THE Prince of Wales is bringing home with him a large collection of living animals, including, among the most important, two Musk Deer, three Thars, a Manis, three adult Ostriches, four Elephants, five Tigers, three Leopards, sixteen Impeyan Pheasants, more than twenty Tragopans and Cheer Pheasants, several other Deer and Antelopes, together with Fruit Pigeons, Peafowl, &c. These His Royal Highness intends to have exhibited as one collection, and as such they will be deposited in the Gardens of the Zoological Society, a suitable house being in course of erection, and now nearly completed, for their reception.

THE additions to the Zoological Society's Gardens during the past week include a Lesser White-nosed Monkey (*Cercopithecus petaurista*) from West Africa, presented by Mr. F. Ward; a Common Marmoset (*Hapale jacchus*) from South-east Brazil, presented by Mrs. Cleaver; a Wild Sheep (*Ovis burrhel*), an Impeyan Pheasant (*Lophophorus impeyanus*) from the Himalayas, deposited; two Wheatears (*Saxicola œnanthe*), European, purchased; two Cuming's Octodons (*Octodon cumingi*) born in the Gardens.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 23.—"Description of a Mammalian Ovum in an early condition of Development," by E. A. Schäfer, Assist. Prof. of Physiology in Univ. College.

The author describes the ovum of the cat from five, in the stage where they were rendered evident as scarcely perceptible swellings in the cornua uteri. In their long axes they were $\frac{1}{7}$ inch long; in their short, $\frac{1}{15}$ inch. No mesoblast was anywhere present between the hypo- and epiblastic layers, which latter were clearly separable from one another and nearly in contact only in a small part, where only the cells of each were in more than single layers. At this spot also, the cellular elements of each layer being perfectly recognisable, an exquisitely fine pellicle, which in section appears as a mere line, passes over and forms a definite boundary to the outer surface of the hypoblast at the thickened area. This is named the *membrana limitans hypoblastica*, and is found to be perfectly homogeneous and continuous, becoming stained slightly with carmine, and is probably a cuticular formation produced by the underlying cells. This structure seems to have been as yet unnoticed; the mesoblast cells without doubt first appear outside it, which is in favour of the epiblastic origin of that layer.

"On the nature of the force producing the motion of a body exposed to rays of heat and light," by Arthur Schuster, Ph.D., Demonstrator in the Physical Laboratory of Owens College. Communicated by B. Stewart, F.R.S., Professor of Natural Philosophy in Owens College, Manchester.

Mr. Crookes has lately drawn attention to the mechanical action of a source of light on delicately suspended bodies *in vacuo*; I have made a few experiments with the view of finding out the seat of the reaction which evidently must tend to move either the enclosure or the source of light. I have found that the action and reaction is entirely between the light bodies suspended *in vacuo* and the exhausted vessel.

Mr. Crookes' "Light-Mill" was suspended by means of two cocoon fibres, forming a bifilar suspension from the top of a vessel which could be exhausted. A slight movement of the enclosure could be easily detected by means of a concave mirror attached to it. A beam of the oxyhydrogen lamp was concentrated on the light-mill, which then revolved about 200 times a minute.

The light was cut off at the beginning of the experiment by means of a screen, and the position of rest of the glass vessel was read off by means of the dot of light on the scale. The screen was then suddenly removed, and in every case a large deflection of the glass vessel was observed. The vessel was deflected in the opposite direction to that in which the mill turned. When the velocity of the mill had become constant, the vessel returned to its original position of rest, but on suddenly cutting off the light the vessel was again deflected, but in the opposite direction as on starting the experiment. The vessel therefore now turned in the same direction in which the mill turned.

These experiments are easily explained on the assumption that the force acting on the vessel enclosing the light-mill is exactly equal and opposite to that acting on the mill itself. While the velocity of the mill in one direction is increasing, a force acts in the opposite direction on the vessel. When the velocity has become constant, the force which tends to drive the mill round is exactly counterbalanced by the resistance which opposes the motion of the mill. The two forces acting on the vessel will therefore counterbalance, and the vessel will return to its original position of rest. When the light is cut off, the resistance will stop the motion of the mill. The reaction of the resistance will act on the enclosure, and the enclosure will turn in the same direction as the mill.

By means of the reaction on the enclosure I have been able to calculate the strength of the force; and I have found that the pressure on a surface on which the light of equal intensity to that used in my experiments falls is equal to that produced by the weight of a film of water equal in thickness to the length of a wave of violet light.

March 30.—"On the Placentation of the Lemurs," by Wm. Turner, M.B. (Lond.), Professor of Anatomy, University of Edinburgh. Communicated by Prof. Huxley, Sec. R.S.

In the introduction to this memoir a description was given of the observations made by M. Alphonse Milne-Edwards on the gravid uteri of several genera of lemurs. The author then proceeded to describe the gravid uteri of six lemurs which he had received from Dr. Andrew Davidson, of Antananarivo, Madagascar, viz., *Propithecus diadema*, *Lemur rufipes*, and *Indris brevicaudatus*. He then summarised the conclusions he had arrived at in the course of his dissections, and showed that the placenta in these animals was diffused, and presumably therefore non-deciduate. The paper concluded with a discussion of the bearing of these observations on the classification of the lemurs, and on the theory of the descent of the deciduate mammals from a primæval root-form of Prosiniæ.

"The Residual Charge of the Leyden Jar," by J. Hopkinson, M.A., D.Sc. Communicated by Prof. Sir William Thomson, F.R.S.

Linnean Society, March 16.—Prof. Allman, president, in the chair.—Messrs. Edward R. Alston and David Blair were elected Fellows of the Society.—Dr. J. Anderson communicated a note "On the plastron of the Gangetic Mud-turtle, *Emyda dura*," detailing an instance where eleven instead of the usual nine bones were present. This occurred in an embryo from the egg, and it further appears that ossification and coalescence of the extra pair of bones is coincident with birth.—Mr. A. W. Bennett read a paper "On the rate of growth of the flower-stalk of the hyacinth," in which he showed that the greatest energy of growth is in the lowermost part of the stalk. This agrees with the recorded observations respecting the relative growth of different nodes of a stem, where the greatest energy is always at a considerable distance from the apex. But it offers a contrast to the phenomena exhibited in the submerged flower-stalk of *Vallisneria*, where the greatest energy of growth is in the terminal portion beneath the flower-bud.—Mr. Francis Darwin laid before the Society the results of his observations "On the hygroscopic mechanism by which certain seeds are enabled to bury themselves in the ground." These related chiefly to the Feather-grass, *Stipa pennata*, but similar phenomena obtain in other grasses, in *Anemone montana* and certain of the Geraniaceæ (as Hanstein has recorded, 1868). The essential structures are—a sharp point with reflexed hairs, and a strong woody awn, so bent as to possess a lower vertically helical and an upper horizontal part. With moisture the spiral portion of the awn untwists, causing the horizontal part to revolve, while the flexure between them disappears and thus straightens the awn. A reversal of this process succeeds on the awn becoming dry. In the case of *Stipa* the long, feathery, horizontal part of the awn is easily entangled in low vegetation, and the seed retained vertically, with point on the ground. With wetting the awn untwists, but the horizontal part prevented from revolving, the rotation is transferred to the seed, which latter has superadded pressure of its point, by a conversion of the awn to straighten itself. Again, as the awn dries the seed is not pulled out of the ground, but curiously enough is thrust deeper down; the reflexed hairs being subservient. By such combinations and alternate actions complete burial of the seed ensues. The special advantage of seeds being thus imbedded is obscure; in *Stipa* being unconnected with germination, though possibly a

protection from birds. The effects of changes of temperature Mr. Darwin points out. Hildebrand's and Hanstein's explanations of the torsion he thinks inadequate. Darwin's observations prove it resides in the individual awn-cells. When isolated and dried these latter twist on their own axis, similarly in direction, &c., to the awn and with moisture untwist. Finally, this remarkable power is shown to depend on the molecular structure of the twisting cell-walls. Nägeli and others' researches into twisting cells have not led hitherto to their importance in plant life.—The Secretary briefly referred to a technical paper by the Rev. J. M. Crombie, "On the Lichens of Antarctic America collected by Dr. R. O. Cunningham during the Voyage of H.M.S. *Nassau*, 1867-9." In this ninety-seven species and varieties are recorded: twenty-four of these and a genus, *Endocena*, are attributed to be new.—A discussion on the potato fungus followed. At the President's request Mr. Carruthers reiterated the salient features of Prof. de Bary's recent investigations. He called attention to the difference in thickness of the mycelial threads carrying oospores and antheridia, to the septate character of the threads, and to other points collectively adverse to Mr. W. Smith's views of the "resting spore" of *Peronospora;* De Bary believing two fungi have been confounded. The Rev. M. Berkeley defended Mr. Smith's conclusions as opposed to De Bary's, asserting that as the former, by photographs and drawings from nature, had shown the sexual congress of antheridium and oogonium derived from the unequal sized spawn-threads, no reasonable doubt of their connection existed. Admitting De Bary's extensive knowledge of fungi, Mr. Berkeley, nevertheless, objected to his style of criticism. Mr. Smith himself read a long written reply answering De Bary's objections in detail. He averred that Sadebeck's recent observations supported his own as to two sizes of mycelial threads, and the other objections raised with regard to the oogonia and antheridia. As to septal character of the threads, this belongs to *Peronospora*, those of *Pythium* being destitute in this respect. He further alluded to the warty bodies of Montagne's *Artotrogus*, showing De Bary had misconceived their nature. The Strasbourg professor's animadversion on the life-history of Smith's "resting-spore" being yet incomplete is weakened when the former admits it may take a year to resolve, and as yet only nine months have elapsed since the discovery of the bodies in question. Other remarks pertaining to the "resting-spores" being found in dry leaves, after decay in water, and on perennial mycelium were made, Mr. Smith concluding that De Bary had not entirely comprehended his publications on the subject. Mr. Renny expressed his opinion that the points were not absoutely settled on either side, discrepancies still appearing to him to exist. De Bary's objections were allowable on the ground of his extensive acquaintance with the subject, while possibly Smith may not have given the exact value to what he saw. Mr. T. Dyer suggested that the bodies of the so-called *Artotrogus* may be but mycelial dilatations, and not true oogonia; on this ground a fresh investigation might be necessary to ascertain its relations to the questions at issue. Mr. A. Murray, Mr. Cooke, and Dr. Masters each made a few remarks. Mr. Carruthers, in conclusion, thought Mr. Renny had put the case fairly. De Bary only meant to question Smith's knowledge of the conidia, not that he was ignorant of the potato fungus; he, De Bary, may have misunderstood Smith's drawings, but in the elucidation of facts and truths he certainly could not fairly be accused of hypercriticism, seeing that he himself had carefully watched and studied the development, mode of hosts, &c., since 1874.

Geologists' Association, March 3.—Mr. William Carruthers, F.R.S., president, in the chair.—On the Bagshot sands in the Isle of Sheppey, by Major F. Duncan, D.C.L., F.G.S. A recent section, made with the object of lowering a road, has exposed a considerable part of Bagshot sands, colour pale or light yellow, with clay lines, resting on the top of the dark London clay. The distinctive features are absence of greensands, presence of thin layers and nodules of iron-sandstone, absence of fossils. As there is no discoloration of the sands at the base of the section the author thought they might have been sub-aërial deposits—blown sand; otherwise he considered that there would have been a shading off between the clays and the sands. This theory, the author thought, might serve to explain the well-known variability of this series.—On some rock fragments in the above-described section, by Mr. W. H. Shrubsole. These had been found 6 to 18 inches from the surface and were all igneous, except some specimens of hard sparry limestones. After discussing the possibility of these fragments having been brought to Sheppey by human agency, the author contended that, although their position in the described section may have been due to such a cause, still that they must originally have been conveyed on ice, towards the close of the Glacial epoch, and been stranded whilst Sheppey was emerging from the sea.—Known facts and unknown problems in Arctic geology, by Charles E. De Rance, F.G.S., H.M. Geol. Survey. The existing glacial phenomena of the Arctic regions, Greenland, and Spitzbergen, were described, marine shells of existing species occurring at heights of more than 1,000 feet above the sea, and living marine Crustacea in fresh-water lakes elevated many feet above the sea-level in Polaris Bay. The observations on the discoloration of the waters of the Arctic Ocean were dwelt upon, and the bearing on the phenomena observable on the English Glacial deposits. The crystalline rocks of the north coast of America and the Greenland coasts were referred to the Laurentian system, and the whole of this area stated to have been land, during the Lower Silurian epoch. The Upper Silurian, however, was shown to be well represented in all the islands of the Arctic Archipelago, and the "Ursa Stage" of Prof. Heer, Devonian, or Lower Carboniferous, with coal-seams, to be present in synclinals in the latter, and also to exist in Spitzbergen and Bear Island, as do the overlying mountain limestones. The Lias and Oolitic rocks of the Arctic Islands, East Greenland, and Spitzbergen were described, and the Cretaceous plant-bearing beds of West Greenland, and their associated coal-seams. The Miocene basalts of Mid-Greenland, with their associated plants, were mentioned as probably connected with the basalts of East Greenland, and as ranging to Spitzbergen.

Physical Society, March 25.—Prof. G. C. Foster, F.R.S., president, in the chair.—The following candidates were elected members of the society:—The Marquis of Salisbury, Prof. Liversidge, W. Ackroyd, Tolver Preston, W. Merritt.—Mr. O. J. Lodge, B.Sc., made a communication on the flow of electricity in a plate, in continuation of a paper which he read before the society on Feb. 26. In order to apply the principle of images already described to the flow of electricity in plates bounded by straight lines, it is necessary that the angles of the plate should be aliquot parts of 180°; and, since this condition excludes obtuse angles, the number of rectilinear figures which can be treated is very limited. They are rectangles, equilateral triangles, two cases of right-angled triangles, the two limiting cases of the isosceles triangle for which the equal angles are 0° and 90° respectively, and many cases of the general two-sided polygon or "wedge," including the regular two-sided polygon or "strip." Since the images of a pole in a wedge lie on a circle as in a kaleidoscope, Cotes' property of the circle may be applied to obtain expressions for the potential of any point, and for the electrical resistance of the plate to the flow from any number of point poles situated anywhere in it. The expressions are rather long, but they become simpler in certain special cases which were pointed out. Making the angle of the wedge vanish the expressions modify into corresponding expressions for the strip, the resistance expressions of which always contain hyperbolic trigonometrical functions of the positions of the poles. The potential functions for a circular sector also follow from a general case of the wedge. The general resistance formula, applied to the case of the isosceles right-angled triangle leads to some continued products, all of which are generalisations of Wallis' expressions for $\frac{\pi}{2}$. The product of these products, which is itself of the same form, has been reduced by Mr. J. W. L. Glaisher to the complete elliptic integral usually denoted by K, its modulus being Sin 45°. This quantity appears in all the resistance expressions for right-angled triangles and squares which the author has yet examined. The case of an equilateral triangle leads to more complex and interesting products, which were reduced by Mr. Glaisher to the product of two theta-functions, with Sin 75° as a modulus. When the conditions of flow are known in one rectilinear figure they may be extended to a large number of others by alternate processes of reflecting the plate in one of its own boundaries, and of cutting it along one of its straight flow or equipotential lines. Diagrams of such transition figures were shown. In order to obtain the resistance of a compound conductor by means of the known resistance of its components, it is necessary that the flow conditions in each component shall remain entirely unaffected by their being connected together. Thus if the resistance of a circuit consisting of two wires side by side is to be deduced from the resistance of the wires separately, by the ordinary method of adding their conductivities, it is

necessary either that the wires shall not touch each other, or that if they do, no flow shall pass across the junction. This rule is often overlooked, and the oversight has given rise in certain cases to a notion of electrical "interference." The concluding part of the paper has to do with the flow conditions when fine poles are combined with point poles in a sheet, especially when point electrodes are introduced into a sheet when a uniform current or "river" is flowing across the sheet.—Dr. Guthrie then communicated a fourth paper on salt solutions and attached water. It consists mainly of an account of an examination of the behaviour of a salt solution, when cooled below the freezing point of water. Having shown in previous communications that every salt solution, when of a certain strength solidifies as a whole, at a certain temperature as a cryohydrate, the present research was directed to the determination of the temperatures at which, (1) ice separates from solutions of strengths weaker than the cryohydrate, and (2), the anhydrous salt or some hydrate richer than the cryohydrate, separates from solutions stronger than the cryohydrate. About twenty typical salts have been examined in this manner, and curves were exhibited in which the abscissæ represent strengths, and the ordinates solidification temperatures. All the curves have a similar character and exhibit a point of contrary flexure, between the origin representing pure water at 0° C. and the cryohydrate. Between the cryohydrate and the 0° C. degree of saturation, they are nearly straight lines, and are continuous with the curves of solubility above 0° C. The joint effect of two salts in depressing the temperature of ice-formation was also examined. From previous experiments the general law that the temperature of a freezing mixture is identical with that of the solidification of the cryohydrate of the corresponding salt, appeared not to be the case with iodide of sodium. It now appears that this salt offers no exception to the general law and that what was previously mistaken for the cryohydrate is really a sub-cryohydrate solidifying at a higher temperature. Certain remarkable cases of supersaturation were discussed which show that a solution may be supersaturated in a 3-fold manner, (1) with regard to ice (2) with regard to a salt, and (3) with regard to the cryohydrate of the salt. The parallelism between a boiling saturated salt solution and a glaciating one was pointed out.

PARIS

Academy of Sciences, March 27.—Vice-Admiral Paris in the chair.—The following papers were read:—Influence of variations of pressure on the working of chronometers, by M. Yvon Villarceau.—On the small movements of an incompressible fluid in an elastic tube, by M. Resal. The velocity of propagation of waves is equal to the square root of the product of the coefficient of elasticity and the thickness of the tube divided by that of the diameter of the tube and the density of the liquid.—Observations of temperature at the Museum of Natural History during 1875, with electric thermometers placed in the air and in turf-covered and bare ground, by M. Becquerel. The temperature was, on an average, somewhat higher in the turf-covered ground than in the bare ground, and in the former it never descended below zero.—On the comparative movements of the thermometer and barometer during the commotion of March, 1876, by M. Sainte-Claire-Deville. The periodic oscillation of the temperature from 9th to 13th March did not fail to be produced, and the law of non-synchronic parallelism of temperature and pressure is realised even in the most sudden variations of these two elements.—Remarks *apropos* of Mr. Lockyer's communication on new lines of calcium, by M. Sainte Claire-Deville. In two neighbouring groups of mineral substances, there are most frequently two minerals belonging respectively to each, and characterised by the same basic element. Now of all simple bodies it is calcium that most commonly plays this double *rôle*. Is this connected with its double behaviour under the influence of dissociants?—Experiments on the schistosity of rocks, and the deformations of fossils correlative to this phenomenon; geological consequences of these experiments, by M. Daubrée (first part). The press used in these instructive experiments could give a total pressure of 100,000 kilogrammes on the plates.—Reproduction of Amblystoma observed in the museum, by M. Blanchard. The Amblystoma of Mexico is the adult form of the Axolotl, and the fact observed is important as disproving the idea of the sterility of certain Batrachians in the adult state.—Continued observations of solar protuberances during the second semester of 1875, by P. Secchi. These comprise seven rotations. It is a period of prolonged minimum; the absolute minimum not yet reached (March). Protuberances varying from 2 or 3 one day to 10 or 12 the next. The hydrogenic flames were commonly *straight*, though 2 or even 3 minutes in height (say 60 terrestrial diameters); this indicates great tranquility. The chromosphere was very low at the equator, but often reached a great height at the poles (24 and 30 seconds). This is the effect of displacement of maxima towards the poles.—Mr. Spottiswoode was elected correspondent in the section of Geometry, in room of the late M. Le Besgue.—Report on a memoir of M. Bourgoin, entitled "Researches in the succinic series."—Employment of coal-tar and of sulpho-carbonates against Phylloxera, by M. de la Vergne.—Analytic theory of the movements of Jupiter's satellites, by M. Souillart.—Results of actinometric measurements on the summit of Mont Blanc, by M. Violle.—Velocity of thermal flow in a bar of iron, by M. Decharme. The times taken by the flow to reach different points in the bar are directly proportional to the squares of the distances of these points from the heated end; or, the velocities of thermal flow are inversely proportional to the squares of the distances. (The cooling is slower than the heating).—Study on stratified light; memoir by M. Neyreneuf.—The elephants of Mont Dol; organogeny of the system of molar teeth of the mammoth, by M. Sirodot.—Photomicrographic researches on the transformation of collodion in photographic operations, by M. Girard. Microscopic examination of collodion enables one to know the nature of the layer and to follow the reactions produced in photographic impression.—On communications at a distance by water-courses, by M. Bourbouze (sealed packet deposited in 1870). Lines are dispensed with, and earth currents utilised.—On the conditions of immediate integrability of an expression with ordinary differentials of any order, by M. Pujet.—Impossibility of the equation $x^7 + y^7 + z^7 = 0$, by M. Pepin.—On the exchange of ammonia between natural waters and the atmosphere, by M. Schlœsing. The ammonia condensed by a given quantity of water increases rapidly with diminution of temperature. It is a mistake to suppose the ammonia of a cloud is condensed almost entirely in rain.—Sources of carbonic oxide; new mode of preparation of very concentrated formic acid, by M. Lorin. In this method dehydrated oxalic acid is used in place of sulphuric acid, with a formiate.—On the constitution of the excretory canal of the hermaphrodite organ in *Leucochron candidissima*, Beck, and in *Bulimus decollatus*, Linn., by M. Dubrueil.—On the relations between number of molar teeth in the dog and dimensions of the bones of the face, by M. Toussaint. The normal formula for molar teeth of the dog is $\frac{6}{7}$, but in the extreme, dissimilar types of bulldog and greyhound the formulæ of $\frac{5}{7}$ or $\frac{5}{6}$ for the former, and $\frac{7}{9}$ for the latter, are met with. One may follow the transformation of the formulæ by examining intermediate types.—Researches on the convergence and divergence of formulæ of Fourier's representation, by M. Paul de Bois Reymond.

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