Gaurav Awasthi | Curriculum Vitae

Email: awasthi7@mit.edu | Phone: +91 7900063107 | Website: awasthigaurav.github.io

Education

Massachusetts Institute of Technology, MA, USA *Fall 2024 - Present*
Doctor of Philosophy in Chemical Engineering

Indian Institute of Technology (IIT) Bombay, Mumbai, India *2020-2024*
Bachelor of Technology (Honors) in Chemical Engineering
GPA: **9.54/10** | Honors GPA: **9.75/10** | Graduated **3rd** in a class of 155 undergraduate students

Scholastic Achievements

- Received **two undergraduate research awards** for exemplary contributions *'24*
- Achieved a **perfect 10/10 SPI** (semester performance index) in the fourth semester *'22*
- Conferred **3 AP (advanced proficiency)** grades for exceptional performance in coursework *'22*
- Awarded the prestigious **KVPY Fellowship** by the Government of India *'20*

Publications

- **Awasthi G**, Khakhar DV, "Characterization of Granular Flow in a Rotating Cylinder" *(in preparation)*
- **Awasthi G**, Sahoo S, Jolly MK, "Elucidating the Mechanisms of Basal Breast Cancer Heterogeneity through Crosstalk between Epithelial-Mesenchymal and Luminal-Basal Plasticity" *(in preparation)*
- Rajoria S, Nair D, Suvarna K, Pai MGJ, Salkar A, Palanivel V, Verma A, Barpanda A, **Awasthi G**, Doshi H, Dhara V, Burli A, Agrawal S, Shrivastav O, Shastri J, Srivastava S. "Proteomic Investigation of COVID-19 Severity During the Tsunamic Second Wave in Mumbai". Adv Exp Med Biol. 2023; 1412:175-195. **DOI:** 10.1007/978-3-031-28012-2_9

Research Experience

Characterization of Granular Flow in a Rotating Cylinder *Aug '23 - May '24*
Guide: Prof. Devang Khakhar, IIT Bombay
Characterizing the velocity and stress profiles to aid understanding of flow, mixing, and segregation dynamics, with relevance in the pharmaceutical and chemical industries

- Simulated the system in **LAMMPS**, highlighted deviations in velocity profiles from existing models and developed alternate formulations that improve goodness-of-fit by up to **10%**
- Suggested a novel definition for the interface between the flowing layer and solid bed in the cascading flow regime, characterized a **transition region** and reconciled the model

Investigating Breast Cancer Heterogeneity due to E-M Plasticity *Nov '22 - Jan '23*
Guide: Prof. Mohit Jolly, Indian Institute of Science, Bengaluru
Investigated the associations between the luminal-basal (L-B) and epithelial-mesenchymal (E-M) nature of cells by comparing correlations between the individual L-B and E-M characteristics

- Performed perturbation analysis on possible gene network topologies using **RACIPE** and implemented clustering algorithms on the steady states to compare them with observed cell phenotypes
- Implemented clustering algorithms on achieved steady states to demonstrate a strong association between the basal nature of breast cancer and a partial E-M signature

Modeling Gene Regulatory Networks Underlying Phenotypic Plasticity *Apr '22 - Jul '22*

Guide: Prof. Mohit Jolly, Indian Institute of Science, Bengaluru

Built a Boolean network to model how "teams" of epithelial and mesenchymal transcription factors interact, specifically to elucidate the existence of a partial E-M hybrid in cancer

- Utilised a Boolean architecture on Python to simulate the dynamic gene regulatory networks underlying phenotypic plasticity during **cell fate switching** through epithelial-mesenchymal transitions
- Developed an alternative computational framework using an adjacency matrix-based approach that increased efficiency by **60%** while simulating up to **100x** larger networks

Modeling Evolution of Microstructures in AM Cu-Al and Fe-Cr Systems *Nov '21 - Oct '22*

Guide: Prof. Anirban Patra, IIT Bombay

Simulated the residual stresses in microstructures during solidification to explain the asymmetry in compressive and tensile stress-strain behavior of additively manufactured (AM) metals

- Implemented **phase-field** models on MOOSE and used **finite-element methods** to perform multi-physics simulations modeling **grain growth** during solidification of pure metals and alloys
- Developed an image-processing pipeline using **OpenCV** to compare simulated microstructural attributes such as primary and secondary dendritic arm spacing with experimental data

Proteomic Analysis of the Second Wave of COVID-19 in India *May '21 - Oct '21*

Guide: Prof. Sanjeeva Srivastava, IIT Bombay

Studied the reasons behind the increased severity of the second wave of COVID-19 by finding differentially expressed proteins and peptides in nasal swab and blood plasma samples

- Leveraged **Skyline** and **MetaboAnalyst** to examine mass spectrometry files of nasal swab samples
- Identified **3** peptides from **2** proteins which were differentially expressed in non-severe and severe cases

Professional Experience

Research & Development Intern | **Hindustan Unilever Limited** *May '23 - Jul '23*

Guide: Dr. Janhavi Raut | Unilever Leadership Internship Program *Mumbai R&D Centre*

Part of the Lifebuoy bars processing team; received a **pre-placement offer** for exemplary performance

- Built a predictive and inferential model of the soap finishing line by analyzing process sensor data, generating insights to help scale-up **4** formulations from pilot plant to factory level
- Implemented a digital twin in Python and used gradient descent algorithms for regression and feature selection, achieving a **98%** reduction in error relative to previous work

Technical & Academic Projects

Design of a Chloroform Plant *Jan '24 - Apr '24*

B. Tech Design Project | Guide: Prof. R. Thaokar & Prof. S. Roy, IIT Bombay *Report*

- Drafted a 100+ page engineering design proposal for the industrial installation of a plant with 60K TPY capacity and 99.5% purity with complete process flow diagrams and process simulations

Bénard-Marangoni Film Instabilities *Aug '22 - Nov '22*

Advanced Transport Phenomena | Guide: Prof. Jason Picardo, IIT Bombay *Report*

- Reviewed **Rayleigh-Taylor** and **Bénard–Marangoni** instabilities in a liquid film, derived the stability criteria and used Python to simulate its time-varying state on perturbation

Academic Projects: Link to document entailing details of course projects taken up at IIT Bombay

Technical Skills

Programming Python, MATLAB, R, C++, LaTeX, scikitlearn, pandas, Shell (Bash)
Software LAMMPS, Ovito, RACIPE, DWSIM, MOOSE, ParaView, OpenFOAM, Gmsh

Positions of Responsibility

Editorial Board Member | **Insight, IIT Bombay** *Apr '22 - Mar '24*
The institute's official student media body, creating content reaching 13k+ students and 650+ faculty
Awarded the **Institute Journalism Color** (max. 2 out of 13000+ students) for exemplary contributions

- Led work on academic policies, technology & research articles, opinion pieces and coverage of student protests; conceptualized a **research newsletter** covering various aspects of research in the institute
- Liaised with student representatives, professors and institute functionaries to propose reforms to the preparatory courses conducted for students from marginalized **SC, ST and PwD communities**

Convener | **Chemical Engineering Tinkerer's Lab, IIT Bombay** *Jun '21 - Apr '22*
Part of the first team establishing a student-run lab focusing on applied chemical engineering projects

- Structured a **2-phase** plan under a budget of **INR 5 million**+ to procure the required equipment
- Conceived **ChemExplore** – engaged with professors to conceptualise **11 projects** for **20**+ students

Teaching, Mentoring & Volunteering Experience

Institute Student Mentor & Department Academic Mentor *May '22 - May '24*
ISMP and D-AMP, Student Mentor Program, IIT Bombay
Only student to receive the SMP **Special Recognition** (awarded by the Dean of Student Affairs) **twice** for mentorship of first-year students, and those part of the institute's Academic Rehabilitation Program

- Responsible for guiding 12 freshmen and 5 sophomores in their academic and extra-curricular pursuits
- Appointed to mentor a specially-abled student part of the Academic Rehabilitation Program

Undergraduate Teaching Assistant *Fall 2022, Spring 2024*
BB101: Introduction to Biology

- Responsible for conducting tutorial sessions and grading answer sheets for a batch of **40**+ **students**
- Conducted one-on-one doubt-solving sessions to help students with conceptual difficulties

Volunteer | **Educational Outreach** *Dec '20 - Jun '21*
National Service Scheme (NSS), IIT Bombay
Awarded the **NSS Special Mention** for exemplary contributions towards remotely tutoring underprivileged students during the COVID-19 pandemic; collaborated with NGO ASHA

- Personally tutored a student of grade 6 in elementary concepts of mathematics and English
- Recorded video lectures to tutor students of grades 8-11 in pivotal concepts of science and mathematics

Extracurricular Activities

- Certified **Pool Lifeguard** with training in rescue techniques, CPR and first aid *'24*
- Certified **Open Water Scuba Diver** with experience of depths up to **25.9 m** *'23*
- Completed the **Green Belt** programme on **Lean Six Sigma** methodology offered by KPMG *'21*
- Secured **4th** place at state-level Higher Secondary School Quiz Competition among **50**+ teams *'19*
- Appointed as **School Head Boy** owing to exemplary academic and extracurricular performance *'17*