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## Creating Tools for Studying DNA Uptake in Bacteria

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**Project Title** - Creating tools for studying DNA uptake in bacteria

**Faculty** - Tatyana (Tanya) Sysoeva, Assistant Professor, Department of Biological Sciences, Shelby Center room 369M, University of Alabama in Huntsville, 256-824-6371, [tatyana.sysoeva@uah.edu](mailto:tatyana.sysoeva@uah.edu)

**Proposal Identifier** - RCEU19-BYS-TS-01

**Project Description** - Antibiotic resistance is an increasing global health threat that is aggravated by apparent stagnation in process of new antibiotics development. Horizontal gene transfer is a main contributor to the spread of antibiotic resistance genes amongst bacteria, and proceeds through conjugation, transduction or natural transformation. The natural transformation allows bacteria take up extracellular DNA. While several prominent human pathogens are known to be competent for DNA uptake, there is no knowledge of what human commensal bacteria are transformable, limiting our understanding of microbial communication in this microbial niche. On one hand, recent bioinformatic analyses show that the majority of bacteria contain genes homologous to those in known transformable organisms. On the other hand, only about a hundred species are shown to be competent for DNA uptake in laboratory settings. This created a huge controversy in estimates of the role of natural transformation as some predict a negligible, below 1% of bacteria, being transformable and the other argue that most of the bacterial species are capable of natural transformation under certain, yet unidentified conditions. There are no experimental tools to find out which microbe is indeed capable of DNA uptake and to measure DNA uptake in complex communities. In this summer project, we will work on developing novel tools to (1) measure DNA uptake and (2) identify transformable bacteria.

**Student Duties, Contributions, and Outcomes** - This project will require full time presence in the lab for 32-40 hours per week, for 10-12 weeks. During this time the student will learn basic microbiological and molecular biology procedures. In particular, this project will entail preparing solutions and plates; working with *Bacillus subtilis* bacterium; transformation assays; DNA manipulation protocols (PCR, qPCR, agarose gel electrophoresis, total and plasmid DNA extraction, molecular cloning); fluorescence microscopy. In addition to practical work, the

researcher will read the peer-reviewed scientific articles that is required for understanding and developing of the project at hand. The student will also learn how to document the experimental work and keep laboratory notebook with the detailed description of the performed experiments. The student will be encouraged to prepare a poster for consecutive presentation at a scientific conference. At the end, the student researcher will be required to write a report with suggestions for future development of the project and analyses of the obtained results that can be used in a future publication. This report will be presented at a lab meeting to share the results and experiences with the whole group.

**Faculty Requirements and Mentorship** - The student (from freshman to senior) should have completed some courses in Molecular Biology, Biochemistry or Microbiology at UAH or as an AP course. While a good academic standing is not a requirement, the applicant has to have a sincere interest in the topic of microbiology in general or antibiotic resistance.

Dr. Sysoeva will provide one-on-one meetings to introduce to the project, supervise literature review, discussions and analyses of the experimental results. In addition, weekly group meetings will be held to share the results and solve any ongoing issues. She will ensure close daily supervision and training in the laboratory setting for the hands-on work at the bench. Dr. Sysoeva will guide the student researcher in writing up the report of the obtained results and preparing for the final presentation.

**Prior Awardees** - Dr. Sysoeva is new to the University and the RCEU program.