

Multi-Cellular Engineered Living Systems: Principles, Challenges, and Applications

Organizers:

Roger Kamm, MIT

Bob Nerem, Georgia Tech

Caroline Lowenthal, MIT

Significant progress in the fields of systems biology, synthetic biology, and developmental biology, combined with recent advances in organoid and induced pluripotent stem cell technologies, have inspired new visions for the design and manufacture of multi-cellular engineered living systems (M-CELS) with useful functionality by design. M-CELS open new possibilities for transformative health and assistive technologies, from biorobotic systems that can be guided by light, to organ-on-chip systems developed as drug screening assays or models of disease. The process of engineering M-CELS is enhanced by understanding how emergent structures naturally arise during developmental processes through mechanical, biochemical and electrical communication. Which aspects of these processes can be circumvented, accelerated or modified according to specification to yield robust, reproducible organoids and microphysiological systems? Computational models that simulate the growth, division, and differentiation of multicellular systems into emergent organization from an initial pluripotent population of cells are an important step in understanding and predicting multicellular systems-level behavior. This interactive workshop will engage participants in conversation about the principles, challenges, and applications of M-CELS.

Program:

Time	Title	Presenter
1:00-1:05	Welcome and Introduction	Bob Nerem, Georgia Tech
1:05-1:35	In Vitro Platforms for Multi-Cellular Engineered Living Systems	Roger Kamm, MIT
1:35-2:05	Computational Methods in Multi-Cellular Engineered Living Systems	Melissa Kemp, Georgia Tech
2:05-2:15	Break	
2:15-2:45	Applications of Synthetic Biology in Multi-Cellular Engineered Living Systems	Ron Weiss, MIT
2:45-3:15	Genetically Engineered hiPSCs in In Vivo Environments	Valerie Gouon-Evans, Boston University
3:15-3:30	Discussion	Moderated by Bob Nerem, Georgia Tech