Current (as of March 1st): Faculty Research Description for HHMI RET Program – 2012

Dr. Eli Hesterman (Biology – Molecular Toxicology)

Briefly describe overall research program at your laboratory.

My laboratory examines interactions among receptors that respond to steroid hormones and environmental toxicants. These include not only the hormones estrogen and progesterone as well as foreign compounds that bind to their receptors, but also common toxicants such as PCBs, dioxins and polynuclear aromatic hydrocarbons (the carcinogens in cigarette smoke). Our work is conducted largely in cultured cancer cells, where we study how combinations of these chemicals cause changes in gene expression. Our studies are basic to the understanding of environmentally-induced cancers and endocrine disruption.

Briefly describe specific project(s) for your research intern.

Those working in my lab will learn tissue culture techniques necessary for working with cultured cells. In typical experiments, we treat cultured breast or endometrial cells with compounds, isolate RNA from the cells, and then use quantitative, real-time PCR to measure changes in abundance of the transcripts from particular genes. We also use a powerful technique called chromatin immunoprecipitation to measure the interactions of specific proteins with DNA that lead to these changes in transcription.

Dr. Bob Posey (Polymer Chemistry / Polymer Testing)

Briefly describe overall research program at your laboratory.

My research program is a continuation of my work in the R&D Department of Mitsubishi Polyester Films (Greer, SC) having to do with synthesis and testing of polyesters, including water-dispersible co-polyesters. Materials to be studied are made in a small batch polymerization system, and subsequent analysis and testing includes molecular weight measurements (both traditional and experimental methods), spectroscopic analysis, and other polymer specific testing.

Briefly describe specific project(s) for your research intern.

The following are a variety of research projects being pursued in my lab:

1. Syntheses of PET using no metallic element based catalysts. This project is the subject of a major push to demonstrate its feasibility at Mitsubishi Polyester Film (MFA, in Greer SC). The work will involve assisting in preparing several metal-free PET batches in a reactor at MFA and then using the material to produce polyester film for testing on the R&D Pilot Line.
2. Begin studies to determine the mechanism of catalysis for the new material
3. Optimization of reaction conditions for a water-dispersible co-polyester to prevent formation of an undesirable by-product.
4. Method development to determine the polymer molecular weights of water-dispersible co-polyesters using water as test solvent (replacing a corrosive chlorinated material.) Replacement of this corrosive, chlorinated solvent in the standard test for PET with a much less hazardous material.

5. Modification of the polymer recipe and reaction conditions to make quality improvements in PET.

Dr. Suresh Muthukrishnan (Earth and Environmental Science)
Geographical Information System (GIS) and its Applications

Briefly describe overall research program at your laboratory.

On the Earth Science side, the focus of my research has been on understanding the impacts of urbanization on hydrology, water quality, and stream geomorphology. On educational side, I have been working on infusing spatial thinking skills and GIS applications into K-16 curriculum. My research involves both field based data collection and analysis and lab based analysis of GIS data, satellite images, and census based data. We use GIS to model the impacts of urbanization on hydrology and water quality. My students have done research with GIS in completely different areas outside of Earth Sciences too – a complete set of example projects can be seen on the web at:

http://gis.furman.edu/ees201/xstudent-projects.html

Briefly describe specific project(s) for your research intern.

When working with local school teachers, I work with them individually to identify their strengths and needs so that an appropriate project to complement their background and interest can be developed. In essence, I will provide the training to introduce the teachers to spatial thinking and applications and methods involved in Geographical Information Systems (GIS). GIS involves computer based methods of mapping and analysis of any data that has location as one of the property. The first two weeks of this summer will be used to train the teachers the basic concepts of GIS, and how to use GIS software and different spatial analysis methods. The next two to three weeks will be spent developing and completing the identified research project. Finally, the last part of the summer will be used to develop an instructional manual for the completed research project, so that it can be used as a small module to be incorporated into the middle or high school curriculum. The teacher will then prepare a poster of all of these and present it.

Dr. Erin Hahn (Psychology - Cognitive Development)

Briefly describe overall research program at your laboratory.

I am interested in the developmental relationship between learning labels and actions for objects. Specifically, I use an Embodied Cognition framework to explain why children and adults demonstrate an advantage for associating objects with arbitrary actions. According to this theoretical perspective, the primary goal of the cognitive system is to promote action in the world. Other cognitive processes, such as language, have evolved to exploit the perceptual and motor underpinnings of the cognitive
architecture. As a result, words may trigger the automatic activation of sensorimotor states. Consider, for example, the word stapler. According to this model, when you hear the word stapler the action of banging would be heightened, as well as other perceptual information such as the weight, texture and hand shapes associated with staplers. A compelling body of evidence using a variety of techniques (e.g., brain imaging, behavioral, reaction times) supports the notion that language is grounded in action.

**Briefly describe specific project(s) for your research intern.**

We will be focusing our efforts of three projects this summer. (1) We will conduct a study with children and adults to compare learning trajectories for arbitrary actions and ones that are related to the structure and design of an object. (2) We will also compare tool use in the context of manufactured objects and naturally occurring objects such as bones, twigs, and stones. (3) We will continue a study designed to investigate scale errors—instances in which children attempt to interact with objects that are obviously mis-sized for the goal. The research intern will likely be involved in all three of these projects. Responsibilities will include reading background literature, design and construction of experimental materials, participant recruitment and scheduling, data coding and entry. The intern will also be required to complete an online tutorial on working with human participants.