Shaurya Goyal

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Education

Indian Institute of Technology (IIT), Kharagpur **2020 - 2025**
BS-MS in Economics Minors : Math, Biology, Artificial Intelligence CGPA: 8.89

Grade 12 (HSC): 92% **Grade 10 (ICSE)**: 95%

Awards and Scholarships

Summer Research Award, Next Gen Scientists Foundation 2022
International Research Fellowship, IIT Kharagpur Foundation 2022
Selected for the graduate-level inStem workshop on Stem Cell research [funded by Govt. of India] 2022
Selected for the ICTP-ICTS graduate-level Winter School in Quantitative Systems Biology 2021
Shortlisted for Chandralekha Singh and Jeremy Levy Student Excellence Award [declined for MCM] 2021
Top 5% grade across batch of 1800 students in the institute at the end of 1st year 2021
Merit-Cum-Means (MCM) Scholarship, IIT Kharagpur [full tuition + stipend] 2020-Ongoing
Top 1% in JEE Advanced from 150,000 selected students across India 2020
Top 0.4% in JEE Mains from over 1 million students across India 2020
Selected as Times Scholar from 300,000+ students and felicitated by Vice-President of India 2019

Preprints

Subbalakshmi, A.R.*, Sahoo, S.*, Manjunatha, P., **Goyal, S.**, . . . , Somarelli, J.# and Jolly, M.K.#, 2022. The ELF3 transcription factor is associated with an epithelial phenotype and represses epithelial-mesenchymal transition. bioRxiv. doi: https://doi.org/10.1101/2022.08.19.504435

Research Experience

White-Grey-Opaque Plasticity in Candida Albicans — June 2022 – Ongoing

Indian Institute of Science (IISc), Bangalore — Prof Mohit Kumar Jolly

- **Constructed gene network** controlling white-grey-opaque plasticity in Candida Albicans using literature
- Simulated the network using **coupled differential equations**, conducted **fold-change experiments** and used **machine learning** to analyze the resulting data to identify critical links controlling grey phenotype
- Analzyed switching dynamics and multistability using **bifurcations** and **stochastic simulations**
- Analyzing experimental **bulk & single cell RNA seq data** to verify predictions

Neuro Inspired Reinforcement Learning — February – September 2022

Brown University — Prof Michael J Frank

- Developed an **actor-critic deep reinforcement learning** model motivated by striatum dopamine circuits
- Created a base deep learning architecture using **CNNs** and **RNNs** and implemented the model and A2C
- Compared performance with A2C on **Atari games** with changing enviorment reward statistics

Epithelial-Mesenchymal (EMT) Plasticity in Cancer — November 2021 – June 2022

Indian Institute of Science (IISc), Bangalore — Prof Mohit Kumar Jolly

- Examined the **effect of ELF3 gene on EMT** and the reverse mesenchymal-epithelial plasticity (MET)
- Conducted fold change experiments to **compare the MET capacity** of ELF3, KLF4 and GRHL2
- Investigated the **clinical outcome** of ELF3 expression in **ER+ breast cancer and tamoxifen resistance**
- Found **increased PD-L1 induced immune evasion** that was driven by increasing ELF3 levels
- Used **Gaussian Mixture Modelling, K-Means Clustering, UMAP, PCA, Regression** and **bulk & single cell RNA** analysis methods like **MAGIC algorithm, AUCell, Gene Set Enrichment** etc

Phylogenetic Analysis of Eukaryote Evolution — April 2021 – May 2022

IIT Kharagpur — Prof Riddhiman Dhar

- **Identified key nuclear proteins** distinctinve of the inside-out or outside-in evolution model from literature
- Processed **eggNOG orthologous groups** and **UniProt BLAST** protein sequences using taxonomy criteria

- Developed a **pipeline** for multiple sequence alignments using **MUSCLE, MAFFT** and **DIALIGN-TX**, combination with **M-COFFEE** into a maximal consensus alignment, and trimming using **trimAl**
- Generated phylogentic trees using **RAxML-NG** on a **supercomputer**, selected best parameters using **Akaike information criterion** and **bootstrapped** for confidence values

Graph Fourier Transform **July – October 2021**

IIT Kharagpur — Prof Sanand Athalye

- Implemented an **empirically faster** version of the parallel approximate graph fourier transform
- Compared running time of single and parallel approximate graph fourier transform for small graph networks
- Theoretically analysed a faster exact graph fourier transform by **Haar unit** and **Givens rotation factoring** of graph laplacian eigenspace and reconstructing the graph network

Skills

Programming: Python, R, MATLAB, C/C++, Linux (Bash), HPC (SLURM), Git & Github
Libraries: PyTorch, Tensorflow, Keras, Numpy, Scipy, Seaborn, Scikit-Learn, Pandas
Wet Lab: Cell Culturing, RNA Isolation, RT-PCR, Immunocytochemistry, Gel Electrophoresis

Relevant Coursework

CS: Machine Learning[2], Artificial Intelligence[1], Deep Learning[2], Signals and Systems[2], Algorithms 1[2]
Math: Probability, Statistics, Non-Linear Dynamics[2], Numerical Analysis, Linear Algebra, Advanced Calculus, Ordinary/Partial Differential Equations, Complex Analysis, Discrete Maths[2]
Bio: Systems Biology[1], Computational Biology[2], Molecular and Cell Biology, Genetics[2], Cancer[1]
Neuro: Computational Neuroscience[1], Computational Cognitive Neuroscience[2], General Psychology
Other: Econometrics 1 & 2, Data Analysis Lab, Linear Programming

1 *PhD level course,* 2 *Online from Stanford, MITOCW etc (not MOOCs)*

Selected Projects

iGEM 2023 — Team Member **September 2022 - Ongoing**

- Brainstorming ideas for the annual International Synthetic Biology Competition hosted by MIT

Simulation & Classification of Theta-Gamma Oscillations **May – June 2022**

- Simulated LFP signals with multiple slow and fast components corresponding to theta-gamma frequencies
- Identified distinct phase - frequency coupled states using clustering and neural signal processing

Human iPSC Culturing and Characterization (Worskhop Project) **May 2022**

- Cultured feeder based and feeder-free cells lines and passaged multiple times in a BSL2 environment
- Conducted RT-PCR and gel electrophoresis to test for β-Actin and Vimentin expression, Alkaline Phosphatase (AKP) assay to check for differentiation and immunofluorescence assay for SOX2 and OCT4

Computational Neuroscience Mini-Projects **Jan - March 2022**

- Analyzed epilepsy - normal EEG data, Analyzed tuning curve of visual neurons, Estimated auditory receptive field, Perceptron classification, Dimensionality reduction and decoding activity, Simulated a LIF neuron

Workshops / Conferences Attended

Alzheimer's Disease - Biology, Pathology & Clinical Treatments **21 September 2022**
Seminar organized by IIT Kharagpur — Online

Computational Neuroscience **11-29 July 2022**
Neuromatch Academy — Online

Essential Stem Cell Lab Techniques **16-20 May 2022**
Workshop organized by inStem and NCBS — Bangalore, India

Sensorimotor Control **6-17 December 2021**
Winter School in Quantitative Systems Biology organized by ICTP-ICTS — Online

Neuromatch 4.0 **1-2 December 2021**
Conference — Online

High Performance Computing and AI for Computational Biology **29-30 October 2021**
Workshop organized by IIT Kharagpur and Tezpur University — Online

Volunteer Work

Academic Mentor **January 2022 – Ongoing**

UG Council, IIT Kharagpur

- Mentoring 6 students in their 1st year (now 2nd) to ensure they have a smooth integration to university life and assisting with academic and non-academic matters

English Mentor **January – July 2022**

Student Welfare Group, IIT Kharagpur

- Guided 4 students who struggled with English to learn and get better by providing feedback and solving doubts based on weekly exercises

Teacher(Independent) **October 2019 – December 2020**

- Taught 2 under privileged kids in my locality of grade 5 (to grade 6) math, science and english.
- Led to improved understanding and skill and their grade also improved by nearly 20 percent.

Leadership / Extracurricular

- Active member of Biotechnology Reading Group, IIT Kharagpur
- Represented institue at various national level debate tournaments as a member of the Debating Society, IIT Kharagpur
- Represented institute in the Inter-IIT Scrabble Tournament
- Selected as Times Scholar (2019) by Times of India Group from 300,000+ students across India
- Silver Medal in National Taekwondo Championship (2017) and 1st Dan Black Belt

Other Interests: Guitar, Piano, Trekking, Cooking, Running, Star Wars, Making memes