The Hidden Threat: Microplastics and Gut Formation in Sea Urchin Larvae

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Pollution is a concern throughout the world, particularly in oceans. Recent concerns have arisen about the impacts of microplastics. Sea urchins are commonly used for developmental studies, particularly in the early part of embryonic development, i.e., to the pluteus stage (72 hours). Further, alkaline phosphate helps build the gastrointestinal system, and determining concentration can give indication of functional impacts to development. By using Pacific purple sea urchins (Strongylocentrotus purpuratus) as a model, the focus of this project is to examine the number of zygotes formed, their growth rate to gut development, and the concentration of alkaline phosphate in the presence of microplastics. I created an ocean with “Instant Ocean™,” ground plastic bottle caps, then created four groups with varying levels of microplastic concentrations: control (0%), low (0.05%), medium (0.5%), and high (5%). Then, I collected sperm and eggs from sea urchins by injecting 0.5M potassium chloride; after which, I fertilized the eggs. I added the new zygotes to each solution. I made observations throughout a 72-hour period, until the pluteus stage, then measured the alkaline phosphatase concentration using spectrophotometry. I found that there was no significant difference in stage progression until day 2, the time when turning and moving during development is critical. Further, on day 3, the pluteus floats to the surface with their newly formed guts at which point the presence of microplastics becomes lethal. There was no significant difference in alkaline phosphatase levels in the groups. The presence of microplastics appears to impact physical growth of sea urchins when immersed in microplastics; however, enzymatic activity and early growth are not impacted.

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