TEXAS TECH UNIVERSITY
Edward E. Whitacre Jr.
College *of* Engineering

Mechanical Engineering Department: Faculty Candidates Seminar Series

Friday, February 28th 9:00-10:00 ME Conference Room – ME 106

Soft Surface Lubricity and Biomimetic Interfaces

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Abstract: Hydrogel materials are emerging as biological mimics, especially in biomedical applications such as contact lenses that rely on lubricity for success. Hydrogels can not only emulate the "softness" of biological tissues with low elastic modulus, but can also contain water as an inherent component of 5-95% by mass. When soft hydrated surfaces slide against each other, as in a healthy human eye, the properties of the tissues and tear fluid combine to lubricate the interfaces over thousands of cycles of blinking in 15-18 waking hours per day. Taking the eye as a model system, a technique was developed to reliably measure the low-pressure friction response of hydrogel soft contact lenses using glass probes. The friction coefficients measured in buffered saline exhibit trends related to surface composition and experimental conditions. An open platform instrument was used to gain insights by testing directly on biological materials: a living mouse eye, a cell monolayer, and a stratified corneal tissue. Though glass probes are suited to contact models and material property investigations, they are not present in physiological conditions – therefore, the low-pressure friction instrumentation was adapted for use to match a hydrogel probe with the hydrogel flat sample, a "Gemini" interface. This resulted in identification of distinct friction and lubrication behavior when a hydrogel is sliding against itself versus a hard impermeable surface such as glass. Details are provided on soft materials contact models, instrumentation, and identification of dominating mechanisms of lubricity. Future research directions are outlined.

Background/Vita: Alison C. Dunn is a Collegiate Scholar in the Department of Mechanical and Aerospace Engineering at the University of Florida. She supervises the Tribology Laboratory, where she specializes in the measurement and modeling of friction on soft biological and biomedical materials. Her particular interest lies in pursuing fundamental lubrication mechanisms of hydrated materials, measuring micro-mechanical and surface properties, and designing and building in situ measurement systems. Alison grew up in 10 U.S. states from Nevada to North Dakota to Virginia, and spent two years with the U.S. Peace Corps in China teaching English to future teachers.