

Undergraduate Research Seminar
Wednesday, August 6th, 2014 5:30 p.m.
Leigh 309

Nhi Tran

“Comparing Lipid Dynamics in Animal Derived and Synthetic Pulmonary Surfactant using ²H and ³¹P NMR”

Pulmonary surfactant (PS) is a lipoprotein mixture found in the alveoli of the lungs and allows for proper lung function by lowering the surface tension at the alveolar air-water interface. Of the four proteins found in PS, surfactant protein B (SP-B) is the only one required for survival. Infants born prematurely often lack mature PS, which leads to respiratory distress syndrome (RDS). The prevailing treatment for RDS is the application of exogenous PS, which is derived from bovine or porcine sources, to the lungs of the afflicted individual. Due to the immunologic risks associated with this treatment, a synthetic mimetic of PS is desired. Here we present the general concepts of ²H and ³¹P NMR used to observe lipid dynamics and apply these types of experiments to study the animal derived Infasurf®, which is the PS formulation used to treat infants with RDS, and a synthetic mimetic of Infasurf will be compared with and without the addition of SP-B1-25.

Noah Steinberg

“Spatial Response of ⁴He Fast Neutron Detectors”

High Pressure helium-4 fast neutron detectors are a recently developed technology with widespread applications in the safeguarding of nuclear material as well as particle and nuclear physics. This study seeks to investigate the spatial response of the detectors, and proposes a method to measure the position of nuclear material.

Michael Chiang

“Expression and Purification of Pulmonary Surfactant Protein-B”

After you are born, you must start breathing immediately. In order to breathe the alveoli, tiny sacs within the lungs, must be able to fill up with air at ambient pressure. To do this, they are coated with a substance known as pulmonary surfactant (PS). Without PS, the act of breathing would be too difficult. Ten percent of all prematurely born babies suffer from respiratory distress syndrome because they are born with insufficient PS. The treatment is PS replacement therapy from a bovine source, which allows the babies to breathe normally and stimulates their own production of PS; however, this treatment is very expensive. Pulmonary Surfactant by dry weight is 90% lipid and 10% protein. There are four proteins that make up PS, surfactant protein A, -B, -C, -D (SP-A, SP-B, -SP-C, SP-D). Despite its low abundance in PS, SP-B is critical to its function, without it the individual would die. In our lab we use magnetic resonance techniques such as NMR and EPR to characterize the structure and dynamics of proteins. In order to do this,

we need relatively large amounts of protein as NMR is inherently an insensitive technique. A relatively inexpensive way of producing large amounts of protein is through expression of recombinant DNA in E. Coli. Understanding the functional structure of SP-B will be a crucial step in understanding its mechanism, and will open the door to creating a synthetic replacement for RDS treatment.