Brandon M. Ruszala

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EDUCATION

University of Rochester: Hajim School of Engineering and Applied Sciences (Rochester, NY) August 2019 – Present
Master of Science (2021) | Doctorate of Philosophy (Expected May 2024) in Biomedical Engineering
GPA: 3.97/4.0

SUNY University at Buffalo: School of Engineering and Applied Sciences (Buffalo, NY) August 2015 – May 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) May – June 2016
GPA: 3.85/4.0

RESEARCH and ENGINEERING PROJECTS

Interfacing with the Cortical Reach-to-Grasp Network using Low-Amplitude Intracortical Microstimulation May 2020 – Present

- 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 can powerfully modulate neurons in distant cortical regions.
- Identified neural processing in motor and premotor cortex independent of the underlying movement kinematics.
- Awarded the National Institutes of Health Ruth L. Kirschstein Predoctoral Fellowship (F31, 17th percentile).

Rotations through Neuroscience Labs at U of R October 2019 – April 2020

1) Programmed a deep neural net in python capable of predicting 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 January 2019 – August 2019

- 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.

Developing In-Vivo Hydrogen Peroxide (HP) Microelectrode Senior Capstone Project September 2018 – May 2019

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

Generating Hydrogen Peroxide (HP) on Orthopedic Implant Biomaterials to Combat Biofilm Growth June 2017 – August 2019

- 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.

Analyzing EEG-NIRS Data for Developing an Autoregressive Transfer Function Model December 2017 – June 2018

- 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 and PRESENTATIONS

1. **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). DOI: https://doi.org/10.1101/2023.08.05.552025. [In Review]
2. **B.M. Ruszala,** K.A. Mazurek, and M.H. Schieber, *Instruction modality modulates neurons in cortical motor areas* [Manuscript in Progress, Expected Submisison 12/2023].
3. **B.M. Ruszala** and M.H. Schieber, *Delivering information throughout the reach-to-grasp cortical network with low-amplitude intracortical microstimulation* [Manuscript in Progress, Expected Submisison 02/2023].
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.* [Manuscript in Progress, Expected Submisison 03/2023].
5. **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* [Conference Poster]. Society for Neuroscience (2023), Washington., DC, United States.

6. **B.M. Ruszala,** K.A. Mazurek, and M.H. Schieber, *Instruction modality modulates neurons in cortical motor areas* [Conference Poster]. Society for Neuroscience (2023), Washington., DC, United States.

7. **B.M. Ruszala,** and M.H. Schieber, *Injecting arbitrary instructions into anterior intraparietal area with low-amplitude intracortical microstimulation* [Conference Poster]. Society for Neural Control of Movement (2023), Victoria, BC, Canada.

8. **B.M. Ruszala,** K.A. Mazurek, and M.H. Schieber, *Effects of intracortical microstimulation on neural activity in distant cortical regions* [Conference Poster]. Society for Neuroscience (2022), San Diego, CA, United States.

9. 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.

10. 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.

11. 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.

12. **B.M. Ruszala,** Clark, C.M., and M.T Ehrensberger, *Production of Hydrogen Peroxide on Orthopedic Implant Biomaterials for Controlling Biofilm Growth* [Conference Poster]. Biomedical Engineering Society (2018), Atlanta, GA, United States.

TECHNICAL SKILLS

Expert in MATLAB, Plexon, Ripple NeuroExplorer, Microsoft Office. Skilled in Python, Adobe Illustrator, AutoCAD Modeling, GAMRY E-Chem Analyst.

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)
- Reviewed course materials in office hours, graded assignments, and assisted with managing course schedule and labs

Biomedical Engineering Society (BMES) Secretary (University at Buffalo)
- Assisted with planning/running club events, present at club meetings, and volunteer work.

Educational Outreach, Boys' and Girls' Club of Buffalo (Buffalo, NY)
- Instructed basic science experiments and helped the children learn/explore basic scientific concepts.

WORK EXPERIENCE

University at Buffalo, Office of Admissions in Engineering December 2017 – August 2019
- Led engineering tours and served on panels as a student representative for Biomedical Engineering at Open Houses.
- Coordinates schedule of academic advisors and assisted students with registration and course schedule concerns.

HONORS and AWARDS

2022 | NIH F31 Ruth L. Kirschstein Predoctoral Fellow, 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