Ian Cone

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Education

Rice University · Houston, TX August 2017 – August 2021
PhD, Applied Physics, Awarded August 2021
MS, Applied Physics, Awarded August 2020
Courses of Note: Statistical Physics, QM, EM, Theoretical Neuroscience I & II

University of San Francisco · San Francisco, CA August 2013 - May 2017
Bachelor of Science, Physics
Minors in Engineering Physics and Astrophysics
Courses of Note: Computational Physics I & II, Digital Electronics, Math Methods, Thermal, QM, EM, GR
Summa Cum Laude

Research Experience

Postdoctoral Research Scientist, Costa Lab · University of Oxford, Oxford, UK
March 2024 – Present

- Investigating the role of hippocampal behavioral timescale plasticity (BTSP) in credit assignment:
  - Used a generalized BTSP model (gBTSP) to analytically solve for the optimal distribution of BTSP-triggering plateau potentials to minimize a given objective function
  - Describing BTSP through the framework of burst-related theories of plasticity (burstprop, burstCCN)

Postdoctoral Research Associate, Clopath Lab · Imperial College London, London, UK
September 2021 – January 2024

- Emergence of conjunctive hippocampal representations from single-cell plasticity:
  - Created a closed-loop model of representation and behavioral learning which learns context-sensitive feature fields (“splitters”) via induction of behavioral time scale plasticity (BTSP)

- Flexibly Learned Errors in Expected Reward (FLEX):
  - Developed a mechanistic theory in which the temporal bases for reinforcement learning are plastic and develop specifically for rewarded stimuli

Graduate Research Assistant, Shouval Lab · UTHealth, Houston, TX January 2018 – August 2021
- Investigating theoretical basis of learning and memory:
  - Designed biophysically realistic modular network to model sequence learning and recall in cortex
  - Modeled behavioral time scale plasticity (BTSP) formation of place cells via a biophysically realistic learning rule with analytically solvable fixed points

Graduate Research Assistant, Robinson Lab · Rice University, Houston, TX August 2017 – January 2018
- Investigating nature of plasticity in neural networks in *Hydra vulgaris*:
  - Designed microfluidic assays for investigating phototaxis and thermotaxis behaviors

Research Assistant, Foreman Lab · University of San Francisco, San Francisco, CA May 2014 - May 2017
- Initiated and managed various projects to create and study femtosecond electron pulses:
  - Built and characterized mode-locking femtosecond pulsed Erbium fiber laser from scratch

Research Assistant, Iavarone Lab · Temple University, Philadelphia, PA Summer 2016
- Studied the effects of edge sites and grain boundaries on the superconducting properties of mono- and few-layer MoS_2:
  - Examined topography, work function, and superconducting band gap through use of STM, SEM, AFM, and Kelvin Probe

Publications

Cone, I, Clopath, C & Costa, RP, *Credit Assignment via Behavioral Timescale Synaptic Plasticity: Theoretical Frameworks*. bioRxiv, https://doi.org/10.1101/2025.06.12.659336 2025

Cone, I, Clopath, C & Shouval, HZ**,** *Learning to express reward prediction error-like dopaminergic activity requires plastic representations of time***.** *Nat Commun* **15,** 5856 2024

Cone I, Clopath C, *Latent Representations in Hippocampal Network Model Co-Evolve with Behavioral Exploration of Task Structure. Nat Commun* **15**, 687, https://doi.org/10.1038/s41467-024-44871-6 2024

Cone I, Shouval HZ, *Learning precise spatiotemporal sequences via biophysically realistic learning rules in a modular, spiking network.* eLife 10, e63751 https://doi.org/10.7554/eLife.63751 2021

Cone I, Shouval HZ, *Behavioral Time Scale Plasticity of Place Fields: Mathematical Analysis.* Front. Comput. Neurosci. 15 https://doi.org/10.3389/fncom.2021.640235 2021

Precner **et al.** *Evolution of Metastable Defects and its Effect on the Electronic Properties of MoS2 Films*, Scientific Reports, 8(1), 6724. https://doi.org/10.1038/s41598-018-24913-y 2018

Selected Presentations

Cone, I, Clopath, C & Costa, RP, *Credit Assignment via Behavioral Timescale Synaptic Plasticity,* COSYNE 2025, Montreal, Canada. Poster Presentation 2025

Cone I, Clopath C, *Self-supervised Induction of Flexible Population Representations in MEC-HPC Network Model.* Gordon Research Conference, Synaptic Transmission, 2022. Lucca, Italy. Oral Presentation. 2022

Cone I, Clopath C, Shouval HZ, *Learning and expression of dopaminergic reward prediction error via plastic representations of time.* COSYNE 2022, Lisbon, Portugal. Poster Presentation. 2022

Cone I, Shouval HZ, *Non-Markovian Sequence Learning and Recall with Hebbian Based Learning Rules*, Gulf Coast Consortium Theoretical and Computational Neuroscience Conference 2020, Houston, TX. Poster Presentation. 2020

Cone I, Shouval HZ, *A model cortical circuit capable of temporal sequence learning and recall*, SfN 2019, Chicago, IL. Nanosymposium. 2019

Awards/Certificates

Travel Award, Smalley-Curl Transdisciplinary Research Symposium February 2019
- Awarded to the best presenter during the SCI Transdisciplinary Research Symposium

Dr. Raymond Genolio Award May 2017
- The University of San Francisco's award for top performing graduate in the physical sciences

Research Fellowship in the Sciences Summer 2015
- The University of San Francisco's summer fellowship for continued research excellence

Teaching Experience

Lead Teaching Assistant, Theoretical Neuroscience I and II· Rice University, Houston, TX
August 2018 – August 2021
- Instructed undergraduate and graduate students through office hours, recitation sections, and grading for advanced theoretical neuroscience courses throughout PhD program.

Physics and Math Tutor · University of San Francisco, San Francisco, CA August 2016 - May 2017
- Provided personalized one-on-one instruction for 25 hours/week in first and second-year physics and mathematics courses
- Developed effective study plans aimed at improving students' problem-solving abilities and time management skills

Lead Teaching Assistant., Astronomy · University of San Francisco, San Francisco, CA
Fall 2015 - August 2016
- Prepared, maintained and operated telescopes for student observation sessions and hands-on learning experiences
- Led recitation sections to reinforce core concepts and provide additional support
- Mentored and trained junior teaching assistants in laboratory management and teaching techniques

ADDITIONAL REFERENCES AVAILABLE UPON REQUEST