REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHB-27-17

Electronic/Electrochemical/Optical Sensor for Molecular Biomarkers

PROJECT DESCRIPTION: Molecular biomarkers indicative of human physiological and psychological status vary from person to person and across different points in time. Developing personal chemical and biochemical sensors that enable the profiling and reporting of biomarker data over an 8–24-hour period for individual operators will greatly benefit USAF/USSF personnel health and performance. Zero-footprint, noiseless, and low-powered sensing platforms that do not require calibration or drift correction are highly desirable in the development of wearable or attachable personal sensor suites. Miniaturizing device size and increasing the sensitivity and selectivity of chemical, biochemical, and optical sensors are key elements in building such sensor suites.

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, including but not limited to:

1. Investigate the structural interactions and functionalities of nanodevice platforms and biomolecule hybrids through experiments and computational modeling.
2. Explore the hybrid system's capabilities as a sensor for the targets of interest.
3. Explore sample collection, delivery, signal processing, and device-to-device communication for miniaturized sensors and devices in collaboration with internal and external partners.

ACADEMIC LEVEL: Undergraduate**,** Master's; Doctoral
DISCIPLINES NEEDED: Biomedical Engineering, Electrical Engineering, Chemistry
RESEARCH LOCATION: Wright-Patterson Air Force Base, Dayton, Ohio
RESEARCH MENTOR: Steve Kim, PhD
Materials Science, University of Connecticut, 2007



Dr. Kim is currently serving as a Physical Scientist within the Air and Space Biosciences Division. After completing a National Research Council Postdoctoral Fellowship (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 nanomaterial 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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