UCLA Engineering
HENRY SAMUELI SCHOOL OF
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BIOENGINEERING

PRESENTS

Research driven tool design: Building the next generation of miniature fluorescence microscopes

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2101 ENGINEERING V

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ABSTRACT:

One of the biggest challenges in neuroscience is to understand how neural circuits in the brain process, encode, store, and retrieve information. Meeting this challenge requires tools capable of recording and manipulating the activity of intact neural networks in freely behaving animals. Head-mounted miniature fluorescence microscopes are among the most promising of these tools. Taking advantage of the past decade's advancements in fluorescent neural activity reporters, these microscopes use wide-field single photon excitation to image activity across large populations of neurons in freely behaving animals. They are capable of imaging the same neural population across months and in a wide range of animal models and different brain regions.

Initiated five years ago, the Miniscope Project -- an open-source collaborative effort—was created to accelerate innovation of miniature microscope technology and to increase global access to this technology. Currently, we are working on advancements ranging from optogenetic stimulation and wire-free operation to simultaneous optical and electrophysiological recording. Using these systems, we have uncovered mechanisms underlying temporal memory linking and investigated causes of cognitive deficits in temporal lobe epilepsy. Through innovation and optimization, this work aims to extend the reach of neuroscience research and create new avenues of scientific inquiry.

BIOGRAPHY:

Dr. Daniel Aharoni has a background in equipment design, test and measurement systems, data analysis, and experimental neuroscience. He received his PhD in Physics in 2013 from the University of California, Los Angeles where he led the development of a novel multimodal virtual reality system for rodents. During his graduate career he also designed, built, and operated high-speed imaging systems for applications in neuroscience and particle physics. As a Post-Doctoral Fellow at UCLA, Dr. Aharoni developed an open-source platform for imaging large-scale neural activity in awake, freely behaving animals. This imaging system is currently being used by 400+ research laboratories and is openly shared through miniscope.org.

Dr. Aharoni's work focuses on bridging the gap between specialized tool design and the intricacies of modern neuroscience. By applying design methodologies from engineering and physics, the Aharoni Laboratory develops specialized neuroscience research devices to address open questions in the field. This group leads the development of the UCLA Miniscope Project and builds other tools with an emphasis on i) neural recording techniques for freely behaving animals and ii) open-source dissemination of new technology.