Dr. Anthony McGoron

Project title: Nanoparticle synthesis for targeted image guided therapy of cancer

Students will optimize the synthesis of near-infrared dye and chemotherapy loaded silica nanoparticles to be able to simultaneously detect and treat cancer. The synthesized nanoparticles are evaluated for their drug and imaging agent loading capacity, and release rate, the stability and degradation, size, size distribution (poly-dispersity) and surface charge (zeta potential) of the nanoparticles. The nanoparticles will then be administered to mice to evaluate their biodistribution and plasma clearance (pharmacokinetics) using appropriate mathematical models. Nanoparticles that demonstrate good pharmacokinetics properties will be tested for efficacy in mice with implanted tumors. The significance is that if new targeted cancer therapies can be developed it will reduce the off-site toxicities of traditional chemotherapies. Image guidance will allow the oncologist to track the fate of the nanoparticles in vivo to ensure the drug is going to its intended target (the tumor) and surgeons can use it to guide their resection of cancer by more easily being able to differentiate normal from diseased tissue.

Project title: Calibration of Fluorescent imager

Students will create phantoms of various organs (liver, spleen, heart, lung, kidney etc.) using gelatin. Fluorescent dyes at different concentrations will be mixed with the gelatin to simulate the imaging agent distribution to organs. The fluorescent dye in the organ phantoms will be imaged and compared to calibration curves to optimize the imager design and verify that the imager can be used to accurately measure the amount of dye in an organ. Different imagers will be compared, including a commercial system as well as an in-lab built system using either a laser or light emitting diodes as sources. The significance is that conducting studies of the distribution of drug in the body (biodistribution) typically requires homogenizing the tissue and extracting the dye from the organ tissue to be measured in a spectrophotometer. It is labor intensive and prone to error. Being able to use a fluorescent imaging system has the potential to increase throughput and accuracy when studying the biodistrution of newly developed drugs.