Neuroscientist

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1 Education

University of Oregon   2019-

- Human Physiology graduate student using computational neuroscience to investigate motor circuitry focusing on research with patients who have movement disorders: advisor **Nicki Swann PhD**

University of Washington   2013-2017

- Bachelor of Science in Neurobiology and Applied and Computational Math Sciences, Biological and Life Sciences

2 Research

Clinical Research Coordinator   June 2017 - August 2019
Principal Investigators: **Alik Widge MD, PhD**, **Darin Dougherty MD**
Harvard/Massachusetts General Hospital
Division of Neurotherapeutics, Department of Psychiatry

- Researched the role of high-level neurocircuitry in psychiatric disorders using MEG, EEG, fMRI and LFP data from deep brain stimulator recordings

- Planned and directed DBS implantation surgery and performed lead optimizations

- Recorded and analyzed longitudinal data and its correlation with patient outcomes

- Studied consciousness using DBS and cingulotomy patients with state-of-the-art compression analysis based on the Integrated Information Theory of Consciousness

- Independently motivated research: an application of Integrated Information Theory to a learning task with greater task engagement during acquisition phase correlated with greater brain complexity

- Worked as a developer on the Multi-modality Visualization Tool to simultaneously image MEG, EEG, fMRI and DBS data interactively

- Organized Art in mARTinos, an biomedical imaging-themed art event

Full time position: 40 hours/week

Researcher   June 2015 - June 2017
Principal Investigators: **Wyeth Bair PhD**, **Anitha Pasupathy PhD**
University of Washington Department of Biological Structure

- Researched the role of an intermediate structure, V4, in the ventral, "object recognition" stream
- Developed complex, three dimensional, rendered stimuli to show to awake, fixating rhesus macaque monkeys and assisted in cell selection and data collection
- Developed computational models and using statistical analysis to characterize data
- Completed neurobiology honors thesis and several posters

Part time: 15 hours/week during the year, full time: 40 hours/week during the summer

Receptionist and Veterinary Assistant   Sept 2015 - Oct 2016, Jan 2017-Mar 2017
Northeast Veterinary Hospital, Ballard Animal Hospital

- Managing patient files and scheduling and coordinating appointments
- Charging clients for procedures and medications
- Cleaning kennels, feeding and walking animals and performing hospital supply and cleaning tasks

Part time position: 20 hours/week

Researcher   June 2014 - Jan 2015
Principal Investigator: **Larry Zweifel PhD**
University of Washington Department of Neuropharmacology

- Measured motor and behavioral task performance of cerebellar serotonin receptor knockout mice
- Observed stereotactic surgery and brain slicing
- Performed PCR genotyping

Part-time credit position 15 hours/week

3 Publications

Markus A, **Rockhill AP**, Brunner P, Hermes D. Dynamic Visualization of Gyral and Sulcal Stereoelectroencephalographic contacts in Humans. IEEE. *Under Review*.

Rockhill AP, Alessandra Mantovani A, Stedelin B, Raslan AM, Swann NC. Stereo-EEG Recordings Extend Known Distributions of Canonical Movement-Related Oscillations. J. Neural Eng. 20 016007 https://doi.org/10.1088/1741-2552/acae0a.

   Abstract

Previous research has characterized canonical oscillatory patterns associated with movement in electrophysiological recordings mostly from recordings of primary sensorimotor cortex. Less work has attempted to decode movement based on electrophysiology recordings from a broader array of brain areas such as those sampled by stereoelectroencephalography (sEEG). Here we decoded movement using a linear support vector machine (SVM). We were able to accurately classify stereoelectroencephalography (sEEG) spectrograms during a keypress movement in a task from those during the inter-trial interval. Furthermore, the time-frequency patterns important in this classification recapitulated previous findings that used non-invasive electroencephalography (EEG) and electrocorticography (ECoG) and identified brain regions which were previously unknown to be related to movement. Specifically, we found these previously described patterns: beta (13 - 30 Hz) desynchronization, beta rebound, pre-movement alpha (8 - 15 Hz) modulation, a post-movement broadband gamma (60 - 90 Hz) increase and an event-related potential (ERP). These oscillatory patterns were newly observed in a wide range of brain areas that were accessible with sEEG that are not with other electrophysiology recording methods. For example, the presence of beta desynchronization in the frontal lobe was more prevalent than previously described, extending outside primary and secondary motor cortices. Additionally, we quantified the relative classification potential of these oscillatory patterns. This could aid movement detection in applications such as brain-computer interfaces (BCIs).

Rockhill AP, Larson E, Stedelin B, Mantovani A, Raslan AM, Gramfort A, Swann NC (2022). Intracranial Electrode Location and Analysis in MNE-Python. Journal of Open Source Software, 7(70), 3897, https://doi.org/10.21105/joss.03897.

Rockhill AP, Raslan AM, Swann NC (2020). pd-parser: A tool for Matching Photodiode Deflection Events to Time-Stamped Events. Journal of Open Source Software, 5(54), 2674, https://doi.org/10.21105/joss.02674.

Olsen ST, Basu I, Bilge MT, Kanabar A, Boggess M, **Rockhill AP**, Gosai AK, Hahn E, Peled N, Ennis M, Shiff I, Fairbank-Haynes K, Salvi JD, Cusin C, Deckersbach T, Williams Z, Baker J, Dougherty DD, Widge AS (2020). Case report of dual-site neurostimulation and chronic recording of cortico-striatal circuitry in a patient with treatment refractory obsessive compulsive disorder. Front. Hum. Neurosci. 14:569973. doi: 10.3389/fnhum.2020.569973

Felsenstein O, Peled N, Hahn E, **Rockhill AP**, Folsom L, Gholipour T, Macadams K, Rozengard N, Paulk AC, Dougherty D, Cash SS, Widge AS, Hämäläinen M, Stufflebeam S. Multi-Modal Neuroimaging Analysis and Visualization Tool (MMVT). arXiv:1912.10079.

Appelhoff S, Sanderson M, Brooks TL, van Vliet M, Quentin R, Holdgraf C, Chaumon M, Mikulan E, Tavabi K, Höchenberger R, Welke D, Brunner C, **Rockhill AP**, Larson E, Gramfort A, Jas M. MNE-BIDS: Organizing electrophysiological data into the BIDS format and facilitating their analysis. Journal of Open Source Software, 4(44), 1896. https://doi.org/10.21105/joss.01896.

Zorowitz S, **Rockhill AP**, Ellard KK, Link K, Herrington T, Pizzagalli DA, Widge AS, Deckersbach T, Dougherty DD (2019). The Neural Basis of Decision Conflict: A Model Based Analysis. eNeuro 25 July 2019, 6 (4) ENEURO.0115-19.2019; DOI: https://doi.org/10.1523/ENEURO.0115-19.2019.

Bilge MT, **Rockhill AP**, Kanabar A, Gosai AK, Hahn E, Cusin C, Deckersbach T, Williams Z, Dougherty DD, Widge AS. Recording and Disrupting Cortical-Striatal Hyperconnectivity in Obsessive-Compulsive Disorder. Biological Psychiatry. Abstract. May 15, 2019.

Widge AS, Boggess MJ, **Rockhill AP**, Mullen A, Sheopory S, Loonis R, Freeman DK, Miller EK. Altering Alpha-Frequency Brain Oscillations with Rapid Analog Feedback-Driven Neurostimulation. PLOS ONE. Dec 5, 2018 https://doi.org/10.1371/journal.pone.0207781.

4 Posters

Appelhoff S, Sanderson M, Brooks TL, van Vliet M, Quentin R, Holdgraf C, Chaumon M, Mikulan E, Tavabi K, Höchenberger R, Welke D, Brunner C, **Rockhill AP**, Larson E, Herbst SK, Luke R, Li A, Gramfort A, Jas M. (2020). MNE-BIDS: MNE-Python + BIDS = easy dataset interaction (Version 1.0.1). Zenodo. http://doi.org/10.5281/zenodo.3891836.

Bilge MT, Kanabar A, Basu I, Olsen ST, Boggess MJ, **Rockhill AP**, Gosai AK, Hahn E, Cusin C, Deckersbach T, Williams Z, Dougherty DD, Widge AS. Treating psychiatric illness through targeted network disruption and electrical biomarker identification. SfN. Poster. October 22, 2019.

Bilge MT, Kanabar A, Basu I, Olsen ST, Boggess MJ, **Rockhill AP**, Gosai AK, Hahn E, Cusin C, Deckersbach T, Williams Z, Dougherty DD, Widge AS. Treating psychiatric illness through targeted network disruption and electrical biomarker identification. SfN. Poster. October 22, 2019.

Rockhill AP, Cirillo P, Camprodon JA, Widge AS, Deckersbach T, Dougherty DD. Perturbational Complexity Index Applied to Deep Brain Stimulation and Psychiatric Surgical Ablations. Poster. 2019 Bi-Annual Meeting Tiny Blue Dot. June 8, 2019.

Rockhill AP, Boggess M, Widge AS, Deckersbach T, Dougherty DD. Perturbational Complexity Index of Associative Learning Task-Evoked Potentials. Poster. 2019 Bi-Annual Meeting Tiny Blue Dot. June 8, 2019.

Bilge MT, Kanabar A, Boggess MJ, **Rockhill AP**, Gosai AK, Hahn EM, Cusin C, Deckersbach T, Dougherty DD, Widge AS. In Search of Biomarkers of Obsessive-Compulsive Disorder: Combined Cortical and Striatal Stimulation for Re-regulating Circuits of Obsessive-Compulsive Disorder. Poster. SfN, San Diego, CA. Nov 3-7, 2018.

Rockhill AP, Hahn EM, Deckersbach T, Widge AS, Dougherty DD. Visualization of Biomarkers of Aversion Reward Conflict in EEG. Poster. Massachusetts General Hospital Clinical Research Day, Boston, MA. Oct 4, 2018.

Rockhill AP, Boggess MJ, Deckersbach T, Dougherty DD, Widge AS. Bayesian State-Space Model for Learning Applied to EEG Lempel-Ziv Complexity. Executive Committee on Research, Massachusetts General Hospital, Boston, MA. April 17, 2018.

Widge AS, Bilge MT, Boggess MJ, **Rockhill AP**, Gosai AK, Cusin C, Deckersbach T, Williams Z, Dougherty DD, Combined Cortical and Striatal Stimulation for Re-Regulating Circuits of Obsessive-Compulsive Disorder. Poster. BRAIN Initiative Investigators Meeting, Bethesda, MD. April 9-11, 2018.

Hahn EM, Felicione JM, Gosai AK, Boggess MJ, **Rockhill AP**, Widge AS, Dougherty DD, Deckersbach, T. Impulsivity and Apathy Predict Involvement of Inhibitory Control Regions During Cognitive Interference. Poster. Cognitive Neuroscience Society, Boston, MA. March 24-27, 2018.

Hahn EM, Felicione JM, Gosai AK, Boggess MJ, **Rockhill AP**, Ellard KK, Herrington T, Patel S, Paulk A, Widge AS, Eskandar EN, Dougherty DD, Deckersbach T. Integrating Behavioral Modeling and Neurocircuitry to Elucidate Approach/Avoidance Behaviors. Poster. American Neuropsychiatric Association, Boston, MA. March 21-24, 2018.

Hahn EM, Felicione JM, Gosai AK, Boggess MJ, **Rockhill AP**, Gold AK, Peters AT, Sylvia GL, Ellard KK, Stange JP, Peckham AD, Dougherty DD, Nierenberg AA, Deckersbach T. Cognitive Functioning and Psychotherapy Response in Bipolar Disorder. Poster. Massachusetts General Hospital Clinical Research Day, Boston, MA. Oct 5, 2017.

Rockhill AP, Bair W, Pasupathy A. Shape Selectivity in V4 Using Novel Time Dynamic Stimuli. Poster Presentation. Neural Computation and Engineering Connection, Seattle, WA. Jan 19-20, 2017.

5 Talks

Rockhill AP. EEG Preprocessing and Analysis with MNE-Python. Invited Talk (remote). World Network of Psychiatric Trainees. Jan 28, 2023.

Dougherty DD, **Rockhill AP**, Chou T, Zelmann R. MGH Consciousness Project. Talk. 2019 Bi-Annual Meeting Tiny Blue Dot. June 9, 2019.

Rockhill AP. Moving Toward Open-Source, BIDS-formatted TMS-EEG Preprocessing and Analysis using MNE-python. TMS-EEG Workshop: Measuring Causality and Complexity in the Human Brain. Milan, Italy. April 4, 2019.

Rockhill AP, Torrico-Teave H. mARTinos: History of and Inspiration for Biomedical Imaging Art. Talk. Science on Tap. Athinula A. Martinos Center for Biomedical Imaging, Boston, MA. Oct 19, 2018.

Rockhill AP. Shape Selectivity in V4 Using Novel Time Dynamic Three-Dimensionalized Stimuli. Talk. University of Washington Undergraduate Research Symposium, Seattle WA. June 2016 and 2017.

Rockhill AP, Bair W, Pasupathy A. Shape Selectivity in V4 Using Novel Time Dynamic Three-Dimensionalized Stimuli. Poster Presentation. The Center for Sensorimotor Neural Engineering Research Summit, Seattle WA. Aug 17, 2016.

6 Awards and Honors

- Computational Neuroscience Program Research Grant University of Washington
  - Funding for one year of research and specialized class laboratory extensions
- University of Washington Institute of Neuroengineering Fellow
  - Funding for two quarters of research
- Neurobiology BS with Honors
  - Thesis paper and presentation
- Massachusetts General Hospital Clinical Research Day 2018
  - Second prize in psychiatry awarded for poster presentation
- University of Oregon Lokey Graduate Science Award
  - Merit-based scholarship for graduate studies
- National Science Foundation Graduate Research Fellowship Program Honorable Mention
  - Study proposal selected for distinction among highly competitive pool

- University of Oregon Special "OPPS" Travel and Research Award
  - A stipend to travel to the 2020 MNE Code Sprint, an electrophysiology software development conference
- University of Oregon General University Scholarship
  - To recognize my academic achievements, extracurricular activities and the strength of my scholarship application
- 2020 and 2021 Shapiro Scholarship
  - For exemplifying outstanding academic and research achievements as well as distinctive service to the faculty and department mission
- 2021 MNE Code Sprint Invited Developer
  - Invitation to intensive electrophysiology development conference, including monetary stipend
- 2022 - 2023 Marthe E. Smith Memorial Science Scholarship
  - Given to outstanding graduate students in the natural sciences nearing completion of their degree based on academic merit
- 2021 and 2022 Google Summer of Code Student Developer
  - Research project stipend to develop an intracranial electrode localization tool (2021) and time-frequency source estimate viewer (2022) based on proposal, accepted after competitive review process
- MNE Steering Committee Member and Core Developer
  - Researchers with several years of contributing are invited to help maintain and support this electrophysiology research software

7 Service

- 2022-2023 Graduate Teaching Fellows Federation (GTFF) Human Physiology Union Steward
  - Elected by Human Physiology Graduate Students as the GTFF Union Representative for the Department