The Influence of Altered Gravity on Drosophila Larval Development: A Genomic and Behavioral Analysis in Simulated Spaceflight Conditions

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The increasing feasibility of commercial space travel has sparked interest in the biological effects of spaceflight. Exposure to altered gravity, including the microgravity of space and the hypergravity of launch and simulated environments, presents significant physiological challenges. To test this, Drosophila larvae were exposed to hypergravity using a centrifuge and simulated hypogravity with a random positioning machine while maintaining controlled environmental conditions. Developmental indicators—including pupation time, survival rates, adult emergence, and morphological changes—were analyzed alongside behavioral tracking. Nanopore sequencing was then conducted to assess gene expression, with results compared to NASA's OSD-96 and OSD-347 datasets on cardiac and general development. The hypothesis was accepted, confirming that altered gravity induces significant genetic and behavioral changes during development. Understanding the effects of altered gravity is important for improving health research. While it can offer benefits, such as enhancing rehabilitation for conditions like cerebral palsy, osteoporosis, and brain damage, it can also disrupt cellular functions and development. Research may also reveal new insights into cancer growth and metastasis. These findings could be critical for the future of human health, offering potential breakthroughs in medical treatments and rehabilitation strategies. Additionally, understanding altered gravity is key to ensuring astronaut safety on long missions. Though this research is still in early stages, it holds great potential for developing gravity-based treatments for medical conditions and improving human performance both in space and on Earth.

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