adopted the name from the 'Flora' without suspicion, unless, indeed (which is unlikely), both species occur on the island. For the satisfaction of other botanists I have brought back specimens of the plants in spirits, showing flower and fruit, as well as dried examples.

The fern, which was new to me, according to Lady Barkly, may be a form of *Polypodium* (*Grammitis*) *australe*.

In the following particulars I am sorry to have occasion to report failure.

The moss-eating Lepidopterous larvæ all died before our arrival at the Cape.

All the larger Algæ collected were spoilt. One suite of dried examples was lost, through the box in which they were contained being placed open, in the rain, by one of the servants a few days before we sailed, without my knowing it had been moved from its place. The second set, gathered the day before we left the island, was sent on board the 'Supply,' with directions that the box should be placed in an accessible position: unfortunately the message miscarried, the box was stowed away in the hold, and I could not get at it until a fortnight afterwards, when almost the whole of its contents were completely decomposed.

Again, series of examples of some of the flowering plants were lost through the difficulty of attending to them when collected.

I left Kerguelen's Island in H.M.S. 'Supply' on the 27th February, arrived at Simon's Bay on the 31st March, and at Gravesend on the evening of the 7th May. In the course of the voyage I collected a few animals and Algæ with the towing-net.

IV. "On the Determination of Verdet's Constant in Absolute Units." By J. E. H. Gordon, B.A., Gonville and Caius College, Cambridge*. Communicated by Professor J. Clerk Maxwell, F.R.S. Received May 5, 1875.

(Abstract.)

In the year 1845 Faraday discovered that certain media possess the property of rotating the plane of polarization of light passing through them when a magnetic force acts on them. About the year 1853 M. Verdet found that with the same magnet and medium the rotation is directly proportional to the strength of the magnet—that is, that the ratio between the amount of rotation and the intensity of the magnetic field is constant.

The object of this investigation is to measure this constant in absolute

* The whole of this work has been done under Prof. Clerk Maxwell's superintendence. He suggested the method and nearly all the details; and any merit which the investigation may have belongs to him. He is, however, in no way responsible for any errors there may be in the numerical results.

units for a standard substance. Distilled water was used, and the magnetic force was produced by means of an electric current in a helix, as the magnetism of iron magnets is an undetermined function of the shape and nature of the iron core.

The strength of the helix was determined by comparing the magnetic force at a series of seven equidistant points along its axis in terms of that at the centre of the great dynamometer of the British Association, whose power is known in absolute measure.

The intensities were compared by varying currents sent opposite ways through each, till the action on a small magnet at their common centre was *nil.*

The intensity at each of a series of points being known for a given current, the difference of magnetic potential at the two ends for that current was obtained by integrating with respect to the length between limits corresponding to the end of the helix.

For this Weddle's rule was used, viz.

$$\int_0^{6h} u_x \, dx = \frac{3}{10} h \{u_0 + u_2 + u_4 + u_6 + 5(u_1 + u_5) + 6u_3\},$$

where 6^h is the length of the helix and u_x the magnetic intensity at any point.

The difference of magnetic potential at the ends for a certain current being known, the strength, N, of the helix (which is the ratio of this difference to the current, or the difference of magnetic potential which would be due to a unit current) is known, and is a *number*, because current and magnetic potential are of the same dimensions.

In the helix used, which was about 26·34 centims. in length and 13 centims. in diameter, we had

$$N = 10752.$$

The absolute value of the degrees of a tangent galvanometer was also determined by placing it under the dynamometer.

To determine the rotation of the plane of polarization, a Nicol's prism, set in a circle, was used, and the light was polarized by means of a prism invented by Professor Jellett, and described by him in vol. xxv. of the Transactions of the Royal Irish Academy.

It was constructed of Iceland spar, and its field of vision consisted of a circle divided by a line, the light of one half of which was polarized in a certain plane, and the light of the other half in a plane inclined at about 2° to that of the first. The intermediate position of the Nicol, when the whole field was equally dark, could be determined with some accuracy.

The water was contained in a tube with glass ends, of the same length as the helix, and placed with it. The polarized ray was sent through it,

and a current, whose intensity, C, was measured by the tangent galvanometer included in the circuit, was sent through the helix first in one direction and then in the other, and the plane of polarization observed. Half the difference of the readings was the rotation produced by the current.

If we call θ this rotation expressed in circular measure, and define Verdet's constant as the rotation which a unit current in a unit coil could produce in unit of length of distilled water, we have

$$\omega = \frac{\theta}{NC}.$$

The result of the series of experiments made was to obtain for ω the value

$$\omega = (10^{-7})4{\cdot}49 \text{ centimetre-gramme-seconds.}$$

Its dimensions obviously are the reciprocal of those of current, viz.

$$[\omega] = [L^{-\frac{1}{2}}M^{-\frac{1}{2}}T].$$

If we put our result in a slightly different form we may say that,

If plane polarized light passes through distilled water, and the magnetic potential of the water at any two points in the path of the ray differs by unity, then the plane of polarization will be rotated between those points $4\frac{1}{2}$ ten-millionths of a unit of circular measure.

Cavendish Laboratory, Cambridge,
April 30, 1875.

V. "On Rolling-Friction." By Professor Osborne Reynolds. Communicated by Dr. Balfour Stewart, F.R.S. Received May 24, 1875.

(Abstract.)

The motion of a roller or wheel on a surface is always attended with resistance. Coulomb made some experiments with wooden rollers on a wooden plane, from which he deduced two laws, viz. that the resistance is proportional to the weight of the roller, and inversely proportional to its diameter. These laws have since been found to apply to other substances, a different coefficient being used in each case. Beyond this, however, nothing appears hitherto to have been ascertained as regards the nature of this resistance to rolling. The source from which it springs does not appear to have been made the subject of investigation.

Some time ago it occurred to the author that it was probable that the deformation of the surface of the roller and of the plane, which must take place at the point of contact, would affect the distance which the roller would advance in turning through a certain angle*. The pressure of the roller on the plane causes a certain temporary indentation and

* The Engineer, 27th Nov., 1874.