

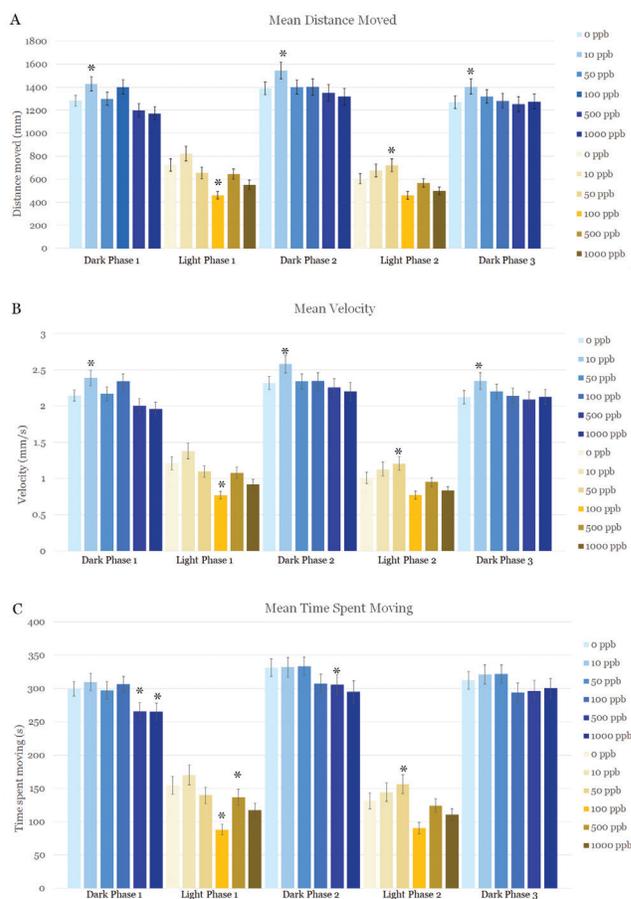
HEALTH & HUMAN SCIENCES

Developmental Behavioral Alterations Following Lead (Pb) Exposure in the Zebrafish Model System

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Lead (Pb) is a toxic heavy metal of concern that can be found in drinking water, dust, and soil. Environmental exposure to lead has been associated with neurological alterations in both adults and children. Numerous studies have suggested adverse health outcomes caused by the neurotoxic effects of lead on the central nervous system. This study used the zebrafish model to investigate the developmental toxicity effects of lead exposure from 1 to 120 hours post-fertilization (hpf) using 0, 10, 50, 100, 500, and 1,000 ppb of lead. The visual motor response test was used to assess changes in behavior and locomotion. Phasic data was collected and analyzed using a repeated measures ANOVA. Phasic behavior data showed hyperactivity through increased velocity and distance moved in all of the dark phases for the 10 ppb treatment group ($p < 0.05$). Larvae in the 50 ppb treatment group showed hyperactivity in the second light phase through increased velocity, time spent moving, and distance traveled ($p < 0.05$). Hypoactivity, depicted through decreased velocity, distance moved, and time spent moving occurred in the 100 ppb treatment group in the first light phase ($p < 0.05$). Larvae in the 500 ppb treatment group only exhibited a decreased time spent moving in the first two dark phases and first light phase ($p < 0.05$). The 1,000 ppb treatment group spent less time moving only in the first dark phase ($p < 0.05$). These findings indicate zebrafish larvae that were exposed to lead early in development display various changes in behavior and locomotive activity dependent on lead exposure concentration.

Research advisor Jennifer Freeman writes: “Jenny’s research is furthering our knowledge and confidence on using the zebrafish as a model to study the developmental toxicity of the heavy metal lead. Her work is contributing to our understanding on concentration-dependent impacts of lead exposure on behavioral outcomes.”



Visual motor response behavioral assay showing mean distance moved (A), mean velocity (B), and mean time spent moving (C) by zebrafish larvae following lead exposure from 1 to 120 hours post-fertilization encompassing the embryonic and early larval developmental stages. Phasic data was collected for alternating dark and light phases, with a total of five phases each lasting ten minutes. Zebrafish larvae are more active during dark phases, allowing evaluation and comparison of impacts of developmental lead exposure on movement during periods of increased and decreased locomotion. $N = 7$, with 16 subsamples per replicate to total 112 larvae per treatment. Error bars represent standard deviations. * $p < 0.05$ indicates significant difference from control treatment (0 ppb) during specific phase.