Allyson Hill, Advisor: Dr. Lauren S. Anderson

Examining cytoskeletal organization and cell morphology on P(MEO2MA-co-OEGMA) thermoresponsive biomaterials of variable lower critical solution temperature.

Thermoresponsive polymer (TRP) substrates as in vitro cell culture platforms have recently gained popularity due to their ability to release cells from the growth substrate without biochemical enzymes and while maintaining cell-cell and cell-matrix interactions. Cells grown on TRPs are released from their culture surface by a simple change in temperature below the lower critical solution temperature (LCST) of the polymer. P(MEO2MA-co-OEGMA) substrates offer a unique advantage over PNIPAM, the gold standard: the ability to tune the LCST. In this work, we investigate cell growth on four P(MEO2MA-co-OEGMA) substrates of varying LCST using immunofluorescence and confocal microscopy. The effects of tunable LCST on cell adhesion was also investigated using contact angle as a proxy for cellular adhesion. Specifically, we quantified the equilibrium spreading coefficient of P(MEO2MA-co-OEGMA) thermobrushes with aqueous LCSTs of 28, 31, 34, and 37°C as a function of temperature and examined cell height and cytoskeletal organization over the course of 48 hours. Results show that surface hydrophobicity increases as LCST decreases, with LCST of 28°C being the most hydrophobic surface. Phase contrast microscopy images revealed an increase in cell adhesion as a function of LCST, with the most hydrophobic surface (28°C) promoting cell spreading comparable to a TCP control. Cell height also varied with changing LCST. In conclusion, thermoresponsive brushes synthesized from random copolymers of 2-(2-methoxyethoxy)ethyl methacrylate (MEO2MA) and oligo(ethylene glycol) methacrylate (OEGMA) (P(MEO2MA-co-OEGMA)) that exhibit variable aqueous LCST values can be used to promote cell adhesion in tissue engineering applications.

Dana Lapides, Advisor: Dr. James Ferri

Water/oil interfaces are extensively used to assemble biomimetic systems. Thermoresponsive particles are of great interest in studying such systems. Here, we demonstrate programmable partition coefficient using a system of gold or silver nanoparticles sterically stabilized with a thermoresponsive copolymer consisting of di(ethylene glycol) methyl ether methacrylate (x = MeO2MA) and poly(ethylene glycol) methyl ether methacrylate (y = OEGMA). A characterization of the polymer-coated nanoparticles and a synthesis method for capped silver nanoparticles are presented. Characterization and comparison between gold and silver thermoresponsive NPs demonstrate that thermoresponsive behavior is due to polymer coating, not core. Both particle species decreased in size from about 40 nm to about 30 nm over a temperature range from 20°C to 50°C. In the presence of 0.15 M NaCl, reversible aggregation was observed in both species at 28°C. We measure partition coefficient of Au@(MeO2MAx-co-OEGMAy) NPs in a water-toluene system at room temperature as a function of copolymer ratio (x:y) and ionic strength. Data show that Ko/w increases as a function of salt concentration and linearly as a function of increase in OEGMA content of polymer. NaCl concentrations on the order of mM were sufficient for observation of interface crossing.
Xingjian (Max) Ma, Advisor: Dr. Polly Piergiannini

Cochineal is a natural red dye extracted from an insect, and used worldwide as a textile and fabric dye. It is an ideal red dye due to its brilliant carmine color, color strength and its colorfastness on many fabrics. The dye permanently adheres to the fabric in the presence of a mordant - a metallic ion that forms a coordination complex with the dye and attaches it to the fabric. Larger concentrations of mordant have been shown to improve colorfastness, but the thermodynamics of the process have not been investigated.

In this project, we studied the thermodynamics of cochineal dye adsorption on wool fabric. Three mordants were selected: tin, alum, and copper. Four different adsorption isotherm models were fit to the data: Langmuir, Freundlich, Redlich-Peterson, and Temkin models. Initial results show that the Langmuir, Freundlich, and Temkin models fit the data. As more data is collected, we will determine the effect of mordant on the model parameters.


Nicole Taschler (Moravian College), Advisor: Dr. Javad Tavakoli

Renewable Fuels for Transportation

Transportation vehicles in the United States consumed over 6.87 billion barrels of oil in 2011. This counts for about 22% of total world petroleum consumption. This has created dependency on a non-renewable energy supply from sources which may not be politically secure. Any attempt to change such trend would be economically and politically beneficial. This poster presents a general view of renewable fuel options that can be used in transportation. In particular, the poster will discuss production of biodiesel from algae, ethanol from biomass (corn and sugarcane), hydrogen from natural gas and via electrolysis, and mechanics of fuel cell operation. The poster briefly addresses pros and cons of each technology.

Matthew Warrener, Advisor: Dr. Christopher Anderson, Dr. Lauren Anderson

Smart biomaterials known as thermoresponsive polymers (TRP) have great potential as cell culture substrates due to their temperature dependent surface properties. Specifically, TRPs exhibit a lower critical solution temperature (LCST) that determines the temperature at which the polymers support cell adhesion and proliferation. The “gold standard” of these TRPs, Poly(N-isopropylacrylamide) (PNIPAM) has been well characterized. However, a relatively new polymer, P(MEO2MA-co-OEGMA), has recently been fabricated that has a significant advantage over PNIPAM: a tunable lower critical solution temperature (LCST). This property
allows the thermoswitching temperature to be controlled simply by alternating the ratio of MEO2MA to OEGMA monomers in the polymer synthesis.

The objective of this study was to synthesize P(MEO2MA-co-OEGMA) (PMO) polymers and investigate the protein adsorption responses to these materials and compare those results to tissue culture plastic (TCP) and PNIPAM. The assay used to obtain this measure was an absorbance-based assay that examined protein concentration. It was found that protein adsorption on the new thermobrushes was equal to or greater than TCP and PNIPAM and that as hydrophobicity of the brushes increased, protein adsorption increased, as well. These findings, along with cell adhesion assays and genomic data, will be used in future work to attempt to optimize the growth substrates via selectively pre-adsorbing protein to the brush.