Yale Institute for Nanoscience and Quantum Engineering

Friday, September 7, 2012

12:00 to 1:00 p.m.

DAVIES AUDITORIUM
Becton Center
Light lunch will be served at 11:45 a.m.

Michael Look

Department of Biomedical Engineering
School of Engineering & Applied Science, Yale University

" Lupus Therapy using Nanoparticulate Drug Delivery"

Lupus is a life-long, debilitating disease caused by the abnormal activation of the immune system against the body. This presentation describes the design and use of a novel, nanogel drug delivery system that can be used for treatment. Nanogels consist of a lipid exterior and gel-like interior that encapsulates the drug mycophenolic acid, an immunosuppressant. The *in vivo* efficacy of nanoparticles was evaluated in a lupus-prone mouse model, and significantly extended the median survival time by approximately 3 months with concomitant delay in the onset and severity of clinically-relevant markers of lupus. Nanogels provided better therapeutic efficacy than the conventional administration of drug solubilized in buffer by localizing to immune cell subsets that participate in lupus pathology and attenuating inflammation. Finally, the use of an alternative and commonly used polymer for formulating nanoparticles, poly(lactic-*co*-glycolic acid) (PLGA), was compared and found to be less efficacious due to its less efficient uptake by dendritic cells. These findings demonstrate the potential feasibility and design considerations of using nanoparticle-based therapeutic immunosuppression for lupus and other autoimmune diseases.

Nathan Flowers-Jacobs

Physics Department, Yale University

"Optomechanics in a Fiber-Cavity"

Abstract:

In quantum mechanics, a measurement of one variable is accompanied by back-action on the conjugate variable. In the particular case of an optical displacement measurement, the quantum back-action is radiation pressure shot noise (RPSN), the Poissonian noise in the momentum transferred by reflecting photons. The goal of observing RPSN is motivated by basic questions about quantum measurements, as well as by the fact that RPSN is expected to limit the performance of next-generation gravitational-wave observatories (though squeezed light can be used to mitigate the effect). In an attempt to measure RPSN, we have made an optomechanical device consisting of a fiber-based optical cavity containing a silicon nitiride membrane. In comparison with typical free-space cavities, the fiber-cavity's small mode size (10 micron waist, 80 micron length) allows the use of smaller, lighter membranes and increases the cavity-membrane linear coupling to 3 GHz/nm. This device is also intrinsically fiber-coupled and uses glass ferrules or v-grooves for passive alignment; these improvements will greatly simplify the use of optomechanical systems, particularly in cryogenic settings. At room temperature, we expect these devices to be able to detect the shot noise of radiation pressure.

HOST: Professor Mark Reed