Department of Molecular & Cellular Physiology
COLLEGE OF MEDICINE

SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN

APLICATION DEADLINE: March 3, 2008

The Department of Molecular & Cellular Physiology, College of Medicine, is pleased to offer the following research project for the summer of 2008. Interested students are urged to contact the faculty member(s) directing the project that most interests them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be and if possible, develop a timetable for the twelve-week research period.

QUANTITATIVE CELL AND TISSUE FUNCTION EVALUATED BY ADVANCED LIGHT MICROSCOPY AND LASER CAPTURE MICRODISSECTION

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Project Description

How do the cells lining the stomach survive in a caustic, acidic environment? We are asking how the epithelial cells lining the stomach repair a breach after microscopic damage to a handful of cells. Advanced light microscopy methods (confocal and two-photon microscopy) are used to study living gastrointestinal tissues from normal and mutant mice. Using anesthetized mice with their stomachs surgically prepared to expose the stomach epithelium, damage is restricted to 2-3 cells in the epithelial layer when it is experimentally induced by two-photon light absorption (photodamage). Repair of the epithelium is then followed in real time by imaging of various fluorescent molecules that report on cell viability, intracellular and extracellular pH, and cell location. After experiments, extensive image analysis is required to derive parameters of damage size, and other values from the collected images.

What are the biochemical features of cells that migrate into an area where an epithelial cell has departed? When cells are shed from the stomach or intestinal lining, they are replaced by neighboring cells in the layer. This process requires activation of specific subset of genes, and alterations in cell phenotype to allow both migration and effective defense against hostile elements in the gut lumen. When tissue is fixed (killed) and sectioned (sliced), select cells within individual sections can be captured using the method of laser capture microdissection. The mRNA or protein in collected cells can be analyzed using microarray or proteomics approaches to evaluate the biochemical phenotype of these repairing cells relative to other cells that are not trying to repair a lesion.