Functionalization of Silica Nanoparticles for Drug Delivery and Optimization of Synthesis Methods

By: **Carolina Guillen*** | Anthony McGoron

Cancer is one of the leading causes of death every year. Advancement of nanotechnology in the biomedical field could provide a solution by crafting an efficient drug delivery system consisting of mesoporous silica nanoparticles that offer excellent target specificity, biocompatibility, biodegradability, and reduce side effects on healthy tissues and retain the anti-cancer drugs for more extended periods. Because researchers in the field are failing to scale and reproduce these nanocarriers due to their cost and the long time it takes to perfect them, the goal of this project is to optimize the synthesis of the nanoparticles to find the minimum conditions required that would yield functional and efficient nanocarriers for drug delivery. Micro-emulsion methods will be compared, varying parameters such as temperature, the concentration of surfactants and pH, to observe how changing these variables affects the size, porosity, shape, and zeta potential of the particles. Water-in-oil and oil-in-water micro-emulsions will be the two primary methods used to synthesize silica nanoparticles. Dynamic Light Scattering (DLS) measurements will be taken to compare size and zeta potential of nanoparticles synthesized under different conditions - surfactants, co-surfactants, pH, type of micro-emulsion, and dialysis time, etc.-. A double-beam spectrophotometer will be used to compare the fraction of light that reflects from the supernatant extracted from a sample of centrifuged nanoparticles with grafted amine groups, to a reference sample that was not centrifuged because it never had functionalized nanoparticles. The fraction of light reflected is useful to calculate the sample absorbency, which is a value proportional to the concentration of amine groups being measured. If successful, the project would represent a turning point in the biomedical field because the production of silica nanocarriers could be taken to the larger, industrial scale and potentially reduce the number of deaths to cancer.