LUKE SHAW

Motor and Vision Systems Neuroscientist

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Curriculum Vitae

2024 Ph.D. Neuroscience, University of Rochester Medical Center (URMC) | Rochester, NY
2020 M.S.   Neuroscience, URMC | Rochester, NY
2013 M.F.A. Imaging Arts, Rochester Institute of Technology (RIT) | Rochester, NY
2010 Take Five Scholar of Photography, University of Rochester (UR) | Rochester, NY
2009 B.S.   Neuroscience, UR | Rochester, NY

Neuroscience Employment and Graduate Education

2018-2024 : Neuroscience PhD Student
Neuroscience Graduate Program, URMC
Co-Mentored by Kuan Wang, PhD and Jude Mitchell PhD
Thesis: **Manipulating Premotor to Parietal Feedback during Visually Guided Reaching Behavior**
2025 Neuroscience Department Vincent du Vigneaud PhD Award Nominee

I developed a marmoset cricket hunting paradigm that utilized DeepLabCut to track marmoset vision guided reaching without the use of physical markers. I participated in cross-institutional working groups lead by Dr. Cory Miller, Dr. Alex Huk, Dr. Jude Mitchell, and others focused on addressing the challenges of quantifying naturalistic primate behavior. In order to interrogate frontal parietal contributions to visuomotor reaching control, I further adapted an intersectional viral labelling approach from the mouse model to the marmoset model, which I validated in awake and anaesthetized electrophysiology. This approach enables projection direction labelling specificity, which I was able to fine tune using different AAV delivery serotypes. This achieved robust and specific labelling that yielded clear and impactful optogenetic responses in electrophysiology. This research sets the stage for experiments combining behavior with targeted optogenetic inhibition.

2018-2019 : First Year PhD Lab Rotations
Krishnan Padmanabhan, PhD : **Intracranial Recordings in a Mouse Model of Batten Disease**
Farran Briggs, PhD: **Novel 3D Reconstruction of Vision in Naturalistic Environment Exploration**
Kuan Wang, PhD: **Testing Reaching Behavior in Aging Marmosets Using Markerless Motion Tracking**

I adapted the human auditory duration mismatch negativity paradigm developed for human Batten Disease patients for intracranial recordings in mice. The pilot data I collected contributed to the center funding application for the Intellectual and Developmental Disabilities Research Center at URMC. I further collaborated with Dr. Farran Briggs to work on integrating motion tracking of ferrets with a world view camera to approximate their field of view. Additionally, I contributed information theory analyses to data collected from optogenetically stimulated thalamic feedback projections.

2015-2018 : Lab Manager for Dr. John Foxe

I conducted human psychophysics, electroencephalography, electrocorticography, and fMRI experiments for Dr. John Foxe and Dr. Ed Freedman while working to build and manage their Cognitive Neurophysiology Lab at University of Rochester Medical Center. I was the lead investigator of an EEG and psychophysics project that revised an old psychophysical finding of speeded responses to multisensory stimuli. Additional experiments were conducted with Batten Disease patients in a search for a pre-attentional EEG biomarker of disease state. We utilized an auditory duration mismatch negativity paradigm and discovered a progression of mismatch negativity signals that tracks disease state for specific types of duration stimuli. Further work was carried out collaborating with neurosurgeons to collect electrocorticography data from epilepsy patients, assisting in the design and assembly of a full body motion capture + EEG system, and collection of data for the Adolescent Brain Cognitive Development study in addition to maintaining the lab space and experimental records, overseeing personnel, and developing analyses.

Papers

2025	**Luke Shaw**, Krishnan Padmanabhan, Amy Bucklaw, Jude Mitchell, Kuan Hong Wang. *Projection-Specific Intersectional Optogenetics for Precise Excitation and Inhibition in the Marmoset Brain.* (in preparation)
	Yang Liu, **Luke Shaw**, Kuan Hong Wang, Feng Vankee Lin, Guoying Zhao. *Cross-Species Behavioral Analysis via Multi-Dimensional Knowledge Transfer* Submitted to: IEEE Signal Processing Letters
2024	Brima T, Freedman EG, Prinsloo KD, Augustine EF, Adams HR, Wang KH, Mink JW, **Shaw LH,** Mantel EP, Foxe JJ. *Assessing the integrity of auditory sensory memory processing in CLN3 disease (Juvenile Neuronal Ceroid Lipofuscinosis (Batten disease)): An auditory evoked potential study of the duration-evoked mismatch negativity (MMN).* J Neurodevelop Disord 16, 3 (2024). https://doi.org/10.1186/s11689-023-09515-8
2023	**Luke Shaw**, Kuan Hong Wang, Jude Mitchell. *Fast prediction in marmoset reach to grasp movements for dynamic prey.* Curr Biol. 2023 Jun 19;33(12):2557-2565.e4. doi: 10.1016/j.cub.2023.05.032.
2020	**Luke Shaw**, Edward Freedman, Mick Crosse, Eric Nicholas, Allen Chen, Matthew Braiman, Sophie Molholm, John Foxe. (2020) *Operating in a Multisensory Context: Assessing the Interplay Between Multisensory Reaction Time Facilitation and Inter-sensory Task-switching Effects.* Neuroscience Volume 436. 1 June 2020. pp 122-135. PMID 32325100. DOI: 10.1016/j.neuroscience.2020.04.013
	Allison Murphy, **Luke Shaw**, J. Michael Hasse, Robbe Gorbis, Farran Briggs. (2020) Optogenetic activation of corticogeniculate feedback stabilizes response gain and increases information coding in LGN neurons. Journal of Computational Neuroscience. June 06. PMID: 32632511. DOI: 10.1007/s10827-020-00754-

Invited Talks

2024   Intersectional Optogenetics for Excitation and Inhibition in the Marmoset Brain.
            Center for Visual Science Symposium, Rochester, NY.

            Fast Prediction in Marmoset Reach to Grasp Movements for Dynamic Prey.
            Animal Behavior Machine Learning Analysis Workgroup, Rochester, NY.

2023   Classification of Marmoset Histological Image Data by Rostral/Caudal Coordinates
            Using Machine Learning. University of Rochester course BCS512.

2021   DeepLabCut tracking of Marmoset Dynamic Reaching for Live Crickets.
            Marmoset Natural Behavior and Gaze/Body Tracking Working Group, Cross-
            Institutional, Zoom.

Selected Posters

2023   **Luke Shaw**, Kuan Hong Wang, Jude Mitchell (2023) Fast Prediction in Marmoset Reach
            to Grasp Movement for Dynamic Prey. Presented at Neural Control of Movement
            Annual Conference 2023, Victoria, Canada.

2022   **Luke Shaw**, Kuan Hong Wang, Jude Mitchell (2022) Intersectional optogenetics for
            excitation and Inhibition of cortico-cortical projections in the mouse and marmoset
            brain. Shown at Society for Neuroscience Annual Conference 2022, SanDiego, USA

2020   **Luke Shaw**, Kuan Hong Wang, Jude Mitchell (2020) Kinematic Descriptions of
            Unrestrained Reaching and Grasping in the Common Marmoset. Presented at
            Marmoset Bioscience Symposium 2020, Virtual

2019   **Luke Shaw**, Kuan Hong Wang, Jude Mitchell (2019) Machine Vision Based Tracking of
            Reach to Grasp Movements in Marmosets Across Age. Presented at Marmoset
            Bioscience Symposium 2019, Chicago

            Abdo Sharaf, Marc Mancarella, Adwiteeya Misra, **Luke Shaw**, Farran Briggs (2019) *A
            Novel Motion Tracking System for Studying the Effect of Awake State and Motor Activity
            on Visual Processing of Natural Stimuli.* Shown at Biomedical Engineering Society
            Conference 2019, Philadelphia

2018   Eric Nicholas, Tufikameni Brima, **Luke Shaw**, Jonathan Mink, Erika Augustine,
            Heather Adams, Ed Freedman, John Foxe (2018) *High Density Electrophysiological
            Measures of Auditory Sensory Processing as Potential Biomarkers of CLN3 Disease.*
            Shown at International Conference on Neuronal Ceroid Lipofuscinoses (NCL), London.

2017   **Luke Shaw**, Eric Nicholas, Matt Braiman, John Foxe (2017) *The Race May Be Over:*

Behavior and Neurophysiology Show Modality Switch Costs Give Rise to Apparent Redundant Target Effect. Shown at International Multisensory Research Forum (IMRF), Nashville.

Shlomit Beker, **Luke Shaw**, Tufikameni Brima, Sophie Molholm, John Foxe (2017) *Components of Cross-Sensory Oscillation in the Human Brain.* Shown at IMRF, Nashville.

Edward Freedman, Ana Francsico, Eric Nicholas, **Luke Shaw**, Lars Ross, Sophie Molholm, John Foxe (2017) *Saccadic Adaptation and Cerebellar Structure May Define a Subphenotype of Autism Spectrum Disorder.* Shown at Society for the Neural Control of Movement Conference, Dublin.

Teaching and Mentorship Experience

2021-Present
>   Multiple undergraduate and junior PhD student mentees and supervisees.

Spring 2021
>   Introduction to Coding for Neuroscientists Teaching Assistant | URMC

Fall 2014
>   Video Narrative, Adjunct Professor | Pennsylvania College of Art and Design

Fall 2012, Winter 2012, Spring 2011
>   Introductory Digital Photography for Non-Majors, Graduate Instructor | RIT

Summer 2012
>   Introduction to the DSLR, Instructor | Community Darkroom, Rochester NY

Spring 2013
>   Graduate Teaching Assistant under Oscar Palacio | RIT

Winter 2011
>   Graduate Teaching Assistant under George Awde | RIT

Extracurricular Contributions

2018-Present   Member, Society for Neuroscience
2021-2025   Low Born Motorcycle Wrench Club Renter
2019-2024   Pre-Doctoral Organization for the Neural Sciences Committee Member, URMC
2022-2023   Member, Society for the Neural Control of Movement
2020-2023   Student Solidarity Organization Founding Member, URMC
2019-2023   NGP Orientation / Bootcamp Committee Member, URMC

Technical Experience

Neuroscience   Mouse and marmoset intracranial, extracellular electrophysiology
Mouse and marmoset stereotaxic viral (AAV) injection and head implant surgery
Mouse and marmoset optogenetics
Marmoset eye tracking
Mouse and marmoset behavior and husbandry
Behavioral tracking and quantification using machine learning algorithms

Histological analysis and categorization aided by machine learning algorithms
Mouse and marmoset brain tissue processing
Confocal and epifluorescence imaging of fixed tissue
Immunohistochemistry
Custom robotics and controller engineering using Arduino
Human psychophysics and behavior
Human EEG collection and analysis
Human ECoG collection and analysis

Software   Matlab
Anaconda//Python
Open Ephys
Arduino // C++
3D Printing workflows
Machine vision powered motion tracking (DeepLabCut and Anipose)
Custom machine learning image identification networks (Keras)
Presentation (NeuroBehavioral Systems)
Brain Electrical Source Analysis (BESA GmbH)
Adobe Creative Suite
Web Design in HTML, CSS

Past Employment

2013-2016   <u>Freelance Photography</u>, self-employed
2014   <u>Adjunct Professor</u> of Video Art at Pennsylvania College of Art and Design, Lancaster, PA
2013-2014   <u>Computer Technician and Repairperson</u> at OMG Computers, Rochester, NY
<u>Assistant Photographer</u> for Natalie Sinisgalli Photography, Rochester, NY
2011-2013   <u>MFA Graduate Student</u> and Graduate Teaching Assistant/Instructor
2010-2011   <u>Dental Assistant</u> at Lockport Dental Group, Lockport NY
Chair-side assistance of dentist; operation of automated crown milling software;
x-ray operation; instrument sterilization; assistance in prosthetic fabrication
2008   <u>Center for Visual Science Summer Research Fellow</u>, URMC
Observation and assistance in the lab of Ed Freedman, PhD; collaboration with Dr.
Freedman on the design of an experiment interrogating expectation-driven modulation
of the vestibulo-ocular reflex in macaques.
2006   <u>Organic Chemistry Intern</u> at American Aerogels Inc., Rochester, NY
Investigation of production parameters and experimental formulas for the carbon based
aerogel produced by American Aerogels, with an emphasis on the effect of solid fiber
additives on the structural integrity of the product.

Selected Photography Exhibitions [* = solo show]

2014   *Alternatives Biennial: Artifact | Ohio University Art Gallery | Athens, OH | juror Judy Natal*
Faculty Biennial | Pennsylvania College of Art and Design Main Gallery | Lancaster, PA
2013   *Approaching Significance: Dr. Rodano Takes a Bath | VSW Siskind Gallery | Rochester, NY **
Archetype Drift | Johalla Projects | Chicago, IL | juror Jason Lazarus

2012   Schmopposites and Contrafrictionisms | Colleen Buzzard Gallery | Rochester, NY*
MFA NOW | VSW Siskind Gallery | Rochester, NY | juror Lisa Sutcliffe
2011   Photo Review Competition Exhibition | Gallery 1401 | Philadelphia, PA | juror Robert Mann
Biotic Semiotics | Allen Priebe Gallery | Oshkosh, WI | curator Michelle Grabner
2010   Interior Explorations from the Future | Hungerford Building | Rochester, NY *
Artificial Selection | 516 Gallery |Albuquerque, NM | curator Rhiannon Mercer