

SAURABH GANDHI

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Education

August 2013 – February 2019

Massachusetts Institute of Technology

PhD, Department of Physics

GPA: 4.5 / 5

Thesis: Population and evolutionary dynamics during microbial range expansions

August 2009 – May 2013

Indian Institute of Technology, Bombay

B. Tech. with Honors, Engineering Physics

GPA: 9.4 / 10

Department Rank 2

Research experience

Indian Institute of Technology, Delhi

December 2021-

Assistant Professor, Department of Electrical Engineering

Allen Institute for Brain Science

July 2019 – October 2021

Scientist 1, Modeling, Analysis and Theory Group

Advisor: Anton Arkhipov (co-mentors: Shawn Olsen, Christof Koch)

- *Differentiation of neural responses across the visual hierarchy in mouse brain and convolutional neural nets*
 - Characterized multiple metrics of spatiotemporal complexity of neural activity in large-scale electrophysiological recordings in mice (~100,000 neurons), and compared the complexity across different regions of the mouse visual hierarchy and with the activity in artificial convolutional neural networks.
- *Analyzing and modeling cortex – claustrum interactions*
 - Developed a technique to characterize different classes of functional response types among cortical neurons based on their response to claustrum stimulation
 - Identified co-activating neuronal ensembles that respond synchronously to stimulation and the dependence of the ensemble response type on the phase and polarization of the cortical delta rhythm
 - Used dynamical models to infer the relative strength of connectivity between claustrum and different cortical regions
- *Quantifying the levels of consciousness in awake or anesthetized mice*
 - Leading the effort to analyze jointly recorded multi-electrode and EEG data from awake and anesthetized mice to quantify neural complexity in cortical and subcortical brain regions and its dependence on the level of consciousness.

Massachusetts Institute of Technology

August 2013 – May 2019

Research Assistant, Department of Physics

Advisor: Jeff Gore (co-mentor: Kirill Korolev, Boston University)

- *Effects of cooperative growth on the evolutionary and population dynamics in spatially expanding populations*
 - Led and executed projects to establish a microbial model system to study the effects of cooperative growth on spatially expanding populations
 - Used the model system to quantitatively establish the relationship between local growth traits and emergent population-level dynamics as well as evolutionary dynamics

Teaching and mentorship experience

- Instructor for ELP101 Undergraduate Electronics Laboratory Spring 2022
- Instructor for ELQ301 Technical Communication seminar course at IIT-Delhi Spring 2022
- Mentoring an undergraduate student research project Spring 2022
 - Identification and quantification of brain states based on EEG activity in mouse
 - Quantification of state-dependence of neural responses to electrical stimuli
- Mentored an intern for the AllenConnect internship program Summer 2021
 - *Led an internship project* investigating the use of recurrent neural networks to predict features in field potential data (EEG, Local Field Potentials).
- Teaching assistant for 8.13 Experimental Physics Lab (MIT UG) Fall 2018
 - Mentored students in designing experiments, correctly collecting data, statistical analysis and interpretation of results, writing manuscripts and presenting at seminars
- Completed the 12 credit "8.399 Physics Teaching" graduate course at MIT Fall 2018
- Teaching assistant for 8.591 Systems Biology (MIT Graduate) Fall 2017
 - Guest lecture on computational systems neuroscience
 - Review sessions, tutorials, grading etc.
- Teaching assistant for 8.241 Introduction to Biological Physics (MIT UG and Graduate) Spring 2017
 - New interdisciplinary course – contributed to syllabus development
 - Designed new problem sets
 - Review sessions, tutorials, grading etc.
- Teaching assistant for 8.951 Systems Biology (MIT Graduate) Fall 2014
 - Review sessions, tutorials, grading etc.

Awards

Travel support for *Berkeley summer course in mining and modeling neuroscience data*, by Helen Wills Neuroscience Institute, 2018

NSF-sponsored q-bio 2016 (conference) Travel Award, q-Bio program committee, 2016

Awarded the 'Working Internship in Science and Engineering' scholarship by Deutscher Akademischer Austausch Dienst (**DAAD WISE**) for a research internship in Germany, 2012

Awarded the **KVPY** fellowship by Indian Institute of Science, Bangalore, India, 2009

National top 1% in Indian National Physics, Astrophysics and Chemistry Olympiads, 2009

Awarded the National Talent Search Examination (**NTSE**) scholarship (National top 650), 2007

Skills

Software: Extensive experience with quantitative analysis and modeling in Python; also comfortable with MATLAB, C/C++.

Wet lab: Extensive experience with yeast and bacterial cultures, flow cytometry and plasmid transformations.

Other technical skills: Experience with designing and programming embedded electronics

Publications and presentations

Publications

1. McBride, E.G., **Gandhi, S.R.**, Kuyat, J.R., Arkhipov, A., Koch, C., Olsen, S. Influence of claustrum on cortex varies by area, layer, and cell type (under review, Neuron). bioRxiv: <https://doi.org/10.1101/2022.02.22.481532>
2. **Gandhi, S. R.**, Mayner, W. G. P., Marshall, W., Billeh, Y., ..., Ttononi, G., Koch, C., Arkhipov, A. A survey of neurophysiological differentiation across mouse visual brain areas and timescales (under review, eNeuro). bioRxiv: <https://doi.org/10.1101/2022.01.21.476869>
3. Mayner, W. G. P., Marshall, W., Billeh, Y., **Gandhi, S. R.**, ..., Ttononi, G., Koch, C., Arkhipov, A. (2022) Measuring stimulus-evoked neurophysiological differentiation in distinct populations of neurons in mouse visual cortex. eNeuro 0280-21 2021. <https://doi.org/10.1523/ENEURO.0280-21.2021>
4. **Gandhi, S. R.**, Korolev, K. S., & Gore, J. (2019). Cooperation mitigates diversity loss in a spatially expanding microbial population. *Proceedings of the National Academy of Sciences*, 116(47) 23582-23587
5. **Gandhi, S. R.**, Yurtsev, E. A., Korolev, K. S., & Gore, J. (2016). Range expansions transition from pulled to pushed waves as growth becomes more cooperative in an experimental microbial population. *Proceedings of the National Academy of Sciences*, 113(25), 6922-6927.

Publications under prep

Invited talks

March 2022 – Brain Mapping and Artificial Intelligence workshop at IIT-Delhi
'Use of large scale standardized datasets for understanding brain function'

Seminar talks

January 2019 – Indian Institute of Technology, Bombay
'Population and evolutionary dynamics during microbial range expansions'

Contributed conference talks

July 2016 – Q-Bio summer conference
Spotlight poster introduction, 'Cooperation increases rate of spatial range expansion in microbial populations'

August 2015 – Ecological Society of America
'Range expansions transition from pulled to pushed waves with increasing cooperation'

March 2015 – American Physical Society March meeting
'Range expansions transition from pulled to pushed waves with increasing cooperation'

Poster presentations

January 2021 – Society for Neuroscience Global Connectome (co-presenting with Ethan McBride)
'Diverse cortical responses to claustrum perturbation'

January 2021 – Society for Neuroscience Global Connectome (co-presenting with Leslie Claar and Irene Rembado)
'Detecting consciousness in mice using perturbational complexity'

October 2019 – Allen Institute Showcase

'Differentiation of neural responses across the visual hierarchy in mouse brain and convolutional neural networks'

March 2018 – American Physical Society, March meeting

'Cooperation mitigates diversity loss during spatial range expansions'

January 2017 – Gordon Research Conference for Statistical Physics in Biology

'Cooperation mitigates diversity loss during spatial range expansions'

July 2016 – Q-Bio summer conference

Spotlight poster titled 'Cooperation increases rate of spatial range expansion in microbial populations'

References

Available upon request.