Troy A. Brier

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Professional Summary

Chemist and computational scientist with an expertise in biological scientific computing. Experienced applying novel computational techniques to diverse scientific challenges. Skilled in the design and management of exploratory multi-year collaborative projects requiring flexibility, self-assessment mechanisms, and publication suitable documentation. Adept at conveying complex technical material to audiences with varying subject-matter expertise.

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 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 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 troubleshot 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*

Selected Publications (0000-0002-9530-6517)

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*

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*