

Soham Dibyachintan

CONTACT INFORMATION	Quarter 3R/4, R.K.Hostel Campus, Khallikote College Brahmapur, Odisha, India, PIN: 760001	Phone: +91 8454 952 533 E-mail: prongs105@gmail.com
EDUCATION	Indian Institute of Technology (IIT) Bombay, Mumbai, India Bachelor of Technology Major: Chemical Engineering Minor: Biosciences and Bioengineering GPA: 8.76/10 Khallikote Junior College, Brahmapur, Odisha, India Intermediate of Science GPA: 91.16%	2016 - 2020 2014 - 2016
RESEARCH INTERESTS	Systems Biology, Synthetic Biology, Computational Biology	
AWARDS AND FELLOWSHIPS	Mitacs Globalink Research Fellowship , Mitacs, Canada Honda Young Engineer and Scientist Award , Honda Foundation, Japan KVPY Fellowship , Department of Science and Technology, India NTSE Scholarship , Government of India	2019 2018 2016 2012-2020
PUBLICATIONS	U Dionne, É Bourgault, AK Dubé, D Bradley, F Chartier, R Dandage, S Dibyachintan , PC Després, GD Gish, JP Lambert, N Bisson, CR Landry (2020) <i>Protein context shapes the specificity of domain-peptide interactions in vivo</i> . (Under Review) bioRxiv DOI: 10.1101/2020.05.18.103002 S Gupta, S Shah, S Chaturvedi, P Thakkar, P Solanki, S Dibyachintan , S Roy, MB Sushma, A Godbole, N Jaseem, P Kumar, S Ravikanti, A Das, GR Babu, T Bhatnagar, A Maji, MK Mitra, S Vinjanampathy (2020) <i>An India-specific Compartmental Model for Covid-19: Projections and Intervention Strategies by Incorporating Geographical, Infrastructural and Response Heterogeneity</i> . (Under Review) arXiv DOI: 2007.14392 S Dibyachintan , P Nandy, K Das, S Vinjanampathy, MK Mitra (2020) <i>Unequal Lives: A Socio-demographic analysis of Covid-19 transmission and mortality in India</i> . (Under Review) medRxiv DOI: 10.1101/2020.09.06.20189506 P Nandy, S Dibyachintan , S Vinjanampathy, MK Mitra (2020) <i>Capturing Complexity: Challenges in Modelling Covid-19 in India</i> . (Manuscript in preparation)	
RESEARCH EXPERIENCE	Evolution of SH3 domain-peptide interactions in humans <i>Institut de biologie intégrative et des systèmes (IBIS), Université Laval</i> Advisor: Dr. Christian Landry Working on developing an end-to-end bioinformatics pipeline to identify the key sequence features which determine the specificity of interactions between human SH3 domains and binding proteins with protein-protein interaction databases as the input. Wrote Python and shell scripts to integrate multiple sequence alignment, and computational sequence feature analysis tools into the pipeline. Developed an algorithm to discriminate between the interacting peptide motifs of specific proteins over a background of the interacting motifs of that protein family	August 2020 - present

Data-driven Modeling of the Spread of SARS-CoV-2 in India

April 2020 - present

*Department of Physics, Indian Institute of Technology Bombay**Advisors:* Dr. Mithun K. Mitra & Dr. Sai Vinjanampathy

Worked in a team of researchers to develop a compartmental meta-population model to predict the spread of the pandemic in various Indian provinces. Wrote Python scripts to collect district-wise time series data on confirmed cases, recovered and deceased patients. Developed a country-wide transportation matrix to study the impact of lifting of lockdown using our model. Worked on identifying the key socio-economic variables driving the spread of the disease and mortality in different districts using a combination of correlation and regression analyses

Predicting Co-translational Protein Folding

August 2019 - December 2019

*Department of Chemical Engineering, Indian Institute of Technology Bombay**Advisor:* Dr. Supreet Saini

Developed a fragment regrowth Monte Carlo algorithm for the hydrophobic-polar model to predict the tertiary structure of proteins (≤ 80 residues) arising from stalled protein folding due to synonymous mutations. Coded the algorithm in Python and compared the lowest energy fold with the ones obtained from existing algorithms to understand the effects of co-translational protein folding

Deep Mutational Scanning of Src-Homology 3 domains

May 2019 - July 2019

*Institut de biologie intégrative et des systèmes (IBIS), Université Laval**Advisor:* Dr. Christian Landry

Performed site-directed mutagenesis on three SH3 domains of yeast proteins using a puc19 vector in *Escherichia coli* to construct a 3600 mutant plasmid library, validated by deep sequencing. Performed CRISPR experiments to optimise the concentration of reagents and achieved 98% efficiency in engineering the mutated domains onto the yeast genome. Wrote Python scripts to prepare datasets for binding energy, conservation score and interaction partners for each residue of the 28 SH3 domains in *Saccharomyces cerevisiae* from online databases

Ubiquitinylation in Bacterial Surface Proteins

July 2018 - September 2018

*Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay**Advisor:* Dr. Anirban Banerjee

Performed an extensive literature review to understand the process of ubiquitinylation in bacterial proteins and identified the degron motifs and upstream features which drive the phenomenon. Developed a set of scripts in Python to identify these degron motifs and upstream lysine residues and generate a list of candidate proteins which have a propensity for ubiquitinylation. Generated a list of such candidates for the surface proteomes of *Streptococcus pneumonia*, *Streptococcus agalactiae* and *Salmonella typhimurium*, some of which have been validated through experiments

Competence in *Streptococcus pneumonia*

December 2017 - April 2020

*Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay**Advisor:* Dr. Anirban Banerjee

Developed simple gene regulatory networks based on existing literature to study the induction and shut-off of competence in a single cell based on varying levels of cellular stress and auto-inducer concentrations. Developed a system of ordinary differential equations to better understand the underlying mechanisms of inter-cellular communication which results in competence being a quorum sensing phenomenon. Developed simple fitness models using a cost-benefit analysis approach to understand the role of non-competent cells in a competent bacterial population

**KEY COURSE
PROJECTS****Evolution of Sexual Cannibalism**

Spring 2020

Topics of Evolution

Performed an extensive literature review to understand the various mechanisms of sexual cannibalism and the evolutionary forces that shape this behaviour in certain organisms. Reported my findings in a term paper, presenting arguments in favour of a non-adaptive evolutionary framework

	Spatio-temporal transmission dynamics of an epidemic Spring 2020 <i>Modeling Biological Systems and Processes</i> Developed a Python code to simulate the spread of an epidemic in a fixed population moving in a 2D space by using the kinetic Monte Carlo framework to compare Susceptible-Infected-Recovered and Susceptible-Exposed-Infected-Recovered models. Simulated the model for varying levels of movement in the population to study the effects of a lockdown.
	Plant Design for Butanediol Production Spring 2020 <i>Process Design Project</i> Conducted extensive literature survey related to Butanediol (BDO) production and selected production of BDO as product using the Reppe process for the plant based on raw material availability, environmental impact and market of by-products. Developed process flow diagram and simulated the plant flowsheet using Aspen Hysys. Performed equipment design, environmental impact assessment and detailed economic analysis of the plant
TECHNICAL PROFICIENCY	Programming: Python, MATLAB, familiar with C++ and Java Packages: pandas, numpy, scipy, matplotlib, seaborn, networkx, Biopython Bioinformatics: BLAST, CD-HIT, MAFFT, rate4site, DALEL, PaleAle, Spot-Dis-Single Wet Lab skills: Site-directed mutagenesis, CRISPR, Colony PCR, Plasmid mini-prep Publishing: L ^A T _E X, Typeset, Microsoft Word
RELEVANT COURSEWORK	Biology: Molecular Cell Biology, Molecular Enzymology, Evolutionary Dynamics, Modelling Biological Systems and Processes, Topics of Evolution, Computational Biology, Molecular Biology, Metabolism and Bioenergetics, Cell Cycle and Epigenetics, Introduction to Biology Mathematics: Multivariable Calculus, Linear Algebra, Differential Equations, Partial Differential Equations, Numerical Analysis, Introduction to Statistics and Data Interpretation Chemical Engineering : Thermodynamics, Heat Transfer, Mass Transfer, Fluid Dynamics, Transport Phenomena
SCHOLASTIC ACHIEVEMENTS	Awarded the AP grade for exceptional performace in Computational Biology 2019 Secured All India Rank 186 in Kishore Vaigyanik Protshahan Yojana exam 2016 Secured All India Rank 1150 in JEE-Advanced, 2016 among 200,000 candidates 2016 Secured All India Rank 1214 in JEE-Mains among 1,200,000 candidates 2016
LEADERSHIP EXPERIENCE	Manager, Biobytes Student Reading Group September 2018 - September 2019 Provided a platform for researchers to come together and innovate in multi-disciplinary fields like Bio-inspired computing and engineering. Organised monthly sessions for researchers and enthusiasts to present their work and findings, along with a means to network with fellow researchers. Areas of focus included Neural Networks, Systems Biology and Bio-inspired sensors.
ORGANISATIONAL EXPERIENCE	Devised the Crime Scene Investigation Event for BioTech Club, IIT Bombay 2019 Researched and hosted the Mythology and Star Wars Quiz for Literati, IIT Bombay 2019 Researched and hosted the Symbiont Quiz for the BioTech Club, IIT Bombay 2018
EXTRA-CURRICULARS	Winner, Cerebra Quiz - Genvision 2018 Winner, Sweden India Nobel Memorial Quiz - Nationals 2017 Winner, Reliance Digital Technology Quiz - Nationals 2017 Platinum Award, State Energy Conservation Quiz 2012-14