Rahul Garg

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Education

Ph.D. Biology, Stowers Institute for Medical Research, Kansas City, USA   (Aug'17 – Aug'24)
Dissertation: "Top-down modulation of sensory processing in goal-directed behaviors"

B.Tech. Biological Sciences and Bioengineering, Indian Institute of Technology, Kanpur, India   (July'13 – April'17)

Research Experience

Graduate student, C. Ron Yu Lab, Stowers Institute for Medical Research   (July'18 – present)

- Designed behavior paradigms in mice with the intention of solving real-life neurological problems in humans that led to the discovery of circuits related to attentional dysfunction and impulsive aggression

- Developed in-house automation and analysis pipelines for neuroscience data collection at a predominantly non-neuroscience institute. Enhanced research on top-down attention and adaptation in sensory learning using these innovations

- Created computational models integrating behaviorally controlled data with spiking neural networks. Pioneered in-silico attention adaptation models with potential applications in machine learning frameworks

- Trained and supervised 5 masters-level students in rodent neuroscience, data analysis, and critical thinking over a span of 4 years and mentored them into graduate school. Collaborated with field experts across microscopy and transcriptomic techniques that led to 2 manuscripts in systems neuroscience

Rotation projects, Stowers Institute for Medical Research   (Jan'18 – June'18)

- Characterization of state dependent olfactory bulb responses in rodent model in Dr. Ron Yu's Lab

- Method for light activated protein dimerization system in cell cultures in Dr. Kausik Si's Lab

- Functional analysis neural crest migration in chick embryo development in Dr. Paul Kulesa's Lab

Summer researcher, Dinu Florin Albeanu Lab, Cold Spring Harbor Laboratory   (May'16 – July'16)

- Two-photon cortico-bulbar feedback imaging (boutons from Piriform cortex to Olfactory bulb) in mice trained mice on a multisensory reversal learning paradigm

- Innovated custom-made behavior setup and transformed complex electrical concepts into accessible language for future students.

Undergraduate researcher, Nitin Gupta Lab, Indian Institute of Technology   (July'15 – April'17)

- Fluid dynamics analysis of CO_2 plume structures in a wind tunnel system to investigate attraction of *Aedes aegypti* to different plume types

- Led an inter-department collaboration consisting of biology, mechanical and electrical engineers to design and manufacture a wind tunnel system

Technical Skills

(Programming and software)	DIY neural recording, behavioral and multi-omics data analysis in MATLAB, python and R, Keras, PyTorch, Tensorflow, C, ImageJ, μmanager, Kilosort, Seurat, monocle, scvelo, IMOD, AutoCAD
(Instrumentation)	DIY mouse behavior and imaging automation, Neuropixel, LFP recording, optogenetics, chemogenetics, mini-endoscope, 2-photon and wide-field calcium imaging, confocal and light sheet microscopy, Transmission electron microscopy, immunohistochemistry, tissue clearance (CUBIC), vibratome serial sectioning
(Mouse surgery and behavior)	GRIN lens and Neuropixel implantation for free moving and head fixed behaviors, Stereotaxic viral injection and cranial window prep for neural imaging and in-vivo optogenetics and chemogenetics, head-fixation implantation, perfusion, Go/no-go and two-choice training (olfactory/auditory), inequity reward paradigm, aggression tube test, resident intruder test

Courses and Conferences

Learning and Memory, NSAS'24

Advanced Techniques in NeuroImaging, Stanford'23

Modulation of Neural Circuits and Behavior, Gordon Research Conference'23 *(oral presentation)*

Vertebrate Sensory Systems, Keystone Symposia'22 *(oral presentation)*

Crossroads conference, Kansas City'19-'24 *(oral presentations '21 and '24)*

<u>Selected Posters</u>

Society for Neuroscience, Washington DC'24

Modulation of Neural Circuits and Behavior, Gordon Research Seminar'23

First Author Publications

Basal forebrain cholinergic engagement underlies performance and attention tradeoff in mouse olfactory system. Rahul Garg, Qiang Qiu, C. Ron Yu. Nature Communications (*In review July'24)*

Dopaminergic Short Axon Cells Integrate Sensory and Top-down inputs to Enable Differential Odor Responses. Rahul Garg, Vikas Kumar, Jae Hyoun Seiler, Yunming Wu, Melainia McClain, Kexi Yi, C. Ron Yu. PNAS (*In review Sept'24*)

References

Dr. C. Ron Yu (cry@stowers.org)

Dr. Kausik Si (ksi@stowers.org)

Dr. Robb Krumlauf (rek@stowers.org)

Dr. Hiroshi Nishimune (nishimun@tmig.or.jp)