

correlated with the large amount of wear and tear entailed by the constant "scraping" of barnacles, &c. This appears to be confirmed by comparison with *Helcion*, in which *Laminaria* constitutes the chief, if not the only, food, and in which the radula is relatively somewhat shorter.

At Granton, in July, the larger limpets appeared to feed most frequently; but at Aberystwyth, during the colder months, the small individuals are far more active. Sheltered corners and warm days afford the best chance of watching the movements. Though limpets undoubtedly regain their scars, or secure places, as the tide advances, I am inclined to think they must also often feed when covered by the water, for (1) the finest specimens are found low down, and their time for feeding when uncovered is limited; (2) I have seen a small limpet feed on *Corallina* in a tide-pool.

The scraping sound heard on the rocks during warm weather is not entirely due to feeding limpets. *Purpura lapillus* is also busy at work "sawing out" *balani* from their shells.

*Locality Sense.*—I still think, *pace* Prof. Lloyd Morgan, that the head-tentacles are not indispensable to homing, though it must be admitted that they may commonly help in the process. One limpet observed homing by me, certainly seemed to be "feeling" its way along by means of these organs, which were extended and waved about and applied to the rock from time to time, not by the extreme tip only, but also laterally for about  $\frac{1}{5}$  of an inch from this. This individual was No. 2 of a small group living among the barnacles, and kept under observation from November 26 till the present time. The dimensions of these limpets are as follows:—No. 1,  $\frac{3}{4}$ "  $\times$   $\frac{3}{8}$ "; No. 2, ditto; No. 3,  $\frac{4}{5}$ "  $\times$   $\frac{3}{8}$ "; No. 4,  $\frac{7}{10}$ "  $\times$   $\frac{3}{8}$ "; No. 5,  $\frac{1}{2}$ "  $\times$   $\frac{7}{15}$ ". On November 28, at 3.15 p.m., I found No. 2 feeding  $1\frac{1}{2}$ " from its scar. About half of each tentacle was excised (*i.e.* the part previously noticed "feeling"), and the animal was replaced where found. On November 29, at 2.55 p.m., it was found back on its scar. A similar operation was performed on No. 5, found feeding  $2\frac{1}{4}$ " from its scar, on December 12, at 3.15 p.m. On my next visit, at 2.55 p.m. on December 14, the animal was found to have regained its scar, which, by-the-by, is permanently submerged, being in a small tide-pool. It is true the tentacles were not entirely removed, as was the case with the two Granton limpets which homed after excision. It now appears to me probable that the *mantle-tentacles* may help in homing. These are small conical structures lodged in pits in the mantle edge (Harvey Gibson, *Trans. R.S. Edin.* 1885), and capable of retraction and extension. About 100 of them are present. In submerged limpets I have seen these tentacles protruded for about  $\frac{1}{8}$ " beyond the margin of the shell, and executing active "feeling" movements. These were particularly noticeable in an individual which, having regained its scar wrong end on, was shuffling round into the right position. When the front end of the limpet came to point in the right direction, one side of the shell was lowered, and the mantle-tentacles on that side were withdrawn; the same events then happened on the other side. These tentacles appeared to be of two kinds, longer and shorter, the latter being two or three times as numerous. Prof. Herdman first suggested to me that the mantle-tentacles might have to do with the locality-sense, and it at any rate appears probable that they are concerned with accurate adjustment on the scar. It is worth noting that very small limpets home as well as large ones, *e.g.* No. 5 above, and much smaller ones which have fallen under my notice. Prof. Lloyd Morgan's observations, so far as they refer to knowledge of local surroundings which limpets possess, are confirmed by an experiment made on No. 1. On December 16, at 4.5 p.m., this animal was busy scraping barnacles 3" west of its

scar. It was removed and placed 10 inches from home, near the top of a nearly vertical barnacled surface (on which it had been seen feeding at 3.15 p.m., November 28), which rises north of its scar. The next visit was deferred till December 26, 12.25 p.m., when the limpet was at home.

The homing faculty is not confined to *Patella*, but is also possessed by *Helcion pellucidum*. This fact is new, so far as I am aware. The animal in question eats out a sheltered home in the bulb, or more rarely in the stalk of *Laminaria*, and wanders out from this along the thallus, rasping a "track" as it goes. I found, for example, one individual at the end of an "eaten road" 3 inches long, and at the other end a very snug dwelling-place drilled out in the side of the stalk. *Helcion* mostly feeds under water. Like *Patella*, it possesses mantle- as well as head-tentacles.

The object of homing appears to be protection from the assaults of the incoming or outgoing tide. There is no danger when the animals are completely covered or uncovered. In many cases the barnacles would otherwise completely cover the rock, and afford very insecure foothold. Once washed loose, a limpet presents a very large surface liable to injury, unlike its neighbour *Purpura lapillus*, which, withdrawn into its thick operculated shell, can stand a good deal of knocking about. The force with which limpets adhere is illustrated by the fact that the five small limpets to which allusion has been made were quite uninjured by the terrible gale and high sea of December 21 and 22, to which they were fully exposed. The much thinner shell of *Helcion* is explained by the sheltered position of its home. The depressed conical shape of a limpet-shell is probably better fitted than any other to resist the waves, but this statement is made under correction.

*Formation of, and Adhesion to, Scars.*—An examination of the 'tween-tide rocks at Aberystwyth would readily convince the most sceptical as to the power which *Patella* possesses of excavating depressed scars. Limpets are able to adhere very tightly to a smooth surface which is much smaller than the foot, and by examination of such cases, and of specimens allowed to fix themselves to a piece of plate-glass, I have come to the conclusion that fixation is neither due to secretion of a glutinous substance, nor to the formation of a vacuum under the foot. It appears, in fact, to be a case of "adhesion," like that between two smooth glass surfaces brought very close together. The muscular foot is, so to speak, rolled out on the rock, with which it is thus brought into close contact. Prof. Michael Foster suggested to me the possibility of this method of explanation, which is most probably the correct one.

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#### TERRESTRIAL HELIUM (?).

WE have received the following statement from Prof. Ramsay:—

"I have been trying for clues to compounds of argon. Mr. Miers, of the British Museum, called my attention to Hillebrand's paper on Cleveite, a rare Norwegian mineral, which Hillebrand said gave off 2 per cent. of nitrogen on warming with weak sulphuric acid. Cleveite consists chiefly of uranate of lead, with rare earths. My idea was, if the so-called nitrogen turned out to be argon, to try if uranium could be induced to combine with argon.

"The gas, on sparking with oxygen in presence of soda loses a trace of nitrogen, probably introduced during its extraction; the residue consists of a mixture of Argon and Helium! The brilliant yellow line, of which Mr Crookes makes the wave-length 587.49, is identical with the Helium line. I am collecting the gas, and shall shortly publish regarding its properties."