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EPIGENETICS AND ZERO GRAVITY : A COMPLEX INTERPLAY RELEVANT TO ADAPTATION IN SPACE

Abstract

Epigenetics and zero gravity : A complex interplay relevant to adaptation in space

1 Introduction:

With increasing interest in space exploration and potential long-duration missions beyond Earth's atmosphere, understanding the effects of zero gravity on human biology is paramount. Epigenetic changes are expected to facilitate more rapid adaption to changing or novel environments.

2 Objectives:

This study aimed to explore the potential impact of zero gravity on human and mammal epigenetics and to present what is currently known.

3 Methods:

We conducted a comprehensive review of the scientific literature using the Pubmed database with the following keywords: Epigenetics/Zero gravity/Space exploration/Adaptation to space

4 Results:

Our search revealed that the majority of papers concerning the effects of microgravity were done on prokaryotic and eukaryotic organisms, plants, and mammals, including rodents and humans. A recent study (2018) exploring the methylome of arabidopsis seedlings (a plant) exposed to microgravity space-flight conditions showed that microgravity stimulation was related to altered methylation of several genes, including DNA methylation-associated genes and hormone signaling related genes. Other studies reported and suggested how altered gravitational conditions might influence epigenetic mechanisms, including DNA methylation, histone modification, and non-coding RNA regulation. Our analysis suggested a complex interplay between gravitational forces and epigenetic regulation.

5 Conclusion:

We postulated through this review, that exposure to zero gravity environments could perturb epigenetic patterns, potentially leading to alterations in gene expression profiles relevant to human health and adaptation in space. Understanding epigenetic marks is important for optimizing space travelers' health and performance during space missions and may also help insights into health conditions in extreme terrestrial environments. Further research in this emerging field is essential to illuminate the intricate relation between gravity and epigenetic regulation, paving the way for safer and more effective space exploration missions.