

## BIOLOGIZATION

### Session Co-Chairs:

Dr. Manu O. Platt; Georgia Institute of Technology and Emory University, Atlanta, Georgia.  
Prof. Nicholas Bishop; Hamburg University of Technology, Hamburg,

The Session “Biologization” covers the integration of physical forces and the mechanical world on the development of novel ways to control biology, and use these principles in the design of engineered living systems and other structures. Synthetic biology and tissue engineering have advanced control and design of biological systems, but next level processes, approaches, and considerations must be appreciated to bring new disruptive change to controlling biology, or the inverse, bio-inspired design. This session will address solutions to integrating cells into new design structures for novel functions, the role of computation for design, analysis, and prediction of outcomes, and multiscale control of these systems to generate self-assembling, self-sustaining, organic systems.

Dr. Timothy Downing from University of California, Irvine will discuss his approaches to using materials and mechanics to control epigenetic modifications that unlock genes and signaling pathways. Dr. Shahrouz Amini from the Max Planck Institute of Colloids and Interfaces in Berlin, Germany will talk about the evolution of stress/strain fields in biomaterials in the context of the formation and function of tissues and their relation to the development of functional materials. Laura De Laporte from the University of Aachen, Germany will introduce the design of polymeric regenerative hydrogel therapies, consisting of nano –and micron-scale building blocks that orient after injection to repair anisotropic tissues. Dr. Ritu Raman is a researcher at Massachusetts Institute of Technology. She is a leader in the nascent field of biohybrid machines, and integration of heterologous cell types with biomaterials under biophysical or electrical stimuli to complete a coordinated function.

### Speaker Bios

**Dr. Timothy Downing**, University of California, Irvine; [tim.downing@uci.edu](mailto:tim.downing@uci.edu)

**Biography:** Timothy Downing is an assistant professor in the Department of Biomedical Engineering at University of California, Irvine, USA. His research investigates how physical forces and changes in mechanical properties of cells and tissues influence the final fates of cells, and their progression from health to disease. His ultimate goal is to build molecular tools that control the epigenome to control cell behavior. He received his B.S. in Chemical Engineering from Northwestern University in 2008 and Ph.D. in Bioengineering from University of California, Berkeley in 2013. Timothy completed postdoctoral training at Harvard University and the Broad Institute (Cambridge, Massachusetts, USA).

**Dr. Ritu Raman**, Massachusetts Institute of Technology; [ritur@mit.edu](mailto:ritur@mit.edu)

**Biography:** Ritu Raman is a researcher in the Langer Lab at MIT. Ritu has a passion for biohybrid design, building machines powered by biological materials with the ultimate goal to develop implantable robots that

dynamically sense and adapt to the human body and help fight disease and damage. She received her B.S. *magna cum laude* in Mechanical Engineering, with a minor in Biomedical Engineering, from Cornell University in 2012. Then she went onto earn her M.S. (2013) and Ph.D. (2016) in Mechanical Engineering at the University of Illinois at Urbana-Champaign.

**Dr. Laura De Laporte**, Aachen University, Germany

**Biography:** Laura De Laporte is Professor in The Department of Chemistry at Aachen University. She develops biohybrid and bioinspired materials for advanced medical applications, for example to replicate the complex structure of natural tissues. She received her Chemical Engineering degree from the University of Ghent, Belgium and her PhD at Northwestern University, US, studying engineered guiding implants for nerve regeneration. She then studied regenerative hydrogels at the EPFL, Switzerland. Since 2013 she has led a group at the Leibniz Institute for Interactive Materials at Aachen University, where she has a professorship since 2018. <https://www.dwi.rwth-aachen.de/person/laura-de-laporte>

**Dr. Shahrouz Amini**, Max Planck Institute of Colloids and Interfaces, Germany

**Biography:** Shahrouz Amini is group leader at the Max Planck Institute of Colloids and Interfaces, Department of Biomaterials, Germany. His work is focused mainly on the micromechanics of biological materials and surfaces and his group investigates the ways physical characteristics and structural complexity modulate and functionalize the mechanical performance of biological materials to promote their multifunctionality. His background is in Mechanical Engineering (B.Sc.), Biomaterials (M.Sc.), and Materials Science (Ph.D.), which he undertook at the Biological and Biomimetic Materials Lab at Nanyang Technological University (NTU), Singapore. After a post doc at the Energy Research Institute of the NTU (ERI@N), he joined the Max Planck Institute in 2017. Since 2020, he started his current position. <https://www.mpikg.mpg.de/6288160/micromechanics-of-biological-materials>