

Howard M. Salis, Assistant Professor

CONTACT INFORMATION	Department of Agricultural and Biological Engineering Department of Chemical Engineering The Pennsylvania State University 210 Agricultural Engineering University Park, PA 16803	Tel: (814) 865-1931 Fax: (814) 863-1031 salis@psu.edu
RESEARCH SUMMARY	The Salis research lab engages in the design and optimization of synthetic biological organisms. We use thermodynamics and kinetics to develop predictive models of gene expression, which are capable of interconverting between DNA sequence and biological function. We combine these models with optimization techniques to rationally design the sequences of synthetic genetic parts and systems – metabolic pathways, genetic circuits, and genomes – for bioenergy and therapeutic applications. Our goal is to convert synthetic biology into a mature engineering discipline.	
PROFESSIONAL EDUCATION	Postdoctoral Fellowship, University of California, San Francisco Ph.D., Chemical Engineering, University of Minnesota , Minneapolis, MN B.S., Chemical Engineering, Rutgers University , New Brunswick, NJ (<i>summa cum laude</i>)	
APPOINTMENTS	Assistant Professor Department of Chemical Engineering Department of Agricultural and Biological Engineering The Pennsylvania State University	November 2009 to present
	Postdoctoral Fellow Advisor: Professor Christopher A. Voigt Department of Pharmaceutical Chemistry, University of California, San Francisco	March 2007 to November 2009
	Developed the Ribosome Binding Site Calculator – a predictive thermodynamic model of translation initiation in bacteria that lets you <i>choose</i> a protein's expression level over a 100,000-fold range (drylab+wetlab)	
	Other: drylab reaction-diffusion modeling of genetic circuits, wetlab optimization of synthetic metabolic pathways, analysis of two-component bacterial sensors	
	Ph.D. Candidate Advisor: Professor Yiannis Kaznessis Department of Chemical Engineering and Materials Science University of Minnesota, MN	September 2002 to February 2007
	Developed Hy3S: Hybrid stochastic simulation for supercomputers – two advanced stochastic numerical methods that greatly speed up the simulation of bio/chemical reaction networks	
	Other: drylab modeling and wetlab engineering of genetic circuits. Stochastic bifurcation theory.	
	Research Assistant Advisors: Professor Troy Shinbrot and Dr. Stephen Conway Department of Chemical and Biochemical Engineering, Rutgers University, NJ	January 2002 to June 2002

Fluid mechanics of granular flows (“chevrons”) and automated image analysis

Industrial Intern

June 2001 to September 2001

Supervisor: Dr. Claudia Kloth

Fermentation Research and Development, Medarex Pharmaceuticals, NJ

Culturing and media optimization of hybridoma cells for antibody production

Research Assistant

January 1999 to September 2000

Advisor: Professor Prabhas Moghe

Department of Chemical and Biochemical Engineering,

Rutgers University, NJ

Culturing of human epithelial cells on biopolymers to model migration

HONORS, AWARDS, AND SERVICE	NSF SynBERC, Student Leadership Council	2008-2009
	Judge, iGEM (International Genetically Engineered Machine) competition	2007
	NIH Biotechnology Training Grant	2004-2005
	Whittaker Foundation Biomaterials Grant	2000
	Omega Chi Epsilon Chemical Engineering Society	1999-2002
	Edward J. Bloustein Distinguished Scholar Award	1998
	Reviewer of manuscripts in: Nature Biotechnology, Journal of Chemical Physics, PLoS Computational Biology, Bioinformatics, BMC Systems Biology, BMC Bioinformatics, and Journal of Biological Engineering	

RESEARCH
PUBLICATIONS

(PubMed link)

(Google Scholar link)

1. **H.M. Salis**, E. Mirsky, C.A. Voigt, “Automated design of synthetic ribosome binding sites to precisely control protein expression”, *Nature Biotechnology*, v27(10), 2009
2. J.J. Tabor, **H.M. Salis**, Z. B. Simpson, A.A. Chevalier, A. Levskaya, E.M. Marcotte, C.A. Voigt, A.D. Ellington, “A synthetic genetic edge detection program”, *Cell*, v137(7), 2009
3. E.S. Groban, E.J. Clarke, **H.M. Salis**, S. Miller, and C.A. Voigt, “Kinetic buffering of crosstalk between bacterial two-component sensors”, *Journal of Molecular Biology*, v390(3), 2009
4. K. Temme, **H. Salis**, D. Tullman-Ercek, A. Levskaya, S.H. Hong, C.A. Voigt, “Induction and relaxation dynamics of the regulatory network controlling the type III secretion system encoded within Salmonella pathogenicity island 1”, *Journal of Molecular Biology*, v377(1), 2008
5. **H. Salis**, Y. Kaznessis, “Computer aided design of modular protein devices: Logical AND gene activation”, *Physical Biology*, v3(4), 2006
6. **H. Salis**, V. Sotiropoulos, Y. Kaznessis, “Multiscale Hy3S: Hybrid stochastic simulation for supercomputers”, *BMC Bioinformatics*, v7, 2006
7. L. Tuttle, **H. Salis**, J. Tomshine, and Y. Kaznessis, “Model-driven designs of an oscillating gene network”, *Biophysical Journal*, v89(6), 2005
8. **H. Salis**, Y. Kaznessis, “An equation-free probabilistic steady state approximation: Dynamic application to the stochastic simulation of biochemical reaction networks”, *Journal of Chemical Physics*, v123(21), 2005

9. **H. Salis**, Y. Kaznessis “Accurate hybrid stochastic simulation of a system of coupled chemical or biochemical reactions”, *Journal of Chemical Physics*, v122(5), 2005
10. **H. Salis**, Y. Kaznessis, “Numerical simulation of stochastic gene circuits”, *Computers in Chemical Engineering*, v29(3), 2005

BOOK CHAPTERS **H. Salis**, A. Tamsir, C.A. Voigt, “Engineering Bacterial Signals and Sensors”. Invited chapter in the book “Bacterial sensing and signaling”. Edited by Mattias Collin and Raymond Schuch. Karger, Basel. 2009

TEACHING BE 302, Transport Processes for Biological Engineers. Spring 2010
 EXPERIENCE CHE 340, Introduction to Biomolecular Engineering. Fall 2010

RESEARCH GROUP Graduate students: Amin Espah Borujeni and Iman Farasat
 Undergraduate students: Andrew Kirk

CONFERENCE
 PRESENTATIONS
 (INVITED)

H. Salis, “Predictive design and optimization of genetic parts and systems”, Computational & Theoretical Biology Symposium, Rice University, Houston, TX, Dec 2009

H. Salis, E. Mirsky, Z. Li, K. Niyogi, C.A. Voigt, “Predictive design & optimization of metabolic pathways”, NSF SynBERC annual retreat, Cambridge, MA, Sept 2008

H. Salis, “Advanced stochastic numerical methods for systems and synthetic biology”, Center for Control, Dynamical Systems, and Computation (CCDC), UC Santa Barbara, January 2008

H. Salis, J. Tabor, C.A. Voigt, “Rationally programming bacteria with quantitative modeling”, Workshop on Metabolic Engineering, Mathematical Biosciences Institute (MBI), The Ohio State University, September 2007

H. Salis, Y. Kaznessis, “Advanced stochastic numerical methods & bifurcation analysis”, Mathematical Sciences Research Institute (MSRI), UC Berkeley, June 2007

H. Salis, Y. Kaznessis, “Engineering biosensors: Hybrid stochastic simulation & biological AND gates”, Workshop on Biosensors & Molecular Recognition, Santa Barbara, CA, August 2005

CONFERENCE
 PRESENTATIONS

H.M. Salis, “Predicting and controlling translation rate in bacteria”, The third q-bio Conference on Cellular Information Processing, Sante Fe, NM

H.M. Salis, “Rational Optimization of Synthetic Metabolic Pathways with the Ribosome Binding Site Calculator”, Annual AIChE Meeting, Nashville, TN, 2009

H.M. Salis, C.A. Voigt, “A One-Step Procedure for the Optimal Connection of Synthetic Genetic Circuits”, Annual AIChE Meeting, Nashville, TN, 2009

H. Salis, E. Mirsky, C.A. Voigt, "Predictive design of synthetic ribosome binding sites", Synthetic Biology 4.0, Hong Kong, China, Oct 2008

H. Salis, K. Niyogi, C.A. Voigt, "Engineering photopigment production in Escherichia coli", Western Photosynthesis Conference, January 2008

H. Salis, J. Barrett, J. Tomshine, J. Maynard, Y. Kaznessis, "Design and construction of logical AND gene and protein networks", Annual AIChE Meeting, San Francisco, CA, November 2006

H. Salis, Y. Kaznessis, "Bifurcation analysis of stochastic gene networks", Annual American Institute of Chemical Engineers (AIChE) Meeting, San Francisco, CA, November 2006

H. Salis, Y. Kaznessis, "Multi-Scale models of gene networks", Joint Conference cosponsored by the Society for Industrial and Applied Mathematics (SIAM) and Society of Mathematical Biology (SMB) on the Life Sciences, Raleigh, NC, August 2006

H. Salis, Y. Kaznessis, "Using advanced hybrid stochastic methods to design oscillating gene networks", 50th Annual Biophysical Society meeting, Salt Lake City, UT, February 2006

H. Salis, Y. Kaznessis, "An equation-free probabilistic steady state approximation: Dynamic application to the stochastic simulation of chemically reacting systems", Annual AIChE Meeting, Austin, TX, November 2005

H. Salis, Y. Kaznessis, "Model driven design of an oscillating gene network" Biochemical Engineering XIV, Harrison Springs, British Columbia, Canada, July 2005

H. Salis, Y. Kaznessis, "Accurate hybrid stochastic simulation of a system of coupled chemical or biochemical reactions" 2004 Annual AIChE Meeting, Austin, TX, November 2004

H. Salis, Y. Kaznessis, "Using stochastic methods to design gene circuits" Synthetic Biology 1.0, Cambridge, MA, July 2004

H. Salis, Y. Kaznessis, "Using a hybrid differential/Master equation method to simulate physical or chemical systems" 2004 Midwest Thermodynamics and Statistical Mechanics Conference, Buffalo, NY, June 2004

H. Salis, Y. Kaznessis, "Stochastic simulations of gene regulatory networks" 2003 Annual AIChE Meeting, San Francisco, CA, November 2003

PROFESSIONAL
MEMBERSHIPS

American Institute of Chemical Engineers (AIChE)
Society of Biological Engineering (SBE)

REFERENCES

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University of California San Francisco, San Francisco, CA, 94158
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Yiannis Kaznessis, Associate Professor, Department of Chemical Engineering and
Materials Science, University of Minnesota, Minneapolis, MN, 55455
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