Department of Biological Sciences
MCMICKEN COLLEGE OF ARTS AND SCIENCES

SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN

APPLICATION DEADLINE: March 1, 2014

The Department of Biological Sciences is pleased to offer the following research project for the summer of 2014. 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.

PROJECT TITLE: Visual coding of spatial and temporal stimuli by the photoreceptor cells in fiddler crabs

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Project Description

An animal uses its eyes to acquire visual information from its environment. The quality of the perceived information is primarily determined by the spatial receptive fields and arrangement of the photoreceptors in the retina, and their responses to changes in the intensity, wavelength and polarization of light. Based on the habitat and the specific behaviors an animal has to perform, they have evolved with several unique retinal designs, sometimes taking forms that appear to be useful only in their specific visual habitat. These retinas emphasize extracting some types of information from the environment, but because of limited morphological and neural resources this emphasis comes at the cost of neglecting other forms of information (Land, 1981). This trade-off is hinted at by initial observations, but in many cases the actual neural advantage of such extreme adaptations is not clearly understood. The knowledge gained in this project will provide insights into how habitat-specific visual adaptation allows some behaviors because of the information gained, but at the same time constrains other behaviors because of the information lost.

The aim of this project is to estimate the spatial and temporal properties of the photoreceptors in one such unique retina found in a semi-terrestrial crab, *Uca pugilator*. The student will make electrophysiological recordings of individual photoreceptor cells. They will estimate the spatial resolution of individual photoreceptor cells by measuring responses to a flashing point source, and estimate the temporal resolution by measuring responses to pseudo-randomly fluctuating light. The student will learn all theory and technique required for measuring and analyzing neural activity in the retina.