Erfan Zabeh

Curriculum Vitae

The Jerome L. Greene Science Center, Columbia University, 3227 Broadway, New York, NY
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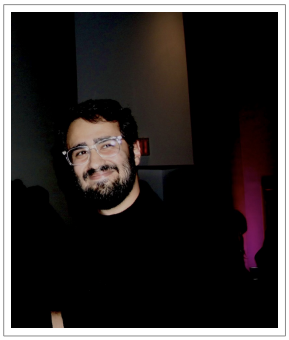

Education

2021–Present **Columbia University**, *PhD candidate, Biomedical Engineering and Biological Science.*
Advisor: Joshua Jacobs and Jacqueline Gottlieb

2019–2021 **Columbia University**, *M.Sc in Biomedical Engineering.*
Thesis: Cortical Traveling Waves as Operational Units for Cognitive Control

2013–219 **Sharif University of Technology (SUT)**.
- B.Sc In Electrical Engineering
- Minor In Physics
- Minor In Mathematical Science

2012–2013 **National Organization for Development of Exceptional Talents (NODET)**.
- Preparation Program for International Olympiads,Young Scholar Club.
  - **Bronze** Medalist, 7th IOAA, Volos, Greece.
  - **Gold** Medalist, 8th National Astronomy Olympiad

Mentorship

From my earliest days in academia, I recognized the profound art of mentorship. It's not a craft mastered overnight, but cultivated over time with care, insight, and a deep commitment to diversity and inclusion. As I stand poised to lead my own research endeavors, my pledge remains: to enlighten, inspire, and nurture a diverse and inclusive cohort of the next generation of thinkers.

2023-now Seokhee Kong [**Master**]

2022 Keen Huei Liew [**Undergrad**].Women In Science Program

2022-now Matin Moezi [**Undergrad**](Currently Master student at Toronto)

2019–2022 Mahdi Mahdavi [**M.D**] (Currently PhD at Mcgill Neuroscience program.) Publication

2020–2022 Hadi Coubdar [**M.D**] (Currently PhD at Mcgill Neuroscience program). Publication

Fellowships and Awards

2023 **Trainee Professional Development Award (TPDA)**, *for the Annual Meeting of the Society of Neuroscience (SfN), San Diego, USA*, Link.

2019 **Research Initiatives in Science and Engineering (RISE) Award**, *Columbia University seed funding to initiate very early-stage, potentially high-impact, interdisciplinary, and high-risk research collaborations that may trigger novel scientific paradigms*, Link.

2017 **Neuroscience Research Fellowship**, *Three months research fellowship from the Department of Biological and Visual Sciences, State University of New York, covering tuition and stipend.*

2016 **Neuroscience Summer Intern Fellowship**, *Brain Engineering Research Center (IPM)-sponsored summer research experience at SUNY College of Optometry.*

2013 **Bronze Medalist**, *7th International Olympiad on Astronomy and Astrophysics (IOAA), Volos, Greece.*

2013 **University Scholarship**, *Merit scholarship of National Elites Foundation.*

2012 **Pre-College Scholarship**, *Full-tuition scholarship for pre-college studies by Allameh Tabatabai high-school .*

2012 **Gold Medalist**, *8th National Olympiad on Astronomy and Astrophysics, Tehran, Iran.*

In preparation

E. Zabeh, J. Jin, R. Lashgari and J. M. Alonso, " Sparse set of axonal afferents sufficiently model thalamocortical development ".

E. Zabeh, J.P. Gottlieb*, J. Jacobs*, " Cortical traveling waves regulates the neuronal spiking activity across space and time".

E. Zabeh*, L.Kunz*, J. Jacobs " The essence of egocentric representation of space in networks trained for path-integration ".

E. Zabeh,[a theory advisor] ,J.P. Gottlieb*, J. Jacobs*, " computational benefits of traveling waves in neural networks".

E. Zabeh*, M. Nejatbakhshesfahani* , H. R. Nasrabadi , V. Davoodnia , N. C. Foley, R.Lashgari, J. Gottlieb " Robust encoding of reward expectation in low beta band power in monkey dorsolateral prefrontal and inferior parietal lobe ".

Publications

14. **E. Zabeh**, N.C. Foley, J. Jacobs*, J.P. Gottlieb*, Beta traveling waves in monkey frontal and parietal areas encode recent reward history, **Nature Communication**, 2023.

13. A. Das, **E. Zabeh**, J. Jacobs. Detection and analysis of traveling waves in human intracranial EEG oscillations. Handbook of Intracranial EEG for Cognitive Neuroscience, 2023.

12. Gottlieb J, Cohanpour M, Li Y, Singletary N, **E. Zabeh**. Curiosity, information demand and attentional priority. Current Opinion in Behavioral Sciences. 2020

11. **E. Zabeh***, M. Mahdavi*, H. Coubdar*, R. Lashgari, H. Omrani. Neural and clinical investigation of pregabalin effectivity in treatment of neurological movement disorder [Under review: Frontiers in human neuroscience]. 2022

10. H. Choubdar*, M. Mahdavi*, Z. Rostami*, **E. Zabeh**, M. Gillies, A. Green, T. Aziz, R. Lashgari. Neural Oscillatory Characteristics of Feedback Associated Activity in Globus Pallidus Interna [Under review: eNeuro]. 2022

9. A. Vafaei, M. Mohammadi, A. Khadir, **E. Zabeh**, F. Yazdani, M. Khorasani, R. Lashgari. V1 receptive field structure contributes to neuronal response latency [bioRxiv]. 2022.

8. Z. Fazlali, Y. Ranjbar, **E. Zabeh**, and E. Arabzadeh, Stimulation of Locus Coeruleus Noradrenergic System Modulates Sensory Processing and Brain State in two different time scales, eLife [under review],2022.

7. Maas B*, **Zabeh E***, Arabshahi S*. QuickTumorNet: Fast Automatic Multi-Class Segmentation of Brain Tumors. Neural Engineering IEEE/EMBS 2021

6. **E. Zabeh***, M. Kheirkhah*, P. Delavari*, A. Ghazizadeh. EEG Alpha waves are induced by activities in superficial depths of the cerebral cortex [preprint]. 2019

5. Rad PN, Behzadi F, Yazdanfar A, Ghamari H, **Zabeh E**, Lashgari R. Cognitive and perceptual influences of architectural and urban environments with an emphasis on the experimental procedures and techniques. Journal of Environmental Psychology 2021

4. Mahdavi M*, Choubdar H*, **Zabeh E***, Rieder M, Safavi-Naeini S, Khanlarzadeh V, Jobbagy Z, Ghorbani A, Abedini A, Kiani A, Lashgari R. A machine learning based exploration of COVID-19 mortality risk. PLOS ONE 2021

3. Hashemi SM, Pirmoradi A, **Zabeh E**. Chaos Control in Virtual Cathode Oscillator by Cathode Structural Optimization. PIERS 2015, Prague

2. GBD research group, "Mapping 123 million neonatal, infant and child deaths between 2000 and 2017." Nature

1. GBD research group, Global, regional, and national cancer incidence, mortality, years of life lost, years lived with disability, and disability-adjusted life-years for 29 cancer groups, 1990 to 2017, JAMA oncology

Abstracts

E. Zabeh, N.C. Foley, J. Jacobs, J.P. Gottlieb, Traveling waves regulate neuronal spiking activity across space and time, Society for Neurosceice, 2022

E. Zabeh, N.C. Foley, J. Jacobs, J.P. Gottlieb, Traveling waves in the monkey frontoparietal network, Society for Neurosceice, 2021

E. Zabeh, J. Jin, R. Lashgari and J. M. Alonso, " 100 thalamic afferents per cortical point are sufficient to accurately map on and off retinotopy in Cat visual cortex", Society for Neuroscience, Washington, DC, 11-15 November, 2017

M. Nejatbakhshesfahani , H. R. Nasrabadi , V. Davoodnia , **E. Zabeh** , N. C. Foley, R.Lashgari, J. Gottlieb " Robust encoding of reward expectation in low beta band power in monkey

dorsolateral prefrontal and inferior parietal lobe ", Society for Neuroscience, Washington, DC, 11-15 November, 2017

E. Zabeh, A. Siahkamari, J. Jin, R. Lashgari and J. M. Alonso, "Horizontal Organization Of Thalamic Inputs In Visual Cortex",Society for Neuroscience, San Diego, CA, 12-26 November, 2016

Invited Talks

John Hopkins University, Maryland United States

5th Basic and Clinical Neuroscience Congress, Terhan, Iran

Brain Engineering Symposium, IPM, Tehran, Iran

Neuroscience Workshop, Sharif University of Technology, Tehran, Iran

Invited Peer Reviewing

- **Frontiers** Link
- **Journal of Neuroscience**
- **Expert Systems With Applications**
- **Academia Letter**

Executive and Leadership Experiences

2022–Now **President**, *IEEE Engineering in Medicine and Biology Society (EMBS), Columbia student chapter, New York.*
Link

2022–Now **Graduate student Liaison**, *Columbia Iranian Students Association (CISA), Columbia University, New York.*
Link

2021–2022 **Trainee member**, *Columbia Neuroscience Seminar selection committee, select, invite, and host speakers for Neuroscience department weekly seminars.*

2020–2021 **Vice President**, *IEEE EMBS, Columbia student chapter, New York.*

2019–2020 **NYC International House Volunteer Resident**, *Resident fellow of the "The Leader In Me Program" and the executive member of International House, I-House NYC, New York.*

Spring 2018 **Workshop Organizer**, *Comprehensive Workshop on Analysis and Interpretation of Primate Electrophysiological data,Institute for Fundamental Research, Tehran,Iran*, Link .

Fall-2018 **Information Officer**, *Executive Board, Sharif Neuroscience Symposium, Sharif University of technology, Tehran*, Link.

2017 **Conference Executive Board**, *Hosting the International Speakers and Faculty Members, Brain Engineering and Computational Neuroscience symposium*, Link.

2015 **Educational Team Leader**, *Leading Talented Students as National Team for International Olympiad on Astronomy and Astrophysics (IOAA)*, Young Scholars Club, Ministry of Education, Tehran, Iran, Link.

Fall 2013 **Competition Executive Member**, *Sharif-Cup-2013, Robotic Competition, Sharif University of Technology*.

2012 **Financial Officer**, *Night sky observation Organization, Allameh Tabatabai High-School, Tehran* .

Research Experience

Jul–Oct 2017 **Department of Biological and Visual Sciences, State University of New York, College of Optometry, New York**, *Summer Research Assistant*, Under Supervision of **Dr.Jose Manuel Alonso**.

- Developing a mathematical model to explain thalamocortical unknown details (such as competition between on and off polarity, number of thalamic afferents per cortical point, etc.) via cat visual cortex receptive fields, measured by 32 channel multielectrod array from layer 4 of V1
- getting trained as a visitor in cat electrophysiology recording lab (current experiments are measured by 96 channel multielectrod)
- Writing the upcoming paper

Jul–Oct 2017 **Kavli Institute for Brain Science, Columbia University, NewYork**, *Summer Research Assistant*, Under Supervision of **Dr.Jacqueline Gottlieb**.

- Analyzing spikes and LFP signals, recorded with 2, 48-channel Utah arrays from both dorsolateral prefrontal cortex (dlPFC) and parietal area 7a of monkey to examine how reward prediction are encoded in this two areas
- Getting more familiar with advance challenges in behavioral task designing and monkey single unit recording

Jul–Sep 2016 **Department of Biological and Visual Sciences, State University of New York, College of Optometry, New York**, *Summer Research Assistant*, Under Supervision of **Dr.Jose Manuel Alonso**.

- Computer simulation to estimate the thalamic axon pattern which reproduce the ON-OFF horizontal cortical changes. (Horizontal changes in ON and OFF cortical retinotopy within cat visual cortex, measured using multielectrode 32 channel arrays
- Preparing Poster contents for 2016 SFN presentation

2015–Present **Brain Engineering Research Center, Institute for Research in Fundamental Sciences (IPM), Tehran**, *Official Research Assistant* , Under Suppervision of **Dr.Reza Lashgari**.

- Analyzing spikes and LFP signals, recorded with 2, 48-channel Utah arrays from both dorsolateral prefrontal cortex (dlPFC) and parietal area 7a of monkey to examine how reward prediction are encoded in this two areas
- Getting more familiar with advance challenges in behavioral task designing and monkey single unit recording.
- Participated in electrophysiology lab setup group (various experience such as visual task designing for monkey training, delay estimation of stimulus presentation system,etc.)
- Involved in International collaboration projects with Alonso Lab (Since 2015,Montly-skype) and Gottlieb Lab in Columbia University (Since 2016, Weekly-Skype meeting)
- Attended in weekly journal clubs and Lab's public seminars

2015–2016 **Sina Robotics and Medical Innovators, Imam Khomeyni Hospital, Tehran**, *Student Intern*.

- Designing CPR patient simulator based on Laerdal group products

Teaching Experience

2021–Present **Teaching Assistant**, *Columbia University*.
- Memory and Navigation (Spring 2021) Prof. Joshua Jacobs

2015–Present **Teaching Assistant**, *Sharif University of Technology*.
- Electrical Engineering Department
  - System Neuroscience (Spring 2018), Dr. Ghazizadeh
  - Adv. Topics in Neuroscience (Fall 2018), Dr.Ghazizadeh
  - Computational Intelligence (Spring 2016), Dr.Hajipoor
  - Principle of Biomedical Engineering (Fall 2017), Dr.Hajipoor
- Physics Department
  - Neuroscience (Fall 2016), Dr.Lashgari
  - Analytical Mechanics(Spring 2015), Dr.Naseri

2013–2015 **Teaching preparation courses for International Olympiad on Astronomy and Astrophysics (IOAA)**, *Young Scholars Club, Ministry of Education, Tehran, Iran.*
- Data Analysis
- Cosmology
- Observation

2012–2016 **Teaching preparation classes for national Olympiad on Astronomy and Astrophysics (IOAA) for high school students**.
- High schools and Institutes
  - Allameh Tabatabaei Complex (ATCCE) (2012–2016)
  - Salam HighSchool (2015–2016)
  - Farzanegan HighSchool (2015)
  - Allameh Helli HighSchool,Tehran, Iran (2013)
- Courses
  - Calculus I and II
  - Special Relativity
  - Celestial Mathematic
  - Astrophysics
  - Analytical Mechanics
  - Observation

Languages

Farsi **Native**

English **Fluent**

Chinese **Elementary**

Membership

2015–Present Society For Neuroscience (SFN)

2017–Present IEEE EMBS

Computer Skills

Scientific Computation

Matlab, R

Neural-Behavioral Softwares

Chronux, FieldTrip, EEGLAB, MonkeyLogic, Psychtoolbox

Programming Languages

Python, C++, Assembly(x86, MIPS, AVR)

Circuit Design/Simulation

VERILOG, Proteus, Pspice, Hspice, Quartus

Layout Sofrtwares

Altium Designer

Academic References

Joshua Jacobs

[Affiliation]: Associate Professor, , Department of Biomedical Engineering, Fu Foundation School of Engineering and Applied Science, Columbia University, New York, USA. [email]: joshua.jacobs@columbia.edu [Office]: 212-854-2445

Jacqueline Gottlieb

[Affiliation]: Professor, Department of Neuroscience, Columbia University, New York, USA. [email]: jg2141@cumc.columbia.edu [Office]: 646-774-7347

Jose Manuel Alonso

[Affiliation]: Distinguished Professor, Department of Biological and Visual Sciences, State University of New York, New York, USA. [email]: jalonso@sunyopt.edu [Office]: 212 938-5573

Reza Lashgari

[Affiliation]: Faculty Member, Brain Engineering Research Center, Institute for Research in Fundamental Science (IPM), Tehran, Iran. [email]: rezalashgari@ipm.ir , rezalashgari@gmail.com

Ali Ghazizadeh

[Affiliation]: Assistant professor, Electrical Engineering Department Sharif University of Technology and Investigator in School of Cognitive Sciences, Institute for Research in Fundamental Sciences (IPM), Tehran, Iran. [email]: alieghazizadeh@gmail