Troy A. Brier

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Professional Summary

Engineer and software developer with a background in biological scientific computing. Experience solving problems in diverse computational science settings enables the application of novel techniques across domains. Skilled in the design and management of exploratory multi-year projects requiring flexibility, self-assessment mechanisms, and documentation suitable for publication. Proficient in presenting technical material to audiences with varying subject-matter expertise.

Technical 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, MARTINI CG

Software : pandas, matplotlib, numpy, scipy, HTSeq, Guppy, minimap2, PyTorch, HDF5, VMD, biopython, MAFFT, Clustal, BLAST, bowtie2, deepTools, SAMtools, GROMACS, AMBERMD, NAMD

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

Experience

Graduate/Postdoctoral Research Assistant | *Luthey-Schulten Group*, Dept. of Chemistry at UIUC *Jan 2018 – present*

- Used GPU-accelerated, hybrid stochastic-deterministic methods (C++, CUDA, python) to simulate whole-cell models of bacteria that capture the reaction and diffusion of ∼10,000 biochemical components at the cell-scale.
- Developed and authored computational models (C++, fortran, python) of chromosomes in bacteria.
  * Continuum polymer model (C++) to simulate motion of chromosomes at 10 base-pair resolution.
    · Developed and documented script-based C++ program to enable a variety of simulation protocols.
    · Programmed new OpenMP-accelerated Brownian dynamics integrator called using C++-API of LAMMPS.
    · Created novel representation for the replication states of circular chromosomes using binary trees.
  * Lattice polymer model (fortran) to generate chromosome geometries using Monte Carlo methods.
  * Created tools (python, fortran) to analyze replication-dependent chromosome conformation capture maps.
- 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).
- 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.

Graduate Teaching Assistant | Dept. of Chemistry at UIUC *Fall 2017, Fall 2029*

- Instrumental Analysis -
- Statistical Thermodynamics -

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

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- NSF STC-QCB Advanced Computational Workshop 2024 TA
- Online Hands-on Workshop on Computational Biophysics TA
- Center for the Physics of Living Cells (CPLC) Summer School TA

REU Summer Research Intern | *The McCullagh Group*, Dept. of Chemistry at Colorado State University *May 2016 – July 2016*

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Undergraduate Research Assistant | *The Baker Group*, Dept. of Chemistry at TCNJ *Sept 2015 – May 2017*

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Education

University of Illinois at Urbana-Champaign (UIUC) — **PhD in Chemistry** — *Aug 2017 – Dec 2024*

The College of New Jersey (TCNJ) — **BS in Chemistry (ACS-certified)** — *Aug 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*

B. R. Gilbert, Z. R. Thornburg, T. A. Brier, J. A. Stevens, F. Grünewald, J. E. Stone, S. J. Marrink, Z. Luthey-Schulten, **Dynamics of Chromosome Organization in a Minimal Bacterial Cell**, *Frontiers in Cell and Developmental Biology 2023*

J. A. Stevens, F. Grünewald, 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*

Z. R. Thornburg, M. C.R. Melo, D. M. Bianchi, T. A. Brier, C. Crotty, M. Breuer, H. O. Smith, C. A. Hutchison III, J. I. Glass, Z. Luthey-Schulten, **Kinetic Modeling of the Genetic Information Processes in a Minimal Cell**, *Frontiers in Molecular Biosciences 2019*