PROCEEDINGS

OF

THE ROYAL SOCIETY.

1838. No. 36.

December 6, 1838.

JOHN W. LUBBOCK, Esq., V.P. and Treas., in the Chair.

Richard Charnock, Esq., was balloted for, but not elected into the Society.

The Rev. Philip Kalland, M.A., was balloted for, and duly elected into the Society.

A paper was in part read, entitled, "Experimental Researches in Electricity." *Fifteenth Series.*—"Note of the Character and Direction of the Electric Force of the Gymnotus." By Michael Faraday, Esq., D.C.L., F.R.S., &c.

December 13, 1838.

The MARQUESS of NORTHAMPTON, President, in the Chair.

The reading of a paper, entitled, "Experimental Researches in Electricity." *Fifteenth Series.*—"Note of the Character and Direction of the Electric Force of the Gymnotus." By Michael Faraday, Esq., D.C.L., F.R.S., &c., was resumed and concluded.

The author first briefly refers to what has been done by others in establishing the identity of the peculiar power in the Gymnotus and Torpedo with ordinary electricity, and then in reference to the intended conveyance to this country of Gymnoti from abroad, gives the instructions which he himself had received from Baron Humboldt for that purpose. A living Gymnotus, now in the possession of the Proprietors of the Gallery of Science in Adelaide Street, was placed for a time at the disposal of the author for the purpose of research, upon which he proceeded, with suitable apparatus, to compare its power with ordinary and voltaic electricity, and to obtain the direction of the force. Without removing it from the water he was able to obtain not only the results procured by others, but the other electrical phenomena required so as to leave no gap or deficiency in the evidence of identity. The shock, in very varied circumstances of position, was procured: the galvanometer affected; magnets were made; a wire was heated; polar chemical decomposition was effected, and the spark obtained. By comparative experiments made with the

animal and a powerful Leyden battery, it was concluded that the quantity of force in each shock of the former was very great. It was also ascertained by all the tests capable of bearing on the point, that the current of electricity was, in every case, from the anterior parts of the animal through the water or surrounding conductors to the posterior parts. The author then proceeds to express his hope that by means of these organs and the similar parts of the Torpedo, a relation as to *action* and *re-action* of the electric and nervous powers may be established experimentally; and he briefly describes the form of experiment which seems likely to yield positive results of this kind.

December 20, 1838.

JOHN GEORGE CHILDREN, Esq., V.P., in the Chair.

Prof. Louis Agassiz, and Prof. Carl. Fred. Philip von Martius, were severally elected Foreign Members of the Society.

A paper was read, entitled, "On the Curvature of Surfaces." By John R. Young, Esq. Communicated by John W. Lubbock, Esq., M.A., V.P. and Treas. R.S.

The principal object of this paper is, to remove the obscurity in which that part of the theory of the curvature of surfaces which relates to umbilical points has been left by Monge and Dupin, to whom, however, subsequently to the labours of Euler, we are chiefly indebted for a comprehensive and systematic theory of the curvature of surfaces. In it the author shows, that the lines of curvature at an umbilic are not, as at other points on a surface, two in number, or, as had been stated by Dupin, limited; but that they proceed in every possible direction from the umbilic.

The obscurity complained of is attributed to the inaccurate conceptions entertained by Monge and Dupin, of the import of the symbol $\frac{0}{0}$ in the analytical discussion of this question, the equation which determines the directions of the lines of curvature taking the form

$$0\left(\frac{dy}{dx}\right)^2 + 0\left(\frac{dy}{dx}\right) + 0 = 0$$

at an umbilic. After stating that Dupin has been guided by the determination of the differential calculus, the author remarks, that in no case is the differential calculus competent to decide whether $\frac{0}{0}$, the form which a general analytical result takes in certain particular hypotheses, as to the arbitrary quantities entering that result, has or has not innumerable values. He then states the principle, that those values of the arbitrary quantities (and none else) which render the equations of condition indeterminate must also render the final re-