

DOUBLE HYDROPORE IN THE DEVELOPMENT OF *ASTERIAS GLACIALIS*

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A TENDENCY to form a "primary madreporic" pore on the right side as well as on the left side exists in *Asterias glacialis* as in other star-fish and in Echinoderms generally. Metschnikoff as far back as 1874 figured and described a late larva of *Asteracanthion* with left and right hydropores and hydrocoeles (water-vascular rudiments). According to Field (1892) the double pore is frequently met with in the early larvae of *Asterias vulgaris*. MacBride (1896) has described a larva of *Asterina* with a pair of water-pores as well as others in the case of *Echinus miliaris* (1919). Gemmill (1914, 1916) observed double-pored larvae in *Asterias rubens* in the proportion of one to ten and in *Asterias glacialis* in a slightly greater proportion.

The material for this work was obtained by artificial fertilisation. Some of the resulting larvae were transferred to large jars containing about 2½ litres of clean sea water. Others were introduced into similar jars, containing sea water in which was dissolved sodium chloride in the proportion of 38 gm. per 1000 c.c. Normal sea water contains about 35.5 gm. per 1000 c.c. Prof. MacBride found that a hypertonic solution of this concentration yielded double-hydrocoeled larvae in *Echinus miliaris*.

The hydropore is formed about the seventh day after fertilisation. When larvae, 8 days old, were examined, an appreciable number of them possessed two pores. Out of nearly 500 larvae examined from the hypertonic cultures about 150 larvae had a right as well as a left hydropore. In the control cultures the proportion of double-pored larvae was much less, being about one in every ten. Therefore the number of double-pored specimens in the hypertonic cultures was three times as much as that found in ordinary sea water. The following tables show the results.

Table I. *Hypertonic cultures.*

No. of larvae examined	Double-pored larvae	Normal larvae
100	31	69
100	33	67
100	32	68
100	30	70
100	33	67
Total 500	159	341

Table II. *Control cultures.*

No. of larvae examined	Double-pored larvae	Normal larvae
100	14	86
100	11	89
100	12	88
100	10	90
100	12	88
Total 500	59	441

The right hydropore does not persist long. It disappears long before the hydrocoele becomes quite distinct; only one or two in a hundred are found after that time. The frequency of the double hydropore varies within the widest limits among different star-fish as among other Echinoderms. Two hydropores have been observed in many star-fish. Among Echinoids the larvae of the regular urchins have normally only a single pore, but a double pore is occasionally found. We cannot therefore ascribe the incidence of the double pore directly to ancestral causes. A strong tendency to form two pores exists in most larvae of *Asterias glacialis*. The right as well as the left enterocoele sends up a pocket towards the ectoderm and this pocket shows at its tip a little clump of cells (smaller than that on the left side) either actually coming or almost coming into contact with the ectoderm. The corresponding ectodermal thickening may not appear at all or may be extremely slight. The right half of one in twenty of such larvae in pure sea water was symmetrical with the left as regards the hydropore and hydroporic canal. This is owing to the preponderant growth of the left side over the right. Three or four larvae in every ten from the hypertonic cultures developed a right pore. This interesting phenomenon may be explained as the result of the failure of the left half of the larva to establish its preponderance over the right at the proper time. The addition of salt to the sea water, quite early in the development of the star-fish larvae, therefore acts as a stimulus to the growth of the larvae equalising the difference between the right and left halves and thus a right hydropore results. This seems to be a reasonable explanation for the occurrence of more double-pored larvae in the hypertonic experimental cultures than is the case in nature.

In conclusion I must thank Prof. E. W. MacBride for suggesting this investigation as well as for constant guidance in the course of the work.

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