PRINCETON UNIVERSITY
DEPT. OF MECHANICAL & AEROSPACE ENGINEERING

SEMINAR NOTICE

Probing Lung Physiology and Pathology Using Indentation and In-situ Imaging

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Of all the internal organs, the lung has arguably the strongest connection between physiologic function and mechanical behavior. In breathing, sufficient compliance and recoil are required for inhalation and exhalation, respectively. Intrinsic tissue properties provide some mechanical influence, but behavior is dominated by surfactant on many levels. Mechanics of lung in inflation has been studied in numerous clinical and laboratory studies, but under shear or high-strains, limited studies have been performed, due to the difficulty in mechanical testing on lung. In this talk I will describe indentation experiments on lung, and how quasi-plastic behavior can be correlated to atelectasis, or alveolar collapse. Atelectasis is a highly important consideration in anesthesia and critical care, but hard to study due to its random occurrence. Our systematic studies have shown that this pathology can be highly sensitive to inflation gas, suggesting a possible alteration of lung surfactant properties. Mechanisms and criteria of atelectasis remain unclear, largely due to the inability to image or preserve deformed lung. In this talk, I will discuss how we have addressed this need, with in-situ images of sub-surface lung deformation using Optical Coherence Tomography (OCT). Mammal lungs were inflated to various physiologic pressures, and indented using both spherical and cylindrical ("rib-like") indenters, and atelectasis observed in-situ. In addition, deformation patterns were compared to FEM models that incorporated lung parenchyma and surface pleural membrane. By comparing the models and experiments, we are able to draw robust conclusions concerning the mechanical criteria for atelectasis, namely the effects of hydrostatic pressure or shear, on alveolar collapse. Results and questions arising from this work have direct relevance to anesthesia and critical care methods and practices.

Friday, November 11th, 2009 ***Room 222***
3:30 PM ***Bowen Hall***

For inquiries, please contact the Dept. of Mechanical & Aerospace Engineering at 609-258-5126

ALL VISITORS ARE WELCOME!

Social Period in atrium outside of Bowen 222 following the seminar.