CARNEGIE MELLON UNIVERSITY
BME 2022 FALL SEMINAR SERIES

Spaceflight and Aging: Regulating Tissue Regeneration with Altered Mechanical Load

PRESENTED BY

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SCHEDULE

Porter Hall (PH) 100

Thursday,
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(10:15AM-11:15AM)

During the last several decades of microgravity (mechanical unloading) research, significant progress has been made in the field of space biology that is shaping our understanding of how gravity regulates physiological processes. Microgravity is specifically known to affect multiple physiological systems including the musculoskeletal, immune, digestive and cardiovascular systems, however, the underlying mechanisms causing these alterations are still being elucidated. Furthermore, microgravity is now thought to cause accelerated physiological aging and early onset of age-based disease phenotypes, including osteoarthritis, cardiovascular disease, and fibrotic liver disease. Our research demonstrated, for the first time, that spaceflight significantly affects stem cell populations, significantly impairing tissue regenerative capabilities in unloaded environments, and that these alterations may be mediated by a specific load-dependent molecular regulator. We are now investigating the role of this molecule on tissue regeneration in both whole animal models and isolated stem cell populations, in both ground-based and spaceflight experiments and in comparison to aging models on Earth. Our work includes both in-vivo and in-vitro studies using stem cell models and microphysiological systems combined with molecular, cellular and physiological analysis techniques ranging from single cell transcriptomics to biomechanics. The results from this work hold the promise of greater scientific understanding of how to maintain and monitor health during future space exploration voyages, as well as having broad applications to debilitating disease progression during aging on Earth.

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