GAUTAM PASSI

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gautambio.github.io

EDUCATION

M.S. in Biotechnology July 2022 – July 2023
Indian Institute of Technology Roorkee Roorkee, India
Advisor: Prof. Jitin Singla

B.S. in Biophysics June 2019 – June 2022
Panjab University Chandigarh, India

- Graduated with Honors and *summa cum laude*.
- Major: Biophysics | Minor Elective: Computer Science
- Class Rank - 1

RESEARCH EXPERIENCE

Computational Cell Structural Biology Lab | Research Fellow & Master Thesis Aug 2023 – Present
Department of Biosciences and Bioengineering, Indian Institute of Technology Roorkee Roorkee, India
Advisor: Prof. Jitin Singla

- Extended previous work by utilizing a random walk-based method to enhance contact maps, highlighting structural features of transient Intrinsically disordered proteins(IDPs) conformations.
- Reformulated the problem within a graph-theoretical framework, leveraging graph algorithms to model the dynamic behavior of IDPs with greater precision.
- Architecting and implementing a hypergraph neural network to capture complex interaction networks within IDPs, aiming to improve predictive modeling of protein dynamics.
- Creating custom algorithms to identify transient conformations, aiming to decipher therapeutic target discovery for IDPs

Master Thesis

- Performed extensive long-timescale molecular dynamics simulations of IDPs using both all-atom and coarse-grained models, generating a comprehensive dataset.
- Developed a pipeline to back-map coarse-grained simulations to all-atom representations, reducing computational cost and simulation time.
- Applied advanced unsupervised machine learning algorithms to identify and characterize structural ensembles of IDPs, revealing novel conformational states.

Bioorganic Chemistry Laboratory | Indian Academy of Sciences Summer Fellow May – July 2023
Jawaharlal Nehru Centre for Advanced Scientific Research Bangalore, India
Advisor: Prof. Thimmaiah Govindaraju.

- Conducted genomic expression assays to elucidate the role of oxidative stress in AD pathogenesis.
- Optimized protocols for differentiating induced pluripotent stem cells into neuronal cell lines using small-molecule regulators.
- Developed and cultured 3D neuronal spheroids and engineered 3D hydrogels to support them, enhancing the physiological relevance of *in vitro* models.
- Designed primers and molecular probes for gene expression validation. Performed molecular expression analyses using qPCR, dynamic light scattering, and live-cell fluorescence imaging, identifying upregulation of key genes linked to Aβ42 accumulation.
- Selected to participate in an advanced microscopy workshop by ZEISS and BioImaging Facility JNCASR.

Molecular Endocrinology Lab | Research Assistant Nov 2022 – Jan 2023
Department of Biosciences and Bioengineering, Indian Institute of Technology Roorkee Roorkee, India
Advisor: Prof. Parha Roy.

- Explored the anti-cancer effects of natural products by culturing and maintaining HeLa, HaCaT, and SiHa cell lines.
- Conducted *in silico* analysis of chemical compounds to identify potential molecular targets against cervical cancer, utilised AutoDock Vina and Rosetta
- Developed and evaluated plant-based adhesives for wound healing and clinical applications, presenting an eco-friendly alternative to petroleum-based products.

Honors and Awards

Qualified GATE Life Sciences May 2024
Ranked 307 out of 44,904 registered candidates (top 0.68%) and awarded monthly funding for a Research Fellow position by the Ministry of Human Resource Development, Government of India.

Indian Academy of Sciences Summer Research Fellowship May 2023
Awarded the prestigious Summer Research Fellowship by The Indian Academy of Sciences to pursue fully funded summer research in Alzheimer's Project.

The DBT Fellowship June 2022
Awarded a monthly fellowship by the Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, to pursue a Master's Degree.

Panjab University Gold Medal July 2022
Awarded Panjab University Gold Medal for securing the highest GPA in B.Sc (Hons.) Biophysics by the Vice President of India.

Biophysics Society - Certificate of Merit July 2021
Awarded Certificate of Merit for securing 1st Position in B.Sc. (Hons) 2nd year by the President of Biophysics Society and Chairperson Department of Biophysics.

Publications

1. Dogra S, Arora A, Aggarwal A, **Passi G**[*], Sharma A, Singh G, Barnwal RP. Mucormycosis Amid COVID-19 Crisis: Pathogenesis, Diagnosis, and Novel Treatment Strategies to Combat the Spread. *Frontiers in Microbiology*, 12, 794176 (2022). doi: 10.3389/fmicb.2021.794176.

2. Khajuria A, Alajangi H, Singh J, **Passi G**[*], Barnwal RP, Singh G, Kaur IP. Applications of Nanotechnology in Converging the Biomarker Science for Advancement in Cancer Detection and Treatment. *Handbook of Oncobiology: From Basic to Clinical Sciences*, 1–30 (2023). doi: 10.1007/978-981-99-2196-6_75-2.

3. Kaur J, Sharma A, **Passi G**, Dey P, Khajuria A, Alajangi HK, Jaiswal PK, Barnwal RP, Singh G. Nanomedicine at the Pulmonary Frontier: Immune-Centric Approaches for Respiratory Disease Treatment. *Immunological Investigations*, 53(3), 295–347 (2024). doi: 10.1080/08820139.2023.2298398.

[*] Equal contribution as first author.

Teaching and Mentoring Experience

Machine Learning and Deep Learning (BE 350) ($\sim$ 100 students) | Teaching Assistant Fall 2023; Fall 2024
Indian Institute of Technology Roorkee Roorkee, India
Instructor: Prof. Jitin Singla.

- Helped students learn mathematical foundations crucial to machine learning and deep learning, including linear algebra, probability theory, statistics, and optimization techniques, complete labs, and develop individual research projects.
- Led weekly discussion sections, held office hours, graded projects, and exams.

Bachelor Thesis Co-Mentor with Prof. Jitin Singla

- Co-mentored five Bachelor theses/Senior Theses, guiding research design and methodology.
- Reviewed and refined thesis drafts. Guided students in effectively presenting their research findings.

Skills

Laboratory Skills: Advanced Cell Culture, 3D Cell Culture, Induced Pluripotent Stem Cells, qPCR, IHC, Animal Handling, Histology, CRISPR/Cas9, Cre/loxP recombination, Electrophysiology, Neuropixels.

Programming: Python, R, SnakeMake, Machine Learning/Deep Learning Algorithms, Neural Networks.

Software & Tools: GROMACS, AMBER, Dynamic Light Scattering, Live-cell/Fluorescence Imaging, Zeiss Microscopy Suite (Multi-photon, Confocal, Spinning Disk, Atomic Force, Time-lapse).

Design: Illustrations, Drug-Molecular Diagrams, 3D Designing, Prototyping, Vectors, LaTeX.

Leadership and Volunteering

Joint Secretary – Photography Section December 2022 – Present
IIT Roorkee Roorkee, India

- Oversee aspects such as finances planning and development.
- Manage and support club training and incubation.
- Lead Astrophotography and Wildlife photography walks and expeditions.

Executive Member – Himalayan Explorer's Club August 2023 – Present
IIT Roorkee Roorkee, India

- Coordinated and organized hiking, mountaineering expeditions to the Himalayas, showcasing effective teamwork and organizational skills.
- Facilitated the planning and execution of adventure sports activities, fostering a spirit of exploration and camaraderie within the club.

Cultural Secretary – The Biophysical Society August 2019 – July 2022
Panjab University, Chandigarh Chandigarh, India

- Helped organize cultural fests.
- Coordinated in identifying talented and interested students and ensured participation in cultural fests and activities.
- Planned and implemented various cultural performances and activities of the department.