

REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHB-21-05

DESIGN OF ROBUST BIOLOGICAL SENSORS FOR SIMULTANEOUS MONITORING OF WARFIGHTER BIOSIGNATURES

PROJECT DESCRIPTION: Modern warfare operations often occur in volatile, uncertain, complex and ambiguous environments accompanied by physical exertion, cognitive overload, sleep restriction and caloric deprivation. Under these circumstances, deployable tools for monitoring of Warfighter biomarkers related to stress, fatigue and cognitive overload would allow for assessment of Warfighter readiness and improvement of their performance in challenging environments. Varied stressors affect multiple interconnected cellular signaling pathways working in a concerted fashion, requiring monitoring of multiple biomarkers levels and their ratiometric signatures. The objective of this project is the development of a versatile pipeline for the design of robust and accurate biological circuits that can integrate any sensor type and be used to rapidly build novel sensors as new Warfighter biosignatures are discovered. Utilizing tools developed in the field of synthetic biology, E. coli cells and/or in vitro cell-free transcription-translation systems will be re-engineered to compute different outputs based on multiple biomarkers levels. Emphasis will be placed on integrating information on different analytes to provide ratiometric biomarkers analysis to monitor conditions that affect Warfighter performance.

ACADEMIC LEVEL: Bachelors, Masters, PhD

DISCIPLINE NEEDED:

- Engineering
 - Bioengineering and Biomedical Engineering
 - Chemical Engineering
- Life Health and Medical Sciences
 - Biochemistry
 - Biology (General)

RESEARCH LOCATION: Wright-Patterson AFB Dayton, OH

RESEARCH ADVISER: Svetlana Harbaugh, PhD
Biochemistry, Moscow State Lomonosov University

Dr. Svetlana Harbaugh is a Research Scientist at the Air Force Research Laboratory. Her research is focused on development of new regulatory RNAs, riboswitches that can respond to analytes relevant to DoD's interests and can be used as sensing elements in cell-free and cell-based biosensors. Dr. Harbaugh obtained her Master's degree in Chemistry and PhD in Biochemistry at the Moscow State Lomonosov University, Russia.