

Siyi Li

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Background Summary

Biomedical engineering researcher with experience spanning soft material fabrication, flexible electrode design, analog front-end circuits, embedded biosignal acquisition, and computational behavioral analysis. Motivated by a long-standing interest in psychiatric neuroscience, with research goals centered on brain-computer interfaces for psychiatric neuromodulation.

Research Interests

Psychiatric Brain-computer Interface | Bioelectronic Interfaces & Physiological Measurement | Amygdala

Education

M.S. in Biomedical Sciences, Icahn School of Medicine at Mount Sinai, New York, NY Aug 2026 - June 2028 (Expected)

B.S. in Biomedical Engineering, Miami University, Oxford, OH Aug 2022 - May 2026

- **Relevant coursework:** Linear Algebra, Differential Equations, Statistics, Bioinstrumentation, Signals & Systems, Biomaterials, Biomechanics, Bioethics, Human Physiology, Deep Learning, BME Signal and Imaging System

Publications & Manuscripts

Li, S. "A Dissipation-Failure Model of Panic and Dissociative State Transitions." *Manuscript in Preparation*.

Posters & Presentations

- **Li S.**, Moon B., Holmes G., Goetz L., Lawson L., Carmosino M., Creps R. "P.I.P: Personal Insulin Pal." Live demonstration and poster presented at Miami University CEC Design Expo, 2026. *2nd Place*.
- Mascarenhas D., Hepkin V., **Li S.**, Borkar C.D. "Internal State-Dependent Modulation of Defensive Behavior in Mice: Effects of Trait Anxiety and Acute Trauma." Poster presented at Miami University Undergraduate Research Forum, 2026.

Research Experience

Undergraduate Research Student, Dr. Chandrashekhara D. Borkar, Miami University, Oxford, OH Jan 2026 - May 2026

Internal State-Dependent Modulation of Defensive Behavior in Mice: Effects of Trait Anxiety and Acute Trauma

- Analyzed how baseline trait anxiety and acute trauma exposure modulate defensive behaviors in mice, including freezing, avoidance, exploration, and social/aggressive interaction
- Organized and analyzed EZM, Fear Conditioning, and Resident Intruder behavioral data using GraphPad Prism, including ANOVA and paired/unpaired t-tests
- Co-authored and presented a research poster at the Miami University Undergraduate Research Forum, linking trauma exposure to reduced exploration and increased passive defensive states

DeepLabCut- and SimBA-Based Computational Behavior Analysis Pipeline

- Developed a DeepLabCut pose-estimation pipeline across multiple training cycles, optimizing frame sampling, annotation strategy, and model parameters to reach approximately 3 px mean training error
- Integrated pose-estimation outputs into a SimBA behavioral classification workflow and authored internal documentation for future lab adoption

Senior Capstone Project, Dr. Jason Berberich, Miami University, Oxford, OH Aug 2025 - May 2026

P.I.P (Personal Insulin Pal): Colorimetric Glucose Biosensor for Pediatric Users — 2nd Place, CEC Design Expo

- Led electrical design, embedded firmware, and data processing within a 7-member CPB capstone team; system achieved 20–400 mg/dL detection range, quadratic calibration, and 200 s response time with quadratic calibration accuracy ($R^2 = 0.9972$)
- Designed reflectance-based optical sensing chain using red LED, TMB test strip, BPW34 photodiode, and

MCP6002 transimpedance amplifier with LED-off/LED-on differential measurement

- Implemented ESP32-WROOM-32E firmware for ADC sampling and OLED readout; integrated MCP1702 LDO and 3.7 V LiPo power management

Undergraduate Research Assistant, Dr. Hui Wang, Miami University, Oxford, OH Feb 2025 - May 2026

Tissue-Mimicking Phantom Fabrication and Optical Characterization

- Fabricated PDMS-based and tape-based tissue-mimicking phantoms with controlled thickness and optical scattering properties using TiO_2 nanoparticle dispersion
- Performed integrating sphere measurements and IAD analysis to extract optical parameters, including μ_a , μ_s' , and anisotropy factor g

PEDOT:PSS-Based Flexible Electrode Design and Fabrication

- Developed PEDOT:PSS-based flexible electrodes across 12+ fabrication–testing cycles, optimizing adhesion, uniformity, and mechanical stability
- Embedded thin copper mesh to improve conductive robustness and long-term recording reliability
- Characterized electrodes in 15+ Biopac sessions, achieving reproducible ECG morphology comparable to Ag/AgCl electrodes

Custom Biosignal Acquisition System (ECG)

- Built a real-time ECG acquisition system using AD8232 and ESP32-C3, with C++ digital filtering for baseline stabilization and motion-artifact reduction

Remote-Control System for Optical Coherence Tomography (OCT)

- Implemented Raspberry Pi-based multi-axis OCT stage control with joystick input, motion constraints, and safety limits for remote imaging

Undergraduate Research Student, Dr. Catherine Almquist, Miami University, Oxford, OH Sept 2023 - Feb 2024

Adsorption Process Using Activated Biomass to Remove Manganese from Potable Water

- Investigated adsorption kinetics and material selection for low-cost water treatment
- Conducted pyrolysis, BET surface-area analysis, TGA, colorimetry, and pH optimization
- Contributed to early-stage development of low-cost point-of-use water filter (team achieved >90% manganese removal efficiency)

Projects

Classical Pupil Segmentation Pipeline (BME Signal and Imaging Processing) Spring 2026

- Implemented a classical image-processing pipeline (Gaussian blur, inverse binary thresholding, morphological opening/closing, contour extraction with area and circularity filtering, minimum enclosing circle fit) for pupil detection on near-infrared eye images
- Achieved 2.24 px center localization error and 0 px radius error against ground-truth reference

Before The Thought Arrives — Interactive 3D Brain Visualization Spring 2026

- Built an interactive 3D brain visualization mapping EEG frequency bands and emotional states onto anatomical regions, with cfos-style fluorescent puncta and live waveform rendering
- Implemented bilingual EN/ZH text overlays and deployed the Three.js/React project via GitHub and Vercel

PPG Analog Front-End and Signal Processing (Bioinstrumentation) Spring 2025

- Designed and tested a complete PPG analog front-end (LED drive, transimpedance, filtering)
- Implemented full signal-processing workflow including DC removal, band-pass filtering, and peak detection

Analysis of LPS-Induced HPA Axis Activation Using Corticosterone and c-Fos Markers (Human Physiology) Spring 2025

- Conducted manuscript-style analysis of LPS-induced HPA axis activation using corticosterone ELISA and c-Fos immunohistochemistry data across PVN, CA1, and mPFC regions
- Generated publication-style statistical figures and interpreted age- and treatment-dependent neuroendocrine activation patterns

Additional Experience

Youth Program Organizer – Ruguo Youth, China

2020 - 2022

- Co-organized 10+ community mental health programs across 10+ provinces in China, serving youth facing psychiatric challenges and emotional distress
- Coordinated program design, volunteer training, and event facilitation; reaching 500+ participants through meditation, peer support, and creative expression workshops

Operations & Data Analysis Intern – DiDi Chuxing, Xi'an, China

Jun - Aug 2021

- Supported weekly reporting and user-behavior analysis for regional operations

Honors & Awards

- **2nd Place**, Senior Capstone Design, Miami University CEC Design Expo (2026)
- Dean's List, Miami University (Fall 2025)
- Dean's List, Miami University (Summer 2024)
- President's List, Miami University (Spring 2020)

Certifications

- Working with the IACUC, CITI Program (Feb 2026 – Feb 2029)
- Animal Care and Use (Research Personnel), Miami University (Jan 2026)
- Human Research Protection Training, U.S. Department of Health and Human Services / OHRP (Mar 2026)
- Google Advanced Data Analytics (Mar 2026)

Technical Skills

Device & Material Fabrication

PEDOT:PSS flexible electrodes, PDMS casting, tissue-mimicking phantom fabrication, FPE treatment, substrate and mold optimization, non-photolithographic patterning

Biosignal Acquisition & Processing

ECG/PPG acquisition, analog front-end design, ADC sampling, digital filtering (notch, band-pass, DC removal), FFT, EEGLAB, BioPac, Moku:Go

Behavioral Analysis

DeepLabCut (pose estimation, single- and multi-animal models), SimBA (behavioral classification)

Embedded Systems & Hardware

ESP32, AD8232, sensor interfacing, grounding and shielding, PCB design (Eagle), soldering, CAD (Fusion 360)

Programming & Data Analysis

Python, C/C++, MATLAB, Java, JavaScript/TypeScript; Linux-based development; React, Three.js, Vercel deployment; socket-based communication; scientific data visualization