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A Larval Exposure to Ionizing Radiation Results in an Increase in Brain Weight in Adult Female Zebrafish, but No Immediate or Latent Expression Changes in the Glutamate Receptor Genes

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Medical use of CT scans has prompted concern regarding potential effects of radiation exposure. The goal of this project was to determine the adverse health effects to the central nervous system of a developmental exposure to low-dose ionizing radiation. Based on a preliminary study using an embryonic zebrafish model that showed radiation-induced changes in the expression of two glutamate receptor genes, this study assessed the expression of eight glutamate receptor genes *(gria1a, gria1b, gria2a, gria2b, gria3a, gria3b, gria4a,* and *gria4b)* following larval radiation exposure. Glutamate receptors are linked to cognitive functions such as learning and memory. Zebrafish were bred and dosed with gamma irradiation 5 days post-fertilization (dpf) at four dose levels (0 Gy, 0.11 Gy, 1.0 Gy, and 2.0 Gy). Full-body tissue was collected at 6 dpf and brain tissue was collected from both sexes 4 months post-fertilization (mpf), 8 mpf, and 12 mpf for sex-specific assessment. RNA was isolated from the tissue, then converted to complementary DNA (cDNA) and analyzed via quantitative polymerase chain reaction (qPCR). Additionally, body length, body weight, and brain weight were measured at 12 mpf. Examination of qPCR data at 6 dpf, 4 mpf, 8 mpf, and 12 mpf revealed no significant changes in expression of any of the eight genes for both sexes; however, a significant increase in brain weight ($p < 0.05$) was observed in adult females. Thus, while no significant effects were observed in expression of the glutamate receptor genes, further research is needed to investigate morphological alterations and molecular mechanisms responsible for brain weight increase in adult female zebrafish.

Research advisor Jennifer Freeman writes, "Isha's project is a collaboration with the laboratory of Dr. Linda Nie and is the initial step in investigating the potential for a developmental radiation exposure to result in long-term adverse health impacts, specifically to the central nervous system, using the developmental origin of adult health and disease hypothesis."

Zebrafish were irradiated during the larval stage (pictured here), then gene expression was assessed at multiple time points during their life span.

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