NCMN

NEBRASKA CENTER FOR MATERIALS AND NANOSCIENCE / NSF-MRSEC SEMINAR SERIES PRESENTS

MRSEC

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IMAGING MECHANICS

Medical imaging techniques can be modified to image the propagation of shear waves, induced by a mechanical actuator, in soft materials including tissues and polymers in a technique termed elastography. Mechanical properties including complex shear moduli can be extracted from elastography images. Elastography is a technique that is gaining a lot of interest in the medical community for diagnosing disease but it is underrepresented in basic sciences including biomaterial and tissue engineering due to limitations in resolution and penetration depth. Elastography is the science of noninvasively imaging. The mechanical properties of soft organs and tissues and can be applied using most imaging modalities including ultrasound (US) and magnetic resonance imaging (MRI). Magnetic resonance elastography (MRE) measures the induced vibratory motion in organs resulting in displacement maps enabling the calculation of the mechanical stiffness of the organ. Recently, we have combined high field MRI with miniaturized mechanical drivers to measure the mechanical properties of small specimens including tissue engineered constructs. Our progress includes monitoring tissue engineered graft such as adipogenic and osteogenic constructs. Adipogenic tissue became “softer” as adipogenic matrix production from the adipogenic cells gradually increases. Conversely, osteogenic tissues became “harder” due to the mineral deposition and development of the extracellular matrix. At the University of Nebraska-Lincoln, we are planning to acquire high resolution MRE capabilities. Our research will focus on technological advancements and novel applications. One major challenge in this research is to develop miniaturized high frequency (>1000 Hz) mechanical actuators with sufficient amplitude for imaging. Our proposed research is to extract non-linear mechanical properties of soft biomaterial (e.g., hydrogel and agarose gel) by visualizing shear waves at different excitation frequencies and loading amplitude. In addition, we plan to validate our MRE measurements with US elastography and nanoindentation.

Host: Jeff Shield

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201 Brace Lab
1:30 p.m.