

## LETTERS TO THE EDITORS

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### Selection of the Genetic Basis for an Acquired Character

THE experimental results reported recently by Prof. C. H. Waddington<sup>1</sup> seem to make explicit in an important way what some zoologists, not professional geneticists, may have felt for long as something unsatisfying in many of the translations of evolutionary problems into Mendelian terms with which we are all familiar. He has reminded us once more that artificial selection, and so by presumption natural selection, acts upon animals having qualities, such as crossveinlessness, and not upon genes. He has shown that there are more genetic ways than one of being a crossveinless fruit-fly, and that, if crossveinlessness is selected for, then crossveinlessness will become established in a relation to the underlying genetic structure about which it is not clear that anything can in principle be predicted.

This most significant work seems to point once more to an element of insecurity in those approaches to the evolutionary problems of biology which by implication or statement rest upon the belief that these problems would be solved if we knew all about the distributions of genes in populations through time. Prof. Waddington has shown that again in his example the relation between the gene and the character is of just such a kind as will *not* enable us to say anything at all about genetic mutation-rates, or, indeed, genetic situations in any sense, in populations of which we know only the appearance through time. May it not also be true that this relation is of such a kind as will *not* enable us to say anything at all about the appearance through time of a population of which we know only the genetic make-up? Have we not been forced to ascribe to the genes qualities and potentialities which impair the biological relevance of any knowledge of them to which we can in principle attain? Part of the population of crossveinless flies at Edinburgh has changed the genetic basis of its crossveinlessness; but could future workers, examining them dead, in principle know this? A genetic situation at Edinburgh has become established by selection, in a relation (supposedly new) to crossveinlessness; but could future population geneticists, seeking to calculate what must have been the frequencies of all genes in Edinburgh, have said anything about the way in which this would happen, or about the new relation which was to be established? Possible future positions in a game of chess can be predicted from a given position, but only, in any practical sense, if the rules are kept. If a pawn can become a queen we must know what makes it a queen: for example, arrival at a certain place on the board. Procedural difficulties seem likely in making a prediction if what makes a pawn into a queen is its relation to other pieces and the necessity that white should win.

Much important recent work has given us a view of the widely differing rates of change through geological time in different groups of animals. Prof. Waddington has surely reinforced the impropriety of saying, and still more of implying, that this information is information about genetic change, whether by mutation, recombination, or of any

other kind. We may not say that lampshells have low rates of genetic change; we may only say that they look alike through long periods. Whether or not the success of a lampshell now is in any intelligible sense a consequence of the same genetic situation as made a lampshell similar to look at, and apparently equally successful, in different conditions a long time ago, is simply unknown, and now looks a little more unknowable. Perhaps Prof. Waddington has made us understand that to ask such a question is not sensible, and to answer it vain.

It may perhaps be urged that Prof. Waddington's example is exceptional, and that possibly argument from, for example, the homology of mutations, may show that, in general, characters are, have been, and will remain, 'due' to genes in a way that will justify translation of thought about populations into thought about genetics, and *vice versa*. But is this now, remembering again the warning of Harland<sup>2</sup>, that "there are as many ways of making petal spot as there are species", more than a gratuitous judgement? Does it even save the phenomena in a Ptolemaic sense? Does it really save anything? Does it not rather reduce the Mendelian concept to tinkling symbols in circumstances where they may not be the most appropriate?

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<sup>1</sup> Waddington, *Nature*, **169**, 278 (1952).

<sup>2</sup> Harland, Proc. Seventh International Genetic Conference (1939).

### Recent Echo Sounder Studies

HODGSON<sup>1</sup> has shown that shoals of several species of fish give rise to traces on echo-sounders, and that a species may be identified by the shape of its trace. Echo-sounder records taken more recently by research vessels of this and other laboratories have shown that traces can be caused by an increasing variety of organisms covering a wide range of sizes, and that physical discontinuities in the water column are often associated with pronounced traces. For example, in August 1951 traces were obtained over a wide area off Whitby by the R.V. *Platessa*, using a Marconi sounder. They were found to be at a depth corresponding to that of a sharp thermocline, and small whiting about 3 in. in length, large medusæ, herring and *Ammodytes* larvae were caught with a pelagic trawl at the depth of the trace. As the thermocline persisted outside the area in which the traces were recorded, the echo could not have been caused by the thermocline itself.

At about the same time, the R.V. *Ernest Holt*, working in the neighbourhood of Hope Island in the Barents Sea, found up to five simultaneous, relatively thin, horizontal traces in the upper 40 fathoms. These echoes persisted through other dense traces, which were associated with fish and other organisms; their depths coincided with those of marked temperature gradients obtained on bathythermograph records; and they exhibited oscillations due to internal waves. The traces were obtained on a Kelvin and Hughes M.S.24 30-kc. sounder using a 1,500-volt output and a 3-stage amplification, and on a Kelvin and Hughes M.S.21b 10-kc. sounder with a 2,000-volt output and a similar amplification. Similar traces were also recorded off southern Spitsbergen, where, as in the Hope Island area, relatively warm Atlantic