

# Connor McCullough

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## EDUCATION

### PhD in Bioengineering

August 2016 – December 2022

University of Colorado Anschutz Medical Campus, Aurora CO, USA

*Outstanding Graduate Student, Department of Bioengineering*

*Outstanding Graduate Student, College of Engineering, Design and Computing*

### Bachelor of Science in Physics

August 2011 – August 2015

University of Florida, Gainesville FL, USA

## CURRENT RESEARCH

Development of miniaturized fiber coupled microscopes and neural implants for recording and modulating neural activity in vivo using multielectrode arrays, two-photon imaging, and holographically patterned optogenetic stimulation

## WORK EXPERIENCE

### Postdoctoral Fellow

January 2023 - Current

**U. of Colorado Anschutz Medical Campus, Dept. of Bioengineering**, Aurora CO, USA

- One of three lead engineers on a multi-group collaborative project leading to design, fabrication, characterization, and demonstration of a first of its kind miniature fiber coupled microscope providing microelectromechanical systems (MEMS) mirror scanner based two-photon calcium imaging and spatial light modulator (SLM) generated holographic optogenetic stimulation in freely moving mice, affordably constructed from off the shelf optics

- Lead engineer on a collaborative project with an electrical engineering group developing a neural implant that combines transparent multielectrode arrays and gradient index lenses for simultaneous electrophysiology and two-photon imaging/optogenetics in overlapping neuronal populations

### Graduate Student Researcher

August 2016 – December 2022

**U. of Colorado Anschutz Medical Campus, Dept. of Bioengineering**, Aurora CO, USA

- Collaborated with neuroscientists, optical engineers, and machinists to develop a neural implant which combined gradient index (GRIN) lenses and tetrodes for two-photon calcium imaging and electrophysiology in overlapping neuronal populations, capable of recording from freely moving mice by optically coupling through a coherent imaging fiber bundle

- Wrote MATLAB finite element analysis code & GUI for simulation of electrowetting lenses for adaptive optics applications

## TECHNICAL SKILLS

**Biomedical Research:** Animal studies, in vivo recording, medical device design, experimental protocol development, data organization & analysis, technical writing, scientific communication, tissue histology, statistics

**Optics:** Optical alignment, characterization, and optimization, optomechanics, adaptive optics, fiber optics, ultrafast pulsed lasers, multiphoton microscopy, nonlinear optics, 2D and 3D imaging

**Software/Programming:** Zemax, SolidWorks, Python, MATLAB, LabVIEW, C++, Git, Arduino for hardware control, National Instruments acquisition systems, Microsoft Office Suite

**Data Analysis:** MATLAB/Python analysis (cross-correlation, generalized linear models, etc.) and plotting, high-quality figure/video generation in Adobe Illustrator/InkScape/Adobe Premiere

**Prototyping:** CAD design, 3D printing, machining, laser cutting

## SELECTED COURSES

Clinical Experiences for Bioengineers, Introduction to Laboratory Animal Research, Research Methods for Bioengineers, Optics and Microscopy for Biomedical Research, Advanced MATLAB, Analytic/Numerical Methods for Engineering Analysis, First Order Optical Design, Optical Efficiency and Resolution, Design of High-Performance Optical Systems

## SELECTED PUBLICATIONS

• **McCullough CM**, Ramirez-Gordillo D, Hall M, Futia GL, Moran AK, Gibson EA, Restrepo D. GRINtrode: a neural implant for simultaneous two-photon imaging and extracellular electrophysiology in freely moving animals.

Neurophotonics. October 2022. doi: 10.1117/1.NPh.9.4.045009

• Ozbay BN, Futia GL, Ma M, **McCullough CM**, Young MD, Restrepo D, Gibson EA. Miniature Multiphoton Microscopes for Recording Neural Activity in Freely Moving Animals. All-Optical Methods to Study Neuronal Function. February 2023. doi: 10.1007/978-1-0716-2764-8\_7

• Zohrabi M, Cormack RH, **McCullough CM**, Supekar OD, Gibson EA, Bright VM, Gopinath JT. Numerical analysis of wavefront aberration correction using multielectrode electrowetting-based devices. Optics Express. December 2017. doi: 10.1364/OE.25.031451

## PATENTS

• Methods and systems for imaging with aberration correction, U.S. Patent No. 11933973. 19 Mar. 2024.