they possessed physiological knowledge. Doubtless those who regard this study as too difficult and technical for young men, will decry it also for women; yet it so happens that for them nothing is so truly interesting as this science. The examination-papers of school-girls of the Ewart Institution, Newton-Stewart, contain an amount of information in physiology perfectly astonishing. Seldom have medical students given better answers. And yet it has been argued that physiology was far too difficult and technical a subject to be studied even by the students in Arts of our University. Hence women in all ranks of society should have physiology taught to them. It should be an essential subject in their primary, secondary, and higher schools. So strong are my convictions on this subject, that I esteem it a special duty to lecture on physiology to women, and whenever I have done so, have found them most attentive and interested in the subject, possessing indeed a peculiar aptitude for the study, and an instinctive feeling, whether as servants or mistresses, wives or mothers, that that science contains for them, more than any other, the elements of real and useful knowledge.

SOCIETIES AND ACADEMIES

London

Geological Society, November 8.—Joseph Prestwich, F.R.S., president, in the chair. Mr. Henry Hicks was elected a Fellow, Dr. Franz Ritter von Hauer, of Vienna, a Foreign Member; and M. Henri Coquand, of Marseilles, a Foreign Correspondent of the Society. The following communications were read:—1. A letter from the Embassy at Copenhagen, transmitted by Earl Granville, mentioning that a Swedish scientific expedition, just returned from the coast of Greenland, had brought home a number of masses of meteoric iron found there upon the surface of the ground. These masses varied greatly in size; the largest was said to weigh 25 tons. Mr. David Forbes, having recently returned from Stockholm, where he had the opportunity of examining these remarkable masses of native iron, took the opportunity of stating that they had been first discovered last year by the Swedish Arctic expedition, which brought back several blocks of considerable size, which had been found on the coast of Greenland. The expedition of this year, however, has just succeeded in bringing back more than twenty additional specimens, amongst which were two of enormous size. The largest, weighing more than 49,000 Swedish pounds, or about 21 tons English, with a maximum sectional area of about 42 square feet, is now placed in the hall of the Royal Academy of Stockholm; whilst, as a compliment to Denmark, on whose territory they were found, the second largest, weighing 20,000 lbs., or about 9 tons, has been presented to the Museum of Copenhagen. Several of these specimens have been submitted to chemical analysis, which proved them to contain nearly 5 per cent. of nickel, with from 1 to 2 per cent. of carbon, and to be quite identical, in chemical composition, with many aërolites of known meteoric origin. When polished and etched by acids, the surface of these masses of metallic iron shows the peculiar figures or markings usually considered characteristic of native iron of meteoric origin. The masses themselves were discovered lying loose on the shore, but immediately resting upon basaltic rocks (probably of Miocene age), in which they appeared to have been originally imbedded; and not only have fragments of similar iron been met with in the basalt, but the basalt itself, upon being examined, is found to contain minute particles of metallic iron, identical in chemical composition with that of the large masses themselves, whilst some of the masses of native iron are observed to enclose fragments of the basalt. As the chemical composition and mineralogical character of these masses of native iron are quite different from those of any iron of terrestrial origin, and altogether identical with those of undoubted meteoric iron, Prof. Nordenskjold regards them as aërolites, and accounts for their occurrence in the basalt by supposing that they proceeded from a shower of meteorites which had fallen down and buried themselves in the molten basalt during an eruption in the Miocene period. Notwithstanding that these masses of metallic iron were found lying on the shore between the ebb and flow of tide, it has been found, upon their removal to Stockholm, that they perish with extraordinary rapidity, breaking up rapidly and falling to a fine powder. Attempts to preserve them by covering them with a coat of varnish have as yet proved unsuccessful; and it is actually proposed to preserve them from destruction by keeping them in a tank of alcohol. Mr. Maskelyne stated that the British Museum already possessed a specimen of this native iron, and accounted for its rapid destruction on exposure by the absorption of chlorine from terrestrial sources, which brought about the formation of ferrous chloride. This was particularly marked in the case of the great Melbourne meteorite in the British Museum; he had succeeded in protecting this, as well as the Greenland specimen, by coating them externally, after previously heating them gently, with a varnish made of shellac dissolved in nearly absolute alcohol. He considered it probable that a meteoric mass falling with immense velocity might so shatter itself as to cause some of its fragments to enclose fragments of basalt, and even to impregnate the neighbouring mass of basalt with minute particles of the metallic iron; but he considered the question of meteoric origin could only be decided by examining the same mass of basalt at some greater distance from the stones themselves, so as to prove whether the presence of such metallic iron was actually characteristic of the entire mass of the rock. Prof. Ramsay referred to the general nature of meteorites and to their mineral relationship to the planetary bodies, and remarked that, supposing the earth to have in part an elementary metallic core, eruptive igneous matter might occasionally bring native iron to the surface. Mr. Daintree mentioned that he had been present at the exhumation of the Melbourne meteorite, and that at that time there was little or no trace of any exudation of ferrous chloride, the external crust on the meteorite being not above $\frac{1}{32}$inch in thickness. 2. "On the Geology of the Diamond-fields of South Africa." By Dr. J. Shaw, of Colesberg. Communicated by Dr. Hooker, F.R.S. The author described the general structure of the region in which diamonds have been found. He considered that the diamonds originally belonged to some metamorphic rock, probably a talcose slate, which occupied the heights during a late period of the "trappean upheaval," to which he ascribed the origin of the chief physical features of the country. This upheaval was followed by a period of lakes, the traces of which still exist in the so-called "pans" of the region; the Vaal river probably connected a chain of these lakes; and it is in the valley of the Vaal and the soil of the dried up "pans" that the diamonds are found. The author referred also to the frequent disturbance and removal of the diamentiferous gravels by the floods which prevail in these districts after thunder-storms. 3. "On the Diamond-gravels of the Vaal River, South Africa." By Mr. G. W. Stow, of Queenstown, Cape Colony. Communicated by Prof. T. Rupert Jones. The author described the general geographical features of the country in which diamonds have been found, from Mamusa on the south-west to the headwaters of the Vaal and Orange Rivers. He then indicated the mode of occurrence of the diamonds in the gravels, gravelly clays, and boulder-drifts of the Vaal Valley, near Pniel, including Hebron, Diamondia, Cawood's Hope, Gong Gong, Klip Drift, Du Toit's Pan, and other diggings. By means of sections he showed the successive deepenings of the Vaal Valley and the gradual accumulation of gravel-banks and terraces, and illustrated the enormous catchment area of the river-system, with indications of the geological structure of the mountains at the headwaters. The specimens sent by Mr. Stow, as interpreted by Prof. T. R. Jones, showed that both igneous and metamorphic rocks had supplied the material of these gravels. The author concluded that a large proportion of these materials have travelled long distances, probably from the Draakensberg range; but whether the original matrix of the diamonds is to be found in the distant mountains or at intermediate spots in the valleys, the worn and crushed condition of some of the diamonds indicates long travel, probably with ice-action. Polished rock-surfaces and striated boulders, seen by Mr. Gilfillan, were quoted in corroboration of this view. Mr. Woodward mentioned that Mr. Griesbach and M. Hübner had been over the country described in these papers, and had communicated a map of it to Petermann's Journal. Mr. Griesbach stated that the rock described as metamorphic in the paper was by M. Hübner regarded as melaphyre, and that in some parts of the Vaal Valley the beds of the Karoo formation might be seen *in situ*. He disputed the possibility of any of the gravels being of glacial origin. He was convinced that there were no metamorphic rocks on the western side of the Draakensberg; those regarded as such probably belonged to the Karoo formation. Prof. Tennant commented on the large size of the diamonds from the Cape, of which he had within the last few months seen at least 10,000, many of them from 30 to 90 carats each. Some broken specimens must, when perfect, have been as large as the Koh-i-Noor. Mr. Tobin corroborated the infor-

mation given by Mr. Stow, and stated that the source of the Vaal was in sandstone, and that it was not until it had traversed some distance that agates, peridot, and spinel were met with. The large diamonds, in his view, occurred principally in old high-level gravels, at a considerable elevation above the river, which had much deepened its valley since the time of their deposit. At Du Toit's Pan, however, none of the diamonds, nor indeed any of the other stones, showed any signs of wear; and he considered that at that spot was one of the centres at which diamonds had been found in their original matrix. Mr. Daintree stated that in Australia there were agate-bearing beds of amygdaloid greenstone similar to those in South Africa, and that he had called attention to their existence in the neighbourhood of the Burnett River, where since then a diamond of the value of 80*l.* had been discovered. Mr. Maskelyne commented on the dissimilarity of the minerals found in the diamond-bearing beds of Brazil from those of Du Toit's Pan or of South Africa generally. He thought that possibly the minerals described as peridot and spinel might be bronzite and garnet, which, however, came from igneous rocks; and the remarkable fact was that with them occurred unrolled natrolite and diamonds in an equally unrolled condition, which was suggestive of their having been due to a common origin. Mr. Ward gave an account of an examination of some of the rock from Du Toit's Pan, with a view of discovering microscopic diamonds, none of which, however, had been found. Prof. Rupert Jones had been equally unsuccessful in the search for minute diamonds, both in sand from Du Toit's and in the ochreous gravel from Klip drift. He pointed out the waterworn condition of the agates from Du Toit's Pan, which showed aqueous action, though there were also several other minerals present in a perfectly fresh and unrolled condition. He thought a careful examination of the constituent parts of the gravel might ultimately throw light on their origin. That fluviatile action was sufficient to account for their presence had already been shown by Dr. Rubidge and others, who had treated of the grand plateaux and denudations of the district under notice.

Royal Geographical Society, November 13.—Major-General Sir H. C. Rawlinson, K.C.B., president, in the chair. The president, on opening the session, delivered an address, in which, after paying an eloquent tribute to the worth of the late president, Sir Roderick Murchison, and expressing his sense of the loss which the Society had sustained in his death, he reviewed the progress of geography since the last meeting of the previous Session. He congratulated the Fellows on being again permitted to meet in the handsome and commodious hall of the London University; and stated that the Council felt that the Senate of that body, in granting the use of the hall, conferred an obligation not only on the Society but on the public at large, whose instruction and education in geography formed the especial objects of their study. He also announced that the Society had, during the recess, taken up its permanent quarters in Savile Row, where it was now located on its own freehold estate. In Physical Geography the important subject of Oceanic Circulation, and Dr. Carpenter's researches thereupon, was prominently noticed; and he stated that Dr. Carpenter, during his Mediterranean voyage of the past summer, had met the objections of his critics in so far as related to the under-current outwards at the Straits of Gibraltar by experimentally proving that such a current really does exist. In Arctic exploration the recent German expeditions were noticed, particularly the voyage of Messrs. Payer and Weyprecht, who, last summer, had found an open sea, in lat. 70°, between Spitzbergen and Nova Zembla. In Central Asia and Eastern Persia much accurate information had recently been obtained by English travellers and surveyors; and in Syria their medallist, Captain Burton, had recently, in company with Mr. Drake, examined the Anti-Libanus and the little-known district east of Damascus,—subjects on which this indefatigable traveller would read papers at a subsequent meeting. An excellent descriptive paper had been received from the well-known and able traveller Captain Blakiston, on the subject of the island of Yezo, the circuit of which he had recently explored in the capacity of an official of the Japanese Government. No direct news had been recently received either from Dr. Livingstone or Sir Samuel Baker; but authentic intelligence of Livingstone could not be much further delayed, as an able and adventurous American gentleman, Mr. Stanley, left Zanzibar for the shores of Lake Tanganyika in February last, taking with him "Bombay," one of Speke and Grant's "faithfuls," as guide. He (the president) added that if Mr. Stanley succeeded in restoring Livingstone to us, or in assisting him to solve the great problem of the upper drainage into the Nile or Congo, he would be welcomed by the Society as heartily and warmly as if he were acting under their own immediate auspices.—A paper was then read "On the Exploration of the Limpopo River," by Captain Frederic Elton. This remarkable journey was performed between July 6 and August 8, 1870, the author starting from the Tati gold-fields and proceeding by an easterly route to the junction of the Tuli River with the Limpopo, and thence descending the great stream or marching along its banks to beyond the junction of the Lipalule, whence he struck across to Lorenço Marques, in Delagoa Bay. The middle part of the Limpopo, between the Tuli and Lipalule, was found to be encumbered with rapids and waterfalls, some of which, especially the cataracts called Tolo-Azime, were truly magnificent, the river, after a series of rapids five miles in length, here plunging over a ledge into a deep chasm. These falls mark the spot where the Limpopo leaves the great interior plateau of Africa and descends abruptly into the plains which extend henceforth to the sea. The paper described the country traversed as rich and abundant in game of all descriptions.

Mathematical Society, November 9.—Dr. Spottiswoode, president, in the chair. The following gentlemen were elected to form the council for the ensuing session:—President: Dr. Spottiswoode. Vice-Presidents: Profs. Cayley, Henrici, H. J. S. Smith, and Mr. S. Roberts. Treasurer: Dr. Hirst. Honorary Secretaries: Messrs. M. Jenkins and R. Tucker. Other members: Profs. Clifford and Crofton, Dr. Sylvester, Hon. J. W. Strutt, Messrs. T. Cotterill, Merrifield, Stirling, and Walker. Mr. A. Freeman was proposed for election. It being unanimously agreed upon that the number of honorary foreign members should be increased to six, the president read out the names which the council recommended for nomination, viz.: Dr. Clebsch, M. Hermite, Prof. Cremona, Dr. Hesse, and Prof. Betti. The only foreign member at present is M. Chasles. Dr. Sylvester then gave an account of his communication "On the partition of an even number into two primes." In one of his minor papers Euler has enunciated as a theorem, resting entirely on intuition from a comparatively small number of instances, that every even number may be decomposed into a sum of two primes. The object of Dr. Sylvester's communication was to obtain some measure of the probable number of ways in which such decomposition can be effected for any given number; if it can be shown to be probably greater than the square root of the number itself, it will follow from generally admitted principles of the theory of chances, that the probability of the theorem being universally true above any assigned limit, if *proved* to be true up to that limit, may be represented by an infinite product of terms, which will approach as near as we please to unity the higher the limit in question is taken. The mere fact of the theorem, as Euler gave it, being proved up to 100,000,000, or any other number however great, would leave the probability of its being universally true, absolutely zero, just as the fact of the sun having risen 100,000,000 times would not contribute an atom of probability to the supposition that it would continue to rise for all time to come. In the case before us, on the contrary, the probability of the theorem being universally true by a sufficiently copious induction, may be made to approach as near as we please to absolute certitude. The author considers that he has established beyond the reach of reasonable doubt that the magnitude which represents the mean probable value of the number of modes of effecting the resolution of a very large even number into two prime numbers is that of the square of the number of primes inferior to the given number divided by the number itself, or which (thanks to the discoveries of Legendre and Tchebicheff) we know to be the same thing, the number of the decompositions in question bears a finite ratio (assignable within limits) to the number to be decomposed, divided by the square of its Napierian logarithm. If we agree provisionally to call preter-primes in respect to n, those numbers which are prime themselves, and also when subtracted from n leave prime remainders, the author shows that the probable number of such preter-primes (*i.e.*, the most probable value attainable under our present conditions of knowledge) may be found approximately by multiplying the number of ordinary primes inferior to n by the product of a set of fractions, depending in part on the magnitude and in part on the constitution of the number n. If n is the double of a prime, the product in question is got by multiplying together all the quantities $\frac{p-2}{p-1}$ where p is every odd prime between unity and the square root of n; but if n itself contains any such

primes among its factors, then the corresponding factors are to be omitted out of the product. We thus see that if two even numbers of considerable magnitude lie adjacent or tolerably near to each other, one of which is the double of a prime, but the other six times a prime, the number of preter-primes relative to the latter will be about twice as many as those relative to the former. For the purpose of greater simplicity of explanation, the formula of approximation has been stated above with less accuracy than it admits of being stated with. Instead of the total number of odd primes being multiplied by the product of factors last described, those only should have been taken which are not intermediate between 2 and $\sqrt{n}$, and the result so modified should have been stated to be the probable value not of the total number of preter-primes, but only of such of them (by far the larger number) as are not of the excluded class above described, nor subtracted from n, give rise to remainders belonging to such class. The author has found by actual trial on an extensive scale, that the estimated values of the number of decompositions never differ by more than a moderate, and in some cases exceedingly slight, percentage from their actual values determined by the use of Borchardt's tables. The same methods enable him also to assign a probable value to the number of modes of resolving an odd number into the sum of one prime and the double of another, and in general lead to an approximate representation of the number of solutions in prime numbers of any system of linear equations of which the total number of solutions is limited, and even to resolve approximately such questions as that of determining how many prime numbers there are inferior to a given limit, which are followed by prime numbers differing from them by any assigned interval. Since the communication made to the Mathematical Society, the secretaries have been favoured with a note from which they understand that Dr. Sylvester has verified his results by quite a different method. The exact number of the solutions of the equation $x + y = n$ in prime numbers may be expressed algebraically by means of the method of generating functions in terms of the inferior primes to n. The expression will be found to consist of two parts, one a constant multiple of n, the other, a function of the roots of unity corresponding to the several inferior primes and their combinations. The former non-periodic part may obviously be regarded as the even value of the expression, and Dr. Sylvester has found that it is identical with the value obtained by the method of averages previously employed. In order to prove strictly Euler's theorem, it only remains to show that the entire expression can never become zero. This Dr. Sylvester believes he has the means of doing, and at the same time of assigning exact limits to the number of solutions in question; but in a matter of so much moment, and of such singular interest, does not wish to express himself in a more decided manner, until he has had the opportunity of subjecting his method to a further rigorous examination.

Royal Astronomical Society, November 17.—Mr. W. Lassell, president, in the chair. The Astronomer Royal showed a drawing of Encke's comet made by Mr. Carpenter of Greenwich; it gave the impression of a somewhat shuttlecock-shaped nebulous haze, with two wings of much fainter light, extending on either side, giving a flattened appearance to the head of the comet. Dr. Huggins made a drawing which coincided in all essential particulars with that of Mr. Carpenter. He thought that he had detected a very minute but distinctly-marked nucleus in the paraboidal-shaped head of the shuttlecock. The whole light of the comet was very faint, but he had succeeded in obtaining its spectrum, which, as in the case of that of Comet II, 1868, consisted of three bands, apparently identical with the bands in the spectrum of the vapour of carbon. The middle band situated near "little b" was much brighter than the other two, and he was quite satisfied of its identity with the middle bands of carbon vapour; the two outlying bands were much too faint for him to speak with confidence of their identity, but they appeared to correspond. The Astronomer Royal showed a celestial globe, on which he had fixed a small white wafer in the place occupied by the sun, and a piece of white paper cut out to represent the comet. He pointed out that its longer axis was directed almost exactly to the sun, and that its head and nucleus were turned away from the sun. This appears to be the almost universal rule with the smaller class of comets. Unlike the sheep of little Bo Peep they carry their tails before them, and not until their smaller fan-shaped appendages have been well warmed by the sun's rays, do they begin to shoot out large tails in the other direction.—A paper was read by Prof. Grant, in which he pointed out that as early as the year 1852 he had recognised the continuity of a red envelope enclosing the sun, of which the prominences were merely the more elevated portions; he had come to this conclusion from a comparison of the observations made during the total eclipses of 1842 and 1851.—A discussion then followed as to whether there were any permanent markings upon Venus. Dr. W. De la Rue and Mr. Browning affirmed that they often saw spots and other irregularities of surface. The authority of Mr. Dawes, and many other observers of note, was cited to the contrary.—Some careful drawings of the Zodiacal light as seen by Captain Tupman while cruising in the Mediterranean were handed round. It was pointed out by Mr. Ranyard that the axis of symmetry of the light was in many instances greatly inclined to the ecliptic, and that the distance of the node of the axis from the sun was in some instances more than 40°.

BOOKS RECEIVED

ENGLISH.—The Geology of Oxford and the Thames Valley: J. Phillips (Macmillan and Co.).—Weale's Treatises: Rudimentary Geology; Historical: R. Tate (Lockwood and Co.).—Profitable and Ornamental Poultry: H. Piper (Groombridge and Sons).—Ganot's Elementary Treatise on Physics, Experimental and Applied: Translated by G. Atkinson, 5th edition (Longmans and Co.).—Tables of Velocity, Time of Flight, and Energy of Various Projectiles; Bashforth Chronograph (E. and F. Spon).—The Discovery of a New World: G. Thomson (Longmans and Co.).

FOREIGN.—(Through Williams and Norgate.)—Les Migrations Humaines en Océanie d'après les faits naturelles: Jules Garnier.

DIARY

THURSDAY, NOVEMBER 23.

ROYAL SOCIETY, at 8.30.—On the Behaviour of Supersaturated Saline Solutions when Exposed to the Open Air: C. Tomlinson, F.R.S.—On Experimental Determination of the Velocity of Sound: E. J. Stone, F.R.S.; (1) Second Paper on the Numerical Value of Euler's Constant, &c.; (2) Second Paper on the Numerical Values of ϵ, log ϵ^2, log ϵ^3, log ϵ^5, and log ϵ^{10}, &c.: W. Shanks.

SOCIETY OF ANTIQUARIES, at 8.30.—On Mediæval Representations of the Months and Seasons: James Fowler, F.S.A.—On some Casts of Ivories from Cologne: Augustus W. Franks.

LONDON INSTITUTION, at 7.30.—The Influence of Geological Phenomena on the Social Life of the People: Harry G. Seeley, F.G.S.

FRIDAY, NOVEMBER 24.

QUEKETT MICROSCOPICAL CLUB, at 8.—On the Minute Structure of Tremelloid Uredines: M. C. Cooke.

MONDAY, NOVEMBER 27.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Exploration of the Volcanic Districts East of Damascus: Capt. R. F. Burton.—Journey in Southern Arabia: Baron de Maetzan.

LONDON INSTITUTION, at 4.—Smell, Taste, and Touch: Prof. Huxley, LL.D., F.R.S. (Course on Elementary Physiology).

WEDNESDAY, NOVEMBER 29.

SOCIETY OF ARTS, at 8.—On Tramways and their Structure, Vehicles, Haulage, and Uses: W. Bridges Adams.

ARCHÆOLOGICAL ASSOCIATION, at 8.

THURSDAY, NOVEMBER 30.

ROYAL SOCIETY, at 8.30.—President's Address.

SOCIETY OF ANTIQUARIES, at 8.30.

LONDON INSTITUTION, at 7.30.—Science and Commerce, illustrated by the Raw Materials of our Manufactures. (II.) P. L. Simmonds, F.R.C.I.

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