5th International Conference on Biomolecular Engineering (ICBE 2015)

Lost Pines, Texas, USA
11-14 January 2015

ISBN: 978-1-5108-1576-6
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEYNOTE</td>
<td>Multipurpose Bacterial Cell Factories: New Production Strains and Novel Tools</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Michael Bott</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-Canonical Amino Acids as Probes of Protein Synthesis in Complex Biological Systems</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>David Tirrell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Signals from the Surface to Promote Human Pluripotent Stem Cell Differentiation</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Laura Kiessling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Development of Microbial Cell Factories for Biorefineries</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Akihiko Kondo</td>
<td></td>
</tr>
<tr>
<td>SYNTHETIC BIOLOGY</td>
<td>Reinforcing Synthetic Biology Against Evolutionary Failure</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Jeffrey E. Barrick</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engineering Smarter and Stronger T Cells for Cancer Immunotherapy</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Yvonne Chen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Synthetic Regulators for Evolutionary Metabolic Engineering</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Gyoo Yeol Jung</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Synthetic Biology with a Cell-Free TX-TL System: Metabolism, Gene Circuits and Minimal Cell in a Test Tube</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Jonghyeon Shin, Filippo Caschera and Vincent Noireaux</td>
<td></td>
</tr>
<tr>
<td>METABOLIC ENGINEERING FOR FUELS AND CHEMICALS</td>
<td>Engineering alcohol tolerance in yeast fermentations</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Gregory Stephanopoulos, Gerald Fink and Felix H. Lam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Quest for Synthetic Methylotrophy</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Eleftherios T. Papoutsakos, W. Brian Whitaker, Nicholas R. Sandoval, R. Kyle Bennett and Alan G. Fast</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metabolic Engineering of Saccharomyces Cerevisiae for the Synthesis of Polyketides and Fatty Acids</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Nancy A. Da Silva, Christopher Leber, Javier Cardenas, Jin Wook Choi and Ruben Fernandez-Moya</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exploring P450 Expression in Escherichia coli for the Synthesis of Complex Molecules</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Bradley Biggs, Chin Giaw Lim, Aditi Das, Mary Jan De Mey and Ajikumar Parayil</td>
<td></td>
</tr>
<tr>
<td>PROTEIN ENGINEERING AND EVOLUTION</td>
<td>Co-Evolution of Affinity and Stability for Domain Antibodies That Recognize Hydrophobic Antigens</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Peter M. Tessier</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engineering Proteases to Detect Post-Translational Modifications</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Navin Varadarajan</td>
<td></td>
</tr>
<tr>
<td>EXPERIMENTAL AND COMPUTATIONAL TOOLS FOR ENGINEERING BIOMOLECULES</td>
<td>Computational Strain Design for Improved Productivity, Yield and Robustness</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Radhakrishnan Mahadevan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Machine-Based Learning for Rational Engineering of Biomolecular Libraries</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Lydia M. Contreras, Jorge Vasquez, Kris Reyes and Warren Powell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>De Novo Biosynthesis of Terminal Alkyne-Tagged Natural Products and Applications</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Wenjun Zhang</td>
<td></td>
</tr>
</tbody>
</table>
Development and Analysis of Precursor Production Strains for Chemical Production ........................................... 19
Xiaolin Zhang, Christopher J. Tervo and Jennifer Reed

BIOPHYSICAL MODELS OF BIOLOGICAL PROCESSES

Micromachines and motility: Single and collective cancer cell invasion ................................................................. 21
Muhammad H. Zaman

Multiscale Models of Antibiotic Cellbots ................................................................................................................ 22
Kathryn Geldart, Brittany Forkus, Panagiota Kyriakou, Yiannis N. Kaznessis and Michail Vlysidis

Nanoscale Architecture of Tension Generation within Focal Adhesions ............................................................... 24
Alexander Dunn

Automated Physics-Based Design of Synthetic Riboswitches from Diverse Aptamers ........................................ 25
Howard M. Salis

HIGH THROUGHPUT BIOLOGICAL DESIGN

Zymergen .......................................................................................................................................................... 26
Zach Serber

Engineering Microbial Fatty Acid Biosynthesis as an Industrial Biotechnology Platform Steve Del Cardayre* ................................................................. 27
Steve del Cardayre

Orthogonal Genetics for Rapid Evolution and Synthetic Biology ........................................................................ 28
Chang C. Liu

Reverse Engineering Enzymes with High-Throughput Sequence-Function Mapping .............................................. 60
Philip A. Romero and Adam R. Abate

BIOMOLECULAR DESIGN OF DIAGNOSTIC AND THERAPEUTIC AGENTS

Engineering Picomolar Affinity into a Rationally Identified 5 Kda Scaffold for Tumor Targeting ......................... 71
Max A Kruziki, Hong Zhou, Patrick Holec and Benjamin J. Hackel

Ultra-High Affinity Engineered Protein Therapeutics for Treating Metastatic Disease ........................................ 73
Jennifer R. Cochran

Modular Receptor Engineering for Programming Cell-Based Therapies to Interface with Host Physiology ......... 74
Nichole Daringer, Rachel M. Dudek, Kelly A. Schwarz and Joshua N. Leonard

DESIGNING NON-NATIVE BIOLOGICAL FUNTION

Non-Native Small-Molecule Biosensors for Screening and Selection of High-Performance Cell Factories ........... 75
Michael K. Jensen, Mette Skjodt, Jie Zhang, Arun S. Rajkumar and Jay D. Keasling

Designing Microbes for Executive Function ...................................................................................................... 76
William E. Bentley, Gregory F. Payne, Jessica Terrell, Hsuan-Chen Wu, Chen-Yu Tsao, Tanya Gordonov, Amin Zargar and David Quan

Engineering Orthogonal Translation Systems .................................................................................................... 77
Michael C. Jewett

Microbial Production of Curcuminoids .................................................................................................................. 78
Nobutaka Funa

POSTER SESSION

Bias and Error Correction in Antibody Repertoire Sequencing for More Accurate Vaccine Profiling .................. 80
Tarik Khan and Sai T. Reddy

Studies on the Influence of Different Metabolic Uncouplers on the Biodegradation of Toluene in a Differential Biofilter Reactor ............................................................................................................ 81
Swaminathan Detchanamurthy and Peter Gostomski
A Biobased Approach to Mechanically Tunable Polyester ................................................................. 82
Kechun Zhang

Tailor Designed Peptides Bio-Inspired from Transmembrane Proteins for the Cosmetic Industry ........ 83
Sonia Milena Aguiera Segura, Vanessa Lucia Nuñez Velez, Oscar A. Alvarez Solano, Luke Achenie, Rodrigo
Torres Suez and Andres Fernando Gonzalez Barrios

Energizing Yeast Cell-Free Protein Synthesis with Glucose Metabolism ............................................ 84
Jessica C. Stark, Mark Anderson, C. Eric Hodgman and Michael C. Jewett

Investigation of Metabolic Capabilities of Recombinant Lactococcus Lactis for Production of
Hyaluronic Acid Using Constraint Based Genome Scale Models ......................................................... 85
Abinaya Badri, Karthik Raman and Guhan Jayaraman

Development and in Vivo Testing of Antibodies Targeting Cancer-Associated Fibroblasts ................ 88
James A. Van Deventer, Saravanan Rajan, Sachdev Sidhu and K. Dane Wittrup

The Bio Phantom Tissue Model ............................................................................................................ 89
Jose Calderon and Carlos Calderon

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
Bashir S. Mienda and Mohd S. Shamshir

Bypassing Local Maxima in Protein Directed Evolution through Negative Selection ......................... 91
Barrett Steinberg and Marc Ostermeier

Controlling Cells through RNA Folding ............................................................................................. 92
Julius B. Lucks

A Human Therapeutic Enzyme Specifically Sabotages Tumor Metabolism By an Engineered
Cystine/Cysteine Degradation Activity ................................................................................................. 93
Shira Cramer, Achinto Saha, Surendar Tudi, Stefano Tiziani, John Digiovanni, Everett M. Stone and George
Georgiou

Glycoengineered Outer Membrane Vesicles Displaying O-Polysaccharide Antigens Elicit Protection
Against Francisella Tularensis .................................................................................................................. 94
Linxia Chen, Jenny Baker, Jack Chung-Jr Huang, Christine Endicott, David Putnam, Bradley Jones and Matthew
P. DeLisa

Engineering and Preclinical Development of a Human Enzyme for Cancer Therapy Via the Depletion
of the Serum L-Cystine Pool ...................................................................................................................... 95
Everett Stone, Shira Cramer, Achinto Saha, Stefano Tiziani, Surendar Tudi, John Digiovanni and George
Georgiou

Towards Biofuel Production in Synechocystis Sp. PCC 6803: Expanding the Molecular Biology
Toolbox for Pathway Engineering ........................................................................................................... 96
Christie A.M. Peebles

Deciphering Transcriptional Regulation Patterns for Novel Enzyme Discovery ................................... 97
Kevin V. Solomon, Charles Haisiema, John K. Henske, Diego Borges-Rivera, Dawn A. Thompson and Michelle A.
O'Malley

Design and Engineer L-Amino Acid Deaminase from Proteus vulgaris As a Robust Biocatalyst for
One-Step Biosynthesis of a-Keto Acids ................................................................................................. 98
Long Liu

Reducing Uncertainty in Metabolic Networks through Thermodynamics Based Flux Analysis .............. 99
Alexandros Kiparissides and Vassiliy Hatzimanikatis

Controlling Local Substrate Concentrations and Enzyme Kinetics through Rationally Designed
Intermolecular Interactions ...................................................................................................................... 100
Yingning Guo, Jie Zhu, Jyun-Liang Lin and Ian Wheeldon

Discovery of a Pre-Eclampsia Associated Antibody That Binds to a Viral Antigen and Human Protein .... 101
Serra E. Elliott, Alex R. Soffici and Patrick S. Daugherty

Study of the Effects of Alternative Fluxes on the Metabolic Control Analysis of Optimally Grown E.
coli ......................................................................................................................................................... 103
Georgios Fengos, Merec Ataman, Daniel Hernandez Garidiol, Ljubisa Miskovic and Vassiliy Hatzimanikatis

Intracellular Trafficking and Degradation of Antibody Drug Conjugates .............................................. 104
Katie Maass and K. Dane Wittrup

Ligand Responsive Hybrid Promoters and Bidirectional Promoters for Metabolic Engineering in
Oleaginous Yeast Yarrowia Lipolytica ....................................................................................................... 105
Murtaza Shabbir-Hussain, Lauren Gumbill, Samuel Williams and Mark A. Blenner

Development of SNAP-Tagged Antibodies for Magnetic Bead-Based Immuno-PCR ............................. 106
Jimmy Gollihar, Arti Potheukachi, Michelle Byrom and Andrew Ellington

Pigment-Based, Low-Cost, Portable Micronutrient Status Tests Using Engineered Bacteria .................. 107
Daniel Wasstein and Mark P. Styczynski
High-Throughput Design of Regulatory Protein-Based Biosensors for Screening Biosynthesis Libraries ................................................................. 108
Patrick C. Cirino, Christopher S. Frei and Shuai Qian

Intracellular FRET-Based Assay for Redesigning the Specificity of Secreted Proteases ................................................................. 109
Jennifer L. Guerrero, Michelle A. O'Malley and Patrick S. Daugherty

Talen Assisted Multiplex Engineering for Accelerated Genome Evolution in Saccharomyces Cerevisiae ................................................................. 110
Guoqiang Zhang and Qinhong Wang

A Novel, in Vivo Continuous Evolution Strategy in Saccharomyces Cerevisiae to Create Pathway and Protein Variants ................................................................. 111
Joe Sun, Nathan Crook, Joe Abatemarco and Hal Alper

Generation of Protease-Inhibiting Monoclonal Antibodies By Novel Paratope Design and Function-Based Screening ................................................................. 112
Dong Hyun Nam, Kaili Fang, Carlos Rodriguez, Tyler Lopez and Xin Ge

Directed Protein Evolution for Specificity and Affinity Towards Chemically Modified RNAs Via Secm Ribosome Display ................................................................. 114
Kevin Baldridge, Amanda Bryant-Friedrich and Lydia Contreras

Engineering Secretion Machinery for High-Throughput Protein Production ................................................................. 117
Danielle Tallman-Ercek

Genome-Wide Search for Intracellular Factors Affecting RNA Folding Via in Vivo Oligonucleotide Hybridization ................................................................. 118
Kevin Vasquez, Jorge Vazquez-Anderson, Taylor Hatridge and Lydia M. Contreras

An Alternative Splicing Platform for Programming Protein Function ................................................................. 119
Melina Mathur and Christina D. Smolke

Transformable Facultative Thermophile Geobacillus Stearothermophilus NUB3621 As a Host Strain for Metabolic Engineering ................................................................. 120
Kristen Blanchard, Srebrenka Robic and Ichiro Matsumura

An Analytical Approach to Bistable Biological Circuit Discrimination Using Real Algebraic Geometry ................................................................. 121
Dan Siegal-Gaskins, Elissa Franco, Tiffany Zhou and Richard M. Murray

Characteristics of Protein Incorporated within Poly(vinyl alcohol) Hydrogel Membrane ................................................................. 122
Adrian Salgado

A Hybrid Riboswitch–Small RNA Molecule for Metabolic Engineering in an n-Butanol Pathway ................................................................. 123
Ashwin Lahary, Samuel D. Stimple, David W. Wood and Richard A. Lease

Bacterial Inner Membrane Display for Isolating Intracellular Antibodies from a Naïve Library ................................................................. 125
Parisa Moghaddam-Taaheri and Amy J. Karlsson

Ensemble Modeling Identifies the Mechanism By Which Clpp Impacts NO• Defense Systems in E. coli ................................................................. 126
Mark P. Brynildsen and Jonathan L. Robinson

Re-Engineered β-Oxidation Reversal for the Synthesis of ω-Functionalized Products in Escherichia Coli ................................................................. 128
Seokjung Cheong

Medium-Chain Carboxylic Acid and Alcohol Production Via Engineered β-Oxidation in E. coli ................................................................. 129
Seokyoung Kim and Ramon Gonzalez

Cloning and Expression Profiling of Polycomb Gene, Vernalization Insensitive 3 from Tomato
Solarium Lycopersicum L. ................................................................. 130
Zainab Almutairi

Engineering, Predicting, and Understanding Cofactor Specificity in Ketol-Acid Reductoisomerases ................................................................. 131
Jackson K.B. Cahn, Sabine Brinkmann-Chen and Frances H. Arnold

A Click Chemistry Approach to Site-Specific Immobilization of a Small Laccase Enables Efficient Direct Electron Transfer in a Biocathode ................................................................. 132
Zhilei Chen and Dongli Guan

Rational Design of Antibody Cocktails to Treat Disease Caused By Bordetellae ................................................................. 133
Jennifer A Maynard, Annalee Nguyen, Ellen K Wagner, Edith Acquaye-Seedah, Roman Wolf, Eric Harvill and James Papin

Production of Fatty Acid-Derived Fuels and Chemicals in Saccharomyces Cerevisiae ................................................................. 134
Leo D. Espaux, Jay D. Keasling and Weerawat Runguphan

Improving Cell-Free Protein Synthesis through Genome Engineering of Escherichia coli Lacking Release Factor 1 ................................................................. 135
Rey W. Martin, Seok Hoon Hong, Yong-Chan Kwon, Ben De Soy, Ioanna Ntai, Alexandra de Paz, Neil Kelleher and Michael C. Jewett

Constructing a Synthetic Metabolic Pathway Protects Escherichia coli Against the Acetic Acid Inhibition and Fulfills Enantiomerically Pure (R, R)-2,3-Butanediol Production ................................................................. 136
Xiaojun Ji and He Huang