

gonism between the two laws of Lamarck. The first law assumes that a past history of indefinite duration is powerless to create a bias by which the present can be controlled; while the second assumes that the brief history of the present can readily raise a bias to control the future.  
EDWARD B. POULTON.  
Oxford, December 2.

The Homing of Limpets.

IN NATURE, vol. xxxi. p. 200, Prof. Ainsworth Davis describes some observations he had made on the habits of the limpet. Marked individuals were found to return from their excursions, extending to a distance of some three feet, and to settle down on the spot which is their permanent home. By excision of the tentacles in two individuals Prof. Davis was led to conclude that it is not by these organs that the limpet finds its way back to its own particular scar. "The sense of smell then suggested itself, and it occurred to me," writes Prof. Davis, "that one reason why limpets kept on their scars when covered by the water was to prevent the scent being washed off. With a view to determine this, the space between a wandering limpet and its scar and the scar was carefully washed again and again with sea-water. In spite of this, the limpet in question readily found its way back again."

Last summer I had some opportunities of making observations at Mewps Bay, near Lulworth, in Dorsetshire. I trust that Prof. Davis will not consider a brief record of the results of these observations a case of unsportsmanlike poaching on his preserves.

The method I adopted was to remove the limpets from the rock and affix them at various distances from their scars. This can be done without difficulty or injury if one catches them as they are moving. But one must make sure that they are just leaving or returning to their own proper homes, and are not taken in the midst of a more extended peregrination, as in that case their special scars cannot be noted. Failure to be careful in this matter vitiated my earlier observations, which are therefore excluded in the following table:—

No. removed.	Distance in inches.	No. returned.		
		In 2 tides.	In 4 tides.	Later.
25	6	21	—	—
21	12	13	5	—
21	18	10	6	2
36	24	1	1	3

From the nature of the strata the removal to a distance of 12 inches or more generally involved taking the limpets over a corner of rock.

In most cases the individuals which failed to return to their respective scars took up new positions. In several cases when they were removed to a distance of a few inches from this new position they returned to it. In one case where the limpet had taken up such a new position it returned thereto after having been removed to its original scar.

Observation of the limpets without such experimental removal shows that they make their excursions in search of food chiefly as the tide leaves them and when it is returning. They generally seem to get back to the scar before the tide has well covered it. I have watched them return over considerable distances. In one case ten inches, over a somewhat curved course, was covered in a little under twenty minutes. In another case the limpet on its return journey had to pass between two other limpets, which necessitated the lifting of the shell to some height so as to pass over one of these. On reaching their scar they twist and turn about so as to fit down. When they come wrong way round they rotate pretty rapidly through the 180° to get into position. The final position on the scar is a constant one. One was observed to make a short excursion from and to return to its scar under stillish water. As a rule they seem to remain fixed under water.

The greatest distance I have watched a limpet reach from its scar was 22 inches. But I have found limpets at a distance of 3 feet from their scars—that is to say, from scars on to which they fitted perfectly. This was on a large flat surface.

When they move, the tentacles are projected out beyond the shell, and keep on touching and slightly adhering to the rock. On reaching the scar they carefully feel round it with the tentacles. I am disposed to question the results of Prof. Davis's experiments on the removal of the tentacles. But further

observations and experiments are needed to settle the point. I understand that Prof. Davis is now at work upon the subject.

An injury to the edge of the shell seems to be repaired with whitish shell-material in the course of about ten days. And when a new position is taken up to which the shape of the shell is not suited, there appears to be a tendency for the shell to accommodate itself to the uneven surface of new growth along the edges. But this again is a matter on which further observation and experiment are required.

C. LLOYD MORGAN.

Gravitation.

THE nature of my suggestion (*vide* NATURE November 15, p. 57) is simply this:—A phenomenon of adhesion between solids immersed in a tensile liquid presents itself. The explanation offered (as I understand it) suggests that whether the bodies are attracted at long or short distances, will be a question entirely of the extension in the stressed medium of the modified layer. If this explanation be a correct one, or if any explanation involving a reaction between a modified layer (whether condensed or rarefied) and a *tensile* liquid will account for the phenomenon, then I say the experiment is a suggestive one as regards gravitation.

How far the modified layer will extend depends upon the law according to which the stress is distributed in the medium. In the case of matter acting upon matter at molecular distances we have reason to believe that the decrement of the stress is a rapid one. We possess no such knowledge when matter and ether alone are involved, and until we know how a modification of the ether around matter would display itself to our observation, I do not think the possibility of a remotely extended modification can be denied. Gravitation might be the sole resultant phenomenon affecting our senses.

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The Ratio of the Specific Heats of Gases.

I REMEMBER that in the discussion of eighteen years ago it was understood that you could get 1.4 for the ratio, if the molecules had each five degrees of freedom only—if they were, for instance, perfectly smooth, elastic spheroids. Probably the ultimate source of our knowledge in this respect was Boltzmann's paper, to which Mr. Bryan refers us. The difficulty at the time seemed to be mainly one of faith. One could not believe that the molecules were solid elastic bodies, however useful the discussion of such bodies might be in defining a limiting case. As the white posts along a road are put to show you where you should not go, not where you should go. It was further supposed, perhaps without sufficient reason, that the phenomena of the spectroscopy required us to attribute many degrees of freedom to the molecules.

I hope Mr. Bryan will, as I have no doubt he can, develop his theory that all these phenomena can be accounted for by the electromagnetic theory of light, without attributing to the molecules more than five degrees of freedom. We have to explain, as it seems to me, how the ether will assume different sets of vibrations according to the shape of the bodies in contact with it.

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An Observation on Moths.

I THINK Dr. L. C. Jones (No. 1308, p. 79) has missed the true reason of the unexpanding wings of his moths liberated from the pupa-case before the struggles of the inmate had split the skin, and freed them in the ordinary course.

What was missing to them was the pressure in the act of emergence, which at one and the same time expels a discharge of superfluous humours from the abdomen, and forces the vital fluids through the folded and crumpled wings. Special extra provision is made for this, in the flask-shaped cocoons of *Saturnia Pavonia-minor*, for example, and if the pupa be taken out of this, and allowed to emerge at full maturity, it is always an abortion with heavy, overloaded abdomen, and wings that never expand. Every collector, also, who has bred the earth-burying sphinxes—*Sphinx Ligustri*, for example—knows how often they emerge in this condition, either through not being supplied with soil of the needful tenacity, or from the difficulty of keeping it of the natural degree of moisture.