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Devin Mair, Ph.D.
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Professional Profile

Dr. Mair provides technical expertise in the areas of biomechanics and biomedical engineering. He utilizes his experience, provided by his educational and research background, to assess biomechanical issues requiring in depth knowledge at the intersection of biology, medicine, and mechanical engineering, including traumatic injuries related to motor vehicles, sports, recreation, industry, and accidents in the workplace and everyday life.

Dr. Mair's research has spanned various scales and scopes. His doctoral research utilized microfabrication and microscopy techniques to design and implement methods to assess forces exerted by a single cell on its surroundings which enabled him to determine how mechanical forces and the mechanical properties of a cell's surroundings influence cell migration in glioblastoma. He supplemented this experimental data with data from finite element computational modeling of cell-matrix interactions.

His research transitioned to the tissue scale, where he investigated how spaceflight effects cardiac tissue function. Utilizing expertise in tissue engineering, stem cell biology, materials science, and cardiac physiology, he fabricated engineered heart tissues that were launched to the International Space Station to assess the effects of microgravity. He determined that spaceflight modified contractile function and mitochondrial function. He then assessed a new material for its ability to be utilized in tissue engineering applications without the detrimental drug absorption present in the then "gold standard" material so that he could launch a second experiment to assess drugs in preventing spaceflight-induced cardiac dysfunction. Once successful, this new platform was launched to the International Space Station and a full assessment of tissue function following drug treatment is still ongoing.

Academic Credentials & Professional Honors

Ph.D., Biomedical Engineering, Johns Hopkins University, 2024

B.S., Biomedical Engineering, Virginia Commonwealth University, 2017

American Heart Association Predoctoral Fellowship 2022-2023.

1st place Young Investigator Oral Presentation Award, Microphysiological Systems World Summit, 2022

Young Investigator Award, Microphysiological Systems World Summit Satellite Meeting, 2021

Tom Scott Award from the American Society for Gravitational and Space Research, 2021

1st Place, American Society for Gravitational and Space Research Student Poster Competition, 2021

1st Place, Von Braun Memorial Symposium Student Poster Competition, 2021

Academic Appointments

Postdoctoral Researcher, Department of Cardiology, School of Medicine, Johns Hopkins University, 2024-2025

Graduate research assistant, Department of Biomedical Engineering, School of Medicine and Whitaker School of Engineering, Johns Hopkins University, 2017-2024

Prior Experience

Postdoctoral Researcher, Johns Hopkins School of Medicine, Department of Cardiology, 2024-2025

Doctoral Candidate, Johns Hopkins School of Medicine, Department of Biomedical Engineering, 2017-2024

Professional Affiliations

American Society for Gravitational and Space Research Early Career Associate

American Astronomical Society

American Society for Gravitational and Space Research

Biophysical Society

Tissue Engineering and Regenerative Medicine International Society

Biomedical Engineering Society

Patents

PCT/US2023/062445 (Patent Pending): Magnetic Actuation System for Tissue Engineering, filed February 2023 (Kim DH, Go G, Mair DB).

Provisional patent 63/388, 279: Polydimethylsiloxane-Based Microfluidic Devices with Reduced Drug Absorption Characteristics, filed July 2022 (Mair DB, Williams MA, Chen JF, Kim DH).

Publications

Mair DB*, Tsui JH*, Higashi T, Dong Z, Koenig P, Chen JF, Ren Z, Meir JU, Smith AST, Lee PHU, Ahn EH, Countryman S, Sniadecki NJ, Kim DH. Effect of spaceflight on contractile and metabolic dysfunction In a 3d engineered human cardiac tissue model. PNAS, 121, 40, 2024.

Ren Z, Ahn EH, Do M., Mair DB, Monemianesfahani A, Lee PHU, and Kim DH. Simulated microgravity attenuates myogenesis in 3d engineered muscle tissue. npj Microgravity 10, 18, 2024.

Allan A, Creech J, Hausner C, Krajcarski P, Gunawan B, Poulin N, Kozlowski P, Clark CW, Dow R, Sraithong P, Mair DB, Block T, Monteiro da Rocha A, Kim DH, and Herron TJ. High throughput longitudinal electrophysiology screening of mature chamber specific hiPSC-CMs using optical mapping. iScience 26, 107142, 2023.

Ren Z, Harriot A, Mair DB, Chung M, Lee PHU, and Kim DH. Biomanufacturing of 3D tissue constructs in microgravity and their applications in human pathophysiological studies. Advanced Healthcare Materials, 2023.

Mair DB, Elmasli C, Barreto AD, Ding S, Gu L, Weinberg SH, Kim T, Kim DH, and Li R. The Arp2/3 complex enhances cell migration on soft elastic substrates. Molecular Biology of the Cell, 2023.

Jenike AE, Buknelman B, Perzel-Mandell KA, Oduor C, Chin D, Mair DB, Jenike KM, Kim DH, Bailey JA, Rafailovich MH, Rosenberg AZ, Halushka MK. Expression microdissection for use in qPCR based analysis of miRNA in a single cell type. Laboratory Investigation, 100133, 2023.

Mair DB, Williams MAC, Chen J, Goldstein A, Wu A, Sniadecki N, and Kim DH. PDMS-PEG block copolymer and pretreatment for arresting drug absorption in microphysiological devices. ACS Applied Materials and Interfaces, 14 (34), 38541-38549, 2022.

Lee PHU, Chung M, Ren Z, Mair DB, and Kim DH. Factors mediating spaceflight-induced skeletal muscle atrophy. American Journal of Physiology-Cell Physiology, 322 (3), C567-C580, 2022.

Sharma A, Clemens R, Garcia O, Taylor L, Wagner N, Shepard K, Gupta A, Malany S, Grodzinsky A, Kearns-Jonker M, Mair DB, Kim DH, Roberts M, Loring J, Hu J, Warren L, Eenmaa S, Bozada J, Paljug E, Roth M, Taylor D, Rodrigue G, Cantini P, Smith A, Giulianotti M, Wagner WR. Opportunities for biomanufacturing in low earth orbit for regenerative medicine. Stem Cell Reports, 17 (1), 1-13, 2021

Williams MAC, Mair DB, Lee W, Lee E, and Kim DH. Engineering three-dimensional vascularized cardiac tissues. Tissue Engineering Part B, 28 (2), 336-350, 2021.

Duan X, Li Y, Yi K, Guo F, Wang H, Wu PH, Yang J, Mair DB, Obregon EM, Kalab P, Wirtz D, Sun SX, and Li R. Dynamic organelle distribution initiates actin-based spindle migration in mouse oocytes. Nature Communications, 11 (1), 277, 2020.

Tsai HJ, Nelliat AR, Choudhury MI, Kucharavy A, Bradford WD, Cook ME, Kim J, Mair DB, Sun SX, Schatz MC, and Li R. Hypo-osmotic-like stress underlies general cellular defects of aneuploidy. Nature, 570, 117–121, 2019.

Mair DB, Ames HA, and Li R. Mechanisms of motility and invasion of high grade gliomas in the brain. Molecular Biology of the Cell 29(21), 2018.

Weinberg SH, Mair DB, Lemmon CA. Mechanotransduction dynamics at the cell-matrix interface. Biophysical Journal 112(9): 1962-74, 2017

Scott LE, Mair DB, Narang JD, Feleke K, Lemmon CA. Fibronectin fibrillogenesis facilitates mechano-dependent cell spreading, force generation, and nuclear size in human embryonic fibroblasts. Integrative Biology 7: 1454-65, 2015.

Presentations

Mair DB, Stoddart L, Tsui J, Higashi T, Koenig P,Smith A, Moerk T, Lee PHU, Ahn EH, Countryman S, Sniadecki N, Kim DH. A human ipsc-based 3D microgravity-induced mitochondrial dysfunction in human iPSC-based 3D cardiac microphysiological system. Platform presentation, Tissue Engineering and Regenerative Medicine-AM, Toronto, CA, July 10-13, 2022.

Mair DB, Stoddart L, Tsui J, Higashi T, Koenig P, Smith A, Moerk T, Lee PHU, Ahn EH, Countryman S, Sniadecki N, Kim DH. A human iPSC-based 3D microgravity-induced mitochondrial dysfunction in human cardiac microphysiological system. Platform presentation, Microphysiological Systems World Summit, New Orleans, LA, May 30-June 3, 2022.

Mair DB, Stoddart L, Tsui J, Higashi T, Koenig P, Smith A, Moerk T, Lee PHU, Ahn EH, Countryman S, Sniadecki N, Kim DH. A human iPSC-based 3D microgravity-induced mitochondrial dysfunction. Platform presentation, NIH Tissue Chip Consortium, Virtual, February 10-11, 2022.

Mair DB, Tsui J, Higashi T, Koenig P, Smith A, Moerk T, Lee PHU, Ahn EH, Countryman S, Sniadecki N, Kim DH. A human iPSC-based 3D microphysiological system for modeling cardiac dysfunction in microgravity. Platform presentation, MPS World Summit Satellite Meeting, Virtual, December 9, 2021.

Mair DB, Tsui Jonathan, Higashi T, Koenig P, Smith A, Moerk T, Lee PHU, Ahn EH, Countryman S, Sniadecki N, Kim DH. A human iPSC-based 3D microphysiological system for modeling cardiac dysfunction in microgravity. Poster presentation, American Society for Gravitational and Space Research, Baltimore, MD, November 3-6, 2021.

Mair DB, Tsui Jonathan, Higashi T, Koenig P, Smith A, Moerk T, Lee PHU, Ahn EH, Countryman S, Sniadecki N, Kim DH. A human iPSC-based 3D microphysiological system for modeling cardiac dysfunction in microgravity. Poster presentation, Wernher von Braun Memorial Symposium, Huntsville, Alabama, October 12-14, 2021.

Mair DB, Tsui Jonathan, Higashi T, Koenig P, Smith A, Moerk T, Lee PHU, Ahn EH, Countryman S, Sniadecki N, Kim DH. A human iPSC-based 3D microphysiological system for modeling cardiac dysfunction in microgravity. Platform presentation, International Space Station Research and Development Conference, Virtual, August 3-5, 2021.

Mair DB, Williams MAC, Tung L, Boheler K, Kim DH. Engineered human heart tissues for studying the effects of galactic cosmic radiation on cardiac function. Poster presentation, NASA Human Research Program Investigator's Workshop, Virtual, February 1-4, 2021.

Mair DB, Perrone M, Zhu J, Elmasli C, Weinberg SH, Li R. Cell migration on compliant substrates requires actin polymerization by the Arp2/3 complex. Platform presentation, Biophysical Society Annual Meeting, Baltimore, Maryland, March 2-6, 2019.

Mair DB, Perrone M, Zhu J, Elmasli C, Weinberg SH, Li R. The Arp2/3 complex is necessary for migration of glioblastoma cells on compliant substrates due to a lamellipodia-provided mechanical advantage. Platform presentation, Biophysical Society Annual Meeting, San Francisco, California, February 17-21, 2018.

Mair DB, Perrone M, Zhu J, Elmasli C, Weinberg SH, Li R. The ARP2/3 complex is necessary for migration of glioblastoma cells on 2D compliant substrates due to a lamellipodia-provided mechanical advantage. Poster presentation, Biomedical Engineering Society Annual Meeting, Atlanta, Georgia, October 17-20,2018.

Mair DB, Saunders SK, Petet TJ, Scott LE, Weinberg SH, Lemmon CA. In vitro validation of a computational model of fibronectin assembly. Poster presentation, VCU School of Engineering Undergraduate Research Symposium, Richmond, Virginia, November 22, 2016.

Mair DB, Petet TJ, Scott LE, Weinberg SH, Lemmon CA. In vitro validation of a computational model of fibronectin assembly. Poster presentation, Biomedical Engineering Society Annual Meeting, Minneapolis, Minnesota, October 5-8, 2016.

Mair DB, Petet TJ, Scott LE, Weinberg SH, Lemmon CA. In vitro validation of a computational model of fibronectin assembly. Platform presentation, Virginia Academy of Science Annual Meeting, Fredericksburg, Virginia, May 17-20, 2016.

Mair DB, Lemmon CA. Signaling pathways and physiological changes involved in tumorigenesis. Poster presentation, Poster Symposium for Undergraduate Research and Creativity, Richmond, Virginia, April 22, 2016.

Mair DB, Petet TJ, Scott LE, Weinberg SH, Lemmon CA. A computational model of cell generated traction forces and fibronectin assembly. Poster presentation, Biophysical Society Annual Meeting, Los Angeles, California February 27- March 2, 2016.

Mair DB, Petet TJ, Scott LE, Weinberg SH, Lemmon CA. A computational model of cell generated traction forces and fibronectin assembly. Platform presentation, Biomedical Engineering Society Annual Meeting, Tampa, Florida, October 7-10, 2015.