Brandon M. Ruszala, Ph.D.

www.linkedin.com/in/brandonruszala
bruszala@caltech.edu
(716) 697-5475
Pasadena, CA 91101

CURRENT POSITION

Postdoctoral Research Scientist studying Brain-Machine Interfacing in Human Participants   2024 – Present
California Institute of Technology (Caltech), Dept. of Biology and Biological Engineering
Principal Investigator: Dr. Richard Andersen

- Scientific goals include increasing sophistication of feedback that can be delivered to the brain with electrical stimulation and characterizing functional connectivity of fronto-parietal cortical networks for improving control of brain-machine interfaces.
- First to discover multiple cortical regions in which stimulation can be appreciated.
- Quantified neural modulation time-locked to stimulation pulses and modeled time-varying properties of the modulation.
- Developed signal processing pipeline that improved extraction of neuron spikes from neural recordings by 6x on average.
- Human clinical trial responsibilities: maintenance of stimulation safety protocols, experimental design, mentoring students.

EDUCATION

University of Rochester (U of R), Hajim School of Engineering and Applied Sciences (Rochester, NY)   2019 –2024
Master of Science (Jan 2021) | Doctor of Philosophy (May 2024) in Biomedical Engineering
Principal Investigator: Dr. Marc H. Schieber
GPA of 3.97/4.0

SUNY University at Buffalo (UB), School of Engineering and Applied Sciences (Buffalo, NY)   2015 –2019
Bachelor of Biomedical Engineering,
GPA: 3.96/4.0, Honors College and Tau Beta Pi Engineering Honors Society

University of Technology of Troyes (Troyes, France)   2016
Engineering Study Abroad Program
GPA: 3.85/4.0

PREVIOUS RESEARCH and ENGINEERING PROJECTS

Interfacing with the Cortical Reach-to-Grasp Network using Low-Amplitude Intracortical Microstimulation   2020 – 2024
University of Rochester, Dept. of Biomedical Engineering

- Implanted several rhesus monkeys with up to 512 neural electrodes in 8 different cortical areas per subject.
- Discovered novel cortical regions where intracortical microstimulation can, or cannot, be used to deliver information.
- Revealed that low-amplitude stimulation in one cortical region powerfully modulates neurons in distant cortical regions.
- Leveraged probabilistic modeling and machine learning to characterize the effects of cortical stimulation on single neurons.
- Awarded the National Institutes of Health Ruth L. Kirschstein Predoctoral Fellowship (F31, 17th percentile).

Rotations in Labs of 1. Dr. Ross Maddox, 2. Dr. Marc H. Schieber, and 3. Dr. Tatiana Pasternak   2019 – 2020
University of Rochester, Dept. of Biomedical Engineering

1. Programmed a deep neural net using Tensorflow (Python) that predicted EEG responses from EEG audio-speech waveforms.
2. Trained to record and analyze neural activity from cortical motor areas in rhesus monkey in search of "mirror neurons".
3. Identified neural processing in the middle temporal area may be critical in committing moving-dot stimuli to memory.

Building a Pipeline to Model Electric Field Distribution during Non-invasive Cerebellar Stimulation   2019
University at Buffalo, Dept. of Biomedical Engineering

- Integrated existing toolboxes and other software in MATLAB to simulate cerebellar transcranial direct current stimulation.
- Simulated electric fields produced by various stimulation montages, showing each targeted unique cerebellar lobules.
- Presented podium talk and poster at International Conference on Rehabilitation Robotics (ICORR) in Toronto, CA.

UB | Developing In-Vivo Hydrogen Peroxide (HP) Microelectrode Senior Capstone Project   2018 – 2019
University at Buffalo, Dept. of Biomedical Engineering

- Converted a microelectrode used for in-vitro detection of hydrogen peroxide to a biocompatible form, preserving sensitivity.
- Accurately measured known concentrations of peroxide

UB | Generating Hydrogen Peroxide (HP) on Orthopedic Implant Biomaterials to Combat Biofilm Growth   2017 – 2019
University at Buffalo, Dept. of Biomedical Engineering

- Improved sensitivity of microelectrodes capable of detecting hydrogen peroxide (HP) by 10x, from 10 μM to 1 μM changes.
- Developed a new fabrication procedure to substantially increase robustness and durability of the fragile microelectrodes.
- Characterized redox chemistry of common orthopedic-implant alloys to identify stimulation parameters that will produce HP.

UB | Analyzing EEG-NIRS Data for Developing an Autoregressive Transfer Function Model   2017 – 2018
University at Buffalo, Dept. of Biomedical Engineering

- Analyzed auto- and cross-correlations of joint EEG/NIRS imaging to troubleshoot the autoregressive model (in MATLAB).
- Identified persistent noise in NIRS dataset hindering model performance.

PUBLICATIONS

1. **B.M. Ruszala** and M.H. Schieber, *Injecting information in the cortical reach-to-grasp network is effective in ventral but not dorsal nodes,* Cell Reports (2025).
2. **B.M. Ruszala,** K.A. Mazurek, and M.H. Schieber, *Disentangling indirect versus direct effects of somatosensory cortex microstimulation on neurons in primary motor and ventral premotor cortex.* J. Neural Engineering (2025).
3. **B.M. Ruszala,** K.A. Mazurek, and M.H. Schieber, *Somatosensory cortex microstimulation modulates primary motor and ventral premotor cortex neurons with extensive spatial convergence and divergence.* bioRxiv (2023).
4. **B.M. Ruszala** and M.H. Schieber, *The effects of low-amplitude intracortical microstimulation in one cortical area don't stay in that cortical area.* (In Prep).
5. Clark, C.M., **B.M. Ruszala**, et al., *Electrochemical generation of hydrogen peroxide during cathodic polarization of metallic orthopedic biomaterials,* Journal of Applied Electrochemistry (2023) **53**(6): 1147-1156.
6. Clark, C.M., **B.M. Ruszala**, and M.T. Ehrensberger, *Development of durable microelectrodes for the detection of hydrogen peroxide and pH.* Medical Devices & Sensors (2020). **3**(5): p. e10074.
7. Rezaee, Z., **B. Ruszala,** and A. Dutta, *A computational pipeline to find lobule-specific electric field distribution during non-invasive cerebellar stimulation*, Abstract: p. 1191-1196, IEEE Conference on Rehabilitation Robotics (2019), Toronto, ON, Canada.

TECHNICAL SKILLS

Expert in GitHub, MATLAB, Plexon Offline Sorter, Ripple NeuroExplorer, Microsoft Office Suite, and Adobe Illustrator.
Skilled in Python with working knowledge of TensorFlow, LINUX, AutoCAD Modeling.

LEADERSHIP and OUTREACH

Fellowship Writing Club Mentor (University of Rochester)
- Mentored 20 graduate students preparing to submit applications for the NIH F31 Predoctoral Fellowship.

Research Mentor, New York State Academic Science and Technology Entry Program (Strong Memorial Hospital)
- Mentored underrepresented high school students on formulating and answering STEM research questions

Teaching Assistant for Intro to Neuroengineering Course and Biosystems and Circuits Course (University of Rochester)
- Taught course materials in office hours, graded assignments, and assisted with managing course schedule and labs

HONORS and AWARDS

2022 – 2024 | NIH F31 Ruth L. Kirschstein Predoctoral Fellow
2022 | Winner of Math and Engineering Graduate Research Symposium at U of R
2019 | Tau Beta Pi Honors Society Scholarship, Melvin H. Baker Scholarship, NYS STEM Scholarship
2018 | Melvin H. Baker Scholarship, Tallman Scholarship Fund, Grace W. Capen Academic Award, NYS STEM Scholarship
2017 | Jack and Barbara Davis Scholarship, NYS STEM Scholarship
2016 | UB Provost Scholarship, NYS STEM Scholarship, James E. Casey Scholarship, UFCW Local District Union Scholarship