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Uptake of Dissolved Macromolecules by Larvae of *Lytechinus variagatus*

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UPTAKE OF DISSOLVED MACROMOLECULES BY LARVAE OF *LYTECHINUS VARIAGATUS*

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Larvae of echinoderms are capable of taking up small dissolved organic materials [(e.g., amino acids)] from seawater. Sea urchin larvae can also take up dissolved macromolecules [(e.g., proteins)] by cells of their digestive system from seawater (Huvard and Holland, 1986). However, Huvard and Holland's experiments contained concentrations of dissolved organic material substantially higher than those found naturally in seawater. We exposed pluteus larvae of the sea urchin *Lytechinus variagatus* to naturally found concentrations of proteins and polysaccharides in seawater. Pluteus larvae of varying ages were incubated in 35‰ filtered seawater containing 264 nM rhodamine-labeled dextran (mw=70000 g/mol), 264 nM fluorescein isothiocyanate-labeled bovine serum albumin (mw=66819 g/mol), 264 nM ferritin (mw=474000 g/mol), or 264 nM iron dextran (mw=70000 g/mol) for 1-4.5 hours. When viewed using fluorescence microscopy, rhodamine-labeled dextran was seen in the stomach cells after a 1-hour incubation. In contrast, labeled albumin was present in the cells of the epidermis, the entire gut lining, and the distal end of the larval kidney after a 1-hour exposure. Using light microscopy, ferritin uptake was detected in the cells of the stomach and the distal end of the kidney after a 4-hour exposure. Uptake was not detected with plutei incubated in 264 nM iron dextran after 4-hours, but the label was present in the stomach when using a 14 μM concentration. Uptake patterns did not vary with larval age. Sea urchin pluteus larvae are capable of absorbing dissolved macromolecules, which better support organism bioenergetics compared to micromolecules, from seawater at concentrations that match their availability in nature suggesting that macromolecular dissolved organic material is a integral part in larval and adult development.