

# Shubham Tripathi

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## EDUCATION

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| <b>Rice University</b><br>Doctor of Philosophy, Systems, Synthetic, and Physical Biology                       | 2016–2022 |
| <b>Indian Institute of Technology Kanpur</b><br>Bachelor of Technology, Biological Sciences and Bioengineering | 2012–2016 |

## RESEARCH EXPERIENCE

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| <b>Postdoctoral Associate</b><br>Department of Immunobiology, Yale University                   | October 2022–Present    |
| <b>Intern - Research &amp; Early Development - Clinical Pharmacology</b><br>Genentech           | May 2021–January 2022   |
| <b>Graduate Research Assistant</b><br>Systems, Synthetic, and Physical Biology, Rice University | August 2016–August 2022 |
| <b>Research Intern</b><br>Department of Biosystems Science and Engineering, ETH Zürich          | May 2015–July 2015      |
| <b>Research Intern</b><br>Department of Bioengineering, Rice University                         | May 2014–July 2014      |

## FELLOWSHIPS & FUNDING

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| <b>1. Yale-Boehringer Ingelheim Biomedical Data Science Fellowship</b><br>Role: Postdoctoral Associate<br>\$59,041/year for 3 years   | 2022–2025 |
| <b>2. Dr. Har Gobind Khorana Fellowship</b><br>Awarded by the Department of Biotechnology, Government of India and the Indo-US Science and Technology Forum to carry out research work at an American University<br>Role: Undergraduate Summer Research Intern at Rice University | 2014      |

## AWARDS & HONORS

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- SSPB Research Award**, by the Systems, Synthetic, and Physical Biology PhD Program at Rice University, recognizing an outstanding PhD thesis (2023)
- SSPB Research Award**, by the Systems, Synthetic, and Physical Biology PhD Program at Rice University, recognizing graduate students for outstanding doctoral research during the academic year (2021)
- Outstanding Teaching Assistant Award**, by the Department of Bioengineering, Rice University, for the class Introduction to Computational Biology (Spring 2018)
- General Proficiency Medal**, awarded by IIT Kanpur to the graduating student ranked 1<sup>st</sup> in the department (2016) and the **Certificate of Merit for Academic Excellence** for the academic years 2012-13, 2013-14, and 2014-15
- Summer Innovation Award**, by the Department of Biological Sciences and Bioengineering, IIT Kanpur and the Joy Gill Endowment Fund, awarded twice (2014 and 2015) for the summer research work carried out at Rice University and at ETH Zürich

1. **Tripathi, S.**, Kessler, D. A., & Levine, H. (2023). Minimal frustration underlies the usefulness of incomplete regulatory network models in biology. *Proceedings of the National Academy of Sciences*, 120(1), e2216109120
2. Al-Radhawi, M. A., **Tripathi, S.**, Zhang, Y., Sontag, E. D., & Levine, H. (2022). Epigenetic factor competition reshapes the EMT landscape. *Proceedings of the National Academy of Sciences*, 119(42), e2210844119
3. **Tripathi, S.**, Brahmachari, S., Onuchic, J. N., & Levine, H. (2022) DNA supercoiling-mediated collective behavior of co-transcribing RNA polymerases. *Nucleic Acids Research*, 50(3), 1269-1279
4. **Tripathi, S.**, Park, J. H., Pudakalakatti, S., Bhattacharya, P. K., Kaiparettu, B. A., & Levine, H. (2022) A mechanistic modeling framework reveals the key principles underlying tumor metabolism. *PLOS Computational Biology*, 18(2), e1009841
5. Deshmukh, A. P., Vasaikar, S., Tomczak, K., **Tripathi, S.**, den Hollander, P., Arslan, E., Chakraborty, P., Soundararajan, R., Jolly, M. K., Rai, K., Levine, H., & Mani, S. A. (2021) Identification of EMT signaling crosstalk and gene regulatory networks by single-cell RNA sequencing. *Proceedings of the National Academy of Sciences*, 118(19)
6. **Tripathi, S.**, Kessler, D. A., & Levine, H. (2020). Biological networks regulating cell fate choice are minimally frustrated. *Physical Review Letters*, 125(8), 088101
7. Jia W., **Tripathi S.**, Chakraborty P., Chedere A., Rangarajan A., Levine H., & Jolly M. K. (2020) Epigenetic feedback and stochastic partitioning during cell division can drive resistance to EMT. *Oncotarget*, 11, 2611-2624
8. Chakraborty, P., George, J. T., **Tripathi, S.**, Levine, H., & Jolly, M. K. (2020). Comparative study of transcriptomics-based scoring metrics for the epithelial-hybrid-mesenchymal spectrum. *Frontiers in Bioengineering and Biotechnology*, 8, 220
9. **Tripathi, S.**, Chakraborty, P., Levine, H., & Jolly, M. K. (2020). A mechanism for epithelial-mesenchymal heterogeneity in a population of cancer cells. *PLOS Computational Biology*, 16(2), e1007619
10. **Tripathi, S.**, & Deem, M. W. (2018). The standard genetic code facilitates exploration of the space of functional nucleotide sequences. *Journal of Molecular Evolution*, 86(6), 325-339
11. **Tripathi, S.**, Jolly, M. K., Woodward, W. A., Levine, H., & Deem, M. W. (2018). Analysis of hierarchical organization in gene expression networks reveals underlying principles of collective tumor cell dissemination and metastatic aggressiveness of inflammatory breast cancer. *Frontiers in Oncology*, 8, 244
12. **Tripathi, S.**, & Deem, M. W. (2015). Hierarchy in gene expression is predictive of risk, progression, and outcome in adult acute myeloid leukemia. *Physical Biology*, 12(1), 016016

## REVIEW ARTICLES

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1. Jia, D., Park, J. H., Kaur, H., Jung, K. H., Yang, S., **Tripathi, S.**, Galbraith, M., *et al.* (2021). Towards decoding the coupled decision-making of metabolism and epithelial-to-mesenchymal transition in cancer. *British Journal of Cancer*, 124(12), 1902-1911
2. **Tripathi, S.**, Levine, H., & Jolly, M. K. (2020). The physics of cellular decision making during epithelial–mesenchymal transition. *Annual Review of Biophysics*, 49, 1-18
3. Jia, D., Li, X., Bocci, F., **Tripathi, S.**, Deng, Y., Jolly, M. K., Onuchic J. N. & Levine, H. (2019). Quantifying cancer epithelial-mesenchymal plasticity and its association with stemness and immune response. *Journal of Clinical Medicine*, 8(5), 725

1. **Tripathi, S.**, Xing, J., Levine, H., & Jolly, M. K. (2020). Mathematical modeling of plasticity and heterogeneity in EMT. In Campbell K., Theveneau E. (eds) *The Epithelial-to Mesenchymal Transition. Methods in Molecular Biology*, vol 2179. Humana, New York, NY

INVITED TALKS

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1. Minimal frustration in the regulation of cell-fate choice. *Physics & QBio Hagoromo Hour*, organized by the Yale Quantitative Biology Institute, New Haven, CT. April 12, 2023 *Chalk Talk*
2. Mechanical control of transcription by DNA supercoiling. *Physics of Life - Students and Postdocs Edition*, organized by the The Center for the Physics of Biological Function, New York, NY. March 25, 2022
3. A mechanistic modeling framework reveals the key principles underlying tumor metabolism. *Systems Approaches to Cancer Biology Conference*, Woods Hole, MA. November 11, 2020
4. How does epithelial-mesenchymal heterogeneity arise in a population of cancer cells? *Annual Meeting of the Society for Mathematical Biology*, Montreal, Canada. July 22, 2019
5. Analysis of hierarchical organization in gene expression networks reveals underlying principles of collective tumor cell dissemination and metastatic aggressiveness of inflammatory breast cancer. *The University of Texas MD Anderson Cancer Center*, Houston, TX. June 15, 2018

ORAL & POSTER PRESENTATIONS

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1. DNA supercoiling-transcription interplay in the presence of nucleosomes. *Genome Architecture and Function Summer School and Workshop*, Sofia, Bulgaria. June 7, 2023 *Poster*
2. Systems-level analysis of co-stimulatory and co-inhibitory signaling between CD8+ T cells and antigen-presenting cells. *Cold Spring Harbor Meeting on Systems Immunology*, Cold Spring Harbor, NY. April 24, 2023 *Poster*
3. DNA supercoiling-transcription interplay in the presence of nucleosomes. *March Meeting of the American Physical Society*, Las Vegas, NV. March 7, 2023 *Talk*
4. Features of gene regulatory dynamics on minimally frustrated topologies. *March Meeting of the American Physical Society*, Chicago, IL. March 15, 2022 *Talk*
5. Mechanical control of transcriptional elongation by DNA supercoiling. *March Meeting of the American Physical Society*. March 18, 2021 *Virtual talk*
6. Networks regulating cell fate choice are minimally frustrated. *International Physics of Living Systems Network Annual Meeting*. June 12, 2020 *Virtual talk*
7. Biological regulatory networks are minimally frustrated. *March Meeting of the American Physical Society*. March 5, 2020 *Virtual talk*
8. Minimal frustration in biological networks facilitates establishment of cell types. *Northeastern Physics of Living Systems Pizza Lunch*, Boston, MA. November 20, 2019 *Chalk talk*
9. Hierarchy near a critical point: from the Ising model to gene networks. *March Meeting of the American Physical Society*, Boston, MA. March 7, 2019 *Talk*
10. Modularity promotes adaptation in a model of exploratory evolution. *March Meeting of the American Physical Society*, Boston, MA. March 4–8, 2019 *Poster*
11. The standard genetic code facilitates exploration of the space of functional nucleotide sequences. *Joint Congress on Evolutionary Biology*, Montpellier, France. August 19–22, 2018 *Poster*

12. Analysis of hierarchy in gene expression reveals principles underlying metastatic aggressiveness of inflammatory breast cancer. *12<sup>th</sup> Annual q-bio Conference*, Houston, TX. June 26–29, 2018 *Poster*
13. Analysis of hierarchical organization in gene expression networks reveals underlying principles of collective tumor cell dissemination and metastatic aggressiveness of inflammatory breast cancer. *March Meeting of the American Physical Society*, Los Angeles, CA. March 8, 2018 *Talk*
14. The standard genetic code facilitates exploration of the space of functional nucleotide sequences. *March Meeting of the American Physical Society*, Los Angeles, CA. March 5–9, 2018 *Poster*

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## PROFESSIONAL LEADERSHIP & SERVICE

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1. **Co-organizer**, focus session on DNA Mechanics and Gene Expression, *March Meeting of the American Physical Society*, Las Vegas, NV. March 6–10, 2023
2. **Co-organizer**, mini-symposium on Systems Biology of Tumor Metabolism, *Annual Meeting of the Society for Mathematical Biology*. June 13–17, 2021
3. **Reviewer**, *Physical Review Letters*, *Physical Review E*, *npj Systems Biology and Applications*

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## PROFESSIONAL DEVELOPMENT

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- *Grow PoLS Virtual Workshop: Growing Equity, Inclusion and Diversity for the Physics of Living Systems*, hosted by the Physics of Living Systems Student Research Network. October 25–26, 2020

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## TEACHING EXPERIENCE

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**Teaching Assistant**, Introduction to Computational Biology Spring 2018  
 Department of Bioengineering, Rice University

- Received Department of Bioengineering **Outstanding Teaching Assistant Award**

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## NON-PEER REVIEWED PUBLICATIONS

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1. **Tripathi, S.**, Gu, L., Arora, A., Brown, J. L., & Schwarber, A. Bridging divides through science diplomacy. *Issues in Science and Technology*. December 22, 2021
2. Brink, K., **Tripathi, S.**, Arora, A., Jackson, C., Schwarber, A., & Tan, M. Rethinking immigration policy for the future of the American STEM workforce. *SciTech Forefront*. August 17, 2021
3. **Tripathi, S.** & Brink, K. Banning Chinese students will hurt U.S. economy, Secure Campus Act will threaten U.S. STEM research. *The Houston Chronicle*. July 11, 2020

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## SCIENCE & PUBLIC POLICY

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**National Science Policy Network** Member, 2020–Present  
*A framework for international scientific collaboration in a post-COVID world*

- Led a group of five early career scientists from across the United States to propose a framework for continued international scientific collaboration amidst geo-political tensions that are likely to dominate a post-COVID world, emphasizing the role early career researchers can play in this context
- Co-authored an article on the subject published in *Issues in Science and Technology*, a magazine published by the National Academy of Sciences

*The need for a modern US foreign service with science at the forefront*

- Collaborated with a group of early career scientists on the need for the US State Department to develop career pathways for professionals with expertise in environment, science, technology, and health (ESTH)-related issues
- Proposed multi-level policies to increase hiring and retention of ESTH experts at the State Department
- Co-authored an issue brief on the topic which was shared with the Biden-Harris Transition Team

*Immigration issues concerning international STEM students in the US*

- Co-founded a policy group involving seven early career researchers from across the US to consider higher immigration issues faced by international students in the US
- During the summer of 2020, the group published op-eds in newspapers in Houston, Denver, and Berkeley, highlighting the immigration-related problems faced by international graduate students in STEM fields
- Co-authored an op-ed in the *Houston Chronicle* protesting the proposed immigration restrictions targeted at Chinese graduate students in the US
- Co-authored a policy analysis in the online publication *Forefront*, comparing the different proposed reforms to the current visa regulations as they relate to international STEM graduate students