UNIVERSITY OF NEBRASKA -LINCOLN COLLEGE OF ENGINEERING

Biomedical Engineering Seminar

Friday, April 19, 2024

12:00 - 1:00 PM

KH A251

Silk Spinning-Inspired Biofabrication for Regenerative Medicine

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Silk spinning is a naturally evolved polymer manufacturing process, found in spiders and silkworms and characterized by proteinaceous feedstocks and ambient and aqueous conditions. Also, the product of silk spinning, i.e., silks, exhibits minimal immunogenicity and mechanical performance superior to many synthetic polymers. These characteristics of silk spinning highlight a source of inspiration for devising sustainable polymer manufacturing and therapeutic scaffolds and devices. In this talk, I will present two silk spinning-inspired strategies to fabricate functional proteinaceous structures for regenerative medicine. One is based on the conformational polymorphism of silk proteins, which leads to a strategy to fabricate highly resilient protein elastomers. We also found a semi-quantitative correlation between molecular conformations and macroscopic resilience. The other is based on the information-rich solvent cues along the spinning gland, which directs the hierarchical assembly of silk proteins and leads to a salt ion-assisted 3D printing approach. This approach exhibits superior printability (e.g., the construction of perfusable branching channels, overhanging filaments, and cantilevers), the bulk integration of biofunctional molecules, and the in vitro formation of bronchial epithelium, holding promise for the advancements of tracheal bioengineering.

Biography: Dr. Xuan Mu is currently an assistant professor at the Roy J. Carver Department of Biomedical Engineering at the University of Iowa. Before joining the current position, Dr. Mu obtained his Ph.D. in Applied Chemistry from the East China University of Science and Technology and performed biomedical research at the National Center for Nanoscience and Technology of China, Peking Union Medical College, Tufts University, and Brigham and Women's Hospital/Harvard Medical School. Dr. Mu received the General Electric (GE) Foundation Scholarship, the Kwan-Cheng Wong postdoctoral fellowship, the Peking Union Medical College Rising Star Award, the Distinguished Abstract Award of NACB, the Jumpstart Tomorrow Feasibility Award of UIOWA, and the 2023 BMES ABioM Junior Investigator Research Award. He has published three book chapters and around fifty peer-reviewed articles and served as an associate editor of Frontiers of Biotechnology and Bioengineering. His research focuses on leveraging bioinspired fabrication to devise sustainable and biofunctional structures, scaffolds, and devices, with an emphasis on therapeutic scaffolds and disease models for the respiratory system.