REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHB-27-02

Molecular Tools for Biosensing Laboratory

PROJECT DESCRIPTION: The group's research focuses on engineering molecular tools to create systems that sense Airmen's and Guardians' (A/G) biosignatures, which we define as the combination of biomarkers related to a specific condition, such as stress or cognitive function, and provide information to assess and improve A/G mental and physical performance. Interns joining the group can participate in the in silico/in vitro selection of biorecognition elements (BREs) responsive to biomarkers of interest; the integration of BREs into different sensing platforms, including nanomaterial-based, electrochemical, and biological platforms; the selection and design of regulatory elements (REs) to control gene expression in different organisms in response to specific biomarkers; the integration of REs into biological circuits to engineer bacteria and their cell-free transcription/translation systems and create sensing platforms with complex data-analysis and decision-making capabilities (sense/assess/respond); and the development of matrices to deploy biological sensors in-body and on-body. Student interns will perform experiments in wet laboratories or use computational tools to aid sensor design.

LEARNING OBJECTIVES: Under the guidance of a mentor, you will gain hands-on experience to complement your education and support your academic and professional goals. Along the way, you will engage in activities and research in several areas. These include, but are not limited to:

1. Participate in research with a multidisciplinary team combining chemistry and biology to design biomarker-sensing platforms.
2. Test sensor performance under different conditions to assess potential use in operational environments.

ACADEMIC LEVEL: Undergraduate; Master's; Doctoral
DISCIPLINES NEEDED: Biochemistry, Chemistry, Materials Science
RESEARCH LOCATION: Wright-Patterson Air Force Base, Dayton, Ohio
RESEARCH MENTOR: Jorge Chavez, PhD
Chemistry (Nanotechnology), University of Florida, 2008



Dr. Jorge Chávez obtained a B.Sc. in Chemistry from the Pontifícia Universidad Católica del Perú, where he performed research in polymer chemistry, and a Ph.D. in Chemistry from the University of Florida, working on the synthesis and characterization of nanomaterials. He continued his career as an ORISE postdoctoral researcher at the Air Force Research Laboratory. Dr. Chávez is currently a principal investigator in the Human Effectiveness Directorate, 711th Human Performance Wing (711 HPW), Air Force Research Laboratory. Dr. Chávez's research focuses on developing sensing capabilities to monitor stressors that affect Airmen's and Guardians' performance. He is also the technical lead for RHB's Health and Performance Sensing and Assessment Core Research Area in the 711 HPW. His mentoring efforts have been recognized with the 2017 Airman Systems Directorate Daniel Repperger Mentor of the Year Award and the 2017 President's Volunteer Service Award (Gold) for a special commitment to service in education. Dr. Chávez's technical work has been recognized with multiple 711 HPW Top 10 Publication Awards (2019, 2020), and he was selected as a 2021 Department of Defense Laboratory University Collaboration Initiative (LUCI) Fellow.

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