



LI. An account of a peculiar optical phænomenon seen after having looked at a moving body

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found that the characters drawn from the combination of the plates, and from the disposition of the ambulacra, form divisions more natural and better defined than the characters taken from the position of the mouth and of the anus.

I shall publish my detailed observations upon this subject in a monograph of the *Echinodermata*, accompanied with plates, for which I have already collected the greater part of the necessary materials.

LI. *An Account of a peculiar Optical Phænomenon seen after having looked at a moving Body, &c.* By R. ADDAMS, Lecturer on Chemistry and Natural Philosophy*.

DURING a recent tour through the Highlands of Scotland, I visited the celebrated Falls of Foyers on the border of Loch Ness, and there noticed the following phænomenon.

Having steadfastly looked for a few seconds at a particular part of the cascade, admiring the confluence and decussation of the currents forming the liquid drapery of waters, and then suddenly directed my eyes to the left, to observe the vertical face of the sombre age-worn rocks immediately contiguous to the water-fall, I saw the rocky surface as if in motion upwards, and with an apparent velocity equal to that of the descending water, which the moment before had prepared my eyes to behold this singular deception.

The cascade is through a depth of about 70 feet, and my position, as I stood when I made the observation, was nearly on a level with the centre of the fall, being the lowest of the two situations where visitors obtain a view of this copious and never-failing infusion of peat† gushing over the giant step and whitening as it flows. My attention was engaged on that part of the fall which corresponded with a horizontal plane passing through my eye and the water. The sun was masked by cloud at the time.

I am not aware of any existing explanation of this class of optical phænomena, and I may be premature in venturing the following.

I conceive the effect to be owing to an involuntary and *unconscious* muscular movement of the eyeball, and thus occasioning a displacement of the images on the retina.

Supposing the eyes to be intently gazing at any point in a

* Communicated by the Author.

† The colour is brown from flowing over peat moors.

transverse plane passing through a vertically moving body, they will naturally and even irresistibly tend to follow the motion of that body; nor can the muscular apparatus of the eye maintain a stable equilibrium when the sight is fatigued and bewildered with a rapid change of moving forms before the eye.

Now in the case of the descending water, the eyes, being directed to a particular part in a horizontal section of it, cannot be prevented moving downwards through a small space: every new form in the moving scene invites the eyes to observe, and for that reason to follow it; but the voluntary powers are engaged to raise the axes of the eyes again to the section. This depression of the axes below the *intentional point of sight* seems to be repeated three or four times per second, whilst looking at the water-fall. Then, when the eyes are suddenly turned upon the rock, the muscles, having been brought into a kind of periodic contraction, will perform at least one of these movements after the exciting cause ceases to act; and thus the axes of the eyes, by moving downwards, will occasion a motion of the image of the rock over the retina in a direction from above downwards, and consequently the object giving that image will *appear* to move the contrary way, that is, upwards, agreeably to observation.

The deception, so far as I could judge, seemed to continue for a time equal to the interval of a periodic motion of the eye downwards when looking at the water, and, as before stated, one third or one fourth of a second.

The same kind of phænomenon may be produced by moving the eye before fixed bodies, and also when the motions are executed horizontally.

I have since been enabled to observe the appearance, with certain peculiar variations, whilst travelling parallel to one side of a narrow valley or lake, and looking across to the other. It takes place when moving in ships in sight of proximate land.

It is also producible by mechanical means, such as by a rapid unrolling of pieces of calico having some pattern or markings on them; and likewise by moving the head up and down, or laterally: but to particularize all the circumstances would make this communication inconveniently long.