

Preliminary Program

Biochemical Engineering XIV:

**Frontiers and Advances in Biotechnology, Biological and
Biomolecular Engineering**

Harrison Hot Springs, BC, Canada

July 10–14, 2005

Conference Chairs

William Bentley
University of Maryland

Hendrik J. Meerman
Genencor International, Inc.

Vice Chairs

Mike Betenbaugh
Johns Hopkins University

Vijay Yabannavar
Chiron

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Sunday, July 10, 2005

- 13:00 Registration opens
- 14:45 **Welcome and Conference Overview**
- 15:00 **Session 1a: Genomics & proteomics for discovery and process development**
Laurel Donahue, Sigma Aldrich, and Gyun Min Lee, KAIST
Acquisition and application of genomic and/or proteomic data to modify cellular processes for product discovery and/or process development.
- Kenneth Reardon, Colorado State University
Proteomic and transcriptomic assessment of the dynamics of *Synechocystis* sp. PCC 6803 during light-dark cycling
 - Ryan Gill, University of Colorado
Integrating reverse and forward approaches for strain engineering
 - Jeroen Hugenholtz, Kluuyver Centre for Genomics of Industrial Fermentations, The Netherlands
Unravelling the metabolic networks in *Lactobacillus plantarum*
- 16:00 Coffee break
- 16:30 **Session 1b: Genomics & proteomics for discovery and process development**
- Daniel Allison, Sigma-Aldrich
Using genomic tools for the identification of important signaling pathways in order to facilitate cell culture medium development
 - David James, University of Queensland, Australia
A combined proteomic and transcriptomic strategy to optimize recombinant mRNA translation in mammalian cells
- 17:15 **Keynote: Stanley Fields, University OF Washington**
Technologies for protein analysis
- 18:00 Dinner
- 19:15 **Retrospective: Michael Shuler, Cornell University**
Biochemical engineering: a field still in ferment?
- 20:00 **Poster Session #1 and Reception**
Poster Session Chairs: Wilfred Chen, University of California - Riverside;
Matthew DeLisa, Cornell University; Greg Frank, Amgen

Monday, July 11, 2005

07:00 Breakfast buffet

08:00

Session 2: Quantitative systems biotechnology

Jeffrey Varner, Genencor International and Charles Roth, Rutgers University

Development and application of technologies to rapidly gather and quantitatively analyze system-wide (whole organism) data in problems of real scope and complexity.

- Sang Yup Lee, KAIST, Korea
Metabolic flux analysis at genome scale: new concepts and applications
- Christophe Schilling, Genomatica
Industrial applications of constraint-based models of microbial metabolism
- Jason Haugh, North Carolina State University
Kinetic and spatial analyses of intracellular signal transduction
- Friedrich Srienc, University of Minnesota
Efficient reaction networks and their determination in single cells

09:30

Plenary 1: Jens Nielsen, DTU

Identification of global regulatory structures in cellular metabolism

10:15

Coffee break

10:45

Session 3: Cell regulatory networks & signal transduction

David Schaffer, University of California-Berkeley, and Jason Haugh, North Carolina State University

The impact of post-translational regulation of proteins in signal transduction pathways, as applied to problems in drug discovery, development and production.

- Ravi Iyengar, Mt. Sinai School of Medicine
Regulatory motifs in cell signaling networks
- Martin Fussenegger, ETH-Zurich, Switzerland
Synthetic mammalian gene networks
- Stanislav Shvartsman, Princeton University
Pattern formation in developing epithelial layers
- Christina Chan, Michigan State University
Reconstructing gene regulatory and signaling pathways from high throughput data

12:15

Lunch

13:30

Free time

15:00

Session 4: Applying biochemical engineering principles to cancer research

Jeffrey Chalmers, Ohio State University, and Randy Knowlton, NCI

Innovative biomolecular technologies applied to help define the nature and pathology of cancer. Includes panel discussion re: funding programs at NIH.

- K. Dane Wittrup, M.I.T.
Pretargeted radioimmunotherapy - theory & experiment
- Sean Palecek, University of Wisconsin
Protein-acrylamide copolymer hydrogel arrays for diagnosing and characterizing chronic myeloid leukemia

- Harvey Blanch, University of California – Berkeley
Quantifying metabolic differences between cancerous and non-cancerous human breast cancer cells: Implications for drug target identification and therapeutic development
- Deirdre Meldrum, University of Washington
Microsystems for multi-parameter single cell analysis for disease and cancer research
- Panel discussion about funding opportunities at NCI

17:00 Coffee break

17:30 **Session 5: Tissue engineering**

Martin Fussenegger, ETH-Zurich, and Arthur Coury, Genzyme

Recent advances in the synthesis of novel biodegradable and biomimetic materials for tissue regeneration.

- Kristi Anseth, University of Colorado
Synthetic hydrogels as 3D cell niches for tissue regeneration
- Kuber Sampath, Genzyme
The use of bone morphogenetic proteins (BMPs) in orthopedic tissue engineering: promises and challenges
- Jens Kelm, ETH-Zurich, Switzerland
Design of artificial microtissues: a novel concept for cell-based therapies and tissue engineering
- Eric Shusta, University of Wisconsin
Strategies for improving in vitro blood-brain barrier models

19:00 Dinner w/local speaker

21:00 **Poster session #1 (reprise)** and Social Hour

Tuesday, July 12, 2005

07:00 Breakfast buffet

08:00 **Session 6: Physiology of protein expression**

Wai Lam Ling, Schering Plough, and Dennis Shields, Albert Einstein

Biosynthesis, folding, processing and secretion of recombinant proteins in various expression hosts. Includes metabolic engineering, i.e. knowledge-based genetic modification of cellular processes to improve product quality, productivity, process robustness, etc.

- Eugene Schaefer, Bristol-Myers Squibb, NJ
Stress-testing protein expression for large scale production
- Daniel I.C. Wang, M.I.T.
Engineering of CHO cell glycosylation through CMP-sialic acid transporter over expression
- Miranda Yap, Bioprocessing Technology Institute, Singapore
Enhanced recombinant protein yield and quality using novel CHO GT (gene targeted) cells
- Diethard Mattanovich, University of Natural Resources and Applied Life Sciences, Vienna, Austria
Molecular physiology of recombinant protein producing *Pichia pastoris*
- Wilfred Chen, University of California – Riverside
Metabolic engineering of *Rhizobacteria* for simultaneous removal of TCE and cadmium

09:45 **Plenary 2: Randal Kaufman, University of Michigan**

Factors limiting protein secretion from mammalian cells: the Unfolded Protein Response

10:30 Coffee break

11:00 **Session 7: Production of complex protein structures**

Laura Alicia Palomares, Universidad Nacional Autónoma de México, Christoph Joosten, Bristol-Myers Squibb, and Diethard Mattanovich, BOKU Vienna

Understanding the synthesis, post-translational modification and assembly of complex protein structures, including glycoproteins, multimeric antibodies and virus particles.

- Peter Prevelige, University of Alabama – Birmingham
Self-assembly of viral capsids
- Antonio Villaverde, Universitat Autònoma de Barcelona, Spain
Structure and physiology of bacterial inclusion bodies: clues to understand recombinant protein aggregation
- Michael Betenbaugh, Johns Hopkins University
N-glycosylation: a critical post-translational processing event in mammalian cells?
- Stefan Wildt, Glycofi
Yeast with human-like glycosylation for the production of therapeutic glycoproteins

12:45 Lunch

14:00

Workshops session 1:

Coordinators: Mike Betenbaugh, Johns Hopkins, and Vijay Yabannavar, Chiron

A. Engineering productivity of recombinant cells (90 minutes)

Alan Dickson, University of Manchester, and Andrew Racher, Lonza Biologics

Engineering improved recombinant production strains, focusing on increasing cellular specific productivity (vs. increasing viable cellmass) to enhance the volumetric productivity of bioprocesses.

- Chris Proud, University of British Columbia
Translational control of recombinant protein synthesis
- Fred Koller, Oncosis
Automated in situ measurement of cell-specific antibody secretion and laser-mediated purification for rapid cloning of highly-secreting producers
- Rachel Chen, Georgia Institute of Technology
Addressing permeability limitations in whole-cell biocatalysis by cellular membrane engineering

B. New technologies in bioseparations and downstream processing (90 minutes)

Joseph Shiloach, NIH, and Kent Goklen, Merck

New developments and current state of the art in process scale separations (incl. expanded bed adsorption, membrane separations, and new resins) and systems for screening and rapid identification of recovery and purification approaches.

- Patrick Santambien, Pall Biosepra, France
Approaches for protein purification design involving interaction with solid phases and mass spectrometry detection
- Rolf Hjorth, GE Healthcare, Sweden
Expanded bed adsorption - an efficient and robust and technique for primary recovery
- Jeff Mora, Sartorius, USA
Rapid and effective separation technology with membrane chromatography

15:30

Coffee break

16:00

Workshops session 2:

Coordinators: Mike Betenbaugh, Johns Hopkins, and Vijay Yabannavar, Chiron

A. Scale-up, mixing, monitoring and control (90 minutes)

Ashraf Amanullah, Merck, and Alvin Nienow, University of Birmingham

Review issues and technology in scale-up, mixing and control of fermentation and recovery operations, e.g. cell lysis for plasmid production.

- Colin Thomas, University of Birmingham
Shear in bioprocessing
- Andreas Lubbert, Martin Luther University, Germany
Mixing, process monitoring and control
- Steve Meier, Genentech
Scaleup/scaledown and mixing in industrial cell culture reactors

B. Protein stability and formulation (90 minutes)

Bernhardt Trout, M.I.T., and Margaret Speed Ricci, Amgen

Discuss issues in maintaining physical, conformational and chemical stability, e.g. preventing aggregation and chemical degradation, in protein formulations.

- Mary Cromwell, Genentech
The impact of self-association on antibody formulation development
- Christian Schöneich, University of Kansas
Intramolecular catalysis and chain reactions controlling protein degradation
- Pavel Bondarenko, Amgen, CA
Novel reversed-phase LC/MS method for characterization of intact antibodies

17:30

Break

17:40

Session 8: Accelerating bioprocess development from the bench to the plant

Michael Hoare, University College London, and Hari Pujar, Merck

Advances in the ability to scale bioprocesses based on better mimics of large-scale downstream unit operations, and improved integration and modeling.

- Peter DePhillips, Merck
Enabling process development: faster and better analytics
- John Fann, Abbott
Fast development and optimization of CHO cell culture process for Phase I/II therapeutic monoclonal antibody production
- Xiaoming (Jerry) Yang, Amgen, CA
Integrated platform process strategy to accelerate finish-in-human development
- Daniel Bracewell, University College London
Ultra scale-down and whole bioprocessing modelling to speed the development of purification process

19:00

Dinner

20:30

Poster Session #2 and Social Hour

Poster Session Chairs: Wilfred Chen, University of California at Riverside; Matthew DeLisa, Cornell University; Greg Frank, Amgen

Wednesday, July 13, 2005

07:00 Breakfast buffet

08:00 **Session 9: Advances in the miniaturization of bioreactor technology**

H. Brett Schreyer, BioProcessors, and Charles Cooney, M.I.T.

Recent progress in addressing the engineering challenges in measurement, control and data acquisition in microbioreactors.

- Govind Rao, UMBC
Culture at the small-scale: challenges, solutions and opportunities
- Klavs Jensen, M.I.T.
Multiplexed, integrated microbioreactor system for high-throughput bioprocess development
- Alfred Gaertner, Genencor International
Growth and enzyme production profiling during fermentation of *Bacillus subtilis* in a novel microscale bioreactor
- Tim Johnson, BioProcessors
Proof of principle of a scaleable, sub-milliliter microbioreactor
- Steve Doig, University College London
Scaling-up microbial cultivation from miniaturized devices to conventional laboratory vessels

09:45 Coffee break

10:15 **Plenary 3: Jonathan Dordick, Rensselaer Polytechnic Institute**

High-throughput biocatalysis for new compound discovery and process development

11:00 **Session 10: Biodevices, BioMEMs and biomedical nanotechnology**

Ping Wang, University of Akron, and Sherri Biondi, Alexza

Issues in design and microfabrication of devices for biological and biomedical applications, including cell characterization and drug delivery.

- Michael Shuler, Cornell University
Animal-on-a-chip: evaluating treatment strategies for cancer
- Luis Cascão Pereira, Genencor International
Lateral diffusion of adsorbed enzymes measured by microfluidic patterning of substrate surfaces
- Pauline Doran, University of New South Wales, Australia
Production of semiconductor quantum dot nanoparticles using plant tissue culture
- Douglas Clark, University of California – Berkeley
Microfluidic multiplex systems for multi-step biotransformations and in-situ product detection
- Gregory Payne, University of Maryland Biotechnology Institute
Biofabrication: beyond self-assembly

12:45 Lunch (box available)

14:00 Free time

16:30

Session 11: Evolutionary approaches in biochemical engineering

Ryan Gill, University of Colorado, and Olga Selifonova, Cargill

Application and further development of traditional evolutionary strategies, including mutagenesis, selection, and recombination, to improve host traits, product formation and protein function.

- George Georgiou, University of Texas – Austin
'Intelligent (re)design' of thiol:disulfide homeostasis in bacteria
- Stephen del Cardayre, Codexis
Evolutionary engineering of enzyme and whole cell biocatalysts
- Thomas Wood, University of Connecticut
Designing oxygenases for green chemistry and bioremediation
- Eric Boder, University of Pennsylvania
Protein directed evolution for biosensors, membrane fusogens, and T cell inhibitors

18:00

Amgen Award Lecture

19:00

Banquet

21:00

Poster session #2 (reprise) and social hour

Thursday, July 14, 2005

07:00 Breakfast buffet

08:00 **Session 12: Novel biocatalysts for biotechnological applications**

Karl-Erich Jaeger, Research Center Juelich, and Marcel Wubbolts, DSM

High-throughput-identification, expression, optimization (directed evolution) and characterization of novel biocatalysts

- Donald Cowan, University of the Western Cape
Metagenomics for biocatalyst discovery
- Hermann Sahm, Research Center Juelich
Microorganisms as efficient biocatalysts
- Marc Ostermeier, Johns Hopkins University
The iterative combinatorial design of protein switches and their application to the creation of novel ligand-binding proteins
- Aldis Darzins, Promega
In vitro evolution of a novel protein reporter capable of efficient covalent tethering to synthetic ligands
- Huimin Zhao, University of Illinois
Development of a novel phosphite dehydrogenase based NAD(P)H regeneration system for industrial biocatalysis

10:00 **Academic curriculum discussion**

Moderators: Anne Skaja Robinson, University of Delaware, and Theresa Good, UMBC

Discuss extent of coursework and training required to adequately prepare engineering students to meet current and future industrial bioprocessing demand.

11:00 **Biochemical Engineering XV discussion**

Moderators: Mike Betenbaugh, Johns Hopkins University, and Vijay Yabannavar, Chiron

12:00 Closing and distribution of box lunches