

REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHD-21-07

MODELING NEURAL ACTION POTENTIAL RESPONSE TO IR SIMULATION

PROJECT DESCRIPTION: The Warfighter Effectiveness Research Center is the research arm of the Department of Behavioral Sciences and Leadership at the United States Air Force Academy, facilitating faculty and cadet research that enhance warfighter effectiveness. The WERC conducts a wide range of research and design projects for operational customers including special operations forces, the Air Force Office of Scientific Research, Air Force Research Laboratory, and Army Research Laboratory. These projects are based in the behavioral sciences and connect to a wide range of disciplines and collaborators across government labs, academia, industry, and military operators in order to generate the most innovative and effective solutions.

Infrared exposure can functionally impact the electrochemical activity of neuronal networks resulting in stimulation or inhibition of action potential. The fundamental mechanics of the neuron's response are not fully understood and effect optimization is an active area of research. Experimental approaches to study these effects have limitations due to the complex nature of the interaction and difficulty in making direct and repeatable measurements. Modeling can be a useful tool for hypothesis testing, so previous efforts worked to combine laser-tissue thermal modeling with temperature dependent neuronal action potential modeling to create an end-to-end analysis tool. This project will investigate refining that model using experimental data and evaluating the model's parameter sensitivity and predictive uncertainty.

ACADEMIC LEVEL: Bachelors, Masters, PhD

DISCIPLINE NEEDED:

- Engineering
 - Bioengineering and Biomedical Engineering

PREFERRED QUALIFICATIONS:

- Self-motivated individual with an interest in computational modeling.
- Experience with Linux, high performance computing, and modeling experience with NEURON desirable.

RESEARCH LOCATION: JBSA, Fort Sam Houston, San Antonio, TX

RESEARCH ADVISER: Chad Oian, MS

Mechanical Engineering, University of Texas at San Antonio, 2018

Chad Oian has an MS in mechanical engineering focusing on continuum mechanics modeling of laser-tissue interaction. He has worked as a computational analyst for 7 years with The Air Force Research Laboratory (711th HPW/RHDO) on the directed energy bioeffects modeling and simulation team. He worked first as an in-house contractor then transitioned to civil service through the PAQ (Palace Acquire) program. His research has included modeling thermal response in skin, cornea, and retinal to laser exposures in the visible and IR bands. He serves on national and international laser safety standard technical committees overseeing policy related to the safe use of lasers. As the manager for the novel

DE bioeffects modeling and simulation work unit, he oversees novel M&S development, contracting, and computational resources at the DE Bioeffects Division of the Air Force Research Laboratory.