is dedicated to the memory of the late Prof. Kessler.—Zoologists will find valuable contributions to the knowledge of Russian zoo-geography in the researches of MM. Khlebnikoff, Nikolsky, and Lavroff as to the fauna of the governments of Novgorod, Astrakhan, and Kaluga, published in vol. xi. of these *Memoirs*.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 15, 1881.—"On some Effects of Transmitting Electrical Currents through Magnetised Electrolytes." By Dr. G. Gore, F.R.S.

This communication treats of a class of electro-magnetic rotations observed and examined by the author. The rotations are produced in liquids by means of axial electric currents either in the interior of vertical magnets, electric or permanent, or near the poles of such magnets; and differ from rotations previously produced in liquids placed in those positions, by the absence of radial currents, to the influence of which rotations in the interior of hollow magnets have hitherto been ascribed. In the full paper it is stated that "the whole of the results may be explained by the well-known principles of electro-magnetism."

It is here shown that a column of an electrolyte placed under similar conditions to an iron wire or rod when subjected to electro-magnetic torsion (*i.e.* inclosed by an electro-magnetic helix, and traversed axially by an electric current), is twisted in a similar manner to the wire or bar. This effect, however, in the case of a liquid, is not limited to paramagnetic substances, nor is the direction of torsion altered by the magnetic character of the solution.

The rotations produced in liquids by means of axial currents are opposite in direction at the two ends of the magnet-tube, are strongest at the poles and at a little distance beyond them, and null at the centre of the tube:—they may be produced at a distance of several inches beyond the poles. The directions of rotation within the tube, and to a short distance beyond the poles, are, in the case of an electro or a permanent magnet, opposite to those produced by a voltaic solenoid; a magnet-tube, therefore, has three points of no rotation with an axial current, viz. one at its centre and one near each end, whilst a solenoid has only the former one. The existence of the outer neutral points produced by a magnet depends upon the position of the latter to the liquid, and the distances of those points from the poles of the magnet are affected by various circumstances which are described in the communication. If the magnet is wholly above the portion of the liquid traversed by the axial current, the outer neutral points do not occur.

By the influence of a vertical current, the liquid as a whole may be made to rotate in either single direction; the motion at one end of the column, therefore, is not dependent upon the opposite direction of motion at the other, and torsion is not a necessary form of the effect. The reaction of the liquid in the production of the rotation is neither upon another portion of the liquid, nor upon the electrodes, nor upon the walls of the containing vessel, but upon the adjacent magnetised body; the rotation of the liquid is confined to the portion traversed by the vertical current.

Under suitable conditions the phenomenon of rotation is definite, conspicuous, and strong, and is usually more powerful with a tubular electro-magnet than with a voltaic coil alone; a very thin iron tube weakens the effect of the coil, whilst a thick one reverses the motion and makes it stronger. The system of rotations, either with a coil or magnet, is also perfectly symmetrical. The directions of rotation produced by a coil alone are independent of the magnetic nature of the wire of the coil. Like other electro-magnetic effects, the rotations are not prevented by the interposition of metallic screens, provided they are non-magnetic. The rotations may be easily produced by the aid of a current from three or four Grove's elements, especially if permanent bar-magnets are used instead of a voltaic coil. The rotations by means of vertical currents in the liquid may be produced by the influence of coils or magnets, either above or below the liquid, as well as around it; with magnets, however, in the former positions, no external reversal points occur. A magnet placed entirely above or below the liquid produces the same directions of rotation as a coil placed either above, below, or around it. The direction of rotation produced in a liquid above a coil by an *upward* current in the liquid agrees with that produced by a *radial centripetal* one.

A rotation apparatus of the same kind, interposed as a screen, does not prevent or appear to affect the movements.

Each electrode may be made to separately revolve in the presence of a coil or magnet, by the well-known influence of the radial currents in them; and the directions of rotation are the same with a magnet as with a coil. In this respect the motion produced by radial currents differs from that produced by vertical ones. With each electrode, diverging currents produce dextro- and converging ones lævo-rotation. The rotation of the electrodes by means of radial currents appears to be independent of that produced in the liquid by means of vertical ones.

The rotation also of the vessel containing the liquid may be obtained independently of that of the electrodes, by means of the vertical current in the liquid, without the aid of the radial currents in the electrodes.

The rotations produced by a vertical axial current are not confined to liquids, but may also be produced in a solid conductor, and probably therefore with any body conveying an electric current or discharge.

The directions of rotation produced in liquids by means of radial currents under the influence of a magnet or coil, are the same as in the solid electrodes, and are lævo at all positions with centripetal currents and dextro with centrifugal ones, when the North Pole is above.

A given direction of axial current, whether in a solid or liquid conductor, whether above or below a given magnetic pole, and whether that pole constituted the upper or lower end of a coil or magnet, produced the same direction of rotation. A given direction of radial current also, whether in the electrodes or electrolytes, or above or below a given pole, provided that the pole was not altered in position, produced the same direction of rotation.

Various other phenomena, such as temporary reversals of the direction of rotation, successive action of the coil and iron tube, &c., &c., are recorded in the paper.

With a Solenoid.—A current flowing upwards from a south to a north-seeking pole produces dextro rotation at the former, and lævo rotation at the latter. *With a magnet* these two directions are reversed at all distances between the two neutral points near the poles of the magnets, but not beyond. The phenomena therefore of rotation are more complex with a magnet than with a solenoid.

The reversals of direction of rotation which occur when a tubular magnet is employed appear to be due to the inner surface of the magnet and to the position of that surface in relation to the current in the liquid. The direction of rotation and the points of reversal appear to be all independent of each other.

The action of radial currents is more simple than that of axial ones, especially near the poles of a magnet. With radial currents, either in the liquid or electrodes, there is no reversal either at the centre of the magnet or coil, or at the poles or beyond them.

The experiments show in a conspicuous manner the difference of property of the interior surface of a hollow magnet and of that of a solenoid having the same kind of poles at their corresponding ends. This difference of property is well known, but is illustrated in the paper in a new way experimentally.

The whole of the foregoing results are illustrated by experiments.

Mathematical Society, January 12.—S. Roberts, F.R.S., president, in the chair.—Dr. G. J. Allman and Mrs. Bryant were elected Members, and Mr. G. H. Stuart was admitted into the Society.—A vote of thanks was passed to the Norwegian Government for the present of a copy of the new edition of Abel's works.—The following communications were made:—The invariants of a certain orthogonal transformation, with special reference to their use in the theory of the strains and stresses of an elastic solid, by Mr. W. J. C. Sharp.—Some formulæ in elliptic functions, by the Rev. M. M. U. Wilkinson.—Complete determination of the real foci, and of the vector equation, of a given ellipse with respect to any proposed point, by Prof. Wolstenholme.—On the calculation of symmetric functions, by Mr. J. Hammond.

Royal Horticultural Society, January 10.—*Hylecœtus dermestoides:* Mr. Pascoe showed a male and a female specimen of this British beetle, and alluded to the report that it feeds on the wood-boring species, but does not itself bore the wood. Mr. Maclachlan remarked that it was an open question whether this idea were true.—*Glastonbury Thorn:* Dr. Masters exhibited specimens of this plant received from Mr. Boscawen,

with buds and fruit. It was flowering later than usual. He also showed a variegated sport of the common laurel from the same gentleman.—*Willow, species of:* Some specimens of new species of willow, *e.g. S. holosericea*, &c., were received from Dr. Fraser, of Wolverhampton. It was suggested that they were hybrids or accidental importations. They were forwarded to the Kew Herbarium.—*Carica condamarcensis, Fruit of:* A fruit of this plant was received from Mr. J. A. Henry, of Edinburgh. It was raised from seed sent by the late Prof. Jameson of Quito, and had been fertilised by the late Prof. Dickson.—*Nitrogen in worm-casts:* Dr. Gilbert described some experiments he had made in order to ascertain the proportion of nitrogen in worm-casts; which latter, according to Mr. Darwin, amount to between 17 and 18 tons per annum per acre, of '2 inch in depth. He collected the casts of two or three weeks' formation, and found, by analysis of the *dried* mould, that it contained '35 per cent. of nitrogen, which is higher than that of mould of pasture land, viz. '25-'3 per cent. in the first nine inches, or two or three times as high as that of arable land, but not so rich as highly manured kitchen garden mould. Ten tons per acre would, therefore, yield 80 lbs. of nitrogen per annum, or more than double that of ordinary meadows without manure. The conclusion was that no gain accrued to the soil except from what the worms brought up from below, as by trenching.—*Plants exhibited: Columnæa Kalbreyerana*, with satin-like pendulous secund leaves and yellow flowers, from New Grenada, exhibited by Messrs. Veitch. It received a botanical certificate. *Tecophilæa cyanocrocus*, from Chili. This had flowered previously at Kew. It was brought by Mr. G. F. Wilson. A small bulbous plant with slender tubed and globular perianth of lilac colour, brought by Mr. Maw from Mount Ida, was exhibited by the Rev. H. H. Crewe. It was referred to Kew for identification and name [*Colchicum montanum*, Bieb.]. *Lygodictyon Forsteri*, a fine specimen of a climbing fern, from Mr. Green, of Kingsford Stanway, near Colchester. *Dracæna Goldiana*, exhibited by Mr. Wills, flowering for the first time in this country, with variegated foliage, received a botanical certificate.

Victoria Institute, January 16.—A paper on "Biblical proper Names, personal and local, illustrated from Sources external to Scripture," was read by the Rev. H. G. Tomkins. Communications from Prof. Sayce, MM. Renouf, Lenormant, Naville, &c., followed, and a discussion ensued, in which Dr. Rassam and others took part.

PARIS

Academy of Sciences, January 9.—M. Jamin in the chair.—The following papers were read:—Documents relative to the subject of Papin's stay at Venice, by M. Daubrée. Papin went to Venice with Paul Sarotti, a Venetian senator whom he met in London, and who had founded an academy in his own house in Venice (beginning about 1632), with a valuable library. M. Daubrée, in a recent visit to Venice, gained some information about the work done at the meetings. The Sarotti Academy still existed in 1690.—On the powers and roots of linear substitutions, by Prof. Sylvester.—Experimental study on metalloscopy, hypnotism, and the action of various physical agents in hysteria, by MM. Dumontpallier and Magnin. Among other things, the authors suppose there is an intercrossing of sensitive and motor fibres in the dorso-lumbar region of the spinal cord, occasioning simultaneous movements of the upper limb on one side, and the lower on the other; excitation of the surfaces of the latter causes movement of the former. This may explain the walk of quadrupeds, of man "on all-fours," &c. The nervous hyperexcitability of hysteric persons in a state of hypnotism is illustrated. The so-called radiating neuric force in hysterics is merely a manifestation of physical acts called into existence (peripheric modifications caused by physical agents).—On the processes of coppering cast-iron, employed at the Val d'Osne, by MM. Mignon and Rouart. They use a distinctly acid solution, whereas *alkalinity* is the basis of M. Weil's method (in which the organic acid is only an accessory).—The Secretary gave the gist of a volume of memoirs by Prof. J. P. Cook of Harvard.—M. Dumas presented a fine work by M. Civiale, "Voyages photographiques dans les Alpes."—On an extension of the arithmetical notion of genus, by M. Poincaré.—On algebraic forms with several series of variables, by M. le Paige.—Differential equations of motion of waves produced at the surface of a liquid by the emersion of a solid, by M. Boussinesq.—On some consequences of the principle of Gauss in electrostatics, by M. Croullebois.—On a sound-transmitter with stringed sounding-board, by M. Bourbouze. A microphone is placed on the sounding-board of a piano or like instrument, and is affected by the strings vibrating in unison with sounds produced (with the voice or an instrument) near them. Such a transmitter is very sensitive.—Measurement of the interior resistance and the electromotive force of electric machines in action, by M. Cabanellas.—Note on the theory of formiates by M. Maumené. Thermal researches on oxychlorides of sulphur, by M. Ogier.—On a carbonic ether of boeïncol, by M. Haller.—On the formation of bases of the quinoleic series in the distillation of cinchonine with potash, by M. Oechsner de Coninck.—On terpine, by M. Walitzky.—On the existence of an automatic rhythm common to several nerve-centres of the medulla oblongata, by M. Fredericq. With inspiration (respiratory centre) there is diminution of arterial pressure and acceleration of pulsations (*i.e.* minimum of action of centres for vasomotors and for stoppage of the heart). With expiration and respiratory pause, the effects are opposite. This intermittent activity occurs apart from all change in the state of the thoracic organs, provided the blood bathing the medulla oblongata has a certain degree of viscosity; if it be too much arterialised, the three centres more or less suspend their action.—On the positions of equal luminous intensity in twin crystals, between crossed Nicols, and application to the study of the concentric bands of felspar, by M. Lévy. The felspars in rocks are generally formed by juxtaposition of *concentric bands;* and in these the optical properties vary irregularly, though the crystallographic orientation seems the same. Some have tried to explain this by supposing a variation in the chemical composition of the bands. M. Lévy pronounces this insufficient, and regards the bands as often due to a submicroscopic association of hemitropic lamellæ of a fundamentally single felspar, according to the laws of albite and of pericline.—On the artificial reproduction of analcime, by M. de Schulten. His former method was heating a solution of caustic soda in sealed tubes of ordinary French glass. In another, he mixes solutions of silicate and aluminate of soda, such that the silica and alumina are in the same ratio as analcime, adds some lime-water (to facilitate crystallisation), and heats in a copper tube at 180° for eighteen hours. While analcime, in natural specimens, has optical properties indicating the quadratic form, the author's first artificial reproduction gave crystals apparently rhombohedral, and his second, distinctly cubical crystals.—Study of subterranean waters in the department of the Meuse, by M. Holtz. Some parts of France, such as Normandy, are almost entirely without subterranean waters, owing to the refractory nature of their ground, but it is otherwise with the departments of the north-east (Meuse included), in the oolithic zone.—M. Pernolet indicated several examples of the diffusion of carbon.

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