Investigating the links between arsenic exposure and behavioral impairment in Chinese mystery snails

Arsenic is a common contaminant of freshwater environments worldwide, where it accumulates in microbe dense environmental compartments like sediment and periphyton. Environmental microbes can metabolize arsenic into less toxic forms, rendering them resistant to arsenic toxicity. Some arsenic resistant environmental microbes may become members of the gut microbiomes of freshwater invertebrates. Previous studies in vertebrates have shown that environmental contaminants can alter gut microbiomes in ways that may be linked to abnormal neurotransmission, cognitive impairment,and behavioral changes. Less is known about how environmental toxins impact the microbiome structures in invertebrates. Chinese Mystery Snails (CMS) are decomposers that bioaccumulate arsenic within their digestive tract through their diet. We hypothesize that arsenic exposure alters the CMS guts' microbiomes which alters neuronal function and ultimately the behavior of the snails. To test this hypothesis, CMS were exposed to 0 or 0.2 ppm arsenic. Behavioral analysis was performed on each condition to assess feeding behavior and mobility of snails to observe any significant changes. We found that 0.2 ppm exposed snails exhibited a significant delay in mobility and decreased contact with food compared to controls. To build on these behavioral results, ongoing work could be focused on sequencing microbial DNA extracted from CMS guts to characterize microbiome shifts. Future analyses could then compare microbial community composition between treatments and determine if links exist between arsenic exposure, microbiome alterations, and potential neurobehaviors.