

Troy A. Brier

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SELECTED EXPERIENCES

Graduate/Postdoctoral Research Assistant | Luthey-Schulten Group, Dept. of Chemistry at UIUC January 2018 – December 2024

- Constructed a stochastic kinetic model using data collected from super-resolution imaging experiments to simulate the sugar-stress response in *Escherichia coli*.
- Collaborated in the use of GPU-accelerated, hybrid stochastic-deterministic methods to simulate whole-cell models of bacteria that capture the reaction and diffusion of ~10,000 biochemical components at the cell-scale.
 - * Constructed a kinetic model of the nucleotide metabolism for a bacterial cell.
 - * Curated genomics, transcriptomics, proteomics, metabolomics, and kinetic rates from experiments/databases.
 - * Updated software/code for use on high performance GPU clusters.
- Developed a methodology to profile the bacterial transcriptome.
 - * Built a bioinformatics pipeline to identify genetic motifs and predict transcriptional events in bacteria.
 - * Analyzed Illumina, Pacific Biosciences, and Oxford Nanopore Technologies RNA sequencing experiments with custom tools to predict transcription units and visualize the RNA isoforms.
 - * Applied existing ML algorithms for predictive analysis on NGS experimental data.
- Assisted PI in preparation and organization of grant materials to acquire federal funding: NSF MCB 2221237 - \$2.00M (proposal, annual reports) | NSF MCB 1818344 - \$1.50M (annual reports) | NSF MCB 1840320 - \$1.18M (annual reports).
- Maintained group's GPU cluster and website.
- Collaborated with industrial and academic partners, both domestic and international.
- Presented research results to broader scientific community at domestic and international conferences.
- Mentored junior graduate and undergraduate student researchers.

Seminar/Workshop Teaching Assistant | Luthey-Schulten Group, Dept. of Chemistry at UIUC May 2024, October 2021, July 2019

- NSF STC-QCB Advanced Computational Workshop 2024—Mentored junior graduate students to construct teaching material, installed software on supercomputer, and troubleshoot errors during live tutorials.
- Online Hands-on Workshop on Computational Biophysics—Held virtual lectures for graduate students and post-doctoral researchers and prepared tutorials to run on AWS instances.
- Center for the Physics of Living Cells (CPLC) Summer School—Held lectures for graduate students and post-doctoral associates and prepared tutorials run on AWS instances.

Undergraduate Research Assistant | The Baker Group, Dept. of Chemistry at TCNJ

December 2014 – May 2017

- Explored atomistic and coarse-grained molecular dynamics simulations of membrane proteins
- Presented research results to broader scientific community at domestic conferences.
- Mentored junior undergraduate student researchers.

EDUCATION

University of Illinois at Urbana-Champaign (UIUC)

PhD in Chemistry

August 2017 – December 2024

The College of New Jersey (TCNJ)

BS in Chemistry (ACS-certified)

August 2013 – May 2017

SKILLS

Programming : PYTHON, MATLAB, BASH, R, TCL, \LaTeX , C/C++, CUDA, HTML

Tools : Unix/Linux, MacOS, Windows, AWS, SVN, Git, SSH, Docker, Apptainer, slurm, Jupyter, VScode, JIRA, NVIDIA DGX

Software : pandas, matplotlib, seaborn, numpy, scipy, biopython, cobra, HTSeq, pysam, Guppy, minimap2, keras, PyTorch, sklearn, HDF5, VMD, MAFFT, Clustal, BLAST, deepTools, SAMtools, GROMACS, AMBERMD, NAMD, AlphaFold2

Theoretical Training : *Mathematics* — Probability Theory, Stochastic Processes, Information Theory, Numerical Analysis, Linear Algebra, ODEs | *Science & Engineering* — Biophysics, Systems Biology, Bioinformatics, Molecular Dynamics, Equil. and Nonequil. Statistical Physics and Thermodynamics, Quantum Mechanics, Chemical Kinetics

Soft : Adaptability, Communication, Critical Thinking, Curiosity, Detail Oriented, Empathy, Interdisciplinary Collaboration, Leadership, Mentorship, Motivated, Open Mindedness, Organized, Problem Solving, Teamwork, Time Management

SELECTED PUBLICATIONS (📄 0000-0002-9530-6517)

- E. Enguang, Z. R. Thornburg*, **T. A. Brier***, R. Wei, B. Yuan, B. R. Gilbert, S. Wang, Z. Luthey-Schulten, **Assembly of Protein Complexes in a Minimal Cell**, *in preparation*
- T. A. Brier**, J. E. Cournoyer, B. R. Gilbert, S. A. Glass, Y. Gao, Z. R. Thornburg, K. Goglin, G. John, T. Mamaghani, S. Shivakumar, Y. Yu, C. Fields, J. I. Glass, A. P. Mehta, Z. Luthey-Schulten, **Unraveling the Transcriptional Landscape within a Minimized Bacterium via Comparative Analysis**, *in preparation*
- J. A. Stevens, F. Grünwald, P.A. Marco van Tilburg, M. König, B. R. Gilbert, **T. A. Brier**, Z. R. Thornburg, Z. Luthey-Schulten, S. J. Marrink, **Molecular Dynamics Simulation of an Entire Cell**, *Frontiers in Chemistry* 2023
- Z. R. Thornburg, D. M. Bianchi, **T. A. Brier**, B. R. Gilbert, T. M. Earnest, M. C.R. Melo, N. Safronova, J. P. Sáenz, A. T. Cook, K. S. Wise, C. A. Hutchison III, H. O. Smith, J. I. Glass, Z. Luthey-Schulten, **Fundamental Behaviors Emerge from Simulations of a Living Minimal Cell**, *Cell* 2022
- D. M. Bianchi, **T. A. Brier**, A. Poddar, M. S. Azam, C. K. Vanderpool, T. Ha, Z. Luthey-Schulten, **Stochastic Analysis Demonstrates the Dual Role of Hfq in Chaperoning *E. coli* Sugar Shock**, *Frontiers in Molecular Biosciences* 2020