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Seth Peacock

GitHub

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EDUCATION

Ohio State University (OSU) **AU22–AU24**
B.S. in Applied Mathematics, Minor in Philosophy (Summa Cum Laude; College Honors) Cum GPA 3.934/4.0

RESEARCH EXPERIENCE

Analyzing self-coherence in oscillations emitted from the ear **Sept 2024–Present**
Supervisors: Prof. Christopher Bergevin; Prof. Natasha Mhatre *York University / The Fields Institute*
Peacock et al., 2025 (preprint on bioRxiv; preparing for submission to PNAS)

- Lead author: wrote sections and edited entire manuscript / integrated collaborators' feedback
- Formulated mathematical framework for our signal processing method
- Engineered a dynamic windowing technique to address time–frequency tradeoff
- Developed documented Python package *phaseco*; integrated all analyses into a unified codebase
- Will be presenting at 2026 Assoc. for Research in Otolaryngology MidWinter Meeting

Topological data analysis of serotonin time-series data **Aug 2023–Oct 2024**
Supervisor: Prof. Janet Best *OSU*
TDA approach to find differences in serotonin time-series data from depressed vs control mice

- Modified sublevel set filtration (TDA) method to design bespoke algorithm for time-series "process" extraction
- Identified trends in these processes indicating depressed mice lost homeostasis due to measurement electrode

Fields Undergraduate Summer Research Program **June 2024–Aug 2024**
Supervisors: Prof. Christopher Bergevin; Prof. Natasha Mhatre *The Fields Institute*
Funded summer research program mathematically modeling oscillatory emissions from the ear

- Implemented and analyzed ordinary differential equation (ODE) models of emission mechanisms in lizards
- Extended existing ODE model to incorporate interaural coupling between lizard ears

Optimizing an efficient eigenvector phase retrieval algorithm **January 2023–May 2023**
Cycle Undergraduate Research *OSU*
Designed and implemented methods for efficiently recovering eigenvectors from the absolute value of their entries

PREPRINTS

Peacock, S. N. S., Vencovsky, V., Whiley, R. E., Mhatre, N., & Bergevin, C. (2025). Spontaneous otocoherence of the active ear. https://doi.org/10.1101/2025.11.14.687084

SELECTED PROJECTS

phaseco
A Python package providing tools for phase autocoherence analysis with dynamic windowing methods

Peak-picking otoacoustic emissions with machine learning
A neural network model to identify "peaks" in power spectra of oscillations emitted from the ear

- Designed neural network architecture by adapting and improving models from related applications
- Generated synthetic (labeled) power spectra for supervised learning

Quantifying uncertainty in college basketball
Devised Elo-style ranking to derive a bootstrapped C.I. for the minimum "uncertainty" in a game

- 1st Place at OSU's Mathematical Competition in Modeling, November 15th–17th 2024

PRESENTATIONS

Assoc. for Research in Otolaryngology MidWinter Meeting (Accepted) **Feb 2026**
Otocoherence: Interspecies analysis of phase self-consistency in spontaneous otoacoustic emission

Ohio State Honors Project Symposium **Dec 2024**
Topological data analysis of depressed mouse serotonin concentrations

Fields Undergraduate Summer Research Program Final Presentations **Aug 2024**
Modeling and signal processing of spontaneous emissions from lizard ears

HONORS AND AWARDS

Conference Travel Award for the 2026 Assoc. for Research in Otolaryngology MidWinter Meeting **2025**
1st Place at OSU Mathematical Competition in Modeling **2024**
Ohio State Dean's List (All Semesters) **2022-2024**
National Merit Scholar Finalist **2018**

TEACHING / MENTORING

Private Tutoring in Mathematics **Aug 2025–Present**
One-on-one tutoring, primarily in real analysis and proof writing with OSU undergraduates

Mentoring at Fields Undergraduate Summer Research Program **June 2025–Aug 2025**
Mentored my supervisor's group in research program I had previously attended *The Fields Institute*

- Proposed accessible entry points based on each student's interests into our research mathematically analyzing and modeling oscillations emitted from ears
- Led regular student meetings for troubleshooting, sharing progress, and developing ideas

Private Music Lessons **June 2018–Present**
One-on-one lessons in music theory, guitar, bass, and drums

SKILLS AND COURSEWORK

Computational Skills
Digital signal processing, machine learning, spectral analysis, algorithm design
Languages: Python, MATLAB, and Java (completed projects); experience with Julia, Mathematica, JS, C++

OSU Coursework
Applied Mathematics: Computational Neuroscience, Machine Learning, Statistics, Infectious Disease Dynamics
Mathematics: Dynamical Systems, Linear Algebra, ODEs, PDEs, Probability, Real Analysis I & II, Complex Analysis
Physics: Classical Mechanics I & II, Electricity and Magnetism, Relativistic Mechanics, Quantum Mechanics

Self Study
Signal processing, topological data analysis, linear systems theory, discrete mathematics, circuit theory

OTHER EXPERIENCE

Cyclops Studio and Effects: *Effect Pedal Technician, Studio Engineer* **July 2019–Present**
Repaired, designed, and built electronic musical effect units; engineered and mixed recordings

Rat Motel: *Band Manager, Songwriter, Performer* **June 2016–Present**
Managed tours, merchandise, and financial records, developing project management and organizational skills