Troy Anthony Brier

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Education

**Ph.D. Chemistry**, August 2017 – June 2024

Advisor: Professor Zaida Luthey-Schulten

University of Illinois at Urbana-Champaign (UIUC), Champaign, IL

**Bachelor of Science: Chemistry ACS certified with research**, August 2013 - May 2017

Advisor: Professor Joseph L. Baker

The College of New Jersey (TCNJ), Ewing, NJ

Honors and Awards

Young Scholars Outstanding Mentor Awardee, UIUC Summer 2018

Alfred P. Sloan Fellow, UIUC Fall 2017

Rodger Adams Fellow, UIUC Fall 2017 Hannum Fellow, UIUC Fall 2017 Goodkin Physical Chemistry Awardee, TCNJ Spring 2017

Research Experience for Undergraduate (REU), Colorado State University Summer 2016

Mentored Undergraduate Summer Experience (MUSE), TCNJ Summer 2015

TCNJ Chairman of the Board Scholar, TCNJ All Semesters

Publications

Talia E. Long, Zane R. Thornburg, Benjamin R. Gilbert, Troy A. Brier, Zaida

Luthey-Schulten. Determining the rules of life for the minimal cell using whole-cell simulation. *Book chapter for Royal Society of Chemistry. Submitted.*

Jan A. Stevens, Fabian Grünewald, PA Marco van Tilburg, Melanie König, Benjamin R. Gilbert, Troy A. Brier, Zane R. Thornburg, Zaida Luthey-Schulten, Siewert J. Marrink. Molecular dynamics simulations of an entire cell. *Frontiers in Chemistry.* 2023

Benjamin R. Gilbert, Zane R. Thornburg, Troy A. Brier, Jan A. Stevens, Fabian Grünewald, John E. Stone, Siewert J. Marrink, Zaida Luthey-Schulten. Dynamics of chromosome organization in a minimal bacterial cell. *Frontiers in Cell and Developmental Biology.* 2023.

Zane R. Thornburg, David Bianchi, Troy A. Brier, Benjamin R. Gilbert, Tyler M. Earnest, Marcelo CR Melo, Nataliya Safronova, James P. Sáenz, Andras T. Cook, Kim S. Wise, Clyde A. Hutchison III, Hamilton O. Smith, John I. Glass, Zaida Luthey-Schulten. Fundamental behaviors emerge from simulations of a living minimal cell. *Cell*. 2022.

Zane R. Thornburg, Marcelo C.R. Melo, David Bianchi, Troy A. Brier, Cole Crotty, Marian Breuer, Hamilton O. Smith, Clyde A. Hutchison III, John I. Glass, Zaida Luthey-Schulten. Kinetic Modeling of the Genetic Information Processes in a Minimal Cell. *Front Mol Biosci*. 2019.

David M. Bianchi\*, Troy A. Brier, Anustup Poddar, Muhammad S. Azam, Carin K. Vanderpool, Taekjip Ha, Zaida Luthey-Schulten. Stochastic analysis demonstrates the dual role of Hfq in chaperoning *E. coli* sugar shock. *Front Mol Biosci.* 2020.

Presentations

Troy A. Brier, Jay E. Cournoyer, Benjamin R. Gilbert, Zane R. Thornburg, John I. Glass, Christopher J. Fields, Angad P. Mehta, Zaida Luthey-Schulten. *Impact of gene expression strategies in near whole-cell models of minimal bacteria.* Seminar presented at the annual Biophysical Society Meeting in Philadelphia, PA, February 2024.

Troy A. Brier, Benjamin R. Gilbert, John I. Glass, Zaida Luthey-Schulten. Stochastic simulations of varied gene expression models within minimal bacteria. Seminar presented virtually for the JCVI Minimal Workshop 2023, September 2023.

Troy A. Brier, Pratap Venepally, John I. Glass, Zaida Luthey-Schulten. *Towards deciphering the*

*influence of genome architecture in minimized bacteria*. Seminar presented at the 8th Annual Sloan UCEM Conference, Urbana, IL, April 2023.

Troy A. Brier, Pratap Venepally, John I. Glass, Zaida Luthey-Schulten.*Deciphering the influence of genome architecture in minimized bacteria.* Poster presented at the annual Biophysical Society Meeting in San Deigo, CA, February 2023.

Troy A. Brier, John I. Glass, Zaida Luthey-Schulten. *Deciphering the influence of genome architecture in JCVI-syn1.0.* Seminar presented virtually for the JCVI Minimal Workshop 2022, September 2022.

Troy A. Brier, Pratap Venepally, John I. Glass, Zaida Luthey-Schulten.*Towards deciphering the influence of genome architecture in a minimized bacterial genome.* Seminar presented at the annual International Physics of Living Systems Meeting in Montepellier, France, June 2022.

Troy A. Brier, Pratap Venepally, John I. Glass, Zaida Luthey-Schulten.*Deciphering the influence of genome architecture in a minimized bacterial genome.* Seminar presented at the annual American Physical Society Meeting in Chicago, IL, March 2022.

Troy A. Brier, Pratap Venepally, John I. Glass, Zaida Luthey-Schulten. *Genome architecture in Syn1.0 and the minimal cell, Syn3A.* Seminar presented virtually for the JCVI Minimal Cell Workshop 2021, September 2021.

Troy A. Brier, David M. Bianchi, Zane R. Thornburg, Marcelo Melo, Marian Breuer, Hamilton O. Smith, Clyde A. Hutchison III, Kim S. Wise, John I. Glass, Zaida Luthey-Schulten. *Modeling the Nucleotide Metabolic Network of a Genetically Minimal Cell.* Poster presented at the annual Biophysical Society Meeting in San Deigo, CA, February 2020.

Troy A. Brier, David M. Bianchi, Anustup Poddar, Muhammad S. Azam, Carin K. Vanderpool, Taekjip Ha, Zaida Luthey-Schulten.*Modeling the impact of point mutations on the regulatory potency of the small RNA SgrS.* Poster presented at the annual Biophysical Society Meeting in Baltimore, MD, March 2019.

Troy A. Brier, Peter T. Lake, and Martin McCullagh. *Developing a method to identify ligand binding sites in proteins using molecular dynamics.* Poster presented at Colorado State University Research for Undergraduates Experience poster session in Fort Collins, CO, August 2016.

Troy A. Brier and Joseph L. Baker. *Molecular simulations of type IV pilin subunits from three organisms in a lipid.* Poster presentation delivered at the American Chemical Society meeting in San Diego, CA, March 2016.

Troy A. Brier and Joseph L. Baker*. Stabilizing effect of a bacterial lipid membrane on type IV pilin subunits.* Poster presentation delivered at the Mentored Undergraduate Summer Experience poster session hosted at TCNJ in Ewing, NJ, September 2015.

Research Experience

**Graduate Research Assistant**, UIUC Spring 2018 – June 2024

Worked in the Luthey-Schulten Group on a doctoral thesis related to the factors shaping the bacterial transcriptome probed via kinetic modeling. Developed a kinetic model for the regulation of *pstG* mRNA via SgrS in *Escherichia coli* using stochastic simulations. Involved in the construction of a fully dynamical whole-cell model of the minimal cell, specifically contributed the kinetic model for the nucleotide metabolism. Developed computational methods to probe the transcriptome of minimal bacteria using bioinformatics and simulation. Combined the computational methods with analysis of experimental characterization of the transcriptome via RNA sequencing. Hosted numerous meetings with collaborators at JCVI, JHU, Harvard, and UIUC presenting results and proposing new experiments.

**Undergraduate Researcher**, TCNJ Fall 2015 – Spring 2017

Worked in the Baker Biomolecular and Baker Biomolecular Modeling and Simulation Group as a part of BS chemistry degree. Investigated individual and multi type IV pilin subunit dynamics and aggregation in a membrane environment using atomistic and MARTINI coarse grained molecular dynamics simulations.

**REU Researcher**, Colorado State University Summer 2016

Worked in the McCullagh Group for a ten-week program consisting of a two-week computational chemistry course and a eight week research period. Developed a method using molecular dynamics to identify binding pockets in each protein based on a specified ligand.

**MUSE Researcher**, TCNJ Summer 2015

Worked in the Baker Biomolecular Modeling and Simulation Group for an eight-week program. Investigated the effect membrane environments have on type IV pilin subunits from *Neisseria gonorrhoeae* and *Pseudomonas aeruginosa* using atomistic molecular dynamics simulations.

Teaching Experience

**STC-QCB Advanced Computational Workshop 2024 TA**  Spring 2024

Served as a mentor to teaching assistants helping to construct and test tutorials to teach about stochastic whole-cell modeling. Installed software used during the workshop to run simulations on supercomputer. Performed minor task as a teaching assistant helping to troubleshoot during the workshop.

**Online Hands-on Workshop on Computational Biophysics TA** Fall 2021

Served as a teaching assistant for the online hands-on workshop on computational biophysics hosted by the NIH Resource for Macromolecular Modeling and Bioinformatics. Instructed graduate students and post-doctoral associates from different schools on simulation techniques using the Lattice Microbes stochastic simulation package. The workshop was held virtually.

**Center for the Physics of Living Cells (CPLC) Summer School TA**  Summer 2019

Served as a teaching assistant for summer school hosted by the CPLC. Graduate students and post-doctoral associates from different schools visit the UIUC to learn new techniques. With fellow collaborators, instructed the students on how to perform super resolution imaging experiments and combine the data with computational techniques.

**Graduate Teaching Assistant (TA)**, UIUC Fall 2017 – Fall 2019

Instrumental Analysis Laboratory (Undergraduate level)

Statistical Thermodynamics (Graduate level)

**Center for the Physics of Living Cells (CPLC) Summer School TA**  Summer 2019

Served as a teaching assistant for summer school hosted by the CPLC. Graduate students and post-doctoral associates from different schools visit the UIUC to learn new techniques. With fellow collaborators, instructed the students on how to perform super resolution imaging experiments and combine the data with computational techniques.

**Math and Science Tutor**, TCNJ Fall 2014 – Spring 2017 Tutored fellow students in Calculus I, General Chemistry I, General Chemistry II, Physics 201, Computer Programming I (Java) through the tutoring center. My objective was to provide students with the tools necessary to succeed in their respective courses.

Additional Experience

**Luthey-Schulten Group Server Administrator**  Winter 2022 – Summer 2024

Maintained research groups DGX and high-performance supercomputer systems. Established usage protocols for the systems, and then taught them to other groups members. Installed containerized (Docker and Apptainer) versions of group software to greatly improve computational performance.

**Sloan UCEM Mini-Conference** Winter 2018 – Winter 2023

Attended a professional development, networking, and research poster session event for the Sloan fellows through the University Center of Exemplary Mentoring. Learned about graduate studies planning along with incorporating diversity at the graduate level. Hosted at the UIUC. Attended January 2018, 2019, 2020, 2021, 2022, 2023.

**Google Chicago PhD Summit Participant** Fall 2019

Accepted and attended an event highlighting opportunities at Google for PhD recipients in computer science related fields.

**Poster Judge for ACS Undergrad Conference** Fall 2019

Served as a graduate student judge for the ACS Undergraduate conference held at the University of Illinois at Urbana-Champaign

**Young Scholars Summer Research Program Mentor Facilitator**  Summer 2019

Served in a more senior role in the Young Scholars Summer Research program this time working with other mentors and their students to provide support throughout the program. Advised two sets of mentor-mentee pairs throughout the program.

**Physical Chemistry Student Seminar Selection Committee Member** Fall 2018 – Fall 2019

Served on panel of students responsible for choosing and hosting guest speakers. Presented brief research presentations to visiting faculty during lunch with fellow committee members.

**Institute on Teaching and Mentoring Conference**  Fall 2018

Attended a multi-day event focused on spreading research, networking, and mentoring/ teaching targeted towards under-represented graduate students. Learned strategies for success at the graduate student level but also in roles as faculty members. Hosted by Alfred P. Sloan Foundation. Attended October 2018.

**Young Scholars Summer Research Program Mentor**  Summer 2018

Mentored a student from a local area high school student through an eight-week research program tailored to teach roughly 30 students about research and the skills necessary to be a productive scientist. Advised the student on a project, which culminated in a poster presentation at the end of the program. Recognized as an “outstanding mentor” by the program. Hosted at UIUC.

**Encouraging Tomorrows Chemist (ETC) Member**  Spring 2018

Performed demos for local middle school students with other graduate students in ETC at UIUC. Focused on promoting science to youth and teaching them about basic concepts such as luminescence. Hosted at UIUC.