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FACULTY APPOINTMENTS

July 2012 – Assistant Professor, Johns Hopkins University, Baltimore, MD
present Department of Biophysics

RESEARCH APPOINTMENTS

March 2010 – Postdoctoral Research Associate, University of Illinois at Urbana-Champaign, Urbana, IL
July 2012 Center for the Physics of Living Cells/Zan Luthey-Schulten Group

Dec 2004 – Graduate Research Assistant, University of Illinois at Urbana-Champaign, Urbana, IL
March 2010 Zan Luthey-Schulten Group

EDUCATION

March 2010 University of Illinois at Urbana-Champaign, Urbana, IL
Ph.D., Biophysics and Computational Biology
Thesis: *Computational Investigations of Evolutionary Transitions during Development of the Cellular Translation and Transcription Machinery*
Advisor: Zaida (Zan) Luthey-Schulten

June 1996 Ohio University, Athens, OH
Russ College of Engineering and Technology
B.S., Computer Science

PEER-REVIEWED PUBLICATIONS

- [17] Max Klein, Rati Sharma, Chris Bohrer, and **Elijah Roberts**. “Scalable analysis of large numerical data sets from biological simulations and experiments using Hadoop and Spark,” *Submitted*, (2016).
- [16] Rati Sharma and **Elijah Roberts**. “Gradient sensing by a bistable regulatory motif enhances signal amplification but decreases accuracy in individual cells,” *In revision*, (2016).
- [15] Chris Bohrer and **Elijah Roberts**. “A biophysical model of supercoiling dependent transcription predicts a structural aspect to gene regulation,” *BMC Biophys.*, In press (2016).
- [14] **Elijah Roberts***, Shay Be’er, Chris Bohrer, Rati Sharma, and Michael Assaf*. “The dynamics of simple gene-network motifs subject to extrinsic fluctuations,” *Phys. Rev. E*, 92:062717 (2015).
- [13] **Elijah Roberts**. “Cellular and molecular structure as a unifying framework for whole-cell modeling,” *Curr. Opin. Struct. Biol.*, 25:86–91 (2014).
- [12] Michael Assaf, Mauro Mobilia, and **Elijah Roberts**. “Cooperation dilemma in finite populations under fluctuating environments,” *Phys. Rev. Lett.*, 111(23):238101 (2013).
- [11] Michael Assaf*, **Elijah Roberts***, Zaida Luthey-Schulten, and Nigel Goldenfeld. “Extrinsic noise driven phenotype switching in a self-regulating gene,” *Phys. Rev. Lett.*, 111(5):058102 (2013).
- [10] Piyush Labhsetwar, John Andrew Cole, **Elijah Roberts**, Nathan D Price, and Zaida A Luthey-Schulten. “Heterogeneity in protein expression induces metabolic variability in a modeled Escherichia coli population,” *Proc. Natl. Acad. Sci. USA*, 110(34):14006–11 (2013).

- [9] Tyler M Earnest, **Elijah Roberts**, Michael Assaf, Karin Dahmen, and Zaida Luthey-Schulten. “DNA looping increases range of bistability of the *lac* genetic switch,” *Phys. Biol.*, 10(2):026002 (2013).
- [8] **Elijah Roberts**, John E Stone, and Zaida Luthey-Schulten. “Lattice Microbes: High-performance stochastic simulation method for the reaction-diffusion master equation,” *J. Comput. Chem.*, 34(3):245–255 (2013).
- [7] Michael Assaf, **Elijah Roberts**, and Zaida Luthey-Schulten. “Determining the stability of genetic switches: explicitly accounting for mRNA noise,” *Phys. Rev. Lett.*, 106(24):248102 (2011).
- [6] **Elijah Roberts**, Andrew Magis, Julio O. Ortiz, Wolfgang Baumeister, and Zaida Luthey-Schulten. “Noise contributions in an inducible genetic switch: A whole-cell simulation study,” *PLoS Comput. Biol.*, 7:e1002010 (2011).
- [5] Ke Chen*, **Elijah Roberts***, and Zaida Luthey-Schulten. “Horizontal gene transfer of zinc and non-zinc forms of bacterial ribosomal protein S4,” *BMC Evol. Biol.*, 9:179 (2009).
- [4] **Elijah Roberts**, John E Stone, Leonardo Sepulveda, Wen-Mei W Hwu, and Zaida Luthey-Schulten. “Long time-scale simulations of *in vivo* diffusion using GPU hardware”. In *Proceedings of the 2009 IEEE International Symposium on Parallel & Distributed Processing*, (2009).
- [3] **Elijah Roberts**, Anurag Sethi, Jonathan Montoya, Carl R Woese, and Zaida Luthey-Schulten. “Molecular signatures of ribosomal evolution,” *Proc. Natl. Acad. Sci. USA*, 105(37):13953–13958 (2008).
- [2] Taras V Pogorelov, Felix Autenrieth, **Elijah Roberts**, and Zaida A Luthey-Schulten. “Cytochrome c_2 exit strategy: dissociation studies and evolutionary implications,” *J. Phys. Chem. B*, 111(3):618–634 (2007).
- [1] **Elijah Roberts**, John Eargle, Dan Wright, and Zaida Luthey-Schulten. “MultiSeq: unifying sequence and structure data for evolutionary analysis,” *BMC Bioinformatics*, 7:382 (2006).

INVITED TALKS, SEMINARS, AND CONFERENCE PRESENTATIONS

- “Directional accuracy in a model of gradient signaling during yeast mating ”, Pacificchem: Life at Small Copy Numbers, Honolulu, HI. Decemver 20, 2015.
- “The influence of external fluctuations on the decisions of cells”, Biophysical Society 58th Annual Meeting, Future of Biophysics Burroughs Wellcome Fund Symposium, San Francisco, CA. February 17, 2014.
- “Gene expression noise in models of *E. coli* decision making and growth”, University of Delaware, Center of Computation Biology and Bioinformatics Seminar Series, Newark, DE. October 14, 2013.
- “Gene expression noise in models of *E. coli* decision making and growth”, University of Maryland Baltimore County, Biological Sciences Seminar Series, Baltimore, MD. May 10, 2013.
- “The contributions of intrinsic and extrinsic noise to cellular decision making”, Virginia Commonwealth University, Physics Colloquium, Richmond, VA. February 15, 2013.
- “Extrinsic noise in models of *E. coli* decision making and growth”, CECAM Wokshop “Towards in silico biological cell: Bridging experiments and simulations”, Lausanne, Switzerland. July 7, 2012.
- “The switching pathway in a stochastic model of *lac* regulation”, Postdoc and Graduate Student Symposium, Center for the Physics of Living Cells, Urbana, IL. March 30, 2012.
- “Computational modeling of spatially reconstructed cells”, Gordon Research Conference on Cellular Systems Biology, Davidson, NC. July 25, 2011.
- “Computational modeling of stochastic gene expression and population heterogeneity in microbial systems”, Biocomplexity Seminar Series, Urbana, IL. December 09, 2010.
- “Noise contributions in an inducible genetic switch: A cell-scale simulation study”, Postdoc and Graduate Student Symposium, Center for the Physics of Living Cells, Urbana, IL. August 26, 2010.

- “The effects of spatial heterogeneity and *in vivo* crowding on the *lac* genetic circuit”, Biophysical Society 54th Annual Meeting, San Francisco, CA. February 23, 2010.
- “Stochastic, cell-scale simulations under *in vivo* conditions”, PI Meeting, FIBR: From Geochemistry to the Genetic Code, Santa Fe, NM. July 13, 2009.
- “Long-time-scale, whole-cell simulations under *in vivo* conditions using CUDA”, Eighth IEEE International Workshop on High Performance Computational Biology, Rome, Italy. May 25, 2009.
- “MultiSeq 3: new features and custom scripting”, NIH Resource for Macromolecular Modeling and Bioinformatics Subgroup Presentation, Urbana, IL. April 7, 2009.
- “Long-time-scale, whole-cell simulations of *in vivo* diffusion using CUDA”, IACAT Accelerator Workshop, Urbana, IL. January 23, 2009.

OTHER PUBLICATIONS

Erica Losito, Rati Sharma, and **Elijah Roberts**. “Running and analyzing RDME simulations of a response to an external gradient using Lattice Microbes ES,” *Roberts Lab Online Tutorial Collection* (2015).
<https://www.assembla.com/spaces/roberts-lab-public/wiki/Tutorials>.

Andrew Magis, Ke Chen, Damien Mathew, John Eargle, **Elijah Roberts**, and Zan Luthey-Schulten. “Evolution of the ribosome at the molecular level,” *NSF Center for the Physics of Living Cells Summer School* (2009).
<http://www.scs.uiuc.edu/schulten/tutorials/ribosome>.

Andrew Magis, Ke Chen, Damien Mathew, John Eargle, **Elijah Roberts**, and Zan Luthey-Schulten. “Evolution of translation EF-Tu:tRNA,” *NIH Computational Biophysics Workshop* (2009).
<http://www.scs.uiuc.edu/schulten/tutorials/ef-tu>.

Elijah Roberts, John Eargle, Dan Wright, Brijet Dhalwal, Anurag Sethi, Patrick O’Donoghue, and Zaida Luthey-Schulten. “Evolution of biomolecular structure,” *NIH Computational Biophysics Workshop* (2006).
<http://www.scs.uiuc.edu/schulten/tutorials/evolution-classII>.

TEACHING

Fall 2015	AS.250.313 Molecular and Cellular System Biology	Instructor
Fall 2015	AS.020.674 Graduate Biophysical Chemistry	Co-Instructor
Fall 2014	AS.250.313 Molecular and Cellular System Biology	Instructor
Fall 2014	AS.020.674 Graduate Biophysical Chemistry	Co-Instructor
Fall 2014	AS.020.607 Quantitative Biology Bootcamp	Co-Developer
Spring 2014	AS.020.674 Graduate Biophysical Chemistry	Co-Instructor
Intersession 2014	AS.360.103 Thinking across Fields Round Table	Guest Lecturer

SERVICE

- Ad-hoc reviewer for *Acta Biotheoretica*, *Biophysical Journal*, *Chemical Biology and Drug Design*, *eLife*, *Journal of Statistical Mechanics*, *Journal of Thermodynamics*, *Mathematical Biosciences*, *Physical Biology*, *PLoS Computational Biology*, *PLoS One*, *PROTEINS*
- Thesis review committee, PMB, 2012-2014
- GBO committee, PMB, 2012-2013, 2015
- GBO committee, CMDDB, 9 students 2012-2015
- HHPC Steering Committee, 2014 –

- NIBIB/NIH Review Panel, “Predictive Multiscale Models for Biomedical, Biological, Behavioral, Environmental and Clinical Research (U01)”, March 2014
- EMSL/DOE Workshop, “Multiscale Computation: Needs and Opportunities for BER Science”, August 2014
- NIH MABS Review Panel, February 2015

POSTDOCORAL SCHOLAR SUPERVISION

- [1] Rati Sharma, December 2013 – present

GRADUATE STUDENT SUPERVISION

- [1] Erica Losito, PMB, Summer 2013 – Fall 2014, Master’s Degree in Biophysics
- [2] Sung Yoon, CMDB, Summer 2013 – Summer 2014, Master’s Degree in Biology
- [3] Max Klein, PMB, Summer 2013 – present
- [4] Chris Bohrer, PMB, Summer 2014 – present
- [5] Cameron Avelis, PMB, Winter 2016 – present

GRADUATE STUDENT ROTATION SUPERVISION

- [1] Erica Losito, PMB, Fall 2012, “Probing electrostatic contributions to transcription factor binding using Brownian dynamics”
- [2] Jesse Yoder, PMB, Fall 2012, “Impact of stochastic fluctuations on yeast mating”
- [3] Carly Smith, CMDB-NIH, Winter 2012, “Quantitative measurements of *E. coli* growth rate distributions”
- [4] Sung Yoon, CMDB, Winter 2012, “Modeling growth rate heterogeneity of *E. coli* using flux balance analysis”
- [5] Max Klein, PMB, Winter 2012, “Simulating *E. coli* population dynamics using CUDA”
- [6] Brian Tenner, PMB, Spring 2013, “”
- [7] Kelsey Gray, PMB, Spring 2013, “”
- [8] Chris Bohrer, PMB, Fall 2013, “”
- [9] Matt Russo, CMDB-NIH, Winter 2013, “”
- [10] Cameron Avelis, PMB, Winter 2013, “”
- [11] Allison Dennis, CMDB-NIH, Winter 2014, “Quantitative analysis of fly ommatidia”
- [12] Min Hyung Cho, CMDB, Spring 2015, “Agent-based modeling of yeast polarization”
- [13] Peter DeFord, CMDB, Spring 2015, “Tools for segmentation and analysis for images of yeast from bright field microscopy”
- [14] Boris Brennerman, CMDB, Fall 2015, “The role of vesicle trafficking in the decisions of cells”

UNDERGRADUATE STUDENT SUPERVISION

- [1] George Alvarez, Biophysics, Spring 2013 – Spring 2014
- [2] Chris Montoya, Biophysics, Spring 2013 – Spring 2014
- [3] Aravind Krishnan, Biophysics, Fall 2013 – Spring 2015

- [4] Noor Khalil, Biophysics, Summer 2014 – Spring 2015
- [5] Joel Pally, Biophysics, Summer 2014 – Fall 2014
- [6] Lousanna Cai, Biophysics, Summer 2014 – Spring 2015
- [7] Aaron Chum, Biophysics, Fall 2014 – present
- [8] Sean Yamakawa, Biophysics, Fall 2015 – present
- [9] Siqi Chen, Biophysics, Fall 2015 – present

PH.D. DISSERTATION COMMITTEES

- [1] Nicole Carbonaro, University of Maryland Baltimore County, Chemistry; Advisor: Ian Thorpe
- [2] Andrew Martens, Johns Hopkins University, Biology; Advisor: Vince Hilser
- [3] Jake Marold, Johns Hopkins University, Biophysics; Advisor: Doug Barrick