

Systems Biology

Topical Conference at the 2012 AIChE Annual Meeting

**Pittsburgh, Pennsylvania, USA
28 October - 2 November 2012**

ISBN: 978-1-62276-747-2

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© (2012) by AIChE
All rights reserved.

Printed by Curran Associates, Inc. (2013)

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

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
Web: www.proceedings.com

TABLE OF CONTENTS

Robustness in Nature: Challenges and Opportunities for the Systems Biology Community	1
<i>Francis J. Doyle III</i>	
Dynamic Modeling of Metabolism. The Cybernetic Approach	2
<i>Doraiswami Ramkrishna</i>	
A Systems-Level Analysis Approach for Identifying Genetic Targets to Treat Biofilm-Forming Pathogens: An Application to <i>Pseudomonas Aeruginosa</i>.....	3
<i>Zhaobin Xu, Xin Fang, Thomas K. Wood, Zuyi (Jacky) Huang</i>	
Engineering ROS Metabolism with Futile Cycles	5
<i>Kristin Adolfsen, Mark P. Brynildsen</i>	
Dynamic Modelling As a Tool for Increasing Single-Chain Antibody Fragment Specific Productivity in <i>Pichia Pastoris</i>	6
<i>Kate Royle, David Leak, Cleo Kontoravdi</i>	
Modeling Intra- and Inter-Kingdom Signaling Through NF-Kb Pathway in Dendritic Cells	9
<i>Shreya Maiti, Robert Alaniz, Juergen Hahn, Arul Jayaraman</i>	
Optimum Perfusion Duration for Machine-Perfused Rat Livers	10
<i>Sinem Perk, Maria-Louisa Izamis, Herman Tolboom, Basak Uygun, Francois Berthiaume, Martin L. Yarmush, Korkut Uygun</i>	
Analyzing the Dynamics of Cell Cycle Transition in Differentiating Embryonic Stem Cells Through an Integrated Experimental and Modeling Approach.....	11
<i>Keith Task, Ipsita Banerjee</i>	
Analysis of EGFR Flux Through Different Endocytic Pathways in Cancer Cells with Elevated EGFR Expression	12
<i>Alice J. Macdonald, Matthew J. Lazzara</i>	
A Stochastic Model of Glycosylation of Monoclonal Antibodies	13
<i>Devesh Radhakrishnan, Andrew Bitner, Melissa St. Amand, Kevin Tran, Anne S. Robinson, Babatunde A. Ogunnaike</i>	
A Systems Strategy for Engineering Families of Orthogonal RNA Transcription Regulators for Engineering Gene Networks	14
<i>Melissa Takahashi, Julius B. Lucks</i>	
Systematic Analysis of Host – Genetic Circuit Interaction Reveals Host-Specific Epistatic Effects On Gene Expression in <i>E. Coli</i>.....	15
<i>Stefano Cardinale, Adam P. Arkin</i>	
Molecular Crowding Shaping of Gene Expression Dynamics.....	17
<i>Cheemeng Tan, Saumya Saurabh, Marcel Bruchez, Philip R. Leduc, Russell Schwartz</i>	
The Single Cell Distribution of Plasmid Copy Numbers	18
<i>James Boedicker, Franz Weinert, Rob Phillips</i>	
Exploring Bacterial Sugar Consumption At the Single-Cell Level Using An Integrated Computational and Experimental Approach.....	19
<i>Konstantinos Biliouris, Taliman Afroz, Chase L. Beisel, Yiannis Kaznessis</i>	
Investigating Heterogeneous System Performance of Synthetic Myosins Computationally	20
<i>Paul Egan, Jonathan Cagan, Christian Schunn, Philip R. Leduc</i>	
Construction of Genetic Programs by Layering Logic Gates in Single Cells	22
<i>Tae Seok Moon, Christopher A. Voigt</i>	
Engineering TAL Effector Nucleases (TALENs) for Targeted Genome Editing	23
<i>Ning Sun, Jing Liang, Zhanar Abil, Huimin Zhao</i>	
Multiplex Recombineering-Enabled Genome Editing Tools.....	24
<i>Nanette R. Boyle, Sean A. Lynch, Thomas J. Mansell, Ryan T. Gill</i>	
Elucidating the Genetic Architecture of Isobutanol Tolerance in <i>Escherichia Coli</i> Through Targeted Genome Engineering and High Throughput Screening	25
<i>Jeremy J. Minty, Jihyang Park, Lawrence Lai, Ted A. Zaroff III, Brian N. Johnson, Mark A. Burns, Harris Wang, George M. Church, Xiaoxia Lin</i>	
Towards a Semi-Synthetic Stress Response System to Engineer Solvent Tolerance.....	26
<i>Kyle Zingaro, Eleftherios T. Papoutsakis</i>	
Improvement of D-Glucaric Acid Production From a Synthetic Pathway in <i>Escherichia Coli</i>	27
<i>Eric Shiue, Kristala Jones Prather</i>	
Integrating Systems and Synthetic Biology for Engineering Chemical Production in Bacteria	28
<i>Rebecca M. Lennen, Brian F. Pfleger</i>	

Repressor-Based Tools for Cell-Cell Communication in Synthetic Biology	29
<i>Jasmine Shong, Cynthia H. Collins</i>	
A Platform for Synthetic, Orthogonal, Intercellular Communication Via Synthetikines	30
<i>Rachel M. Dudek, Nichole Daringer, Joshua N. Leonard</i>	
Refactoring the Partial Photosynthesis Gene Cluster for the Biosynthesis of the Key Pigment, Bacteriochlorophyll a	31
<i>Hui Zhou, J. Thomas Beatty, Christopher A. Voigt</i>	
Proteomic Study of High Vaccine DNA Producer	32
<i>Jonathan Meade, Patrick R. Bartlow, Ram N. Trivedi, Saleem A. Khan, Mohammad M. Ataai, Michael M. Domach</i>	
Metabolic Tradeoffs in Resource Investment and Function: A Switch or a Dial?	33
<i>James P. Folsom, Reed Tiffs, Ross P. Carlson</i>	
Does the Introduction of Non-Native Secondary Metabolite Pathways Affect Flux in Upstream Primary Metabolism? A 13C-Metabolic Flux Analysis of Yeast Engineered to Produce Artemisinin Precursors	34
<i>Matthew Conway, Ashish Misra, Eddy Agbo, Ganesh Sriram</i>	
Metabolomics and Integrated "Omics" Analysis of the Mesenchymal-Epithelial Transition in Ovarian Cancer.....	35
<i>Kathleen Vermeersch, Lijuan Wang, John McDonald, Mark P. Styczynski</i>	
Multiplex, Longitudinal Immune Cellular Functional Proteomic Analyses Correlated with the Clinical Outcome of a Melanoma ACT Immunotherapy Trial.....	36
<i>Chao Ma, Ann Cheung, Antoni Ribas, James Heath</i>	
Phospho-Proteomics Reveals a Metabolic and Signaling Amplification Loop Leading to Cell Death Following Glucose Deprivation.....	37
<i>Nicholas A. Graham, Martik Tahmasian, Bitika Kohli, Evangelia Komisopoulou, Maggie Zhu, Igor Vivanco, Michael A. Teitel, Hong Wu, Antoni Ribas, Roger S. Lo, Ingo K. Mellinghoff, Paul S. Mischel, Thomas G. Graeber</i>	
Cooperation Between Subtypes of Tumor Cells Promotes Malignancy Studied by Multiplexed Super-Resolution Single Cell Proteomic Assay.....	38
<i>Jun Wang, James Heath</i>	
Integrated Processing of Microalgae for Valuable Food Ingredients, Chemicals and Fuel Production.....	39
<i>Kaige Wang, Yi Liang, Zhiyou Wen, Robert Brown</i>	
Pyrolytic Fractionation of Oleaginous Feedstocks.....	40
<i>Balakrishna Maddi, Sridhar Viamajala, Sasidhar Varanasi</i>	
Hydrothermal Carbonization and Supercritical Ethanol in Situ Transesterification for the Production of Algal Biodiesel	41
<i>Robert Levine, Phillip E. Savage</i>	
Integrating Photo-Bioreactor and Fermentor to Produce Biofuels and Bioelectricity.....	42
<i>Alim Dewan, Marci Kerls, M. Nazmul Karim</i>	
Determination of Lipid Hydrolysis Kinetics in Soybean Oil and Algal Systems	43
<i>Joshua C. Wissinger, Amber L. Bosley, Constance Schall</i>	
Microwave-Assisted Subcritical Water Extraction of Lipids From Wet Algae.....	44
<i>Harvind Kumar Reddy, Yingqiang Sun, Yin Li, Tapaswy Muppaneni, Sundaravadivelnathan Ponnusamy, Shuguang Deng, Tanner Schaub, Barry Dungan, Francisco Holguin, Peter Lammers, Wayne Voorhies, Peter Cooke</i>	
Multi-Scale Agent-Based Modeling of Cancer Cell Chemotaxis within a Microfluidic Assay: Investigating the Role of Receptor Dynamics and Ligand Isoforms	45
<i>S. Laura Chang, Stephen P. Cavnar, Danielle Trakimas, Shutichi Takayama, Gary D. Luker, Jennifer J. Linderman</i>	
In Silico Prediction of Cancer Mechanism of Action	46
<i>E. A. Whitebay, J. D. Ramsey, B. J. Neely, K. A. M. Gasem</i>	
Linking Microbial Structure to Function in Representative Simulated Biological Systems	47
<i>Ian Marcus, Sharon L. Walker</i>	
Nanoscale to Macroscale Modeling of Biochemical Linked Muscle Response	48
<i>Richard Long Jr.</i>	
Optimization Driven Identification of Genetic Perturbations Accelerating the Convergence of Model Parameters in Ensemble Modeling of Metabolic Networks	49
<i>Ali R. Zomorodi, Jimmy G Lafontaine Rivera, Thomas Wasyleenko, Ali Khodayari, Gregory Stephanopoulos, James C. Liao, Costas D. Maranas</i>	
Mathematical Modeling of Synaptic Vesicle Trafficking in C. Elegans	50
<i>Adriana San Miguel Delgadillo, Celine Maeder, Emily Wu, Kang Shen, Hang Lu</i>	
High-Content Movement Analysis As a Diagnostic Tool in C. Elegans	51
<i>Peter B. Winter</i>	
Insilico Multiscale Models for Identifying Driver Versus Passenger Mutations in Cancer Progression.....	52
<i>Ravi Radhakrishnan</i>	

Magnetic Separation of Algal for Biofuel Production	53
<i>Jeffrey J. Chalmers, Wei Xue, Jie Xu, Maciej Zborowski, Brad Postier</i>	
A Novel Taylor-Couette Photobioreactor for Energy Efficient Micro Algae Cultivation	54
<i>Bo Kong, R. Dennis Vigil</i>	
Effect of Growing Conditions On Algal Carbohydrate to Butanol Production.....	55
<i>Alice C. Jernigan, Christa N. Hestekin</i>	
Photoautotrophic Growth and Lipid Production Kinetics of the Microalgae Scenedesmus Dimorphus	56
<i>Joanne Belovich, Jacob Schwenk, Christopher Hardulak, John Van Blargan</i>	
Use of Sodium Bicarbonate for Efficient Carbon and Water Management for Autotrophic Microalgae Cultivation in Open Pond System	57
<i>Jinsoo Kim, Joo-Youp Lee, Ting Lu</i>	
Transgenic Expression of a Bacterial Exo-Acting Intracellular α-Amylase in the Chlamydomonas Reinhardtii Chloroplast	58
<i>Xiaoqing Wang, Barbara Sears, Yan(Susie) Liu, Wei Liao</i>	
Modeling the Molecular Crosstalk Between a Growth Factor and a Differentiation Inducing Receptor.....	59
<i>Konstantinos Biliouris, Harinder Singh, Yiannis Kaznessis</i>	
Coordination of Quorum Sensing with Cell Motion	60
<i>David N. Quan, William E. Bentley</i>	
Tissue-Specific Reconstructions of Mouse Metabolism and Interactions Among the Multi-Tissue Network	63
<i>Chunjing Wang, Yuliang Wang, Nathan D. Price</i>	
Development of a Metabolite Stress-Response Model in Solventogenic Clostridia by Coupling Multiple –Omic Data with a Genome-Scale Model.....	64
<i>Eleftherios T. Papoutsakis, Shawn W. Jones, Keerthi P. Venkataraman, Blake C. Meyers, Sridhara G. Kunjeti, Kevin P. McCormick, Kelvin H. Lee, Shuyu Hou, Maciek R. Antoniewicz, Jungik Choi, Jennifer Au, Costas D. Maranas, Patrick F. Suthers, Qinghua Wang, Hongzhan Huang, Cathy H. Wu</i>	
Metabolic Engineering in Silico Enabled by Manipulating Metabolic Pathway Flux Ratios.....	65
<i>Ryan S. Senger</i>	
Host Metabolic Interaction During Viral Infection: A Model of Bacteriophage T7 In E. Coli.....	66
<i>Elsa Birch, Nicholas Ruggero, Markus Covert</i>	
In Silico Model of Suppression and Desynchronization of Peripheral Clock Genes in Human Endotoxemia	67
<i>Panteleimon D. Mavroudis, Steve E. Calvano, Ioannis P. Androulakis</i>	
Coarse-Grained Modeling of Molecular Release from an Actin Network	69
<i>John Kang, Kathy M. Puskar, Russell S. Schwartz, Philip R. Leduc</i>	
Integrating High-Throughput Data with Biochemical Networks Identifies Functional Regulatory Interactions	70
<i>Sriram Chandrasekaran, Nathan D. Price</i>	
Large-Scale Kinetic Model of Chlamydomonas Reinhardtii Metabolism Reveals Diffuse Control Over Growth Precursors	71
<i>Mariajose Castellanos, Jon Bollinger</i>	
Comparison of Network Structures That Confer Resilience Against Genetic Perturbations in Microbial Metabolism	72
<i>Chintan Joshi, Ashok Prasad</i>	
Contrasting the Metabolic Capabilities of Cyanobacterial Strains for Assessing Bio-Production Platform Selection.....	73
<i>Rajib Saha, Alex T. Versepuit, Thomas J. Mueller, Costas D. Maranas</i>	
MC³: A Tool for Model and Constraint Consistency Checking of Stoichiometric Biochemical Network Models.....	74
<i>Ehsan Ullah, Mona Yousofshahi, Soha Hassoun, Russell Stern</i>	
Linear Programming-Based Algorithm for Computing Metabolic Pathways From Genome-Scale Networks.....	75
<i>Hyun-Seob Song, Noam Goldberg, Ashutosh Mahajan, Sven Leyffer, Doraiswami Ramkrishna</i>	
Thermodynamically Constrained Flux Analysis of <i>Actinobacillus Succinogenes</i>	76
<i>Liliana Angeles-Martinez, Michael Binns, Constantinos Theodoropoulos</i>	
From Genomes to Tissue-Level Metabolic Models- A Step towards Pathogenesis and Personalized Medicine	78
<i>Anu Raghunathan, Mridula Prasad, Riya Uthup</i>	
The Membrane Environment Can Promote or Suppress Bistability in Cell Signaling Networks	79
<i>Steven M. Abel, Arup K. Chakraborty</i>	
Prediction of Therapeutic Microrna Based On Human Metabolic Network.....	80
<i>Ming Wu, Christina Chan</i>	

Minimal Reaction Network for Bistability in the MAPK Signalling Cascade	81
<i>Otto Hadac, Igor Schreiber, Michal Pribyl, Stanislav Y. Shvartsman</i>	
Modeling the Dynamics of Acute Phase Protein Expression in HepG2 Cells Stimulated by IL-6	88
<i>Jens O. M. Karlsson, Zhaobin Xu, Arjun Plakkat, Calvin Hong Li, Zuyi (Jacky) Huang</i>	
Resolution of Incoherent Immune Stimuli Through Intracellular Crosstalk	90
<i>Camila Benaim, Yishan Chuang, Joshua N. Leonard</i>	
A Kinetic Platform to Determine the Fate of Nitric Oxide in Bacteria	91
<i>Jonathan L. Robinson, Mark P. Brynildsen</i>	
Decoding Robustness in Integrated Signaling and Gene Regulatory Networks Using a Combination of Global Sensitivity Analysis and Decision Trees.....	92
<i>Hirenkumar Makadia, James S. Schwaber, Rajanikanth Vadigepalli</i>	
Doubly Penalized Approach for Reconstructing Biological Networks.....	94
<i>Behrang Asadi, Mano R. Maurya, Shankar Subramaniam, Daniel M. Tartakovsky</i>	
Effect of Quorum-Signaling Molecules On Human Epithelial Cells: Implications for Interkingdom Response and Communication.....	96
<i>Amin Zargar, William Bentley</i>	
Freq-Seq: A Method for Rapid, Cost-Effective Allele Frequency Determination in Microbial Populations.....	97
<i>Lon Chubiz, Ming-Chun Lee, Nigel F. Delaney, Christopher J. Marx</i>	
PTM Curator: An Automated Method for the Frequency Analysis of the Experimental and Putative Post-Translational Modification Statistics Contained in the Swiss-Prot Database	98
<i>George A. Khouri, Richard C. Baliban, Christodoulos A. Floudas</i>	
Genomic Approaches to Evolution and Adaptation of Modern Human Populations.....	100
<i>Lawrence I. Grossman, Denis Pierron, Thierry Letellier, Nicolás Gutiérrez Cortés, Harilanto Razafindrazaka, Christophe Rocher</i>	
Gene Network Inference and the Immune Response: A Novel Approach to Identifying Biology's Risk Assessment Strategies.....	101
<i>Jason E. Shoemaker, Satoshi Fukuyama, Hiroaki Kitano, Yoshihiro Kawaoka</i>	
Combinatorial Transcriptional Regulatory Network Driving Aberrant Effects of Chronic Alcohol Consumption On Liver Regeneration	103
<i>Daniel Cook, Lakshmi Kuttipurathu, Biswanath Patra, Jan Hoek, Babatunde A. Ogunnaike, Rajanikanth Vadigepalli</i>	
Author Index	