The Center for Environmental Health Sciences (CEHS) sponsors a summer educational research experience for outstanding college undergraduates. The Summer Undergraduate Research Program (SURF, formerly known as STEER) is part of a national program to attract and train undergraduates to research careers in the environmental health sciences. Advisors for SURF are Drs. Andrö Hallon and Mark Pershouse. The program is funded though a grant obtained from the National Institute of Environmental Health Sciences (NIHES, R25S5502286) and a grant from the Society of Toxicology.

### Projects

#### Shelby Cole with Dr. Celine Beamer

**Evaluating Epigenetic Alterations by Nanoparticles Exposure**

Carbon nanotubes (CNT) are a class of engineered nano-materials (ENM) being developed and used for a wide variety of medical, engineering, and personal products and have many potential benefits. CNT have been shown to cause significant pathological changes, particularly in the airways, in animal models raising the concern that adverse human health effects will emerge with increasing use and exposure of these materials. Potential bioactivity including in vitro and in vivo toxicity and increased inflammation and pathology of CNT has been attributed to unique physical and chemical characteristics of CNT such as their length, diameter, contaminants and rigidity. However, a mechanistic predictive model based on physical and surface properties of ENM has not been established to aid in protecting human health. Given the increasingly widespread use of CNT and significant potential for exposures to these materials during their lifecycle, it is imperative that we gain a better understanding of the disease process associated with this material. Epigenetics is the study of heritable changes in gene expression that occur without directly altering the DNA sequence. Epigenetic regulation offers a plausible advantage of cell-specific DHA metabolism in mice after CNT exposure of different doses and length of exposure. This summer project will be to develop epigenetic biomarkers to detect for CNT exposure to determine the potential disease risk. In this summer project, a mouse model will be used to determine epigenetic changes and examine their relationship to increased inflammation and development of lung disease in response to various size and/or contaminants CNT exposure.

Shelby will develop expertise in the field of epigenetics. DNA preparation, assays for methylated 5mC'A, and capture sequencing, and capture of non-methylated. She is also a recipient of the Society of Toxicology funding this summer.

#### Maggie Honig with Dr. Mark Pershouse

**Evaluating the Role of the PTEN Tumor Suppressor Gene in Mesothelioma Tumorigenesis**

PTEN deficiency occurs in many types of human tumors including those of the prostate, breast, brain, and melanoma. The PTEN gene is mutated in over 50% of human mesothelioma tumors and inactivation of PTEN has been linked to tumor development. The project will evaluate the role of PTEN expression in the tumorigenic potential of mesothelial cells. The project will take advantage of cell lines in which PTEN expression has been down-regulated, mimicking the status of these tumors, several new publications have shown clear involvement of this gene and have provided new tools to explore this behavior. The project will use a novel set of drugs with low toxicity and exquisite specificity. The project will take advantage of cell lines in which PTEN expression has been down-regulated, mimicking the status of these tumors.

Maggie will develop expertise in cell culture, protein expression measurements, quantitative PCR, and apoptosis detection.

### Highlights

- A ten-week summer program with a $4,000 stipend.
- Presents extraordinary opportunities to learn from expert faculty and student mentors about the philosophy and practice of conducting current biomedical research.
- Students gain extensive hands-on research experience working in the Center’s state-of-the-art laboratories.
- Guest seminar lectures and presentations by graduate students, postdoctoral fellows, faculty and staff provide SURF students with personal experiences in biomedical research to round out the program.
- Students receive guidance for graduate applications.
- Students participate in research laboratories and a summer field trip.
- Students participate in a half-day symposium at the end of the program.
- Previous SURF students have had numerous opportunities to contribute to the generation of a number of manuscripts on which they were co-authors.
- Students from outside the Missoula area receive on-campus housing at no cost.
- Previous undergraduates have come from universities around the country – including Gorazda, Washington State University, University of Massachusetts of Lowell, Stanford University, Northern Arizona University, Notre Dame University and University of Texas – Austin.

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Laura Fisch will develop expertise in cell culture, protein expression measurements, quantitative PCR, and apoptosis detection.