be the subject of a special report. From the Pelew Islands the indefatigable traveller proceeded to the southern and then to the northern shore of Admiralty Island, noticing the remarkable prognathous development of the Melanesian natives of this island, as well as those of the island Agomes, of the Hermite Archipelago. After a short visit to the Ninigo Islands, Dr. Maclay returned to the shore bearing his name, the natives of which received him very kindly. He built a house for himself, where he intended to remain, pursuing his anthropological researches.

THE *Journal of Forestry and Estates Management* is the title of a new shilling monthly, which will appear on May, 1 published by Messrs. J. and W. Rider, of Bartholomew Close, E.C. It will be devoted to the interests of Arboriculture in its scientific, practical, and economic aspects, and will give a large portion of its space to matters appertaining to the general management of estates.

WE have received through Mr. Tucker, from Mr. J. M. Wilson, Rugby, two guineas towards the Gauss Memorial Fund.

THE inventor of the new electric seismograph referred to last week is not Father Secchi, but Father Cecchi, of the Scuole pié at Florence.

THE additions to the Zoological Society's Gardens during the past week include a Rusa Deer (*Cervus rusa*) from Java, presented by Mr. A. A. Frazer, F.Z.S.; a Bay Bamboo Rat (*Rhizomys badius*) from India, presented by Mr. J. Wood Mason; a Horned Lizard (*Phrynosoma cornutum*) from Texas, presented by Mr. T. Clover; a Brown Monkey (*Macacus brunneus*) from Assam, deposited; a Demeraran Cock of the Rock (*Rupicola crocea*) from Demerara, purchased; two Chinchillas (*Chinchilla lanigera*), born in the Gardens.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 15.—"On the Tides of the Arctic Seas.—Part VII. Tides of Port Kennedy, in Bellot Strait." (Final Discussion.) By the Rev. Samuel Haughton, M.D. Dublin, D.C.L. Oxon., F.R.S., Fellow of Trinity College, Dublin.

The tidal observations at Port Kennedy were made hourly for twenty-three days; and in my former discussion of these tides (Part VI.) I used only the observations made in the neighbourhood of H. W. and L. W., obtaining the following results for the tidal coefficients :—

Diurnal Tide.	*Semidiurnal Tide.*
S = 23·4 inches.	S = 7·0 inches.
$i_s = 5^h\ 12^m$.	i_s = ,,
M = 20·9 inches.	M = 17·0 inches.
$i_m = 0^h\ 33^m{\cdot}8$.	$i_m = -\ 0^h\ 12^m$.

In the present discussion I have employed all the hourly observations made during the twenty-three days, and have obtained the following results :—

Diurnal Tide.	*Semidiurnal Tide.*
S = 36·4 inches.	S = 5·9 inches.
$i_s = 3^h\ 2^m$.	$i_s = 2^h\ 48^m$.
M = 18·5 inches.	M = 15·5 inches.
$i_m = -\ 2^h\ 48^m$.	$i_m = 6^h\ 2\frac{1}{2}^m$.

The present more complete discussion fully confirms the result before obtained by me, respecting the great magnitude of the solar diurnal tide at this station, and also shows a satisfactory agreement in the other coefficients obtained from H. W. and L. W. observations only.

The method employed in the present paper is based on Fourier's Theorem, by which the height of tide is expressed as follows :—

$$F = A_0 + A_1 \cos s + A_2 \cos 2s + \&c., + B_1 \sin s + B_2 \cos 2s + \&c.,$$

where

F = height of water.
s = hour-angle of sun.

The coefficients A_0, A_1, A_2, B_1, B_2, &c., being found by well-known formulæ, they are again expressed, by Fourier's Theorem, as follows :—

$$A_n = a_0 + a_1 \cos u + a_2 \cos 2u + \&c. + b_1 \sin u + b_2 \sin 2u,$$

where u passes through all its changes in a fortnight, and the coefficients are calculated in a similar manner.

The known theoretical formulæ for the diurnal and semi-diurnal tides, expressed in terms of parallax, declination, lunar and solar, hour-angles, are now converted into functions of the true and mean anomaly, and of the sun's hour-angle, and finally into simple functions of s and u. These expansions are now compared, term by term, with the terms of the tidal expansions found by means of Fourier's Theorem, and the final lunar and solar tidal coefficients calculated out with ease.

Although the short period of observation at Port Kennedy (23 days) renders this method of discussion not much more valuable than the usual method of H. W. and L. W. observations, I have developed it at length in the hope of applying the method to more complete series of Arctic tides, which I hope shortly to lay before the Royal Society.

March 22.—"On Friction between Surfaces moving at Low Speeds," by Fleeming Jenkin, F.R.SS. L. and E., Professor of Engineering in the University of Edinburgh, and J. A. Ewing.

The common belief regarding friction, which is based on the researches of Coulomb and Morin, is that between surfaces in motion the friction is independent of the velocity, but that the force required to start the sliding is (in some cases at least) greater than the force required to overcome friction during motion; in other words, the static coefficient is usually considered to be greater than the kinetic. It occurred to the authors that there might possibly be continuity between the two kinds of friction, instead of an abrupt change at the instant in which motion begins. We should thus expect that when the relative motion of the surfaces is very slow there will be a gradual increase of friction as the velocity diminishes. Whether any such increase takes place at very low speed is left an open question by the experiments of Coulomb and Morin, whose methods did not enable definite measurements of the friction to be made when the velocity was exceedingly small. The authors have succeeded in measuring the friction between surfaces moving with as low a velocity as one five-thousandth of a foot per second, and have found that in certain cases there is decided increase in the coefficient of friction as the velocity diminishes.

The surfaces examined were steel on steel, steel on brass, steel on agate, steel on beech, and steel on greenheart—in each case under the three conditions, dry, oiled, and wet with water. In the cases steel on beech oiled or wet with water, and steel on greenheart oiled or wet with water, the coefficient of friction increased as the velocity diminished between the two limits given above, the increase amounting to about twenty per cent. of the lower value. It appeared that at the higher limit of velocity there was little further tendency to change in the coefficient, but it is impossible to say how much additional change might take place between the lower limit of the velocity and the higher. In the case of steel on agate wet with water there was a similar but much less marked increase of friction as the velocity decreased. And in the case of steel on steel oiled there was a slight and somewhat uncertain change of the opposite character, that is, a decrease of the friction as the velocity decreased. This case, however, would require further examination. In all other cases the friction seemed to be perfectly constant and independent of the velocity. Out of all the sets of circumstances investigated, the only ones in which there was a large difference between the static and kinetic values of the coefficient of friction were those in which a decided increase was observed in the kinetic value on the speed decreased. This result renders it exceedingly probable that there is continuity between the two kinds of friction.

Linnean Society, April 5.—Prof. Allmann, F.R.S., president, in the chair.—Capt. Chimmo, R.N., the Rev. J. Constable, and Prof. Liversidge, of Sydney, N.S.W., were elected Fellows of the Society.—In acknowledging a donation from the author (Mr. H. J. Elwes), of the first part folio, "Monograph of the Genus Lilium," the President congratulated the Society on

the issue of this handsome work by the private energy of one of its members.—Sir Chas. Strickland exhibited a specimen of *Crinum aquaticum* obtained from Grahamstown, South Africa, but which showy plant hitherto has rarely been seen in flower in Britain.—A paper on ferns collected by Miss Gilpin in the interior of Madagascar, was read by Mr. J. G. Baker. Some seventeen are new out of 150 species, a fair proportion, and evidence of an unsuspected richness in this department of the Madagascar flora.—The Secretary announced a paper on the fresh-water algæ of the Cape of Good Hope, by Prof. Reinsch: this being of a technical character, and in Latin, was taken as read.—Mr. R. Collett, of Christiania, then read a communication on *Myodes lemmus* in Norway. His observations on the habits and economy of the Lemming had extended over several years, and in 1876 he had published these in *Nyt. Mag. f. Naturvsk.* But his attention had lately been called to Mr. Crotch's contributions in the Linnean *Journal*, and as in many particulars he differed from that author, the present notice resulted. The number of young at a birth vary from three to eight, and two sets are annually produced. Mr. Collett regards their wandering as a necessary consequence of their temporarily strong vitality, together with an inherent migratory instinct. The tendency at intervals to appear in unusually large numbers is not confined to the genus, but is common to all the species of the sub-family Arvicolinæ. The majority of the wanderers are young, and in one instance observed, by himself, were chiefly males. The migration closes with the death of the individuals, generally brought about by an epizootic disease, the result of over population; the denser the masses the higher the rate of mortality. The bare patch on the rump considered by Mr. Crotch to be due to the habit of protecting themselves against stones in resisting attack, Mr. Collett states is due to a skin disease. He however, supports Mr. Crotch's statement as to the number of winged and four-footed enemies which devour the Lemming, and also that domestic cattle and reindeer destroy them. Their occasional enormous increase in numbers he holds to be owing to periodic prolific years, the facility of rearing their young, and the early procreative faculty of the latter. Parallel instances among other groups of animals, for instance unusual swarms of butterflies and locusts are well known, though as to the true reason of such departures in number, &c., much is only conjectural. Coincidently with the notable years of the Lemming migrations, the increase above the normal number of rats, mice, shrews, and even the grouse tribe, have been recorded. Mr. Collett affirms that the Lemmings travel chiefly in the direction of the valleys, and not constantly due west as has been asserted; their great movements are chiefly nocturnal. He is inclined to question Mr. Crotch's notion of hereditary search for a "Miocene Atlantis," and rather is of opinion that in accounting for the periodical excess of multiplication and migratory impulse a physiological necessity impels them; the nature of this is at present beyond our power to explain rationally. —A further contribution to the natural history of swine, by Prof. Rolleston, was read in abstract, this paper forming an appendix to that previously brought under the notice of the Society. The additional information is in the main confirmatory of the views already expressed, but several important facts relative to the striping of the young of *Sus celebensis* and *S. verrucosus* according to Dr. A. B. Meyer, with information from others, necessarily causes a modification in former conclusions.—On South African Hepaticæ (Liverworts), by Mr. W. Mitten, and on new Irish Lichens, by the Rev. W. A. Leighton, were two technical papers the titles only of which were read by the Secretary.

Royal Astronomical Society, April 13, Dr. Huggins, F.R.S., president, in the chair.—Lord Lindsay read a paper on the diurnal parallax of Juno observed at Mauritius in 1874 with the heliometer, which (rejecting one discordant observation) gave a value of 8″·82 for the solar parallax.—Mr. Gill read a paper on the proposed expedition to observe the approaching opposition of Mars. Observations can be made during six weeks. At the Island of Ascension the geometrical conditions are about as favourable as possible; and what is of great importance, the meteorological conditions are no less so, the range of temperature between 6 P.M. and 6 A.M being only two or three degrees. None of the stars of comparison are of less than the eighth magnitude, and they are selected so as to determine the position of the planet in right ascension as accurately as possible. Mr. Gill proposes also to observe the oppositions of the minor planets Ariadne, Iris, and Melpomene. That of Ariadne occurs ten days earlier than Mars. Its declination will be 15° south. Melpomene has 2° north declination.—Mr. Christie explained the principle of his new form of spectroscope. It depends on the fact that the half of an isosceles prism, cut perpendicular to the base, magnifies the angle between two incident pencils, by virtue of the oblique emergence. By using a compound prism composed of a half prism of flint with a prism of crown cemented to the oblique face, to correct the deviation, the magnifying effect might be increased to ten or fifteen times. By turning the half-prism about its centre different parts of the spectrum would be brought into the field without any movement of the viewing telescope. With two half-prisms the dispersion of ten ordinary compound prisms has been obtained, and with better definition; for with ten prisms the errors of forty surfaces are accumulated. When the breadth of the lines is diminished by narrowing the slit, the spectrum is still far brighter than in the other form, for the loss by absorption is enormous, amounting to 50 per cent. for three or four inches of glass, and in the large Greenwich spectroscope only $\frac{1}{300}$th part of the incident light reaches the eye. Mr. Bidder, Lord Lindsay, and Mr. Gill offered some criticisms, and Mr. Christie replied, showing that he had anticipated all the objections offered.—Prof. Pritchard read a paper on the comets of 1877. The recent dearth of comets he attributed to the probable sleepiness of seekers. Two had been observed at Oxford, and the elements and an ephemeris of Winnecke's calculated. They had made observations on April 7 and 11, which were combined with Prof. Winnecke's of the 5th. in making the calculations.—Prof. Pritchard also read a paper on a mechanical solution of Kepler's problem.—Mr. J. W. L. Glaisher read a paper on an elliptic-function solution of Kepler's problem.—The Rev. S. J. Perry described how neither he nor his assistants could see Vulcan.—Lord Lindsay stated that M. Leverrier thought it would be useless to look for Vulcan for the next six years.

Mathematical Society, April 12.—Lord Rayleigh, F.R.S., president, in the chair.—Mr. C. Pendlebury was elected a member.—The following communications were made:—On Hesse's ternary operator and applications, by Mr. J. J. Walker.—Geometrical illustration of a theorem relating to an irrational function of an imaginary variable, and on the general differential equation $\frac{dx}{\sqrt{X}} + \frac{dy}{\sqrt{Y}} = 0$, where X, Y are the same quartic functions of x, y, respectively, by Prof. Cayley, F.R.S. (Profs. Smith and Henrici took part in a discussion on these papers, the former making remarks on the question whether infinity is a point or a straight line).—Mr. Merrifield, F.R.S., vice-president, having taken the chair, Mr. Harry Hart deduced some cases of parallel motion from the consideration that the contra parallelogram represents the motion of two equal ellipses rolling upon each other, and that of these (*i.e.*, parallel motions) two especially were very simple, inasmuch as the motion was obtained in either case by the use of five bars only and was moreover perfectly continuous.—Mr. Tucker, hon. sec., read an abstract of a paper by Prof. H. W. Lloyd Tanner, on a method of solving partial differential equations which have a general first integral, applied to equations of the third order with two independent variables.

Chemical Society, April 19.—Dr. Gladstone in the chair. —The following papers were read:—On the estimation of manganese in spiegeleisen, and of manganese and iron in manganiferous iron ores, by E. Riley. For estimating manganese in spiegeleisen the author recommends the indirect method, *i.e.*, estimating the iron, adding five per cent. for impurities, and taking the difference as manganese, for accuracy and rapidity; for the estimation of manganese in its ores the author prefers to separate the iron as basic peracetate with carbonate and acetate of ammonia, and to precipitate the manganese with bromine and ammonia, taking care that the ignited precipitate contains no baryta, zinc, or lime. For the determination of the iron a standard solution of bichromate of potash yields the best results, the iron being reduced with pure sulphite of soda.—On a method of detecting small quantities of bismuth, by M. M. Pattison Muir. The author proposes Schneider's reagent, consisting of a clear solution of 12 grm. of tartaric acid and 4 grm. stannous chloride in caustic potash; one part of bismuth in 210,000, if warmed to 60°–70° C. with this reagent, gives a brownish colour. —On certain bismuth compounds, by M. M. Pattison Muir. This paper gives an account of the properties and reactions of bismuth ferricyanide.—Notes on madder colouring matters, by E. Schunck and H. Roemer. Munjistin: this substance resembles purpuroxanthic acid in its physical properties. Purpurin: a pure specimen was examined, and its properties are

given. Alcoholic lead acetate gives with purpurin dissolved in alcohol a precipitate soluble in excess, with alizarin a precipitate insoluble in excess. Triacetyl-purpurin and brom-purpurin were prepared and analysed by the authors. By heating pure purpurin in sealed tubes to 300° C. it was found to be partially converted into quinizarin.

Physical Society, April 14.—Prof. G. C. Foster, president, in the chair.—The secretary described a new form of colorimeter, devised by Dr. Mills. It consists of two vertical glass tubes about ten centimetres in length and two centimetres in diameter, and contracted at their lower ends, which are graduated in millimetres and fixed in a frame. In each tube a loosely-fitting disc of white or black glass (as occasion may require) can be raised or lowered from below by means of a glass rod fitting water-tight, and the meniscus of the liquid is concealed by a wooden screen. The two liquids under examination are introduced into the tubes to the same level, and the discs adjusted until rendered invisible.—Mr. Christie gave an account of a new form of spectroscope, in which "half-prisms" are used to magnify the dispersion (see Astronomical Society).

GENEVA

Society of Physics and Natural History, March 1.—Prof. Zahn presents preparations of the human costal cartilage, showing a fragmentary infiltration of the cellules. This infiltration is very frequent; it is observed in half of the men over forty, and especially in such as have any touch of lung disease.—Dr. Prevost described a case of aphasia observed at the Cantonal Hospital, in a young girl attacked with a right *hemiplegia*, in whom the aphasia subsisted after the cure of the hemiplegia. Though she cannot speak she has recovered the power of articulating words when she sings, and her intellect is untouched.

March 15.—M. Alph. de Candolle announced the conclusion of his work on the family of the *Smilaceæ* for the work which he will publish under the name of "Monographs of the Phanerogameæ." This family includes three principal species, *Heterosmilax*, *Smilax*, and *Riphozonum*, and is found in the division of the globe between India, Japan, and the Sandwich Islands. The first of these species is probably the most ancient.

PARIS

Academy of Sciences, April 16.—M. Peligot in the chair.—The following papers were read:—Note on a problem of mechanics, by M. Bertrand. Knowing that the planets describe conic sections, and without supposing more, to find the expression for the components of the force soliciting them, in function of co-ordinates of its point of application.—On a solar spot which appeared on April 15, by M. Janssen. While the disc had been wholly without spots on the 14th, it had, next day, a space near the centre some 2′ diameter, covered with them. This is of the order of things that occurs at a maximum; and the old idea seems incorrect that the rarity of spots at the minimum is due to an absence of activity of the photosphere. There is a tendency to prompt extinction of the phenomena.—Researches on iodic acid, by M. Berthelot.—On the theory of plane elastic plates, by M. Kirchhoff.—Determination of the differences in longitude between Paris and Marseilles, and between Algiers and Marseilles, by MM. Loewy and Stephan. The apparatus comprised a meridian instrument and pendulum, a Hipp's chronograph, a very sensitive Siemens' relay, a galvanometer, and a rheostat. The difference of longitude observed between the Paris and Marseilles instruments was 12m. 13·430s. ± 0·009s.; that between the Algiers and Marseilles instruments 9m. 23·219s. ± 0·009s. The difference of these, viz., 2m. 50·211s. expresses the difference of longitude between Paris and Algiers; which closely agrees with that got by MM. Loewy and Perrier by direct measurement (viz., 2m. 50·217s.). The velocity of transmission of the signals the authors state to be 36,000 km. per second in the aërial line and 4,000 km. in the cable.—New experiments on the origin and nature of typhoid fever, by M. Guerin. Experimenting with vomited bilious matters, bile, and fecal matters proper from the larger intestine (of typhoid subjects) introduced into rabbits by injection, he found that they rarely caused death—once in twelve experiments; while the special diarrhœic matter from the small intestine caused death almost constantly in a few hours or days. Experiments distinguishing the periods of the disease also pointed to the special toxical matter being almost entirely contained in he smaller intestine. M. Guerin offers some interpretation of these facts.—Divisibility of the electric light, by MM. Denayrouze and Jablochkoff. Using alternating currents and induction coils with interrupter and condenser suppressed, and a kaoln plate between the wires, a steady light is obtained. There is a central artery of the series of interior wires, and as many distinct conductors branch off as there are coils in the circuit. Each luminous centre is thus quite independent, and each may be extinguished or lit separately.—Discovery of a Gallo-Roman port and a Gaulish port near St. Nazaire; determination of the age of the layers at different heights (second note), by M. Bertrand.—The Phylloxera in the department of the Gironde (continued), by M. Azam. At the end of 1873 97 communes were attacked; at the end of 1876, 268.—On ozœna, by M. Brame.—Investigation of the law which must be obeyed by a central force, so that the trajectory it produces may be always a conic, by M. Darboux.—On the laws of reciprocity in the theory of the residues of powers, by M. Pepin.—On the radii of curvature of the successive podaries of a plane curve, by M. Niewenglowski.—On the rolling of ships in calm water, by M. Bourgoin.—On the state of salts in solution, by M. Gernez. His experiments contradict M. Tscherbatschew's view that saturated solutions of sulphate of soda, made under 33°, contain the hydrate with 10HO, those heated to a higher temperature the hydrate with 7HO.—On a new series of acid salts, by M. Villiers.—Transformation of ordinary pyrotartaric acid with tribromic bromhydrate of ethylene, by M. Bourgoin.—On the properties of resorcine, by M. Calderon.—Male flowers of Cordaites, by M. Renault.—Note on the calcifugal flora of the Albe of Wurtemberg, by M. Contejean.—Researches on the cardiac disorders which produce the intermittences of the arterial pulse, called *false intermittences*, by M. François Franck.—Experiments proving that the septicity of putrefied blood is not due to a soluble ferment, by M. Feltz.—On the winter of 1877 in Paris, by M. Renou. It is very rare that the minimum of the cold season falls in November or March (which show the lowest in the present case), or that March should present the lowest monthly average.—On the thunderstorm of April 4, 1877, by M. Godefroy. Figures of the hailstones are given, the form being that of a solid of revolution from a spherical pyramid.—On poisoning with salts of copper, by M. Decaisne.—On the precautions taken by tortoises against cold, and the indications they may furnish to farmers, by M. Bouchard.

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