

Stephenson School of Biomedical Engineering Seminar Series
Presents
**Engineering the Niche to Address Emerging Challenges in
Regenerative Medicine**



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Friday, May 5, 2017

1:30 P.M.

Devon Energy Hall, Room 120

Brendan Harley is an Associate Professor in Chemical and Biomolecular Engineering at the University of Illinois at Urbana-Champaign. He received a B.S. in Engineering Sciences from Harvard University (2000) and a Sc.D. in Mechanical Engineering from MIT (2006). He was a post-doctoral fellow in the Joint Program for Transfusion Medicine at Children's Hospital Boston and Harvard Medical School from 2006 – 2008. Dr. Harley co-authored the book 'Cellular materials in nature and medicine' (Cambridge University Press, 2010). He has received funding from the NSF, NIH, American Cancer Society, the U.S. Army, and the AO Foundation. He received an NSF CAREER award in 2013, the 2014 Young Investigator Award from the Society for Biomaterials (USA), and was elected a Fellow of the American Association for the Advancement of Science in 2014. He also co-founded UK-based Orthomimetics, Ltd. (acquired by TiGenix, Ltd.), currently performing Phase I clinical trials on a material to repair osteochondral defects in the knee.

Advances in the field of tissue engineering are increasingly reliant on biomaterials that instruct, rather than simply permit, a desired cellular response. Instructive biomaterials hold significant promise for clinical applications as well as to enable mechanistic studies in the laboratory. As tissues can be dynamic, spatially-patterned, or inhomogeneous over multiple length and time scales, my lab is developing new approaches to engineer biomaterials at the structural and biomolecular level in order to replicate these heterogeneities. These efforts are providing new insight regarding the degree of biomaterial complexity required to instruct cell behavior in the context of development, disease, and regeneration. I will describe a collagen biomaterial under development to address current barriers preventing regeneration of musculoskeletal tissues such as the osteotendinous (tendon-bone) junction and craniofacial bones. Here we use inspiration from nature (*e.g.*, porcupine quills, honeycombs, and plant stems) to better co-optimize bioactivity and mechanical competence. I will subsequently describe a microfluidic forming technique to create libraries of optically-translucent hydrogels containing overlapping patterns of cell, matrix, and biomolecule cues. We are using this platform to explore the coordinated impact of cell and matrix signals on (1) niche-mediated regulation of hematopoietic stem cell fate; and (2) malignancy and therapeutic response of human glioblastoma. I will show how these biomaterials can be used as rheostats to regulate processes such as self-renewal vs. differentiation; tissue regeneration and vascularization; and the expansion and therapeutic targeting of glioblastoma stem cells.