Arsenic-Induced Gut Dysbiosis and Behavioral Activity in Chinese Mystery Snails: Exploring the Microbiome–Nervous System Link

Multicellular organisms depend on their internal microbial communities to support various physiological processes through a symbiotic relationship between the host and microbes. Gut dysbiosis serves as a biomarker for poor health outcomes across multiple species. The gut-nervous system signaling network in invertebrates can serve as a gateway to deepen our understanding of the gut microbiome and its influence on the nervous system, analogous to the gut-brain axis. Our research used Chinese Mystery Snails (CMS), to examine how arsenic exposure disrupts the gut microbiome and how it affects the nervous system. Through their feeding and mobility behaviors and the presence of arsenic-metabolizing bacterial genes in the snail gut. We hypothesized CMS gut microbiota influences neuronal behavior, then increased arsenic exposure will alter the microbiome composition, causing measurable decreases in the snail's feeding and movement activity. We exposed CMS to two different arsenic concentrations 0 ppm and 0.2 ppm. And conducting feeding and mobility assays, (time spent out of the shell and time spent in contact with food) to quantify their behavior. At the end of the tests, we dissected the snails to analyze gut microbiome composition and assess the abundance of bacterial genes involved in arsenic metabolism. Results showed, arsenic treated group experienced a 6.25% decrease in mobility and a 75 % decrease in feeding behavior compared to the control, with at least one arsenic-metabolizing gene being more abundantly present in the arsenic-exposed group, suggesting that selection for bacteria that can metabolize arsenic may have occurred in the arsenic-treated snails.