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Patterns and Pathways of Nutrient Circulation in Larval Sea Urchins

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Poster Presentation 27

PATTERNS AND PATHWAYS OF NUTRIENT CIRCULATION IN LARVAL SEA URCHINS

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Within the body of a larval sea urchin, a juvenile that will eventually mature into an adult develops. Each juvenile depends on the "host" larva for nutrients necessary to support growth and development. Patterns of nutrient circulation in the larvae, and of nutrient delivery to the juvenile are poorly understood. Ruppert and Balser (1986) propose the existence of a kidney in larvae of starfish (a sister group to sea urchins), functioning in excretion and possibly circulation of nutrients. The kidney is composed of a coelomic cavity (the left axocoel) where filtration of the body's blastocoelic fluid occurs, a pore canal where selective resorption occurs, and an external opening or hydropore. We tested the proposed function of the kidney complex by tracking the distribution of an iron-containing protein, ferritin, in the body of sea urchin larvae. Larvae of Lytechinus variegatus and Arbacia punctulata were incubated in ferritin for known periods of time. After incubation, ferritin was detected in the larval digestive system, in free cells in the body cavity (mesenchyme cells), in the developing juvenile, in the axocoel, and in the pore canal-hydropore complex. These results suggest that fluid is filtered from the blastocoel into the axocoel, circulated within the connected coeloms, and excreted through the hydropore. This fluid flow may serve as a mechanism for circulation within the body cavity, and provides a route for nutrient delivery to the developing juvenile. We observed high concentrations of ferritin particles in the pore canal and hydropore relative to other larval structures. This supports the occurrence of selective resorption by pore canal cells, hypothesized by Ruppert and Balser (1986), and gives evidence for a kidney and circulatory system in larval sea urchins.