LETTERS TO THE EDITORS

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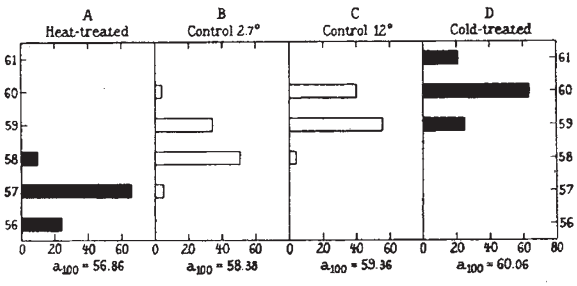
Influence of the Environment on Number of Vertebræ in Teleostean Fishes

For some years now it has been known that the environmental conditions during the development of the fish embryo may exert an influence leading to the number of vertebræ of the offspring becoming different from the number in the parents. Very few experiments, however, have been made on this subject, which is of considerable interest both from the systematic point of view and in the use of racial investigations in applied fishery biology. On earlier occasions, for example, in *Nature* and elsewhere[1], I have referred to some experiments on the sea-trout dealing with this matter. On exposing the developing eggs to varied influences, especially by changing the temperature, we succeeded in determining the period when the temperature had a special effect on the number of vertebræ found later in the fry. The embryo was specially sensitive during a fairly short period, which was called the supersensitive period. A temperature-change of no great amount (3–6° C.) could in this period produce a difference of about 1·5 vertebræ, which is regarded as a great difference when found in so-called races of fish in Nature.

Starting from this result, it seemed, on both theoretical and practical grounds, advisable to try whether even greater differences could be produced in the average number of vertebræ in offspring of the same parents when the eggs in the specially sensitive period were exposed to even greater differences of temperature than used previously. The experiment was carried out on sea-trout in the winter of 1947–48, and the procedure was similar to that used earlier[1]. The eggs were exposed during the supersensitive period to a brief but considerable change of temperature (*c.* 10–13°), in such a way that the eggs which, for example, were developing at *c.* 12°, received *cold treatment* at *c.* 2·5° for about eight days (equal to *c.* 20 day-degrees), while those developing at a temperature of about 2·7° received *warm treatment* up to *c.* 16° for twenty-four hours (also equal to *c.* 20 day-degrees). After the cold or warm treatment, the eggs were returned to their original temperature, and their development proceeded until the young were old enough for the final number of vertebræ to be determined exactly by means of Alizarine staining and clearing.

Experimenting in this way during the supersensitive period, it was found that differences of no less than 3·2 vertebræ could be produced in the average number of vertebræ in offspring of the same parents. The accompanying diagram shows the results of this experiment, the results for the warm and cold treatment being respectively to the left and right (*A* and *D*) of the control samples (*B* and *C*).

In this species the number of vertebræ varies between 56 and 61, and the treatment has brought out the surprising result that, although they are offspring of the same parents, no variant is common to the samples of cold- or heat-treated specimens. In our long series of experiments, whether with quite small or large temperature changes, there is nothing to indicate that the genetic basis in the specimens treated has changed in any way, that is, the alterations are only phenotypic responses to environmental conditions.



Number of vertebræ in offspring of the same parents (sea-trout), which were subjected during the supersensitive period of the embryonic development to heat (left) and cold (right), both of short duration. The values for the control samples are shown in the middle (*B* and *C*), and the average number of vertebræ (100 specimens) is given under each sample (both parents had 57 vertebræ). *A*: *heat-treated sample*; reared at 2·7°, but transferred to 16° during a period of 20 day-degrees (from the 147th day-degree to the 167th day-degree); *D*: *cold-treated sample*; reared at 12°, but transferred to 2·5° during a period of about 20 day-degrees (from the 143rd day-degree to the 165th day-degree)

It is worth noting here that a variant distribution almost corresponding to the low values of the heat-treated samples is found in Nature at the southern boundary of the distribution of the trout (for example, in Italy), whereas in northern countries, at its northern limit, the higher variants are dominant. As is known, the southern forms of trout are described as special species or races.

Our experiments have thus produced modifications (comparable to the so-called phenocopies) among offspring of the same parents, which systematists of a generation ago would presumably have taken for separate species, if their origin had been unknown. Similar surprising results have also been found in other meristic characters (fin-rays) in the sea-trout, and these results indicate that one must be careful in using differences in meristic characters in fish populations for taxonomic purposes, even though such differences naturally *may* be due to genetic diversities.

I shall, however, not discuss the results of these and other experiments in further detail here; a report on them will be published elsewhere.

Å. Vedel Tåning

Marinbiologisk Laboratorium,
Charlottenlund Slot.

[1] Tåning, *Medd. Komm. Danmarks Fiskeri- og Havunders., Fiskeri*, **11**, 3 (1944); *Nature*, **157**, 594 (1946).

D.D.T. and 'Gammexane' as Residual Insecticides against *Anopheles maculatus* in Malaya

Muirhead-Thomson[1] has reported on the use of an experimental hut with a light-trap fitted into the window, as a method of assessing the efficiency of the residual insecticides D.D.T. and 'Gammexane' against *Anopheles gambiæ* in Africa. Similar experiments have recently been conducted against *A. maculatus*, the principal vector of malaria in Malaya. Unlike *gambiæ*, *maculatus* normally leaves houses at or before dawn to rest out of doors by day, and nearly all those captured in an untreated experimental hut were found in the light-trap in the morning.

A preliminary trial with wettable powders of D.D.T. (Stafford Allen's 33 per cent at 100 mgm. D.D.T./sq. ft.) and benzene hexachloride (I.C.I.'s *P.*530 at