Education

Ph. D. in Chemical Engineering

- Research at the Novo Nordisk Foundation Center for Biosustainability
- Co-advised by Prof. Lars Nielsen and Prof. John Villadsen

M. S. in Chemical Engineering

- Research work in group of Prof. Alexander Dunn
- Course GPA: 3.904/4

B. Tech. in Chemical Engineering

- First position in the graduating batch with a GPA of 9.849/10
- Minor Area in Biological Sciences

Research Interests

- Analytical and computational modeling of biochemical and biophysical networks
- Alternative representations and mathematical solution of reactive systems
- Mechanism of molecular motors and ion channels

Awards and Honors

Stanford Graduate Fellowship as a meritorious incoming graduate student	2015
President's Gold Medal for securing highest CGPA in the outgoing batch, IIT Delhi	2015
Cargill Global Scholarship for academic excellence and leadership skills	2013
Kishore Vaigyanik Protsahan Yojana (KVPY) award for scientific research aptitude	2011

Selected Publications and Patents

- Nath, S. S., Nielsen, L. K., & Villadsen, J. (2022). Elucidating dynamics and mechanism of cyclic bioreaction networks using topologically-equivalent electrical circuits. Chemical Engineering Science, 262.118015.
- Nath, S. S. & Villadsen, J. (2022). Modeling dynamics of chemical reaction networks using electrical analogs: Application to autocatalytic reactions. Chemical Engineering Journal Advances, 12, 100374.
- Nath, S. S. (2022). Evaluation of thermodynamic consistency of kinetic parameters in cyclic enzymecatalyzed reaction networks. Chemical Physics Letters, 804, 139890.
- Tan, S. J., Chang, A. C., Miller, C. M., Nath, S. S., & Dunn, A. R. (2018). Direct Measurement of the Magnitude and Dynamics of Mechanical Forces Exerted by Single Integrins in Living Cells. Biophysical Journal, 114(3), 653A.
- Wang, P., Querard, J., Maurin, S., Nath, S. S., Le Saux, T., Gautier, A., & Jullien, L. (2013). Photochemical Properties of Spinach and its Use in Selective Imaging. Chemical Science, 4, 2865-2873.
- Jullien, L., Le Saux, T., Gautier, A., Croquette, V., Nath, S. S., Wang, P., & Querard, J. (2013). FR Patent No. 1361476. Paris: French Patent Office.
- Nath, S. S., & Nath, S. (2009). Energy Transfer from Adenosine Triphosphate: Quantitative Analysis and Mechanistic Insights. Journal of Physical Chemistry B, 113, 1533-1537.

Relevant Research Projects and Internships

Kinetic Modelling of Large-Scale Metabolic Networks

Advisors: Prof. Lars Nielsen, Prof. John Villadsen

- Developing improved isotope labelling schemes to study the kinetics of chemical reaction networks

- Applying and improving Bayesian methods to solve whole-cell models and extract cellular dynamics

Representing Reaction Networks as Electrical Circuits

Advisors: Prof. Lars Nielsen, Prof. John Villadsen

- Transforming chemical and biochemical reactive systems into equivalent modular electrical circuits
- Applying this approach on chaotic systems (Olsen attractor) and cyclic mechanisms (DHFR pathway)

2019-Present

Stanford University 2015-2018

Indian Institute of Technology Delhi

Technical University of Denmark

2011-2015

DTU Biosustain

June 2019 - present

DTU Biosustain

June 2019 - present

Molecular Mechanisms of Integrin Clustering

Advisor: Prof. Alexander Dunn

- Executed molecular dynamics simulations to generate a phase space for integrin cluster formation
- Determined energetic and configurational barriers to association and interaction at the molecular scale

Tension Sensor Calibration and Adhesion Experiments

Advisor: Prof. Alexander Dunn

- Calibrated molecular tension sensors in a magnetic trap to relate force, FRET output, and extension
- Employed the sensors to image force distribution within focal adhesions in human foreskin fibroblasts

Alignment of Rings in Shear Flow

Advisors: Prof. Shantanu Roy, Prof. Vikram Singh

- Designed and fabricated an experimental setup to visualize alignment of ring-like bodies in shear flow
- Analyzed the effect of modifying body shape by boundary element method simulations in MATLAB

Genome Scale Metabolic Modeling

Advisors: Prof. Parmesh Ramanathan, Prof. Aseem Ansari

- Automated metabolic model reconstruction to engineer biological systems for desirable functionalities
- Explored feasibility of biosynthesis of secondary metabolites through *in silico* optimization routines

RNA Imaging using Spinach-DFHBI

Advisor: Prof. Ludovic Jullien

- Formulated a mechanistic and kinetic model of photoswitchable Spinach-DFHBI RNA imaging system
- Published results in *Chemical Science* and patented novel proof of concept for fluorescence detection

Teaching Experience

Junior TA in Chemical Kinetics and Reaction Engineering, Stanford University - March-June 2017 Senior TA in Chemical Kinetics and Reaction Engineering, Stanford University - March-June 2018

Relevant Coursework

Physiology Computational Biology in 4D Chemical Reaction Engineering

Computational Skills

Languages: C++, Python, MATLAB, Mathematica, R ChemE Softwares: LT-SPICE, ProMax, Gambit, Fluent, COMSOL Systems Biology: COBRA, RAVEN, DFBAlab Toolboxes Molecular Modeling: LAMMPS, NAMD-VMD, Gaussian, HyperChem, Materials Studio Other Tools: LATEX, Beamer, Audacity, Adobe Premier Pro, Dreamweaver

Language Skills

GRE: 339/340 Fluent in French

References

Lars Nielsen Scientific Director Novo Nordisk Foundation Center for Biosustainability Technical University of Denmark 2800 Kgs. Lyngby DENMARK Email: lars.nielsen@uq.edu.au

Carey Witkov **Physics** Preceptor Harvard University Cambridge, MA 02138 USA Email: witkovc@erau.edu

Alexander Dunn Associate Professor Department of Chemical Engineering Stanford University Stanford CA 94305 USA Email: alex.dunn@stanford.edu

Shantanu Roy Professor Department of Chemical Engineering Indian Institute of Technology Delhi New Delhi 110016 INDIA Email: roys@chemical.iitd.ac.in

May - July 2013

Indian Institute of Technology Delhi

École Normale Supérieure Paris May - July 2012

Stanford University

Stanford University

January 2016 - July 2017

July 2014 - September 2015

July 2017 - January 2019

Soft Matter **Biometry and Biostatistics** Cheminformatics and Molecular Modelling

University of Wisconsin-Madison