Anal Kumar

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Anal Kumar
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Interests

Primary: Neural encoding, single neuron computations, learning algorithms, networks of biophysically realistic neurons

Secondary: Working memory, synaptic and intrinsic plasticity, disinhibitory networks, predictive coding, memory consolidation, neural sequences

Expertise

- Python
- MOOSE
- NEURON
- Brian2
- LATEX
- xarray, pandas
- Tensorflow
- Shell programming
- Optimization and fitting
- PCA, tSNE, Laplacian eigenmaps, Autoencoders
- SVM, GLM, Bayesian decoders
- Feedforward ANNs
- Statistics
- Docker
- Arduino
- Inkscape, GIMP
- I&F, Izhikevich neuron models
- Morphologically realistic conductance based models
- Models of ion channels
- Electrophysiology (Beginner)
- Immunohistochemistry
- Handling, blood perfusion, and dissection of mouse, rat, zebra finch and catfish

Education

Ph.D. *National Centre for Biological Sciences, Tata Institute of Fundamental Research*
Doctor of Philosophy degree program *July 2018 – August 2024*
Thesis: Contributions of ion channel sub-types and morphological parameters to action potential firing baseline and temporal precision
Using stochastic parameter search in detailed conductance-based single-neuron models I identify ion-channels and morphological factors that play roles in two electrophysiological features of CA1 pyramidal neurons - Depolarization Baseline Offset (DBLO) and spike-timing precision.
Supervisor: Prof. Upinder S. Bhalla, NCBS, TIFR, Bangalore

Int. MSc. *National Institute of Science Education and Research, Bhabaneswar*
Integrated Master's degree program *July 2013 – June 2018*
Major: Life Sciences
Thesis: Ontogeny of CART- and NPY- containing systems in the brain of Zebra Finch, Taeniopygia guttata
Using immunostaining, we identified neuronal populations in the brain of juvenile and adult Zebra Finch expressing anorexigenic neuropeptide CART and orexigenic neuropeptide NPY. Surprisingly, we found colocalization of these neuropeptides in MSt, AcC, IH, RPO, and Raphe Nucleus.
Supervisor: Prof. PS Singru, NISER, Bhubaneswar

Research experiences

Dr. Vatsala Thirumalai *NCBS, Bangalore*
Investigation of projections of eurydendroid cells onto reticulospinal neurons in Zebrafish larvae (Danio rerio) *October 2018 – December 2018*

Dr. Sumantra Chatterjee *NCBS, Bangalore*
Effect of Acute Immobilization Stress on Response to 22kHz Ultrasonic Vocalization Playback in Adult Male Rats *August 2018 – October 2018*

Dr. Pratik Mutha, IIT, Gandhinagar *Indian institute of Technology, Gandhinagar*
Online control of arm movement *May 2016 – July 2016*

Dr. Joby Joseph, UOH *University of Hyderabad, Hyderabad*
Electrophysiology of Tonic Immobility in Grasshoppers *May 2015 – July 2015*

Dr. Sourav Bannerjee, NBRC *National Brain Research Centre, Manesar*
Molecular Biology techniques to analyze the expression of proteins through RNAi *May 2014 – July 2014*

Publications

[1] Anal Kumar, Anzal K. Shahul, and Upinder S. Bhalla. *Mechanisms and implications of high depolarization baseline offsets in conductance-based neuronal models*. en. Pages: 2024.01.11.575308 Section: New Results. Jan. 2024. DOI: 10.1101/2024.01.11.575308.

[2] Omprakash Singh, Devraj Singh, Saptarsi Mitra, Anal Kumar, Ronald M Lechan, and Praful S Singru. "TRH and NPY Interact to Regulate Dynamic Changes in Energy Balance in the Male Zebra Finch". In: *Endocrinology* 164.3 (Mar. 2023), bqac195. ISSN: 0013-7227. DOI: 10.1210/endocr/bqac195.

Teaching Experience

Project Teaching assistant at Computational Neuroscience Neuromatch 2024. Held online

Teaching assistant-ship at Computational Approaches to Memory and Plasticity, 2022 held at NCBS, Bangalore

Teaching assistant-ship at the Neuro-Cells, computation, and synapses graduate level course, 2021 at NCBS, Bangalore

Teaching assistant-ship at Computational Approaches to Memory and Plasticity, 2019 held at NCBS, Bangalore

Conferences & workshops

Attended the Neuroscience 2024 conducted by Society for Neuroscience (SfN), Chicago, USA, 2024

Attended the 32nd Organization for Computational Neurosciences conference (CNS 2023) at Leipzig, Germany

Attended the 3rd No Garland Neuroscience conference (NGN 2023) at IISER, Pune

Attended the 6th National Post doctoral symposium (NPDS 2023) at Ashoka University, Sonipat

Attended the 2nd No Garland Neuroscience conference (NGN 2020) at IISER, Pune

Participated in the workshop entitled, "Lights on: Applications of Fluorescence Imaging in Endocrine Research" held at NISER, Bhubaneswar in 2016

Participated as an attendee in symposium on 'Neuropeptides and Neurotransmitters: Role of Physiology and Pathophysiology' held at NISER, Bhubaneswar in 2015

Attended 14 day workshop on 'Computational approaches to Memory and Plasticity' at NCBS, bengaluru in 2014

Podium and Poster presentations

1. **Anal Kumar**, Anzal K. Shahul, and Upinder S. Bhalla. Research poster. *Decoding the mechanisms behind a commonly ignored electrophysiological feature - the Depolarization Baseline Offset*. Neuroscience 2024 conducted by Society for Neuroscience (SfN), Chicago, USA, 2024
2. **Anal Kumar**, Anzal K. Shahul, and Upinder S. Bhalla. Research poster. *A common error in models of pyramidal neurons: Fixes and functional implications*. 32nd Organization for Computational Neurosciences conference (CNS 2023), Leipzig, Germany, 2023
3. **Anal Kumar**, Anzal K. Shahul, and Upinder S. Bhalla. 2-minute elevator pitch. *Depolarization Baseline: An ignored electrophysiological property of neurons*. 6th National Post doctoral symposium (NPDS 2023), Ashoka University, Sonipat, India, 2023
4. **Anal Kumar**. Lecture. *Grooving to the rhythms of the body: The physiology of sleep*. 16th Annual Sympotein, NCBS, Bangalore, India, 2023
5. **Anal Kumar**, Anzal K. Shahul, and Upinder S. Bhalla. Research poster. *A common error in models of pyramidal neurons: Fixes and functional implications*. 3rd No Garland Neuroscience conference (NGN 2023), IISER, Pune, India, 2023
6. **Anal Kumar**, Anzal K. Shahul, and Upinder S. Bhalla. Research poster. *A common error in models of pyramidal neurons: Fixes and functional implications*. Annual Talks, NCBS, Bangalore, India, 2023
7. **Anal Kumar**, Deepanjali Dwivedi, and Upinder S. Bhalla. Research poster. *Changes in ion channel physiology of hippocampal cells in mouse models of fragile-X syndrome*. Annual Talks, NCBS, Bangalore, India, 2020
8. **Anal Kumar** and Upinder S. Bhalla. Research poster. *Analyzing the electrophysiological properties of CA1 pyramidal neurons of Fragile X syndrome mice using computational models*. 2nd No Garland Neuroscience conference (NGN 2019), IISER, Pune, India, 2019
9. **Anal Kumar**, Jopby Joseph. Research talk. *Tonic Immobility in grasshoppers*. 2nd Annual Summer Research Symposium, TIFR Centre for Interdisciplinary Sciences (TCIS), Hyderabad, India, 2015
10. **Anal Kumar**. Lecture. *Memory ,Learning and its Computational Models*. Science Activities Club, NISER, Bhubaneswar, India, 2015

Awards

2024	Trainee Professional Development Award to attend Neuroscience 2024 conference at Chicago, USA
2023	Infosys Travel Award for attending "32nd Annual Computational Neuroscience meeting (CNS 2023)", Leipzig, Germany
2017	Ranked 68th Nationally in CSIR- National Eligibility Test. Awarded Junior Research Fellowship to fund Ph.D.
2016	Scholarship to participate in the Student Summer Research Internship Programme (SRIP) 2016 by Indian Institute of Technology, Gandhinagar scholar.
2015	Scholarship to participate in the Summer Research Fellowship Programme (SRFP) 2015 by Indian Academy of Science
2013-2018	DST-Inspire – Full Funding to Pursue Integrated Masters in Science at NISER, Bhubaneswar

Clubs and other activities

Coordinator of the NeuroBiology Journal Club at NCBS, Bangalore from May 2019 to December 2020

Co-founder of the neuroscience club 'Brain Matters' at NISER, Bhubaneswar (link)

References

Prof. Upinder S. Bhalla
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National Centre for Biological Sciences,
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Prof. Rishikesh Narayanan
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