Yale Institute for Nanoscience and Quantum Engineering

Friday-November 18, 2016

*11:30 to 12:30 p.m.

BECTON SEMINAR ROOM

Light lunch will be served at 11:15 a.m.

Hojoong Jung
Department of Electrical Engineering, Yale University

On-chip optical frequency comb generation and frequency conversion in aluminum nitride micro-ring resonator

A number of dielectric materials have been employed for on-chip frequency comb generation. Silicon based dielectrics such as silicon dioxide (SiO_2) and silicon nitride (SiN) are particularly attractive comb materials due to their low optical loss and maturity in nanofabrication. They offer third-order Kerr nonlinearity ($c^{(3)}$) but little second-order Pockels ($c^{(2)}$) effect. Materials possessing both strong $c^{(2)}$ and $c^{(3)}$ are desired to enable self-referenced frequency combs and active control of comb generation. In this talk, we introduce another CMOS-compatible comb material, aluminum nitride (AlN), which offers both second and third order nonlinearities. A review of the advantages of AlN as linear and nonlinear optical material will be provided, and fabrication techniques of low loss AlN waveguides from the visible to infrared (IR) region will be discussed. We then show the frequency comb generation including IR, red, and green combs in high-*Q* AlN micro-rings from single CW IR laser input via combination of Kerr and Pockels nonlinearity. Finally, the fast speed on-off switching of frequency comb using the Pockels effect of AlN is shown, which further enriches the applications of the frequency comb.

Gregory Tietjen
Department of Biomedical Engineering, Yale University

Nanoparticle targeting during *ex vivo* perfusion of human kidney: A new quantitative approach to defining the principles of targeting *in situ*

Polymeric nanoparticles can be used as drug delivery vehicles with the capacity to act as slow release therapeutic depots in the treatment of a wide variety of diseases. Molecular targeting (e.g. via surface conjugation of antibodies) has emerged as a strategy to ensure that the particles have specificity for the anatomic location and cellular subtype of greatest clinical need. Unfortunately several studies and multiple clinical trials have demonstrated we don't yet know how to translate robust targeting in a petri dish into a effective therapeutic for a person. This is largely due to the fact that we lack a theoretical understanding of the conditions necessary to ensure maximal targeting benefit in a complex *in vivo* environment. In this talk, I will describe our recent efforts to leverage *ex vivo* perfusion of human kidney (a newly developed clinical technique in organ transplant used to resuscitate marginal organs) to quantitatively define nanoparticle targeting specificity and kinetics in a experimentally viable human organ that was declined for transplant. In addition to hastening new therapeutic paradigms in clinical organ transplant, we believe these results can provide new insights for the engineering of nanomedicines capable of anatomic precision after systemic administration.

Host: Professor Eric Altman