

REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHB-25-13

Electronic/Electrochemical/Optical Sensor for Molecular Biomarkers

PROJECT DESCRIPTION: Molecular biomarkers indicative of human physiological and psychological status vary both person-to-person and by the measurements' point in time. Developing personal chemical and biochemical sensors that enable the profiling/reporting biomarker data throughout an 8-24 hour time frame for individual operators will greatly benefit USAF/USSF personnel health and performance. Zero footprint, noiseless, and low-powered sensing platforms without the need for calibration and drift correction are highly desirable in development of a wearable or attachable personal sensor suite. Miniaturizing device size and increasing sensitivity and selectivity of chemical/biochemical/optical sensors are key elements in building such sensor suites.

LEARNING OBJECTIVE: In this research, the structural interactions and functionalities of nano device platforms and biomolecule hybrids will be systematically probed by using both experiments and computational modeling. The hybrid system will be further explored for its capability as a sensor for the target of interest. The sample collection, delivery, signal processing, and device-to-device communication for the miniaturized sensors and devices will be explored collaboratively with both internal and external partners.

ACADEMIC LEVEL: Masters; Doctoral

DISCIPLINE NEEDED:

- Biomedical Engineering
- Electrical Engineering
- Chemistry

RESEARCH LOCATION: Wright-Patterson Air Force Base, Dayton, Ohio

RESEARCH MENTOR: Steve Kim, PhD

Polymer Science, University of Connecticut, 2007



Dr. Kim is currently serving as a Physical Scientist within the Air and Space Biosciences Division. After completing National Research Council Postdoctoral Fellow (2007-2010), Dr. Kim continued to work as a contract research scientist at AFRL (2010-2016). Dr. Kim's research interest is developing electronic / electrochemical / optical molecular biomarker and chemical sensors for human performance monitoring and force health protection. He leads research on developing an electronic biosensor platform for trace level cognitive molecular biomarkers, a crucial piece of information to increase the human performance monitoring / assessment capability for the United States Air Force (USAF). His pioneering nano material study and analytical strategy have unveiled the governing factors in the Nano-Bio interface. Dr. Kim has authored and coauthored 73 peer-reviewed scientific journal articles including his main-authored AFRL works that were recognized as a "Top 20 most read article on the web in a year" and a "Top 20 most read article on the web in a month" in a high impact journal, Nano Letters.

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