

THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT COLLOQUIUM SERIES PRESENTS:

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Tech L211

But Wait There's More!: How Musculoskeletal Tissues Resist Failure

Musculoskeletal injuries result in 65 million health care visits per year in the United States. The most common injuries are bone fractures and tendon tears or strains. In healthy musculoskeletal tissues, the body is able to decrease failure risks via complex hierarchical structures. These structures include composition gradients, energy absorbing and stress minimizing architectures, as well as multiphase composites. Disease, previous injury, and environmental factors, such as increased body acidity or muscle unloading, can modify the unique tissue structure and significantly increase failure risk and extent. To develop techniques for preventative and post-injury care it is therefore important to identify the musculoskeletal structures at multiple hierarchies and determine their mechanical roles. In addition, understanding these natural tissues can aid in the creation of new implants and devices. Alix Deymier has been investigating the role of architecture and composition from the nano- to the macro-scale on the mechanics of the musculoskeletal system via a variety of techniques including electron-energy loss spectroscopy, synchrotron x-ray diffraction, micromechanical testing, and microcomputed-tomography. She will present her work explaining how bones and tendons employ a hierarchy of structures and mechanisms to minimize failure and how these can be controlled and modified.

Alix Deymier, Ph.D., is currently an assistant professor in Biomedical Engineering at the UConn School of Dental Medicine. She is interested in studying the role of mineral composition, structure, and organization on the mechanics of mineralized biological tissue especially in the context of acid-base interactions in the body. Her interests focus on how pH modifying pathologies such as acidosis and unloading can affect bone structure and function at the nano-, micro-, and macro-scales. She was previously a postdoctoral fellow in Orthopedic Surgery at Columbia University and Washington University where she had an NSBRI fellowship studying the role of mineral structure and organization on the mechanics of biological systems in microgravity. She obtained her Ph.D. in Materials Science and Engineering at Northwestern University where she was a NDSEG and NSF Graduate Fellow working with High Energy X-ray Diffraction to study load transfer and mineral structure in mineralized biological systems. She completed her B.S. in Materials Science and Engineering at the University of Arizona in 2006 with a specialization in spectroscopy and the science of cultural heritage materials.