

# **Systems Biology**

**Topical Conference at the 2009 AIChE Annual Meeting**

**Nashville, Tennessee, USA  
8-13 November 2009**

**ISBN: 978-1-61567-919-5**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2009) by AIChE  
All rights reserved.

Printed by Curran Associates, Inc. (2010)

For permission requests, please contact AIChE  
at the address below.

AIChE  
3 Park Avenue  
New York, NY 10016-5991

Phone: (203) 702-7660  
Fax: (203) 775-5177

[www.aiche.org](http://www.aiche.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

<b>Antisense RNA, Transcriptional Interference and Genetic Switch: Train Wreck or Noise Filter?</b> .....	1
<i>Wei-Shou Hu</i>	
<b>Stochastic Effects in Viral Gene Expression Contribute to HIV-1 Latency</b> .....	3
<i>David Schaffer</i>	
<b>Robustness of Metabolic Networks. Some Fresh Insights</b> .....	4
<i>Hyun-Seob Song, Doraiswami Ramkrishna</i>	
<b>A Phenomenological Systems-Level Theory of Bacterial Cellular Metabolism</b> .....	5
<i>Luis A. N. Amaral</i>	
<b>Designing Effective Trials Regarding Treatments against Cancerous TUMOR Growth</b> .....	6
<i>Ileana C. Carpen, Nemoj Rau</i>	
<b>Agent-Based Simulation of Endotoxin Induced Acute Inflammatory Response in Human Blood Leukocytes</b> .....	7
<i>X. Dong, P.T. Foteinou, S.E. Calvano, S.F. Lowry, Ioannis P. Androulakis</i>	
<b>Molecular Level in Silico Analysis of Mass and Energy Flows in Microbial Communities</b> .....	9
<i>Ross P. Carlson, Reed Taffs</i>	
<b>Metabolic Reconstruction and Analysis of Butanol Producing Strain Clostridium Beijerinckii NCIMB 8052</b> .....	10
<i>Caroline B. Milne, Ravalí Raju, Pan-Jun Kim, Nathan D. Price</i>	
<b>Constraint-Based Analysis of Metabolic Capacity of Salmonella Typhimurium LT2</b> .....	11
<i>Jennifer L. Reed, Anu Raghunathan, Sookil Shin, Bernhard O. Palsson, Simon Daeßler</i>	
<b>Genome Scale Modeling of Pseudomonas Aeruginosa in a Microbial Air-Cathode Single Chamber Fuel Cell</b> .....	12
<i>Andrés Fernando González Barrios, Juan Diego Mejía Méndez, Felipe Racines Pérez, Nubia Milena Velasco Rodríguez, María Teresa Cortes Montañez, Martha Josefina Vives-Flórez</i>	
<b>Deterministic and Stochastic Population Level Simulations of An Artificial Lac Operon Genetic Network</b> .....	13
<i>Michail Stamatakis, Kyriacos Zygourakis</i>	
<b>Stochastic Simulation of Cytosolic Calcium Dynamics</b> .....	14
<i>TaiJung Choi, Mano R. Maurya, Daniel M. Tartakovsky, Shankar Subramaniam</i>	
<b>Quantitative Analysis of the Gene Regulatory Network Activated by Angiotensin II Type 1 Receptor in the Brainstem</b> .....	16
<i>Gregory M. Miller, Rajanikanth Vadigepalli, James S. Schwaber, Babatunde A. Ogunmaike</i>	
<b>Using Mutual Information to Identify TAR-Tat Coevolution in HIV-1 and Its Implications for Viral Latency</b> .....	18
<i>Siddharth S. Dey, John C. Burnett, Adam P. Arkin, David V. Schaffer</i>	
<b>Endocytosis and Signaling: Insilico Modeling at Multiple Scales</b> .....	20
<i>Neeraj Agrawal, Sean Engles, Randall Toy, Ravi Radhakrishnan</i>	
<b>A Dynamic Analysis of Insulin Signaling and Its Feedback Mechanisms: A Discrete Modeling Approach</b> .....	21
<i>Ming Wu, Xuerui Yang, Christina Chan</i>	
<b>Emergent Bistability by a Growth-Modulating Positive Feedback Circuit</b> .....	22
<i>Chee Meng Tan, Philippe R. Marguet, Lingchong You</i>	
<b>Bistable Gene Regulatory Networks: Intrinsic Versus Externally Induced Bistability</b> .....	23
<i>John S. F Barrett, Jennifer A. Maynard, Yiannis N. Kaznessis</i>	
<b>A Synthetic Approach to Understanding Signal Processing in MAPK Cascades</b> .....	24
<i>Ellen C. O'Shaughnessy, Santhosh Palani, James J. Collins, Casim A. Sarkar</i>	
<b>Tuning Gene Expression Heterogeneity with Cis-Encoded Epigenetic Switches</b> .....	25
<i>Narendra Maheshri, Leah Octavio</i>	
<b>A One-Step Procedure for the Optimal Connection of Synthetic Genetic Circuits</b> .....	26
<i>Howard Salis, Christopher Voigt</i>	
<b>Bottom up Engineering of Synthetic Gene Networks</b> .....	27
<i>Xiao Wang, Tom Ellis, James J. Collins</i>	
<b>Enhancing Production of Glucaric Acid From a Synthetic Pathway in Recombinant Escherichia Coli</b> .....	28
<i>Tae Seok Moon, John E. Dueber, Sang-Hwal Yoon, Eric Shiue, Kristala Jones Prather</i>	
<b>Will Cell-Free Synthetic Pathway Biotransformation (SyPaB) Compete with Microbial Fermentation for Producing Biocommodities?</b> .....	29
<i>Y.-H. Percival Zhang</i>	

<b>Using Synthetic Metagenomics to Discover Biocatalysts for Fuels Synthesis</b> .....	30
<i>Travis S. Bayer</i>	
<b>Towards Construction of a Synthetic Self-Replicating Entity</b> .....	31
<i>Michael C. Jewett</i>	
<b>Design and Construction of a Synthetic, Tunable Microbial Consortium</b> .....	32
<i>Alissa R. Kerner, Xiaoxia Lin</i>	
<b>Engineering Human T-Cell Receptor Signaling Dynamics</b> .....	33
<i>Wilson W. Wong, Ethan Corcoran, Arthur Weiss, Wendell A. Lim</i>	
<b>A Multi-Scale Model for the Assessment of Autonomic Dysfunction in Human Endotoxemia</b> .....	34
<i>P.T. Foteinou, S.E. Calvano, S.F. Lowry, Ioannis P. Androulakis</i>	
<b>How Antigen Quality and Quantity Determine T Cell Triggering In Vivo</b> .....	37
<i>Huan Zheng, Arup Chakraborty</i>	
<b>Model-Based Analysis and Quantitative Measurement of Key Components of Tumor Necrosis Factor Trafficking in a Tuberculosis Granuloma</b> .....	38
<i>Mohammad Fallahi-Sichani, Matthew A. Schaller, Denise E. Kirschner, Steven L. Kunkel, Jennifer J Linderman</i>	
<b>An Integrate-and-Fire Network Model to Investigate Circadian Rhythmicity in the Suprachiasmatic Nucleus</b> .....	40
<i>Christina Vasalou, Michael A. Henson</i>	
<b>Mechanochemical Energy Transduction in Muscle Contraction</b> .....	41
<i>Richard L. Long</i>	
<b>Reprogramming Innate Immune Cells to Probe and Modulate Immunosuppressive Tumor Microenvironmental Networks</b> .....	42
<i>Joshua N. Leonard</i>	
<b>MicroRNA Profiling and Discovery for Process Enhancement in Chinese Hamster Ovary Cells</b> .....	43
<i>Kathryn C. Johnson, Nitya M. Jacob, Matthias Hackl, Peter Morin Nissom, Wei-Shou Hu</i>	
<b>Gene-Pair Relative Expression Binary Barcode for the Diagnosis of Various Diseases of the Human Brain</b> .....	45
<i>Jaeyun Sung, Pan-Jun Kim, Nathan D. Price</i>	
<b>Novel Approaches to High-Throughput Delivery of Silencing RNA</b> .....	46
<i>Susan T. Sharfstein, Haiyuan Zhang, Michael Hogg, Moo-Yeal Lee, Jonathan S. Dordick</i>	
<b>Species Comparison Analysis Based On Metabolic Pathways</b> .....	47
<i>Meric A. Ovacik, I. P. Androulakis</i>	
<b>Searching for Self-Renewal and Pluripotency Defining Genes in Transcriptome Space of Embryonic Stem Cells</b> .....	49
<i>Shikha Sharma, Raamesh Deshpande, Meri T. Firpo, Catherine Verfaillie, Chad L. Myers, Wei-Shou Hu</i>	
<b>Identifying Tightly Regulated and Variably Expressed Pathways by Differential Rank Conservation (DIRAC)</b> .....	51
<i>James A. Eddy, Donald Geman, Nathan D. Price</i>	
<b>Development of a Constraint-Based Model for Photobiological Production of Hydrogen in Cyanothecae Sp. ATCC 51142</b> .....	52
<i>Trang T. Vu, Sergey Stolyar, Alex Belieav, Andrei Osterman, Jessica De Ingeniis, Jennifer L. Reed</i>	
<b>Convergent Transcription and Transcriptional Interference as a Regulatory Element in the Rhamnose Regulon of Escherichia Coli</b> .....	54
<i>Lon Chubiz, Supreet Saini, Christopher V. Rao</i>	
<b>Understanding the Role of Autophagy in Filamentous Fungi</b> .....	55
<i>Mark R. Marten, Liming Zhao, Judith K. Pollack, Yonghyun Kim, Bill J. Moss, Usha Sripathineni, Steven D. Harris, David Schaefer</i>	
<b>A Metabolomics-Based Analysis of Central Carbon Metabolism in 14 Yeast Species</b> .....	56
<i>Mark P. Styczynski, Dawn A. Thompson, Jenna Pfiffner, Courtney French, Aviv Regev</i>	
<b>High-Throughput Reconstruction and Optimization of 130 New Genome-Scale Metabolic Models</b> .....	57
<i>Christopher Henry, Matt DeJongh, Aaron Best, Rick Stevens</i>	
<b>A Novel Outer Approximation Algorithm for the Global Optimization of Metabolic Networks</b> .....	59
<i>Carlos Pozo, Gonzalo Guillén-Gosálbez, Laureano Jimenez, Albert Sorribas</i>	
<b>ciFBA: A Scalable Framework for Integrated Analysis of Metabolism and Regulation</b> .....	61
<i>Paul A. Jensen, Jason A. Papin</i>	
<b>Topological Metabolic Analysis for the Interrogation of Metabolic Networks</b> .....	62
<i>Adam C. Baughman, Lealon L. Martin, Susan T. Sharfstein</i>	
<b>Qualitative Multiscale Methodology for Biological Networks Driven by Experimental and Clinical Data: Insulin Network in Beta Cells and Association with Diabetes</b> .....	63
<i>Kosta Makrodimitris, Tom Woolf</i>	
<b>Author Index</b>	