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Author: Ms. Sara Edsall
Canada, sara.edsall@dal.ca

Dr. Tamara Franz-Odendaal
Canada, tamara.franz-odendaal@msvu.ca

DETERMINING THE EFFECTS OF SIMULATED MICROGRAVITY ON THE DEVELOPMENT OF CRANIAL NEURAL CREST-DERIVED TISSUES

Abstract

The engineering and science involved in exploring the frontiers of space requires some of the most advanced technology of our time. It is therefore important to perform experiments that help explain the consequences of long-term space travel so that further advancements can be made with little to no risk to those making the journeys to space. To study the effects of space travel on Earth, the conditions in space must be simulated. To do this we used a rotating wall vessel filled with water and exposed *Danio rerio*, a popular model organism in the field of developmental biology, to simulated microgravity (SMG). We then analyzed the effect exposure had on a multipotent population of cells present in all vertebrates, namely the neural crest cells. During neurulation, the neural crest cells migrate anteriorly and posteriorly giving rise to several different cell types. Trunk neural crest cells give rise to melanocytes (pigment cells), the adrenal medulla, and much of the peripheral nervous system. Cranial neural crest cells, in addition to the above, are capable of differentiating into the cranial skeleton. We exposed groups of zebrafish embryos to different durations of SMG starting at time points corresponding with the onset of cranial neural crest cell migration. We then analyzed the pigmentation pattern of fish for several days after removal from the rotating wall vessel. In addition, we analysed the cranial skeleton of juvenile and adult specimens. Our data shows that there are no statistically significant differences in the pigmentation patterns but that both the larval and adult skeletons are affected. Morphometric analysis of larval specimens indicates that fish exposed to SMG as embryos exhibit greater variation in the shape of the pharyngeal skeleton (jaws and gill supports) whereas those raised to adulthood show variations in the size and shape of particular skeletal elements only. These elements will be discussed. Overall, we conclude that the development and growth of the cranial skeleton is resistant to the effects of SMG during embryonic stages.