REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHB-26-02

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's) biosignatures, which we define as the combination of biomarkers related to a specific condition like stress or cognitive function, and provide information to assess and improve A/G's mental and physical performance. The five main technical research areas that interns joining the group can participate on are: 1) In silico/in vitro selection of biorecognition elements (BREs) responsive to biomarkers of interest, 2) Integration of BREs in different sensing platforms including nano-, electrochemical- and biological, 3) Selection and design of regulatory elements (REs) to control gene expression in different organisms in response to specific biomarkers, 4) Integration of REs in biological circuits to engineer bacteria and their cell-free transcription/translation systems to design sensing platforms with complex data analysis/decision-making capabilities (sense/assess/respond), 5) Development of matrices to deploy biological sensors in- and on-the body. Student interns will participate in experiments in the "wet" labs or using computational tools to aid sensor design.

LEARNING OBJECTIVES: 1) Participate in research in a multidisciplinary team combining chemistry and biology to design biomarker sensing platforms. 2) Gain skills in testing sensor performance in different conditions to assess potential use in operational environments.

ACADEMIC LEVEL: Masters; Undergraduate; 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 in 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. Jorge'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 Volunteers Service Award (Gold) with special service commitment to Education. Dr. Chávez's technical work has been recognized with multiple 711 HPW Top 10 Publications Awards (2019, 2020) and he was selected as a DOD 2021 Laboratory University Collaboration Initiative (LUCI) Fellow. *Photo courtesy of the U.S. Air Force Research Laboratory.*