24, Mr. E. B. Ellington read a paper on the distribution of hydraulic power in London. In the course of his remarks he took occasion to refer to the large extent to which lifts are now used, and he considered it necessary, he said, to urge the importance of securing the greatest possible safety in their construction by the general adoption of the simple ram. Suspended lifts depended on the sound condition of the ropes or chains from which the cages hung. As they became worn and untrustworthy after a short period, it was usual to add safety appliances to stop the fall of the cage in case of breakage of the suspending ropes, but these appliances could not be expected to act under all circumstances.

MISS MARIE BROWN, well known for her researches on the earliest colonization of North America by the Scandinavians, has presented a petition to the United States Congress urging that steps should be taken to secure a thorough search of the

Vatican and other Italian libraries with a view to further light being thrown upon this question.

MR. W. CHANDLER ROBERTS-AUSTEN will give the discourse on Friday evening, May 11, at the Royal Institution in place of Mr. W. H. Barlow, who is unwell.

THE additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus sinicus* ♀), from India, presented by Mr. Lionel H. Hanbury; a Macaque Monkey (*Macacus cynomolgus* ♂), from Burma, presented by Mrs. G. E. Buchanan; a Scarlet Ibis (*Eudocimus ruber*), a Roseate Spoonbill (*Platalea ajaja*), from Brazil, presented by Mr. Charles Booth; a Common Kestrel (*Tinnunculus alaudarius*), British, presented by Mr. H. Weetman, F.Z.S.; a Hoffmann's Sloth (*Cholopus hoffmanni*), from Panama, deposited; three Lined Finches (*Spermophila lineola*), from South America, purchased; two Persian Gazelles (*Gazella subgutterosa* ♂ ♀), two Chinchillas (*Chinchilla lanigera*), born in the Gardens.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 *MAY* 6–12.

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

At Greenwich on May 6

Sun rises, 4h. 24m.; souths, 11h. 56m. 25·9s.; sets, 19h. 29m.: right asc. on meridian, 2h. 55·5m.; decl. 16° 44′ N. Sidereal Time at Sunset, 10h. 29m.

Moon (New on May 11, 1h.) rises, 3h. 15m.; souths, 8h. 49m.; sets, 14h. 34m.: right asc. on meridian, 23h. 47·5m.; decl. 5° 36′ S.

Planet.	Rises. h. m.	Souths. h. m.	Sets. h. m.	Right asc. on meridian. h. m.	Declination on meridian. ° ′
Mercury..	4 16	11 36	18 56	2 35·1	14 29 N.
Venus ...	3 56	10 49	17 42	1 47·9	9 35 N.
Mars ...	16 9	21 51	3 33*	12 51·5	4 15 S.
Jupiter ...	20 53*	1 9	5 25	16 6·7	19 52 S.
Saturn ...	9 16	17 13	1 10*	8 12·5	20 35 N.
Uranus ...	16 13	21 52	3 31*	12 52·3	4 52 S.
Neptune..	5 7	12 50	20 33	3 49·6	18 25 N.

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

May.	h.	
9	9	Venus in conjunction with and 3° 50′ north of the Moon.
10	22	Mercury in conjunction with and 5° 6′ north of the Moon.
11	0	Mercury in superior conjunction with the Sun.

Saturn, May 6.—Outer major axis of outer ring = 40″·2; outer minor axis of outer ring = 14″·3: southern surface visible.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
R Andromedæ	0 18·1	37 57 N.	May 10,		*M*
U Cephei	0 52·4	81 16 N.	,, 7,	2 19	*m*
			,, 12,	1 58	*m*
ζ Geminorum	6 57·5	20 44 N.	,, 10,	0 0	*m*
δ Libræ	14 55·0	8 4 S.	,, 8,	21 12	*m*
U Coronæ	15 13·6	32 3 N.	,, 7,	20 39	*m*
U Ophiuchi	17 10·9	1 20 N.	,, 7,	2 56	*m*
		and at intervals of		20 8	
Z Sagittarii	18 14·8	18 55 S.	,, 8,	0 0	*m*
U Sagittarii	18 25·3	19 12 S.	,, 7,	2 0	*m*
			,, 10,	1 0	*M*
η Aquilæ	19 46·8	0 43 N.	,, 8,	0 0	*M*
T Aquarii	20 44·0	5 34 S.	,, 7,		*m*
δ Cephei	22 25·0	57 51 N.	,, 8,	23 0	*m*

M signifies maximum; *m* minimum.

Meteor-Showers.

	R.A. °	Decl. °	
Near ε Crateris	170	10 S.	Very slow.
,, α Coronæ	232	27 N.	Rather faint and slow.
,, ζ Draconis	260	64 N.	Rather slow.

GEOGRAPHICAL NOTES.

THE *Mouvement Géographique* contains details of Lieut. Van Gèle's recent exploration of the River Mobangi, the great tributary of the north bank of the Congo, which discharges a little below the equator. It will be remembered that the Rev. George Grenfell succeeded in making his way up the river as far as 4° N. latitude, where he was stopped by the Zongo rapids. Lieut. Van Gèle started on October 26 last, and reached the rapids on November 21. There are six of them, covering a space of 34 miles. They are situated in what is really a mountain gorge, the mountains, in gentle slopes, coming down to the river banks. The steamer *En Avant* had to be unloaded several times and dragged up the rapids. The spaces between the rapids are mostly covered with islands, with great bars of rock stretching between them. The country on each side is described as being fine, fertile, and covered with villages. The people here are all of the same tribe; head shaved except at the nape, bristling moustaches, and no tattooing. Above the middle falls, the Bakombé inhabit the country. These arrange the hair in *queues*, some of which are over 6 feet long. From the upper end of the falls the river continues in a north-east direction for about 32 miles, when it rounds to the east. It has a breadth of about 2600 feet, and the navigation is easy, the average depth being 14 feet. The easterly direction is maintained as far as the *En Avant* went, about 172 miles further. The mountains disappear from the right bank, and the left is marked by low hills, with grassy plains and woods alternating. The villages are at some distance from the river, but the people came down to the vessel in crowds all the way up, and were perfectly friendly until the last few days. Over the whole course tropical cultures of every kind were abundant, as well as sheep, goats, and fowls. The natives on the right bank belong to the Buraka and Maduru tribes; those on the right to the Bakangi, the Mombate, and the Banzy. They mostly shave the head so as to leave a triangle of hair, with the forehead as base. The ears are enormously elongated with heavy copper rings. The river here is covered with islands, mostly cultivated and inhabited. Among the Banzy the huts have the shape of huge conical extinguishers, resting on a circular wall about 2 feet high. These huts are ranged in circular rows, forming broad streets, well kept, and with a common meeting-house in the centre. Each hut is divided into two apartments, one used for sleeping. Iron is admirably worked into all sorts of implements, weapons, and ornaments. Ivory is abundant, but used only for bracelets, anklets, and *pelelé* or lip-ornaments. About 100 miles above the Zongo rapids a second is met with, at Bemay. The vessel succeeded in passing it, and a third 25 miles further up. Just above Bemay, the only tributary met with from the Zongo rapids upwards—the Bangasso—discharges into the right bank of the Mobangi. Above the river the country is densely peopled by the Mombongo and Yakoma, and these showed themselves distinctly hostile to the expedition. There were unfortunately several conflicts, in which lives were lost on both sides. Rocks and sand-banks obstructed the navigation, and after getting as far as 21° 55′ E., Lieut. Van Gèle turned back, making his way downwards with some difficulty, as the river had lowered about 10 feet. He arrived at Equator Station on February 1. The river was about 8000 feet wide at the furthest point, and covered with islands, mostly inhabited. On the north bank of the river, one village extended along a distance of 3 miles. As Dr. Junker's furthest point on the Wellé was 22° 55′ E., only 1° of longitude separates his point from Van Gèle's furthest, or about 68 miles. As they are both on the same line of latitude, there can be no doubt that the Mobangi and the Wellé are the same river.

FROM an official Report by Mr. Percy Smith, Assistant Surveyor-General of New Zealand, on a visit to the Kermadec Islands, in August last, we glean some information as to this recent annexation to the British dominions. The group is situated between the parallels of 29° 10′ and 31° 10′ S. lat., and between the meridian of 177° 45′ and 179° W. long. There are four islands, with some outlying islets and rocks, the most northerly, Raoul or Sunday Island, being 674 miles north-east of Auckland. The islands are all volcanic; in two of them, indeed, signs of volcanic activity are to be seen at the present day, though on a limited scale. They appear to be situated on an oceanic plateau which extends from New Zealand to the Tonga Group, on which soundings are obtained at depths much less than in the adjacent areas, but still so great as to show that the islands form, as it were, the tops of volcanic cones rising to a great height above their bases. The group is situated on the north-easterly projection of the axis of the volcanic zone of the Bay of Plenty, which, continued still further north-eastward, strikes the Tonga and Samoan Groups, places where volcanic action is still going on. Two, if not three, volcanic disturbances have taken place at the Kermadec Islands within recent years, and earthquakes were very frequent there at one time; but since the eruption of Tarawera, June 10, 1886, they have ceased entirely. On Sunday Island the most prominent feature is the large crater near the centre of the island. It is $1\frac{3}{4}$ mile long by $1\frac{1}{4}$ mile wide; its walls are generally over 1000 feet high. Steam escapes occasionally from the Green Lake on the south side, and from the crevices in the precipitous cliffs of Denham Bay, while warm water oozes out of the sand on the north coast.

DR. HANS MEYER, who recently ascended Kilimanjaro, and Dr. O. Baumann, who accompanied Dr. Lenz up the Congo, are preparing to start on a new expedition to East Africa. Their object will be to make a thorough exploration and survey of the whole of the Kilimanjaro region.

RECENT issues of the journals published in French Indo-China, contain an interesting letter from M. Gauthier, describing a journey down the Meikong River, from Luang Prabang into Cambodia. The traveller spent forty days on the journey, and passed twenty cataracts, in one of which his boat was almost dashed to pieces. He visited the Laos States, and describes its inhabitants as doing nothing except laughing, smoking, and singing throughout the day, such business as there is being wholly in the hands of the Chinese.

OUR ELECTRICAL COLUMN.

GOUY has found that the attraction between two electrified surfaces maintained at a constant potential-difference is one hundred times greater in distilled water than in air.

ADMIRABLY well-equipped public electrical laboratories have been established in Paris and Vienna. When are we to see one in London?

VAN AUBEL (*Arch. de Genève*, xix. p. 105, 1888) has been studying the effect of magnetism and heat on the electric resistance of bismuth and of its alloys with lead and tin. Contrary to all other metals, the resistance of bismuth sometimes increases with reduction of temperature. He also verified the fact that the resistance of bismuth at low temperatures increases in the magnetic field. The effect is very feeble with alloys.

FOEPPL (*Ann. Wiedemann*, xxxiii. p. 492) has been endeavouring to prove Edlund's hypothesis that a perfect vacuum is a conductor, but has completely failed to do so. He makes the resistance of a vacuum to be three million times greater than that of copper.

MR. C. VERNON BOYS has communicated to the Royal Society some further details of his beautiful radio-micrometer. It is a thermo-electric circuit, consisting of a bar of antimony and bismuth, of small sectional area, the ends being formed by a loop of copper wire, suspended by a torsion fibre in a strong magnetic field. It is possible to observe by its means a difference of temperature of one ten-millionth of a degree Centigrade.

C. L. WEBER (*Centralblatt für Elektrotechnik*, 1887, vol. ix.), experimenting on various amalgams and alloys of tin, bismuth, lead, and cadmium, has found that many of them have a higher conductivity than that of each of their constituents.

SIRKS, of Deventer (Holland), has found a peculiar dynamical action of the current on the electrodes. An electrical current passing through a solution of $CuSO_4$ between two electrodes of copper, which are varnished at the back, pulls *both against* the direction of the positive stream. Independently of the concentration, if only high enough to prevent the formation of gases, the pressure at the anode and the traction at the kathode amount to nearly 1 gramme per ampere and per square metre.

ON THE COMPARISON OF THE CRANIAL WITH THE SPINAL NERVES.

THE origin of vertebrate animals is to be found according to many morphologists in those invertebrates which are composed of a series of segments, and one of the chief arguments in favour of this view has always been the fact that the spinal nerves are arranged segmentally. It has, however, long been felt that the cranial nerves ought to give evidence of a segmental arrangement as clearly as the spinal before it is possible to speak of a segmentation based upon the arrangement of the nervous system; and indeed many ingenious tables have been manufactured by morphologists in order to bring the cranial nerves into the same system as the spinal. The failure of these attempts is to my mind due largely to the following reasons:—

1. Confusion has arisen because anatomists have been in the habit of looking upon the nervous system of the vertebrate as composed of two separate nervous systems, viz. the cerebro-spinal and sympathetic.

2. In the comparison of cranial and spinal nerves the morphologists have directed their attention too exclusively to the exits of the nerves from the central nervous system without taking into account the place of origin of the nerves in the central nervous system itself.

3. It has been assumed on insufficient grounds that the presence of ganglia in connection with motor cranial nerves indicates that the cranial nerves do not follow Bell's law, and are therefore not strictly comparable with spinal nerves.

These difficulties are all found to vanish as soon as a clear conception is obtained of what is meant by the nerves of a spinal segment.

Since the time of Charles Bell it has been recognized that a spinal nerve is formed by two roots: the one, posterior, which contains only afferent fibres, *i.e.* fibres which convey impulses from the periphery to the central nervous system; and the other, anterior, containing exclusively efferent fibres which convey impulses from the central nervous system to the periphery. In correspondence with these two sets of fibres the grey matter of the spinal cord is divided into two portions, named respectively the posterior and anterior horns. Another division, however, exists of almost equal importance, which is not so generally recognized, viz. a division both of the nerve fibres and their centres of origin in the grey matter for the purpose of supplying the internal and external portions of the body—a division of nerves and nerve centres into splanchnic and somatic as well as into afferent and efferent. The centres of origin of the splanchnic nerves are situated in the internal part of the grey matter of the spinal cord, being arranged in groups in the neighbourhood of the central canal, and the nerves themselves supply the viscera and internal surfaces of the body, together with certain muscles of respiration and deglutition which are derived from special embryonic structures known as the lateral plates of mesoblast. On the other hand, the centres of origin of the somatic nerves are situated in the outlying horns of grey matter, and the nerves themselves supply the integument and the ordinary muscles of locomotion, &c.,—muscles which are derived from the muscle-plates or myotomes.

Further, these two sets of nerves are arranged in the posterior and anterior roots in a special manner, the significance of which is the key to the whole question of the segmental nature of the cranial nerves. In the posterior roots the afferent fibres of both splanchnic and somatic systems pass into the spinal ganglion, which is always situated on the nerve root soon after its exit from the central nervous system; so that we may speak of the afferent fibres of both systems as being in connection with a ganglion which is stationary in position. In the anterior roots, on the other hand, we find that some of the fibres are in connection with no ganglia, while others are in connection with ganglia which are not fixed in position, but are found at various distances from the central nervous system (it is this system of ganglia which has hitherto been looked upon as forming a separate nervous system, viz. the sympathetic system), so that the fibres of the anterior root, all of which are efferent, are divisible into a ganglionated and a non-ganglionated group, of which the ganglionated group belongs to the splanchnic system, and is characterized by the smallness in the size of its fibres, while the non-ganglionated group is composed both of somatic and splanchnic nerves, and forms the ordinary large-sized motor nerve fibres of the voluntary striped muscles both of respiration and deglutition as well as of locomotion.

Again, it has been shown that these efferent ganglia are in reality offshoots from a primitive ganglion mass situated on the spinal nerves into which both afferent and efferent fibres ran.

We see, then, that both roots of a fully formed spinal nerve are ganglionated, so that the presence of a ganglion is no longer the sign of a posterior root, and we must define a spinal nerve as being formed by—

1. A posterior root, the ganglion of which is stationary in position and is connected with both splanchnic and somatic afferent nerves.

2. An anterior root, the ganglion of which is vagrant, and is connected with the efferent small-fibred splanchnic nerves.

Also it is not a fundamental characteristic of a spinal nerve that the anterior root should necessarily pass free from the spinal ganglion, for it is clear that both anterior and posterior roots may pass into the same stationary ganglionic mass if the whole or part of the efferent ganglion has not travelled away from the parent mass. This passage of the fibres of the anterior as well as of the posterior roots into the spinal ganglion is common enough in the lower animals, and is a peculiarity of the first two cervical nerves in such an animal as the dog. If, then, the cranial nerves are formed on the same plan as the spinal, their efferent roots ought to be divisible into a large-fibred non-ganglionated portion and a small-fibred ganglionated portion, the ganglia of which may be vagrant in character, while their afferent roots should possess stationary ganglia near their exits from the brain; also the centres of origin for the different sets of nerve fibres, *i.e.* for the splanchnic and somatic nerves, ought to be the direct continuation of the corresponding centres of origin in the spinal cord. Such I find to be the case; if we leave out of consideration the nerves of special sense, viz. the optic, olfactory, and auditory nerves, the remaining cranial nerves are found to divide themselves into two groups—

(1) A foremost group of nerves, which in man are entirely efferent, viz. third, fourth, motor part of fifth, sixth, and seventh nerves.

(2) A hindmost group of nerves of mixed character, viz. ninth, tenth, eleventh, and twelfth nerves, and the sensory part of fifth.

The nerves of the first group resemble the spinal nerves as far as their anterior roots are concerned, for they are composed of large-fibred non-ganglionated motor nerves and small-fibred splanchnic efferent nerves, which possess vagrant ganglia, such as the ganglion oculomotorii, the ganglion geniculatum, &c.

They resemble spinal nerves also as far as their posterior roots are concerned, for they have formed upon them a ganglion at their exit from the brain corresponding strictly to the stationary posterior root ganglion of a spinal nerve. One great difference, however, exists between their posterior roots and those of a spinal nerve, for neither the nerve fibres nor the ganglion cells of these roots are any longer functional; they exist simply in the roots of this group of cranial nerves in man, and other warm-blooded animals, as the phylogenetically degenerated remnants of what were in ages long since past doubtless functional ganglia and functional nerve fibres.

This foremost group of cranial nerves, then, is built up on precisely the same plan as the spinal nerves; the apparent difference being due to the fact that the afferent roots with their ganglia have degenerated.

The hindmost group of cranial nerves is also composed of the same constituents as the spinal nerves, and their different components arise from centres of origin in the medulla oblongata and in the cervical region of the spinal cord which are directly continuous with the corresponding groups of nerve cells in other parts of the spinal cord. Here, however, the deviation from the spinal nerve type which has taken place consists not in the suppression of any particular component, but in the scattering of the various components, so that none of the nerves of this group form in themselves complete segmental nerves, but rather the whole of them taken together form a broken up group of segmental nerves which are capable of being rearranged not only into afferent and efferent but also into splanchnic and somatic divisions of precisely the same character as in a group of spinal nerves.

I conclude therefore that both these two great groups of cranial nerves are built up on the same plan as the spinal nerves, not only with respect to the structure, function, and distribution of their nerve fibres, but also as far as the arrangement of the centres of origin of those nerve fibres in the central nervous system is concerned; and I think it probable that the reason for the deviation of the cranial nerves from the spinal nerve type is bound up with the changes which occurred at the time when a large portion of the fibres of the foremost group of cranial nerves lost their functional activity. I imagine that in the long past history of the vertebrate animal some extensive tract in connection with the foremost part of the nervous system has become useless and disappeared, and in consequence the nerves supplying those parts have degenerated. In this phylogenetic degeneration the whole of the splanchnic and somatic afferent nerves of that region were involved, and probably also some of the efferent nerve fibres, with the result that certain only of the motor elements have remained functional. In the further history of the vertebrate, the parts which have replaced those which became useless have received their nerve supply from tracts of the central nervous system situated behind this foremost group of nerves; in consequence of which the component parts of that hindermost group have become more or less separated from each other. The extent of the area involved is especially well seen when the sensory nerves of this area, both somatic and splanchnic, are considered; for we see not only that the sensory part of the trigeminal, representing the somatic sensory elements, and the sensory part of the vagus, representing the splanchnic sensory elements, are derived from their respective ascending roots, *i.e.* arise in connection with a series of nerve segments extending well into the cervical region, but also that the peripheral distributions of these two nerves are very extensive. Without speculating further at present upon the nature of the change which has disturbed the orderly arrangement of the cranial nerves, enough has been said to prove that the cranial nerves considered in this article are built up on the same plan as the spinal nerves. Further it is worthy of notice that just as the division into somatic and splanchnic has thrown great light upon the conception of the manner in which a segmental nerve is formed, so also it lends aid to the consideration of the segmentation of structures other than the nervous, for we find that two distinct segmentations exist in the body which do not necessarily run parallel to each other: the one, a segmentation which may be fitly called splanchnic, and is represented by the orderly arrangement of visceral and branchial clefts; and the other, a somatic segmentation, characterized by the formation of somites, *i.e.* of vertebræ and somatic muscles arranged also in orderly sequence.

The splanchnic segmentation is most conspicuous in the cranial region, the somatic segmentation in the spinal region, and it is most advisable to remember that a valid comparison between cranial and spinal segments can only be made when like is compared with like, for it by no means follows that the somatic and splanchnic segmentations have proceeded on identical lines; consequently, in comparing cranial with spinal nerves, we must compare structures of the same kind, and seeing that the spinal nerves are arranged according to somatic segments so also must the cranial nerves be arranged in accordance with their relation to the somatic muscles of the head, and not in relation to the branchial and visceral clefts.

It is not advisable in this article to enter upon any discussion as to the number of segments supplied by the cranial nerves, or to speculate upon the nature of the changes which have taken place in the past history of the vertebrate animal, whereby the present distribution of the cranial nerves has been brought about. I desire only to put as shortly as possible before the readers of NATURE the general results of my recent investigations into the structure of the cranial and spinal nerves.

W. H. GASKELL.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. T. C. Fitzpatrick, of Christ's College, has been appointed an Assistant Demonstrator of Physics.

Prof. H. M. Ward, M.A., of Christ's College, has been appointed Examiner in Botany in the place of Prof. Bayley Balfour.

Dr. R. D. Roberts has been appointed an Elector to the Harkness Scholarship.

The name of Mr. Adami, the new Demonstrator of Pathology, was misprinted Adams in our last issue.

SCIENTIFIC SERIALS.

Bulletin de l'Académie Royale de Belgique, February.—Researches on the colloidal state, by C. Winssinger. This is the first part of a memoir describing a series of experiments undertaken to determine the various conditions of the colloidal state—that is, of the state assumed under certain circumstances by bodies generally insoluble in water. For the present the author confines himself to describing the mode of preparation and the chief properties of the colloidal substances. All the fifteen sulphides studied by him (those of mercury, zinc, tungsten, molybdene, indium, platinum, gold, palladium, silver, thallium, lead, bismuth, iron, nickel, and cobalt) have been obtained in the colloidal state. They bring up to thirty-one the number of colloids now known to science. Some have been prepared by Graham's method, others directly by treating the oxides suspended in the water with hydrosulphuric acid.—On the pretended pro-atlas of mammals and *Hatteria punctata*, by Jules Cornet. The bony process between the occipital and the atlas known as the pro-atlas or proto-vertebra, and found in crocodiles and some other reptiles, is here shown not to exist in the mammals as supposed by some naturalists. The view of Smets regarding its absence from Hatteria is also confirmed.—On the process employed by the fresh-water Gasteropods for crawling over the liquid surface, by Victor Willem. This process is shown to be somewhat analogous to that of snails moving on dry land, being effected by secreting a mucus which enables the mollusk to adhere to the surface.—Researches on the volatility of the carbon compounds; chloro-oxygenated compounds, by Louis Henry. The object of these researches is to examine, in reference to their volatility, the compounds in which chlorine and oxygen are simultaneously combined with carbon. The subject is discussed under three heads: (1) the compounds comprising the system >C – O; (2) the system ⋟C – OX; (3) the mixed derivatives simultaneously including both these systems.

Rendiconti del Reale Istituto Lombardo, March 22.—Observations made in the Brera Observatory, Milan, during the total lunar eclipse of January 28, 1888, by G. V. Schiaparelli. These observations were made under favourable conditions in accordance with the instructions issued by the Pulkova astronomers, with the ultimate view of determining more accurately than has yet been possible the exact length of the diameter of the moon. In the accompanying tables are given the results of the observations, comprising the comparison-stars with their magnitudes and numbers as in the catalogue distributed by the Pulkova astronomers.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 22.—"The Chemical Composition of Pearls." By George Harley, M.D., F.R.S., and Harald S. Harley.

(1) As regards oyster pearls. Of these, three varieties were examined—British, Australian, and Ceylonese.

The qualitative analyses showed that they all had an identical composition, and that they consisted solely of water, organic matter, and calcium carbonate. There was a total absence of magnesia and of all the other mineral ingredients of sea-water—from which the inorganic part of pearls must of course be obtained. Seeing that ordinary sea-water contains close upon ten and a half times more calcium sulphate than calcium carbonate, one might have expected that at least some sulphates would have been found along with the carbonates, more especially if they are the mere fortuitous concretions some persons imagine them to be; a view the authors cannot indorse, from the fact that by steeping pearls in a weak aqueous solution of nitric acid, they are able to completely remove from them all their mineral constituents without in any way altering their shape, and but very slightly changing their naked eye appearances, so long as they are permitted to remain in the solution. When taken out they rapidly dry and shrivel up. Dr. George Harley will take occasion to point out in his next communication, which will be on the microscopic structure of pearls, that a decalcified crystalline pearl bears an intimate resemblance to a decalcified bone, in so far as it possesses a perfectly organized matrix of animal matter. No phosphates whatever were found in any of the three before-named varieties of pearls.

The next point being to ascertain the exact proportions of the substances composing the pearls, and pure white pearls being expensive, from having ascertained that all the three kinds they were operating upon had exactly the same chemical composition, instead of making separate quantitative analyses of them, they simply selected two pearls from each variety, of as nearly the same size and weight—giving a total of 16 grains—and analyzed them collectively, the result obtained being: carbonate of lime 91·72 per cent; organic matter (animal), 5·94 per cent; water 2·23 per cent.

(2) Composition of cocoa-nut pearls.

A portion of a garden pea sized cocoa-nut pearl, weighing 14 grains, was subjected to analysis, and found that, like shell-fish pearls it consisted of carbonate of lime, organic matter (animal), and water.

It had all the external appearances of the pearls found in the large clams (*Tridacna gigas*) of the Southern Ocean, being perfectly globular, with a smooth, glistening, dull white surface, and resembling them exactly in microscopic structure. Besides which in chemical composition it bore no similarity to cocoa-nut milk, to which it is supposed to be related; for cocoa-nut milk is said to contain both the phosphate and the malate, but not the carbonate of lime. That there are pearls found in cocoa-nuts the authors do not presume to deny; all they mean to say is that they are doubtful if the specimen examined had such an origin.

(3) As regards mammalian pearls.

These so-called pearls have been met with in human beings and in oxen.

In so far as naked-eye appearances are concerned, a good specimen of the variety of pearl now spoken of is quite undistinguishable from a fine specimen of Oriental oyster pearl, from its not only being globular in shape, and of a pure white colour, but from its also possessing the iridescent sheen so characteristic of Oriental oyster pearls of fine quality.

In chemical composition, however, mammalian pearls bear no similarity whatever to pearls found in shell-fish, for they are composed of an organic instead of an inorganic material—namely, cholesterin. In microscopic structure again, they bear a marked resemblance to the crystalline variety of shell-fish pearls.

April 19.—"On Hamilton's Numbers. Part II." By J. J. Sylvester, D.C.L., F.R.S., Savilian Professor of Geometry in the University of Oxford, and James Hammond, M.A. Cantab.

§ 4. *Continuation, to an infinite Number of Terms, of the Asymptotic Development for Hypothenusal Numbers.*

In the third section of this paper (Phil. Trans. A., vol. clxxviii. p. 311) it was stated, on what is now seen to be insufficient evidence, that the asymptotic development of $p - q$, the half of any hypothenusal number, could be expressed as a series of powers of $q - r$, the half of its antecedent, in which the indices followed the sequence $2, \frac{3}{2}, 1, \frac{3}{4}, \frac{5}{8}, \frac{1}{2}, \ldots$

It was there shown that, when quantities of an order of magnitude inferior to that of $(q - r)^{\frac{3}{4}}$ are neglected,

$$p - q = (q - r)^2 + \tfrac{4}{3}(q - r)^{\frac{3}{2}} + \tfrac{11}{18}(q - r) + \tfrac{10}{81}(q - r)^{\frac{3}{4}};$$

but, on attempting to carry this development further, it was found that, though the next term came out $\frac{88}{1215}(q - r)^{\frac{5}{8}}$, there was an infinite series of terms interposed between this one and $(q - r)^{\frac{1}{2}}$.

In the present section it will be proved that between $(q - r)^{\frac{3}{4}}$ and $(q - r)^{\frac{1}{2}}$ there lies an infinite series of terms whose indices are—

$$\tfrac{5}{8}, \tfrac{9}{16}, \tfrac{17}{32}, \tfrac{33}{64}, \tfrac{65}{128}, \ldots$$

and whose coefficients form a geometrical series of which the first term is $\frac{88}{1215}$ and the common ratio $\frac{2}{3}$.

We shall assume the law of the indices (which, it may be remarked, is identical with that given in the introduction to this paper as originally printed in the *Proceedings* but subsequently altered in the Transactions), and write—

$$\begin{aligned} p - q = {} & (q - r)^2 + \tfrac{4}{3}(q - r)^{\frac{3}{2}} + \tfrac{11}{18}(q - r) + \tfrac{10}{81}(q - r)^{\frac{3}{4}} \\ & + \frac{2^3}{3^3}A(q - r)^{\frac{5}{8}} + \frac{2^4}{3^4}B(q - r)^{\frac{9}{16}} + \frac{2^5}{3^5}C(q - r)^{\frac{17}{32}} \\ & + \frac{2^6}{3^6}D(q - r)^{\frac{33}{64}} + \frac{2^7}{3^7}E(q - r)^{\frac{65}{128}} + \text{\&c., } ad\ inf. \quad . \ . \ (1) \\ & + \Theta\,^* \end{aligned}$$

The law of the coefficients will then be established by proving that—

$$A = B = C = D = E = \ldots\ldots = \tfrac{11}{45}.$$

If there were any terms of an order superior to that of $(q - r)^{\frac{1}{2}}$, whose indices did not obey the assumed law, any such term would make its presence felt in the course of the work; for, in the process we shall employ, the coefficient of each term has to be determined before that of any subsequent term can be found. It was in this way that the existence of terms between

* In the text above, Θ represents some unknown function, the asymptotic value of whose ratio to $(q - r)^{\frac{1}{2}}$ is not infinite.

$(q - r)$[illegible] and $(q - r)^{\frac{1}{2}}$ was made manifest in the unsuccessful attempt to calculate the coefficient of $(q - r)^{\frac{1}{2}}$.

It thus appears that the assumed law of the indices is the true one.

It will be remembered that $p, q, r, \ldots$ are the halves of the sharpened Hamiltonian Numbers $E_n + 1$, E_n, $E_n - 1$, ... and that consequently the relation—

$$E_{n+1} = 1 + \frac{E_n(E_n - 1)}{1 \cdot 2} - \frac{E_{n+1}(E_{n-1} - 1)(E_{n-1} - 2)}{1 \cdot\cdot 2 \cdot\cdot\cdot 3} + \ldots$$

may be written in the form—

$$p = \tfrac{1}{2} + \frac{q(2q-1)}{2} - \frac{r(2r-1)(2r-2)}{2 \cdot 3} + \frac{s(2s-1)(2s-2)(2s-3)}{2 \cdot 3 \cdot\cdot 4}$$
$$- \frac{t(2t-1)(2t-2)(2t-3)(2t-4)}{2 \cdot 3 \cdot\cdot\cdot 4 \cdot\cdot 5}$$
$$+ \frac{u(2u-1)(2u-2)(2u-3)(2u-4)(2u-5)}{2 \cdot\cdot\cdot 3 \cdot 4 \cdot 5 \cdot\cdot\cdot 6}$$
$$- \ldots \qquad (2)$$

The comparison of this value of p with that given by (1) furnishes an equation which, after several reductions have been made in which special attention must be paid to the order of the quantities under consideration, ultimately leads to the determination of the values of A, B, C, ... in succession.

Physical Society, April 14.—Shelford Bidwell, F.R.S., Vice-President, in the chair.—Mr. W. E. Sumpner read a paper on the variation of the coefficients of induction. The author pointed out that there are three ways of defining the coefficient of self-induction of a circuit, expressed by the following equations—

$$(1)\ e = L_1 \frac{dC}{dt}\ ; \qquad (2)\ N = L_2 C\ ;$$
$$(3)\ T = \tfrac{1}{2} L_3 C^2\ ;$$

where e = back E.M.F. due to change of current, C = current, N = total induction through the circuit, and T the kinetic energy of the circuit. If the medium be air, L_1, L_2, and L_3 are identical, but in the case of iron this is no longer the case. When the curve of magnetization is given, their values, corresponding with any value of C, can be easily determined by the above equations. Maxwell's absolute method of measuring self-induction gives L_2, and by a modification due to Prof. Ayrton, where the current is altered from C_1 to C_2 instead of from 0 to $C = \frac{C_1 + C_2}{2}$, the value of L obtained is approximately L_1, if $C_1 - C_2$ is small compared with C. From the known character of the curves of magnetization of iron, it is easily seen that the value of L_2 increases with the current when the current is small, then becomes nearly constant, and afterwards decreases. For an electro-magnet having a horse-shoe core of best Swedish iron ½" diameter and 14" long, wound with 800 convolutions, the value of L_2 for currents between ·047 and ·107 amp. was found to satisfy the equation $L_2 = \frac{A}{5} + {\cdot}0425$, where A = current in amperes. A method of comparing self-induction with capacity is described, in which the arm of a Wheatstone's bridge opposite the one containing self-induction is shunted by a condenser of capacity K. The bridge is balanced for steady currents, and the deflection, θ_1, of the galvanometer observed on breaking the battery circuit. θ_1 is :: $L_2 - Kps$, where p and s are the resistances of the two remaining arms of the bridge. The condenser is then disconnected, and another swing, θ_2, obtained, on again breaking the battery circuit. θ_2 is :: L_2,

$$\therefore \frac{\theta_2}{\theta_1} = \frac{L_2}{L_2 - Kps}, \text{ or } L_2 = \frac{\theta_2}{\theta_2 - \theta_1} Kps.$$

Further experiments were made on the electro-magnet when its poles were joined by a piece of soft iron, the currents being reversed. The resulting values of L_2, $\mathfrak{B}$, $\mathfrak{H}$, and μ are given in absolute measure, and from them the author deduces—

$$L_2 = {\cdot}05 + 3{\cdot}9\,A, \qquad \mu = 210 + 720\,\mathfrak{H},$$
$$\mathfrak{B} = 210\,\mathfrak{H} + 720\,\mathfrak{H}^2, \quad \text{for values of A between } {\cdot}06 \text{ and } {\cdot}9.$$

The difficulties experienced in determining the induction coefficients for strong magnetizing forces produced by the testing current are described. They arise chiefly from the fact that in order to obtain strong currents, the resistances must be small. This makes the "*time constant*" large, and in order to obtain the values of L in absolute measure, a ballistic galvanometer of very long period would be required. A method of calibrating a galvanometer of comparatively short period to give approximate results is described. Where the magnetizing force is produced by an independent coil, no such difficulties present themselves. Results obtained for the coefficients of self-induction of a gramme armature (A type) for different currents round the field magnets vary from ·0218 for current 0 to ·0117 for a current of 29 amperes. The value of L for a given point on the curve of magnetization is not a definite quantity, but has always two or more distinct values, depending on whether the magnetization is increased or decreased by the test currents, and on the previous history of the iron. That this must be the case is easily seen from the curves obtained by Prof. Ewing in his "Experimental Researches on Magnetism." The values of L corresponding to the three sides of a small Ewing's cycle are denoted by L_p (*progressive coefficient*), L_r (*return coefficient*) and L_c (*cyclic coefficient*). L_p is always the largest, whether the magnetization be increased or decreased by the testing current. Numerical values of L_p and L_c obtained from a Kapp and Snell transformer are given. L_c can be very accurately determined by Profs. Ayrton and Perry's secohmmeter, and some of the results given in the paper were thus obtained. Having given the curve of magnetization and that connecting impressed E.M.F. and time, a simple graphical method is described for drawing the current curve. Applying this to an alternating current where the E.M.F. is a pure sine function of the time, it is shown that the resulting current curve differs considerably from a sine curve. The case of the rise of current in the magnet coils of a dynamo excited by accumulators is also discussed, the derived curves being in accordance with observation. In conclusion the author pointed out that the time taken to discharge a condenser through a given resistance may be decreased by adding self-induction to the circuit, provided L is less than $\frac{1}{2}KR^2$. When $L = \frac{1}{4}KR^2$, the discharge is completed in one-half the time required when L = 0. This may account for the remarkable results observed by Dr. Lodge in his experiments on iron and copper as lightning-conductors.—Mr. C. V. Boys described and performed some experiments on soap-bubbles, and by their aid demonstrated in a remarkable manner the phenomena of surface tension, diffusion, and the magnetic properties of gases. By blowing one bubble inside another, he showed that there is no electrical force inside a closed conductor. A peculiar property of soap-bubbles is their refusal to come into contact when knocked against each other; they may receive violent shocks and still remain separate. If, however, an electrified body be brought in the vicinity, they immediately coalesce. So sensitive are they to electrical attraction that a potential difference due to one Leclanché cell between the two bubbles causes them to unite. They may thus serve as very delicate electroscopes. Many other beautiful and extremely interesting experiments on liquid films of different shapes were performed in a masterly manner.

Geological Society, April 11.—W. T. Blanford, F.R.S., President, in the chair.—The following communications were read:—On the lower beds of the Upper Cretaceous series in Lincolnshire and Yorkshire, by W. Hill.—On the Cae Gwyn Cave, North Wales, by Dr. Henry Hicks, F.R.S.; with an appendix by C. E. De Rance. The author gave an account of the exploration of the cavern during the latter part of 1885, and during 1886–87. He considered that the results obtained during that time proved conclusively that there was no foundation for the views of those who contended that the drift which covered over the entrance and extended into the cavern was *remanié*, but they proved that the deposits which lay over the bone-earth were *in situ*, and were identical with the normal glacial deposits of the area. These deposits had once extended continuously across the valley, and the cavern (400 feet above Ordnance datum) had consequently been completely buried beneath them. The cave must have been occupied by animals during the formation of the bone-earth, before any of the glacial deposits now found there had accumulated, and a thick floor of stalagmite had covered this "earth" before the cavern had been subjected to water-action. This action had broken up the floor, and completely re-sorted the materials, and added sandy and gravelly material to the deposits; this sand and gravel had been examined by Prof. Boyd Dawkins, who found that it agreed in every particular with the glacial sand

and gravel occurring in the valley a little way above. The large limestone blocks in the cavern had also been evidently disturbed by water-action; they were invariably found in the lowest deposits, and were covered over by laminated clay, sand, and gravels. The author considered it certain that the caverns had been completely filled with these materials, and in the case of the Cae Gwyn Cave they appeared to have been conveyed mainly through the entrance recently discovered under the drift. The stratification at this entrance was so marked, and could be traced so continuously inwards over the bone-earth, that there could be no doubt that this was the main entrance. There was not the slightest evidence that any portion of the material had been conveyed in through a swallow-hole, and the conditions witnessed throughout were such as to preclude any such idea. The author quoted a Report by Dr. Geikie, who considered that the wall of the cavern had given way, but before the deposition of the glacial deposits, which were subsequently laid down against the limestone bank so as to conceal this entrance to the cavern. In conclusion, he referred to the presence of reindeer remains in these caves, in conjunction with those of the so called older Pleistocene Mammalia, proving that these had reached the area long before the period of submergence, and evidently at an early stage in the Glacial period. It was important to remember that reindeer remains had been found in the oldest river-gravels in which implements had been discovered. Man, as proved by the implements discovered, was also present at the same time with the reindeer, and it was therefore natural to suppose that he migrated into this area in company with that animal from some northern source, though this did not preclude the idea that he might also have reached this country from some eastern or southern source, perhaps even at an earlier period. In the course of the discussion which followed the reading of this paper, Dr. Evans said the archæological evidence was against Dr. Hicks's views.

Chemical Society, April 19.—Mr. W. Crookes, F R.S., in the chair.—The following papers were read:—The influence of temperature on the composition and solubility of hydrated calcium sulphate and of calcium hydroxide, by Messrs. W. A. Shenstone and J. T. Cundall. The authors find, contrary to the usual statements on the subject, that hydrated calcium sulphate, whether of natural or of artificial origin, parts with a portion of its water at moderate temperatures, *e.g.* 40° C., and that it may be almost completely dehydrated in dry air at temperatures below 100° C. The effect of heat in diminishing the solubility of calcium sulphate in water at temperatures between 40° and 150° may therefore be possibly due to the unequal solubility of the hydrated and anhydrous salts. Calcium hydroxide is likewise less soluble in hot than in cold water, but the authors have failed to obtain evidence in favour of the view that the diminished solubility in this case may depend upon the dissociation of the hydroxide or of some hydrate of the hydroxide.—Thermo-chemical constants, by Mr. S. U. Pickering. In a criticism of several deductions drawn by Thomsen from thermo-chemical data, the author refers to the supposed "common constant of affinity"—a quantity whose multiples by numbers up to 10 are supposed to represent various reactions, some of which are similar, and others totally dissimilar (*Ber. Deutsch. Chem. Ges.*, v. 170, vi. 239); and points out that any number taken at random, *e.g.* 15,000 cal., would have given results similar to those obtained by employing Thomsen's value of the constant, viz. 18,361 cal.—Action of hot copper on the mixed vapours of phenol and carbon bisulphide, by Prof. T. Carnelly and Mr. J. Dunn. A small yield of a new diphenylene ketone (m.p. = 83°) is obtained in this reaction.—Oxidation of oxalic acid by potassium bichromate, by Mr. E. A. Werner.—The action of phenylhydrazine on urea and on some of its derivatives, by Mr. S. Skinner and Dr. S. Ruhemann.—Derivatives of phenylisobutyric acid, by Dr. L. Edeleanu.—The logarithmic law of atomic weights, by Mr. G. J. Stoney, F.R.S.

Zoological Society, April 17.—Dr. St. George Mivart, F.R.S., Vice-President, in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of March 1888.—Mr. C. Stewart exhibited a preparation showing the structure and development of the brood-pouch of a Marsupial Tree-Frog (*Nototrema marsupiatum*).—Mr. Boulenger exhibited and made remarks on the type specimen of a new species of Marsupial Tree-Frog (*Nototrema fissipes*) recently discovered by Mr. G. A. Ramage near Pernambuco, in Brazil.—Mr. Herbert Druce read the descriptions of some new species of Heterocera collected by Mr. C. M. Woodford at Suva, Viti Levu, Fiji Islands. The collection had been made during the months of February, March, and April, 1886, and was especially interesting on account of the exact localities being noted, as well as for the new species it contained. Ninety-four species were represented, eight of which were described by the author as new to science.—A communication was read from Mr. T. D. A. Cockerell, containing some remarks on atavism, with reference to a paper on the same subject read by Mr. J. Bland Sutton at a previous meeting of the Society.—Prof. G. B. Howes gave an account of the vocal pouch of *Rhinoderma darwini*, and described in detail the mode of its attachment and the position of the embryos in it. The author controverted the idea of Espada that the alimentary functions were arrested during the development of the embryos in this Batrachian.—Mr. Oldfield Thomas read a paper describing a new genus and species of Muridæ obtained by Mr. H. O. Forbes during his recent expedition to New Guinea. The author proposed to call this form, which was characterized by the possession of a prehensile tail, *Chiruromys forbesi*, after its discoverer.—Lieut.-Colonel Godwin-Austen, F.R.S., read the first of a proposed series of papers on the Land-Mollusca of Burma. The present communication gave an account of the shells collected by Capt. Spratt, R.A., in Upper Burma, among which were specimens of several new and very interesting species. A communication was read from Mr. R. Bowdler Sharpe, containing the sixth of his series of notes on the specimens of the Hume collection of birds. The present paper treated of some of the species of the genus *Digenea*.

Anthropological Institute, April 24.—Francis Galton, F.R.S., President, in the chair.—A paper by Dr. Venn on recent anthropometry at Cambridge was read, and was followed by a communication by the President on the head-growth of Cambridge students. The President's paper we print elsewhere. Mr. Galton also read a paper on the answers he had received from teachers in reply to questions respecting mental fatigue.

PARIS.

Academy of Sciences, April 23.—M. Janssen, President, in the chair.—Influence of gravity on the co-ordinates measured by means of equatorials, by MM. Lœwy and P. Puiseux. The paper deals mainly with the equatorials *coudés*, such as the large instrument intended for the Paris Observatory, and gives the general formulas of reduction.—On the aperiodic regulation of the amortisement and of the phase in a system of synchronized oscillations, by M. A. Cornu. The principle is explained of this aperiodic method of control, which is shown to possess several advantages over the systems at present in use. It reduces to a minimum, if not to zero, the influence of the more ordinary disturbing causes, and supplies a continuous check for the regulating apparatus as well as a simple means of readjustment should it get out of order.—Remarks on M. Stoletow's recent communication on a class of electric currents set up by the ultra-violet rays, by M. Edm. Becquerel. The note referred to the passage of an electric current between two disks, or metallic conductors, placed parallel to, and at a little distance from, each other, by means of the layer of intervening air, which requires to be more or less heated by the radiation of a voltaic arc. M. Becquerel points out that these effects appear to be analogous to those which he observed and analyzed in a different way in the year 1853. He then showed that heated gases may conduct electric currents, these effects being functions of the nature and density of the gases, as well as of the relative dimensions of the electrodes.—On the fixation of nitrogen by vegetable soil, by M. Berthelot. This is a reply to M. Schlœsing's recent remarks, the main object of the note being to more clearly establish the history of these researches and their present character.—On the optical properties of natural pharmacolite, by M. Des Cloizeaux. The author, having recently resumed his interrupted studies of this crystal, finds that its optical crystallographic properties are absolutely identical with those of the artificial crystals lately obtained by M. Dufet. The only difference is an excess of about 4 per cent. of water as determined by previous analyses of the natural crystals. But these crystals are hygrometric, and lose some of their water at 100° C. The specimens analyzed were also probably mixed with a little wapplerite, which has yielded as much as 29 per cent. of water, and which in the state of an efflorescent powder is usually associated with pharmacolite.—Note on the optical characters of haidingerite, by M. Des Cloizeaux. An examination of some small specimens of this extremely rare crystal found in association with a few fragments of pharmacolite shows that it must be grouped with the family of the positive acute bisector crystals. One of its indices of refraction, formerly measured by Haidinger on a natural prism of 40°, formed by two opposite facets, *h'* and *m*, must be the maximum index, $\alpha = 1{\cdot}67$.—Observations of Palisa's new planets 275 and 276, made at the Observatory of Algiers, by MM. Trépied, Rambaud, and Sy. These observations, which were made with the 0·50 m. telescope, cover the period April 17–18, when the two planets were of the respective estimated magnitudes 11 and 11·5.—On the employment of gas thermometers, by M. Crafts. These remarks are made in connection with the hydrogen instrument recently described by M. Cailletet, who mentions an analogous type of thermometer devised ten years ago by M. Crafts.—On a new system of telephonic communication between trains in motion and the neighbouring stations, by M. P. Germain. A series of electric measurements effected on rails from the stand-point of their resistance, insulation, and diffusive electric power, has satisfied the author that the two metallic parts of the same line connected together constitute an excellent conductor, provided the circuit and pile be insulated from earth. He has established curves of resistance for the rails according to the variations caused by the temperature and by the humid condition of the ballast. A new line shows less resistance than an old, owing to the oxidation of the points and the slow transformation brought about in the molecules of steel under the influence of vibration. By setting up the necessary apparatus in the stations and in the guard's van, telephonic correspondence may be carried on in both directions; but the details of the process are for the present withheld.—On a new fossil fish of the Commentry (Allier) Coal-measures, by M. Charles Brongniart. This fish, of which several good specimens have been found, presents peculiarities distinguishing it from all other fishes extinct or living. It is here consequently constituted a separate order of Pleuracanthides, as the prototype of the star-fish, Ceratodus, and allied forms. The present specimen is named *P. gaudryi*, in honour of M. Albert Gaudry.

BERLIN.

Physiological Society, April 13.—Prof. Munk, President, in the chair.—Prof. Gad made a complementary communication to his previous one dealing with the proof of the Wallerian law. His experiments were carried out, in conjunction with Dr. Joseph, on the vagus nerve and its jugular ganglion. The nerve was cut through either on the central or peripheral side of the ganglion, and after six or eight weeks degeneration was looked for in the ganglion and nerve. These experiments yielded only a general confirmation of Waller's law; at the same time they brought to light so many peculiarities and divergencies, that, even with the help of physiological experiment, it was found impossible to deduce any universal laws from the details communicated to the Society.—Dr. Baginski spoke on the Bacteria normally present in the fæces of children which are being fed on the milk of the mother. As is well known, Eschricht has distinguished two kinds among the above, viz. *Bacterium lactis* and *Bacterium coli*; of these the first is said to be capable of inducing the lactic fermentation of milk-sugar. The speaker had investigated the truth of this statement by cultivating the *Bacterium lactis*, with all needful precautions, in a solution of milk-sugar to which neither peptone nor any other nutrient fluid had been added. When the fermentation was at an end, the fluid was strongly acid, but no lactic acid, or at most the minutest trace of this acid, could be discovered in it: all the reactions which it did yield pointed to the presence in it of acetic acid. This *Bacterium lactis* (which should now rather perhaps be called *Bacterium aceti*) produced no effect on casein or any other proteid, and no putrefactive change was induced. Similarly it had no action on starch paste. Bearing in mind the practical medical interest which attaches to fermentative processes which may occur in the alimentary canal of children at the breast, Dr. Baginski had next investigated the behaviour of the Bacterium and the nature of the fermentation it produces when deprived of air and oxygen, and found that the fermentation was in all respects the same as that which takes place with access of air. The gaseous products of the fermentation were carbonic acid gas, hydrogen and marsh-gas. From among the various substances whose action on the Bacterium was tried, it is sufficient to mention that acetic acid very speedily killed it, so that no growth of the organism was observed in gelatine made acid with the product of its own activity. This product therefore plays the part of an active poison as regards the further life of the organism.—Dr. Mertsching spoke on the histology of the skin and hairs, and in some detail on the mode of origin of horny growths. The speaker exhibited a large number of preparations in support of his views.

AMSTERDAM.

Royal Academy of Sciences, March 31.—Mr. Martin stated that he had been charged by Mr. van Lansberge, late Governor-General of Dutch India, to present to the Leyden Museum a portion of a jaw of a gigantic Ichthyosaurus from the south coast of Ceram. From this fossil the existence of Mesozoic strata in that island may be inferred; and the fact that in British India and in Australia remains of the same animal have been found in the Chalk suggests that in Ceram also there may be a Cretaceous formation. The statement made in Berghaus's Physikalischer Atlas, to the effect that a Palæozoic formation is to be found on the south coast of Ceram, is without foundation.

BOOKS, PAMPHLETS, and SERIALS RECEIVED FOR REVIEW.

The Australian Race, 4 vols.: E. M. Curr (Trübner).—Abhandlungen und Berichte des K. Zoologischen und Anthropologisch-Ethnographischen Museums zu Dresden: Dr. A. B. Meyer (Friedländer).—Diamagnetism and Magne-Crystallic Action; New Edition: John Tyndall (Longmans).—Silk-worms: E. A. Butler (Sonnenschein).—A Treatise on Hydrodynamics, vol. i.: A. B. Basset (Deighton, Bell, and Co.).—Publications of the Lick Observatory of the University of California, vol. i., 1887 (Sacramento).—Methodik der Gesamten Naturwissenschaft: K. Kollbach (Leipzig).—Turbans and Tails: A. J. Bamford (Low).—Antipodean Notes: Wanderer (Low).—Lights and Shadows of Melbourne Life: J. Freeman (Low).—The Land of the Pink Pearl: L. D. Powles (Low).—The Birds of Dorsetshire: J. C. Mansel Pleydell (Porter).—Argentine Ornithology; A Descriptive Catalogue of the Birds of the Argentine Republic, vol. i.: P. L. Sclater and W. H. Hudson (Porter).—Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs; Erster Band, Protozoa: Dr. O. Bütschli (Williams and Norgate).—Mémoire sur la Théorie de la Figure des Planètes: M. O. Callandreau.—Bulletin de l'Académie Royale des Sciences de Belgique, No. 3, 1888 (Bruxelles).—Transactions of the New York Academy of Sciences, vol. vi. (New York).

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