

**Department of Biological Sciences  
MCMICKEN COLLEGE OF ARTS AND SCIENCES**

**SUMMER RESEARCH OPPORTUNITIES  
FOR UNDERGRADUATE WOMEN**

**APPLICATION DEADLINE: March 3, 2008**

*The Department of Biology 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.*

**MOLECULAR GENETICS AT GEOTHERMAL TEMPERATURES**

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**Project Description**

A group of unusual micro-organisms called hyperthermophilic archaea thrive in geothermal environments at temperatures that kill all well-studied organisms. These prokaryotes represent a source of extremely thermostable enzymes for biotechnology, and molecular clues regarding the early evolution of cellular life. The Grogan lab has developed genetic techniques for one of these species and is using them to investigate cellular function under extreme conditions (see [www.biology.uc.edu/faculty/grogan/grog.htm](http://www.biology.uc.edu/faculty/grogan/grog.htm)). A WISE participant would contribute to one or more projects that investigate various molecular-genetic processes in *Sulfolobus acidocaldarius*. Depending on the project, the experimental techniques would include DNA purification and analysis, PCR, genetic selections for mutants or recombinants, biochemical and genetic assays, cloning, and related techniques.

**Genetic Recombination**

Homologous recombination in *S. acidocaldarius* exhibits unusual properties that suggest an abundance of non-reciprocal events.

*Questions:*

- Does circular DNA recombine into the *S. acidocaldarius* chromosome?
- Is the process more efficient with a "gapped circle" than with an intact circle?

**Genetic Fidelity**

Replication of the *S. acidocaldarius* chromosome appears to be extremely accurate, but this has not been confirmed for a plasmid that replicates in this species.

*Questions:*

- What kind of mutations occur spontaneously in *Sulfolobus* plasmids?

How do these replication errors compare to those seen in chromosomal genes?

**Genetic Engineering**

Availability of the complete genome sequence of *Sulfolobus acidocaldarius* creates the opportunity to clone and disrupt specific genes, and thereby determine their biological functions. However, this process has been difficult using conventional recombinant DNA approaches, so new methods should be tested.