



# DEPARTMENTAL SEMINAR



## EMILY DAVIDSON

Harvard University

Friday, January 31, 2020 | 10:00 AM

102 Colburn Lab

Emily Davidson joined the John A. Paulson School of Engineering and Applied Sciences at Harvard University in 2017, where she works as a postdoctoral researcher with Prof. Jennifer Lewis. Her postdoctoral research focuses on the development and 3D assembly of liquid crystal elastomers with light-activated dynamic bonds. Prior to joining Harvard, she carried out her doctoral research at UC Berkeley (Ph.D. 2016) and UC Santa Barbara with Prof. Rachel Segalman, where she synthesized and studied sequence-defined block copolymers to gain insights into the physics of their self-assembly. Emily received her bachelor's degree in Chemical Engineering from the Massachusetts Institute of Technology in 2010. From 2010-2012, Emily taught high school chemistry and physics through the Teach for America program. Emily was recently recognized as a recipient of the 2019 Scientista Foundation 'Born Seekers' fellowship.

## **HIERARCHICAL CONTROL OVER 3D POLYMER ASSEMBLY FOR FUNCTIONAL POLYMER ARCHITECTURES**

Nature creates materials with remarkable properties by controlling hierarchical assembly from the molecular through the macroscopic length scales. Inspired by natural systems, my research combines molecular design with directed assembly via extrusion-based 3D printing to programmably define the structure and function of polymer-based materials

across length scales. First, I will describe how we leverage bioinspired sequence-defined polypeptoids to systematically investigate the impact of helical secondary structures on block copolymer self-assembly. We find that the molecular helix is stiffer but more compact than the analogous coil, and that the stiffness of the molecular helix dominates space-filling effects in controlling self-assembly. Next, I will introduce the design of liquid crystal elastomers (LCEs) that contain light-activated dynamic bonds. Using extrusion-based 3D printing, the molecular alignment of bulk LCEs can be programmed to encode desired shape transformations when thermally cycled above and below their nematic-to-isotropic phase transition temperatures. These functional elastomers can be reprogrammed on demand via exposure to UV light due to the coupling of the functional and dynamic components of the elastomer network. Finally, I will highlight a path towards integrated polymer architectures with stimuli-responsive structure and function via multimaterial 3D printing.