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"The Mendenhall Lab uses Genetic Engineering to Determine how our Geonome Regulates or Turns Genes On or Off in Certain Tissue or Cell Types"

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Project Summary – The Mendenhall lab uses genetic engineering to determine how our genome regulates, or turns genes on or off in certain tissues or cell types. We have developed tools using the Crispr/Cas9 system of genetic engineering to create single base substitutions in a few genetic loci in human cell lines. Specifically we are looking at the consequence of single base substitutions at distal regulatory elements called enhancers in a human leukemic cell line called K562. The next phase of the project will require computational skills to analyze and interpret the functional consequence of these single base substitutions on the function of the distal enhancer. Additional work in the lab is being done to extend this same method to additional cell lines that might be of interest to specific human diseases.

Student Duties – The RCEU student will be responsible for two aspects of this project.

1. They will learn to grow bacterial cultures and prep plasmid DNA containing Cas9 or guide RNAs for targeting human genomic loci. The student will be responsible for analyzing extracted plasmids by Sanger DNA sequencing and restriction enzyme digestion. These are standard molecular biology lab skills that they will be able to use in future research opportunities.

2. They will be trained in analysis and interpretation of Next-generation DNA sequencing data using computational programs such as Python, R, and Unix. The student will be given access to these programs through the Alabama Super Computing center, and/or through the Bioinformatics platform at HudsonAlpha Institute for Biotechnology. Bioinformatics is a difficult topic to teach in a classroom setting, especially for undergraduates who are just beginning to learn computer programming languages and genetics from very different courses.

This internship will provide the student with a unique opportunity to learn both “wet” and “dry” biology research. Specifically the exposure to bioinformatics through real application of testing and solving problems with biological datasets will benefit the student in future course work and research endeavors.

Students should have taken BY219 and CS102 or CS122. Additional 300+ level BY2 coursework is a plus. Students should be self-motivated to learn new computer programming languages and the basics of genomic data analysis. While the number of hours per week will not exceed 32-40, students must be flexible to frequently come in early or late in the day to properly tend to bacterial cell cultures.

Mentor Supervision and Interaction – The student will be supervised directly by Dr. Mendenhall, and will work collaboratively with computational biology researchers in the Mendenhall lab as well as collaborators at other institutions. The Mendenhall lab holds weekly lab meetings, and student will be expected to present once during the summer. Additional weekly meetings at HudsonAlpha with the Myers lab will provide students exposure to additional biological research and networking opportunities. Finally the student will have scheduled one on one meetings with Dr. Mendenhall to discuss data, progress and future analysis.