Contact Information

Farzaneh Najafi
Assistant Professor
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Research Interests

Using experimental and computational approaches to understand the neural circuits and computations that underlie perception and learning, with the eventual goal to apply the findings to the treatment of psychiatric and neurological disorders.

Positions

Assistant Professor
- Biological Sciences, Georgia Institute of Technology (2023-present)

Training Faculty
- Computational Neural Engineering Training Program (CNTP), Georgia Institute of Technology (2024-present)

Adjunct Faculty
- School of Electrical and Computer Engineering, Georgia Institute of Technology (2025-present)
- Neuroscience Graduate Program, Emory University (2023-present)
- Biomedical Engineering Graduate Program, Georgia Institute of Technology (2023-present)
- BioEngineering Graduate Program, Georgia Institute of Technology (2023-present)

Scientist II
- Allen Institute for Brain Science, Seattle, WA (2019-2022)

Education

PhD, Biology
- University of Pennsylvania, Philadelphia, PA, USA
- 2007-2014

MSc, Biotechnology
- University of Tehran, Tehran, Iran
- 2005-2007

BSc, Biotechnology
- University of Tehran, Tehran, Iran
- 2002-2005

Research Training

Postdoctoral Fellow
2014-2019, Cold Spring Harbor Laboratory, NY**,** USA
- Population coding of decision-making signals by excitatory and inhibitory neurons in mouse parietal cortex
- Advisor: Anne Churchland

PhD student

2007-2014, University of Pennsylvania, PA, USA
- Trial-by-trial coding of instructive signals in the cerebellum: insights from eyeblink conditioning in mice
- Advisor: Javier Medina

Visiting Student Research Collaborator
2010-2012, Princeton University, NJ, USA
- Two-photon imaging of sensory-evoked calcium signals in Purkinje cell dendrites of awake mice
- Advisor: Sam SH Wang

Master's student
2005-2007, Royan Research Institute, Tehran, Iran
- Differentiation of dorsal cell types of the neural tube from mouse Embryonic Stem Cells using BMP4
- Advisor: Hossein Baharvand

Honors and Awards

HHMI Freeman Hrabowski Scholar Finalist [pending final interviews]
"Neural Circuitry Underlying Predictive Processing During Passive and Active Behavior"
PI: Najafi F
2024

Scialog Collaborative Award
"Rewiring Genome in 3D to Enhance Cognition after Sleep Deprivation across Species"
PI: Najafi F, Tan L (Stanford), Tabuchi M (Case Western)
2024

Scialog Collaborative Award:
"From Spikes to Neuromodulation: Uncertainty Coding in Rodents and Primates"
PI: Najafi F, Disney A (Duke), Chen R (UCSF)
2024

Whitehall Foundation Award:
"Neural Circuitry Underlying Sensorimotor Temporal Processing"
PI: Najafi F
2024

Chan-Zuckerberg Initiative, Collaborative Supplemental Award:
"Investigating Temporal and Novelty Coding in Hippocampal-Parietal Circuits"
PI: Najafi F, Mortensen L
2024

Scialog Fellow, Molecular Basis of Cognition
2024

Chan-Zuckerberg Initiative, Collaborative Pairs Pilot Project Award:
"Does the Cerebellum Sleep? Exploring the Mechanisms and Significance"
PI: Najafi F, Tononi G (U Wisconsin)
2024

1st place award winner for poster presentation at the Gordon Research Conferences on the Cerebellum
2013

College Award scholarship from the Ministry of Sciences, Research and Technology, Iran
2004

Achievements

Georgia Tech President *Ángel Cabrera* recognized Najafi's Scialog Collaborative Awards

2024

Proposal selected for Cluster Hire Initiative, College of Science, Georgia Tech: Science for Georgia Communities
2024

Collaborative proposal selected to organize *Frontiers in Science Symposium* at Georgia Tech in 2025: "Biological and Artificial Intelligence"
2024

Proposal accepted to mentor interns for the Summer Internship Program at the Allen Institute
2020, 2022

Ranked 29th nationwide in the National University Entrance Exam among ~ 500,000 participants; hence, admitted to the Medical School & the Continuous PhD Program in Biotechnology, University of Tehran, Iran
2002

Qualified for the 1st level for the Iranian National Biology Olympiad
2000

Student Success Activities

PhD students, Yicong Huang, selected as GT/Emory CNTP scholar, Computational Neural Engineering Training Program
2024

PhD students, Sana Aminnaji, selected as GT/Emory CNTP scholar, Computational Neural Engineering Training Program
2024

Master's student, Esha Choudhary, received GRA for the Bioinformatics Master's Program
2024

Master's student, Hosala Patil, received GRA for the Bioinformatics Master's Program
2023

Papers and Preprints

Spike Reliability is Cell-Type Specific and Shapes Excitation and Inhibition in the Cortex
- Russo S, Stanley GB, **Najafi F**
- Scientific Reports (2025); PMID: 39747147

Constructing Biologically Constrained RNNs via Dale's Backprop and Topologically-Informed Pruning
- Balwani A, Wang AQ, **Najafi F**, Choi H
- bioRxiv (2025); DOI: https://doi.org/10.1101/2025.01.09.632231

Unexpected events modulate context signaling in VIP and excitatory cells of the visual cortex
- **Najafi F***, Russo S, Lecoq J*
- iScience (2025); DOI: https://doi.org/10.1016/j.isci.2024.111728 [***Co-corresponding author**]

Stimulus novelty uncovers coding diversity in visual cortical circuits
- Garrett M*, Groblewski P*, Piet A*, Ollerenshaw D*, **Najafi F***, Yavorska I*, ..., Zeng H, Philips J, Mihalas S, Arkhipov A, Koch C, Olsen S
- bioRxiv (2023) [***Co-first author**]

Excitatory and inhibitory subnetworks are equally selective during decision-making and emerge simultaneously during learning
- **Najafi F**, Elsayed GF, Cao R, Pnevmatikakis E, Latham PE, Cunningham JP, Churchland AK
- Neuron (2020); PMID: 31753580

Bidirectional short-term plasticity during single-trial learning of cerebellar-driven eyelid movements in mice
- **Najafi F**, Medina JF

- Neurobiology of Learning and Memory (2020); PMID: 31610225

CaImAn: An open source tool for scalable Calcium Imaging data Analysis
- Giovannucci A, Friedrich J, Gunn P, Kalfon J, Koay SU, Taxidis J, **Najafi F**, Gauthier JL, Zhou P, Tank DW, Chklovskii DB, Pnevmatikakis E
- eLife (2019); PMID: 30652683

Perceptual Decision-making: a field in the midst of a transformation
- **Najafi F**, Churchland AK
- Neuron (2018); PMID: 30359608

Cerebellar granule cells acquire a widespread predictive feedback signal during motor learning
- Giovannucci A, Badura A, Deverett B, **Najafi F**, Pereira TD, Gao Z, Ozden I, Kloth AD, Pnevmatikakis E, Paninski L, De Zeeuw CI, Medina JF, Wang SS
- Nature Neuroscience (2017); PMID: 28319608

Sensory-driven enhancement of calcium signals in individual Purkinje cell dendrites of awake mice
- **Najafi F**, Giovannucci A, Wang SSH, Medina JF
- Cell Reports (2014); PMID: 24582958

Coding of stimulus strength via analog calcium signals in Purkinje cell dendrites of awake mice
- **Najafi F**, Giovannucci A, Wang SSH, Medina JF
- eLife (2014); PMID: 25205669

Beyond “all-or-nothing” climbing fibers: graded representation of teaching signals in Purkinje cells
- **Najafi F**, Medina JF
- Frontiers in Neural Circuits (2013); PMID: 23847473

Differentiation of mouse embryonic stem cells into dorsal interneurons of the spinal cord using BMP4 and Activin A
- **Najafi F**, Hatami M, Zare N, Baharvand H
- Yakhteh Medical Journal (2009) 11(3): 277-84

Press

2025: Podcast: A New Healthcare Era, invited guest

2025: Georgia Tech News
[From Molecules to Mind: Farzaneh Najafi Receives Multiple Awards for Cognitive Research]

2023: Podcast: WiN (Women in Neuroscience), invited guest
[Stories of WiN]

2021: Podcast: Konjab (in Farsi on Neuroscience), invited guest

2020: Podcast: Experimental (in Farsi), Biotechnology Integrated PhD Program, University of Tehran, Iran

Books

Translation of “Developmental Biology, 8th edition by S.F. Gilbert” to Persian
- Baharvand H, Afzal E, Faghihi F, Karamali F, Moghaddasali R, **Najafi F**, Piryaee A, Siadat SF

Publicly Available Data and Code

Data:
- http://repository.cshl.edu/36980
  Postdoc Dataset: CSHL repository, 2018

- https://portal.brain-map.org/explore/circuits/visual-behavior-2p
  Allen Institute Visual Behavior Dataset, 2021

Code:

- https://github.com/najafi-laboratory
- https://github.com/farznaj/imaging_decisionMaking_exc_inh
- https://github.com/AllenInstitute/mesoscope_manuscript
- https://github.com/AllenInstitute/visual_behavior_analysis/tree/feature/clustering/visual_behavior/clustering
- https://github.com/AllenInstitute/visual_behavior_analysis/tree/feature/clustering/visual_behavior/decoding_population

Service

Member, Collaborative community experiment through the OpenScope program: Neural mechanisms of predictive processing
2025

Organizer of Frontiers in Science symposium: *Intelligence: From AI to the Brain — and Back*; College of Science, Georgia Tech
2025

Quantitative Biosciences PhD Program, Admission Committee Member, Georgia Institute of Technology
2024-present

Barrels Pre-SFN Meeting organizer
2024-present

Inaugural member, steering committee: Center of Excellence in Computational Cognition (CoCo) , Georgia Institute of Technology
2023-present

Organizer of Sybeco: virtual, author-led journal club on Systems, Behavioral & Computational Neuroscience, Atlanta Neuro Community
2023-present

Member of the committee for selecting the Next Generation Leaders (NGLs), Allen Institute for Brain Science
2021

Cochair of the committee for selecting distinguished Brain Science seminar speakers, Allen Institute for Brain Science
2020-2022

Organizer of author-led Journal Club for Systems & Computational Neuroscience, Allen Institute for Brain Science
2020-2022

Reviewer of Cosyne abstracts
2019-present

Reviewer for Nature Communications, eLife, PlOS Computational, Frontiers, etc. manuscripts
2019-present

Mentoring and Outreach

Exhibitor at Atlanta Science Festival, CNTP booth (Computational Neural Engineering Training Program), Georgia Tech
2025

Mentor for high school student participant in NIH STEP-UP program: Short-Term Research Experience Program to Unlock Potential, Georgia Institute of Technology
2024

Interviewed as an alumnus for the 25th Anniversary of the Biotechnology Program, University of Tehran, Iran
2024

Interviewed for an episode of Women In Neuroscience (WIN) Podcast series
2023

Mentor for a student participant in the Summer Internship Program, Allen Institute for Brain Science
2022

TA and mentor at the Summer Workshop on the Dynamic Brain (SWDB), Allen Institute for Brain Science
2021

Mentor for a student participant in the Summer Internship Program, Allen Institute for Brain Science
2020

Mentor for 2 groups of students at Neuromatch Academy: online course for computational neuroscience
2020

Mentor for undergraduate student participant in NSF-funded REU in Computational Neuroscience & Bioinformatics at Cold Spring Harbor Laboratory
2016

Volunteer at Girl Scout of Nassau County - STEM conference, Cold Spring Harbor
2017

Mentor at 1000 girls, 1000 futures mentorship program,
2015-2017

Volunteer at DNA Learning Center for WiSE (Women in Science and Engineering), Cold Spring Harbor
2016

Volunteer at Long Island Makers Festival
2015

Science Pen Pal for a high school student
2015

Teaching

Scientific Communication, Georgia Institute of Technology
2025

Human Neuroanatomy, Georgia Institute of Technology
2023

Teaching Assistant at the University of Pennsylvania for the following courses:
Introduction to Brain and Behavior; 2) Cellular Neurobiology; Cell Biology and Biochemistry; 4) Principles of Microbiology
2007-2009

Talks

Invited speaker, Frontiers in Science, hosted by the College of Sciences, “Intelligence: From AI to the Brain and Back”
2025, Georgia Tech, Atlanta

Invited speaker, Regenerative Bioscience Center
2025, University of Georgia, Atlanta

Invited speaker, Department of Biomedical Informatics
2025, Emory University, Atlanta

Invited speaker, Frontiers in Neuroscience

2024, Emory University, Atlanta

Speaker at the Intersection of Biology and Engineering (IBE) workshop
2024, Georgia Tech Research Institute (GTRI)

Short Talk: “Predictive processing in the whisker system”
2024, Barrels meeting, Chicago

Talk; zoomed colloquium for Biology department, Illinois Tech biology
2024, virtual

Invited speaker at Neuroscience Competition Program to promote neuroscience among college students in Iran
2024, virtual

Talk: Novelty modulates neural coding and reveals neuronal functional diversity
2023, Barrels meeting, Johns Hopkins University

Invited speaker at Atlanta Neuro Community
2023, Atlanta

Invited speaker at Biology Seminar Series
2023, Emory University

Invited speaker, Institute of Neuroscience (ION) Seminar Series
2022, University of Oregon

Invited speaker at the symposium 'Neural Basis of Auditory Decision- Making
2022, Association for Research in Otolaryngology (ARO)

Speaker at the Summer Workshop on the Dynamic Brain (SWDB): Introducing the Visual Behavior project of the Allen Institute
2021

Invited speaker at the Simons Collaboration on the Global Brain (SCGB), postdoc meeting
2021, SCGB

Invited speaker: *“Distinct cortical representation & interaction following unexpected events in a visual task”*
2021, Weill Cornell Medicine

Invited speaker: *“Multiplane Mesoscope reveals distinct cortical interactions following violations of expectation”*
FINS
2020, Iran, Basic & Clinical Neuroscience Congress

Invited speaker: *“Cerebellar encoding of teaching signals and PPC encoding of decision signals”*
2017, Iran, Institute for Research in Fundamental Sciences

Conference Presentations

Balwani, Wang A, **Najafi F**, Choi H
“Constructing biologically constrained RNNs with Dale’s backprop and topologically-informed pruning”
2025, Cosyne

Huang Y, Shamsnia A, Stamm T, Aminnaji S, Patil H, Coplenad L, Zhang Y, **Najafi F**
“Cerebellar-Parietal Dynamics During Predictive Motor Timing Behavior”
2024, SFN, Chicago

Medepalli S, **Najafi F**
“VIP Inhibitory Neurons in the Visual Cortex Perform Two Types of Predictive Processing: Stimulus Specific & Non-specific”
2022, Neuromatch Conference

Najafi F*, Yavorska I*, Garrett M*, Piet A*, Groblewski PA*, Arkhipov A, Mihalas S, Olsen SR
"Novelty modulates neural coding and reveals functional diversity within excitatory and inhibitory populations in the visual cortex"
2022, Portugal, Cosyne

Gupta A, **Najafi F**
"Recurrent Neural Networks reveal distinct signal flow in mouse visual cortex following expectation violations"
2020, Neuromatch Conference

Najafi F, Orlova NY, Tsyboulski D, Seid SM, Kato I, …, Olsen SR, Lecoq J
"Activation of distinct cortical circuitries by expected and unexpected stimuli"
2020, Denver, Cosyne

Najafi F, Orlova NY, Tsyboulski D, Seid SM, Kato I, …, Olsen SR, Lecoq J
"Representation of unexpected stimuli across functionally connected cortical columns during visual behavior in mouse"
2019, Chicago, Society for Neuroscience

Najafi F, Elsayed GF, Pnevmatikakis E, Cunningham JP, Churchland A
"Inhibitory and excitatory populations have similar accuracy yet different redundancy in predicting the choice during perceptual learning"
2018, San Diego, Society for Neuroscience

Najafi F, Elsayed GF, Pnevmatikakis E, Cunningham JP, Churchland A
"Inhibitory and excitatory populations in parietal cortex are equally selective for decision outcome in both novices and experts"
2018, Main, Gordon, Neurobiology of Cognition

Najafi F, Elsayed GF, Pnevmatikakis E, Cunningham JP, Churchland A
"Excitatory and inhibitory neural populations reflect single trial decisions"
2018, Denver, Cosyne

Najafi F, Elsayed GF, Pnevmatikakis E, Cunningham JP, Churchland A
"Single-trial decision can be predicted from population activity of excitatory and inhibitory neurons"
2017, Salt Lake City, Cosyne

Najafi F, Elsayed GF, Pnevmatikakis E, Cunningham JP, Churchland A
"Population dynamics of excitatory and inhibitory neurons in mouse parietal cortex during decision-making"
2016, San Diego Society for Neuroscience

Najafi F, Medina J.F.
"Contribution of short-term memory to single-trial motor adaptation in mice"
2013, New London, NH, Gordon Research Conference

Najafi F, Giovannucci A, Kloth AD, Wang SSH, Medina JF
"Climbing fibers code for the strength of periorbital airpuff stimuli in single trials"
2011, Washington, DC, Society for Neuroscience

Giovannucci A, **Najafi F**, Kloth AD, Medina JF, Wang SSH
"Calcium imaging from cerebellar neuronal populations after eyeblink conditioning in head-fixed mice"
2011, Washington, DC, Society for Neuroscience

Najafi F, Medina JF
"Trial-by-trial motor adaptation to error size during eyeblink conditioning in mice"
2010, San Diego, Society for Neuroscience

Arlt C, **Najafi F**, Giovannucci A, Mcdougle S, Wang SSH, Ozden I, Medina JF
"Eyeblink conditioning and in vivo calcium imaging in mice walking on a floating-ball apparatus"
2010, San Diego, Society for Neuroscience

Najafi F, Baharvand H, Hatami M, Zare N, Farrokhi A
"Generation of dorsal cell types of the neural tube through BMP signaling"
2006, Innsbruck, Austria, Society of Differentiation

Najafi F, Baharvand H, Hatami M, Massumi M, Zare N
"Specification of diverse cell types of the dorsal half of the neural tube in the mouse embryo by BMP4"
2006, Toronto, Canada, Society for Stem Cell Research

Attended Conferences and Workshops

Society for Neuroscience (SFN)
2008-Present: 2024 (Chicago)

Chan-Zukerberg Initiative (CZI) Awardees meeting
2025, San Jose, CA

Chan-Zukerberg Initiative (CZI) Awardees meeting
2024, Monterey, CA

Gordon Research conferences: Thalamocortical
2024, Ventura, CA

Barrels Meeting
2023 (Baltimore), 2024 (Chicago)

Gordon Research conferences: Cognition
2018, Main

Gordon Research conferences: Cerebellum
2013 (NH), 2023 (NH)

Cosyne
2017, 2018, 2020, 2022

Courses

Summer Workshop on the Dynamic Brain (SWDB)
2021, Allen Institute

Neuropixels workshop
2021, Allen Institute

Computational Vision Course
2016, CSHL

Machine Learning (by Andrew NG)
2016, Coursera

Programming Skills

Python
2015-present

Matlab
2008-present