

5th International Conference on Biomolecular Engineering (ICBE 2015)

Lost Pines, Texas, USA
11-14 January 2015

ISBN: 978-1-5108-1576-6

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© (2015) by AIChE
All rights reserved.

Printed by Curran Associates, Inc. (2015)

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

AIChE
120 Wall Street, FL 23
New York, NY 10005-4020

Phone: (800) 242-4363
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

KEYNOTE

Multipurpose Bacterial Cell Factories: New Production Strains and Novel Tools	1
<i>Michael Bott</i>	
Non-Canonical Amino Acids as Probes of Protein Synthesis in Complex Biological Systems	2
<i>David Tirrell</i>	
Signals from the Surface to Promote Human Pluripotent Stem Cell Differentiation	3
<i>Laura Kiessling</i>	
Development of Microbial Cell Factories for Biorefineries	4
<i>Akihiko Kondo</i>	

SYNTHETIC BIOLOGY

Reinforcing Synthetic Biology Against Evolutionary Failure	5
<i>Jeffrey E. Barrick</i>	
Engineering Smarter and Stronger T Cells for Cancer Immunotherapy	6
<i>Yvonne Chen</i>	
Synthetic Regulators for Evolutionary Metabolic Engineering	7
<i>Gyoo Yeol Jung</i>	
Synthetic Biology with a Cell-Free TX-TL System: Metabolism, Gene Circuits and Minimal Cell in a Test Tube	8
<i>Jonghyeon Shin, Filippo Caschera and Vincent Noireaux</i>	

METABOLIC ENGINEERING FOR FUELS AND CHEMICALS

Engineering alcohol tolerance in yeast fermentations	9
<i>Gregory Stephanopoulos, Gerald Fink and Felix H. Lam</i>	
The Quest for Synthetic Methylo trophy	10
<i>Eleftherios T. Papoutsakis, W. Brian Whitaker, Nicholas R. Sandoval, R. Kyle Bennett and Alan G. Fast</i>	
Metabolic Engineering of <i>Saccharomyces Cerevisiae</i> for the Synthesis of Polyketides and Fatty Acids	11
<i>Nancy A. Da Silva, Christopher Leber, Javier Cardenas, Jin Wook Choi and Ruben Fernandez-Moya</i>	
Exploring P450 Expression in <i>Escherichia coli</i> for the Synthesis of Complex Molecules	12
<i>Bradley Biggs, Chin Giaw Lim, Aditi Das, Marjan De Mey and Ajikumar Parayil</i>	

PROTEIN ENGINEERING AND EVOLUTION

Co-Evolution of Affinity and Stability for Domain Antibodies That Recognize Hydrophobic Antigens	13
<i>Peter M. Tessier</i>	
Engineering Proteases to Detect Post-Translational Modifications	14
<i>Navin Varadarajan</i>	

EXPERIMENTAL AND COMPUTATIONAL TOOLS FOR ENGINEERING BIOMOLECULES

Computational Strain Design for Improved Productivity, Yield and Robustness	16
<i>Radhakrishnan Mahadevan</i>	
Machine-Based Learning for Rational Engineering of Biomolecular Libraries	17
<i>Lydia M. Contreras, Jorge Vasquez, Kris Reyes and Warren Powell</i>	
De Novo Biosynthesis of Terminal Alkyne-Tagged Natural Products and Applications	18
<i>Wenjun Zhang</i>	

Development and Analysis of Precursor Production Strains for Chemical Production	19
<i>Xiaolin Zhang, Christopher J. Tervo and Jennifer Reed</i>	

BIOPHYSICAL MODELS OF BIOLOGICAL PROCESSES

Micromachines and motility: Single and collective cancer cell invasion	21
<i>Muhammad H. Zaman</i>	
Multiscale Models of Antibiotic Cellbots	22
<i>Kathryn Geldart, Brittany Forkus, Panagiota Kyriakou, Yiannis N. Kaznessis and Michail Vlysidis</i>	
Nanoscale Architecture of Tension Generation within Focal Adhesions	24
<i>Alexander Dunn</i>	
Automated Physics-Based Design of Synthetic Riboswitches from Diverse Aptamers	25
<i>Howard M. Salis</i>	

HIGH THROUGHPUT BIOLOGICAL DESIGN

Zymergen	26
<i>Zach Serber</i>	
Engineering Microbial Fatty Acid Biosynthesis as an Industrial Biotechnology Platform Steve Del Cardayre*	27
<i>Steve del Cardayre</i>	
Orthogonal Genetics for Rapid Evolution and Synthetic Biology	28
<i>Chang C. Liu</i>	
Reverse Engineering Enzymes with High-Throughput Sequence-Function Mapping	60
<i>Philip A. Romero and Adam R. Abate</i>	

BIOMOLECULAR DESIGN OF DIAGNOSTIC AND THERAPEUTIC AGENTS

Engineering Picomolar Affinity into a Rationally Identified 5 Kda Scaffold for Tumor Targeting	71
<i>Max A Kruziki, Hong Zhou, Patrick Holec and Benjamin J. Hackel</i>	
Ultra-High Affinity Engineered Protein Therapeutics for Treating Metastatic Disease	73
<i>Jennifer R. Cochran</i>	
Modular Receptor Engineering for Programming Cell-Based Therapies to Interface with Host Physiology	74
<i>Nichole Daringer, Rachel M. Dudek, Kelly A. Schwarz and Joshua N. Leonard</i>	

DESIGNING NON-NATIVE BIOLOGICAL FUNCTION

Non-Native Small-Molecule Biosensors for Screening and Selection of High-Performance Cell Factories	75
<i>Michael K. Jensen, Mette Skjdt, Jie Zhang, Arun S. Rajkumar and Jay D. Keasling</i>	
Designing Microbes for Executive Function	76
<i>William E. Bentley, Gregory F. Payne, Jessica Terrell, Hsuan-Chen Wu, Chen-Yu Tsao, Tanya Gordonov, Amin Zargar and David Quan</i>	
Engineering Orthogonal Translation Systems	77
<i>Michael C. Jewett</i>	
Microbial Production of Curcuminoids	78
<i>Nobutaka Funa</i>	

POSTER SESSION

Bias and Error Correction in Antibody Repertoire Sequencing for More Accurate Vaccine Profiling	80
<i>Tarik Khan and Sai T. Reddy</i>	
Studies on the Influence of Different Metabolic Uncouplers on the Biodegradation of Toluene in a Differential Biofilter Reactor	81
<i>Swaminathan Detchanamurthy and Peter Gostomski</i>	

A Biobased Approach to Mechanically Tunable Polyester	82
<i>Kechun Zhang</i>	
Tailor Designed Peptides Bio-Inspired from Transmembrane Proteins for the Cosmetic Industry	83
<i>Sonia Milena Aguilera Segura, Vanessa Lucia Nuñez Velez, Oscar A. Alvarez Solano, Luke Achenie, Rodrigo Torres Saez and Andres Fernando González Barrios</i>	
Energizing Yeast Cell-Free Protein Synthesis with Glucose Metabolism	84
<i>Jessica C. Stark, Mark Anderson, C. Eric Hodgman and Michael C. Jewett</i>	
Investigation of Metabolic Capabilities of Recombinant Lactococcus Lactis for Production of Hyaluronic Acid Using Constraint Based Genome Scale Models	85
<i>Abinaya Badri, Karthik Raman and Guhan Jayaraman</i>	
Development and in Vivo Testing of Antibodies Targeting Cancer-Associated Fibroblasts	88
<i>James A. Van Deventer, Saravanan Rajan, Sachdev Sidhu and K. Dane Wittrup</i>	
The Bio Phantom Tissue Model	89
<i>Jose Calderon and Carlos Calderon</i>	
In silico Prediction of Gene Deletion Targets in Escherichia coli for Enhanced Succinic Acid Production Using a Model-Guided Approach Under the Optflux Software Platform	90
<i>Bashir S. Mienda and Mohd S. Shamsir</i>	
Bypassing Local Maxima in Protein Directed Evolution through Negative Selection	91
<i>Barrett Steinberg and Marc Ostermeier</i>	
Controlling Cells through RNA Folding	92
<i>Julius B. Lucks</i>	
A Human Therapeutic Enzyme Specifically Sabotages Tumor Metabolism By an Engineered Cystine/Cysteine Degrading Activity	93
<i>Shira Cramer, Achinto Saha, Surendar Tadi, Stefano Tiziani, John Digiovanni, Everett M. Stone and George Georgiou</i>	
Glycoengineered Outer Membrane Vesicles Displaying O-Polysaccharide Antigens Elicit Protection Against Francisella Tularensis	94
<i>Linxiao Chen, Jenny Baker, Jack Chung-Jr Huang, Christine Endicott, David Putnam, Bradley Jones and Matthew P. DeLisa</i>	
Engineering and Preclinical Development of a Human Enzyme for Cancer Therapy Via the Depletion of the Serum L-Cysteine Pool	95
<i>Everett Stone, Shira Cramer, Achinto Saha, Stefano Tiziani, Surendar Tadi, John Digiovanni and George Georgiou</i>	
Towards Biofuel Production in Synechocystis Sp. PCC 6803: Expanding the Molecular Biology Toolbox for Pathway Engineering	96
<i>Christie A.M. Peebles</i>	
Deciphering Transcriptional Regulation Patterns for Novel Enzyme Discovery	97
<i>Kevin V. Solomon, Charles Haitjema, John K. Henske, Diego Borges-Rivera, Dawn A. Thompson and Michelle A. O'Malley</i>	
Design and Engineer L-Amino Acid Deaminase from Proteus vulgaris As a Robust Biocatalyst for One-Step Biosynthesis of α-Keto Acids	98
<i>Long Liu</i>	
Reducing Uncertainty in Metabolic Networks through Thermodynamics Based Flux Analysis	99
<i>Alexandros Kiparissides and Vassily Hatzimanikatis</i>	
Controlling Local Substrate Concentrations and Enzyme Kinetics through Rationally Designed Intermolecular Interactions	100
<i>Yingning Gao, Jie Zhu, Jyun-Liang Lin and Ian Wheeldon</i>	
Discovery of a Pre-Eclampsia Associated Antibody That Binds to a Viral Antigen and Human Protein	101
<i>Serra E. Elliott, Alex R. Soffici and Patrick S. Daugherty</i>	
Study of the Effects of Alternative Fluxes on the Metabolic Control Analysis of Optimally Grown E. coli	103
<i>Georgios Fengos, Meric Ataman, Daniel Hernandez Gardiol, Ljubisa Miskovic and Vassily Hatzimanikatis</i>	
Intracellular Trafficking and Degradation of Antibody Drug Conjugates	104
<i>Katie Maass and K. Dane Wittrup</i>	
Ligand Responsive Hybrid Promoters and Bidirectional Promoters for Metabolic Engineering in Oleaginous Yeast Yarrowia Lipolytica	105
<i>Murtaza Shabbir-Hussain, Lauren Gambill, Samuel Williams and Mark A. Blenner</i>	
Development of SNAP-Tagged Antibodies for Magnetic Bead-Based Immuno-PCR	106
<i>Jimmy Gollihar, Arti Pothukuchy, Michelle Byrom and Andrew Ellington</i>	
Pigment-Based, Low-Cost, Portable Micronutrient Status Tests Using Engineered Bacteria	107
<i>Daniel Watstein and Mark P. Styczynski</i>	

High-Throughput Design of Regulatory Protein-Based Biosensors for Screening Biosynthesis Libraries	108
<i>Patrick C. Cirino, Christopher S. Frei and Shuai Qian</i>	
Intracellular FRET-Based Assay for Redesigning the Specificity of Secreted Proteases	109
<i>Jennifer L. Guerrero, Michelle A. O'Malley and Patrick S. Daugherty</i>	
Talens Assisted Multiplex Engineering for Accelerated Genome Evolution in Saccharomyces Cerevisiae	110
<i>Guoqiang Zhang and Qinhong Wang</i>	
A Novel, in Vivo Continuous Evolution Strategy in Saccharomyces Cerevisiae to Create Pathway and Protein Variants	111
<i>Jie Sun, Nathan Crook, Joe Abatemarco and Hal Alper</i>	
Generation of Protease-Inhibiting Monoclonal Antibodies By Novel Paratope Design and Function-Based Screening	112
<i>Dong Hyun Nam, Kuili Fang, Carlos Rodriguez, Tyler Lopez and Xin Ge</i>	
Directed Protein Evolution for Specificity and Affinity Towards Chemically Modified RNAs Via Secm Ribosome Display	114
<i>Kevin Baldrige, Amanda Bryant-Friedrich and Lydia Contreras</i>	
Engineering Secretion Machinery for High-Throughput Protein Production	117
<i>Danielle Tullman-Ercek</i>	
Genome-Wide Search for Intracellular Factors Affecting RNA Folding Via in Vivo Oligonucleotide Hybridization	118
<i>Kevin Vasquez, Jorge Vazquez-Anderson, Taylor Hatridge and Lydia M. Contreras</i>	
An Alternative Splicing Platform for Programming Protein Function	119
<i>Melina Mathur and Christina D. Smolke</i>	
Transformable Facultative Thermophile Geobacillus Stearotherophilus NUB3621 As a Host Strain for Metabolic Engineering	120
<i>Kristen Blanchard, Srebrenka Robic and Ichiro Matsumura</i>	
An Analytical Approach to Bistable Biological Circuit Discrimination Using Real Algebraic Geometry	121
<i>Dan Siegal-Gaskins, Elisa Franco, Tiffany Zhou and Richard M. Murray</i>	
Characteristics of Protein Incorporated within Poly(vinyl alcohol) Hydrogel Membrane	122
<i>Adrian Salgado</i>	
A Hybrid Riboswitch–Small RNA Molecule for Metabolic Engineering in an n-Butanol Pathway	123
<i>Ashwin Lahiry, Samuel D. Stimple, David W. Wood and Richard A. Lease</i>	
Bacterial Inner Membrane Display for Isolating Intracellular Antibodies from a Naïve Library	125
<i>Parisa Moghaddam-Taaheri and Amy J. Karlsson</i>	
Ensemble Modeling Identifies the Mechanism By Which Clpp Impacts NO• Defense Systems in E. coli	126
<i>Mark P. Brynildsen and Jonathan L. Robinson</i>	
Re-Engineered β-Oxidation Reversal for the Synthesis of α-Functionalized Products in Escherichia Coli	128
<i>Seokjung Cheong</i>	
Medium-Chain Carboxylic Acid and Alcohol Production Via Engineered β-Oxidation in E. coli	129
<i>Seohyoung Kim and Ramon Gonzalez</i>	
Cloning and Expression Profiling of Polycomb Gene, Vernalization Insensitive 3 from Tomato Solanum Lycopersicum L	130
<i>Zainab Almutairi</i>	
Engineering, Predicting, and Understanding Cofactor Specificity in Ketol-Acid Reductoisomerases	131
<i>Jackson K.B. Cahn, Sabine Brinkmann-Chen and Frances H. Arnold</i>	
A Click Chemistry Approach to Site-Specific Immobilization of a Small Laccase Enables Efficient Direct Electron Transfer in a Biocathode	132
<i>Zhilei Chen and Dongli Guan</i>	
Rational Design of Antibody Cocktails to Treat Disease Caused By Bordetellae	133
<i>Jennifer A Maynard, Annalee Nguyen, Ellen K Wagner, Edith Acquaye-Seedah, Roman Wolf, Eric Harvill and James Papin</i>	
Production of Fatty Acid-Derived Fuels and Chemicals in Saccharomyces Cerevisiae	134
<i>Leo D. Espaux, Jay D. Keasling and Weerawat Runguphan</i>	
Improving Cell-Free Protein Synthesis through Genome Engineering of Escherichia coli Lacking Release Factor 1	135
<i>Rey W. Martin, Seok Hoon Hong, Yong-Chan Kwon, Ben De Soye, Ioanna Ntai, Alexandra de Paz, Neil Kelleher and Michael C. Jewett</i>	
Constructing a Synthetic Metabolic Pathway Protects Escherichia coli Against the Acetic Acid Inhibition and Fulfills Enantiomerically Pure (R, R)-2,3-Butanediol Production	136
<i>Xiaojun Ji and He Huang</i>	

A Reusable Immobilized Intein Segment That Eliminates Premature Cleaving and Thiol Requirements in Intein-Based Protein Purification	137
<i>Changhua Shi, David Cain and David W. Wood</i>	
Design of Molecular Biosensors for New or Improved Polyketide Synthase Activities	138
<i>Patrick C. Cirino and Zhiqing Wang</i>	
Modular Pathway Optimization for Production n-Butanol from Red Seaweed in Escherichia coli	139
<i>Hyun Gyu Lim, Jae Hyung Lim and Gyoo Yeol Jung</i>	
Metabolic Engineering of Escherichia coli for Production of L-Tryptophan Using Synthetic Biology Tools	140
<i>SungHo Jang, Sangwoo Seo and Gyoo Yeol Jung</i>	
Modular Ligand-Activated Enzymes from Antibody Mimetic Proteins	141
<i>Nathan Nicholes, Amol Date, Pamphile Beaujean, Manu Kanwar, Pricila Hauk and Marc Ostermeier</i>	
Developing an Enzymatic Switch from HSV-Thymidine Kinase As a Potential Cancer Therapeutic	142
<i>Nirav Shelat and Marc Ostermeier</i>	
Heterologous Reconstruction of a Synthetic Bacterial Oscillator	143
<i>Anna H. Chen</i>	
Synthetic Biology Approach to Systematic Optimization of Protein Function	144
<i>Sridhar Govindarajan</i>	
Design and Characterization of Synthetic, Minimal Promoters in Yeast	145
<i>Heidi Redden and Hal Alper</i>	
Introduction of Heterologous Mevalonate Pathway in Methylobacterium Extorquens AM1 for High Production of Value-Added Compounds from Methanol	147
<i>Wen-Liang Zhu, Chong Zhang, Lan-Yu Cui and Xin-Hui Xing</i>	
Antibody Mediated Protection in Whooping Cough Infection Due to Bordetella Pertussis	148
<i>Edith Acquaye and Jennifer Maynard</i>	
New Biophysical Model for Characterization of Human Heart Valves	149
<i>Juan Garcia, Jose Padilla, Gerardo Rivera-Silva and Maria Moreno</i>	
Reengineering the Genetic Code to Expand the Language of Biology Using a Cell-Free Synthetic Biology Approach	150
<i>Bradley C. Bundy, Mark T. Smith, Jeremy Hunt, Amin Salehi, Andrew Broadbent and Matt Schinn</i>	
A Novel Storage Method for Umbilical Cord Blood	151
<i>Gul Afshan and Eryn Hassemer</i>	
Design of Halotolerant Bovine Dnase Guided By Phylogenetic and Domain Structure Studies of Bacterial Dnases	152
<i>Gediminas Alzbutas, Milda Kaniusaite, Algirdas Grybauskas and Arunas Lagunavicius</i>	
Composability and Design of Parts for Large-Scale Pathway Engineering in Yeast	153
<i>Eric M. Young, Johannes A. Roubos, Ben Meijrink and Christopher A. Voigt</i>	
Cofactor Engineering for the Production of Short Chain Fatty Acid	154
<i>Songi HAN and Ka Yiu San</i>	
Photocrosslinking with p-Azidophenylalanine Used to Identify the Location of Cic Binding on ERK	155
<i>Alan Futran, Stanislav Y. Shvartsman and A. James Link</i>	
In-Depth Determination and Analysis of the Human Paired Heavy and Light Chain Antibody Repertoire	156
<i>Brandon J. DeKosky, Takaaki Kojima, Alexa Rodin, Kam Hon Hoi, Jiwon Lee, Wissam Charab, Gregory C. Ippolito, Andrew D. Ellington and George Georgiou</i>	
Integrative Characterization of Human Cellular and Serological Antibody Repertoires Elicited by Seasonal Influenza Vaccine	157
<i>Jiwon Lee, Daniel R. Boutz, Christopher Vollmers, Brandon J. DeKosky, Andrew P. Horton, Ellen M. Murrin, Daechan Park, Gregory C. Ippolito, Edward M. Marcotte, Stephen R. Quake and George Georgiou</i>	
Author Index	