

BioChE- 03

CONFERENCE SCHEDULE

SATURDAY, July 19, 2003

- 4:30 PM** **Conference opening**
- 4:45– 5:30 PM** **Plenary 1**
*Integration and quantification, the needs of new
biology and the engineering ethos*
Gregory Stephanopoulos, MIT, Boston, MA
- 5:30-7:20 PM** **Session 1**
**THE NEW MICROBIAL PHYSIOLOGY IN
THE ERA OF GENOMICS**
Session Chairs: Sang Yup Lee, KAIST;
Hendrik Meerman, Genencor, Palo Alto, CA
- Description:** Microbial physiology is the functional and contextual characterization (qualitative and/or quantitative) of microorganisms and their components. Since the advent of wide-scale genome availability, this classical discipline has been renewed through the use of holistic approaches to elucidate cellular function and response to environmental stimuli. This session will highlight the advances in the application of post-genomic technologies to elucidate fundamental physiology, applied (industrial, environmental and medical) microbiology and cell biology.
- 5:30-6:10 PM** *Using functional genomics to understand
pathogenicity of Mycoplasm*a tuberculosis**
Gary Schoolnik, Stanford Medical School, Stanford, CA
- 6:10-6:40 PM** *Application of functional genomics in Trichoderma
reesei to improve industrial conversion of biomass to useful
sugars*
Pam Foreman, Genencor, Palo Alto, CA
- 6:40-7:00 PM** *Unravelling the full metabolome of Bacillus
subtilis*
Mariët van der Werf, TNO, Netherlands
- 7:00-7:20 PM** *Bacterial autoinduction: looking outside the
cell for insight on gene expression*
Bill Bentley, University of Maryland, College Park, MD

Saturday, July 19, 2003 cont'd...

7:30 – 9:00 PM Dinner: Outdoors (Pavilion, Millennium Hotel)

9:00 – 10:30 PM Reception and Posters I
Session Chairs: William Bentley, University of Maryland;
Lars Nielsen, University of Queensland, Australia; Sigma
Mostafa, Eli Lilly, IN; Dana Andersen, Genentech, CA

Sunday, July 20, 2003

6:45 – 8:00 AM **Breakfast**

8:00 – 9:30 AM **Session 2**
COMPUTATIONAL BIOLOGY,
BIOINFORMATICS AND DATA MINING

Session Chairs: John Quackenbush, The Institute for Genomic Research, Rockville, MD; Isidore Rigoutsos, IBM, Yorktown Heights, NY

Description: Acquisition, organization, and analysis of biological and medical data require the development and application of mathematical, statistical, and computational frameworks. Recent advances in these areas will be highlighted.

8:00-8:30 AM *Minimal cell models: A potential tool towards understanding the design principles of life*
Michael L. Shuler, Cornell University, Ithaca, NY

8:30-8:50 AM *Mapping and re-engineering of regulation circuits*
James C. Liao, University of California, Los Angeles, CA

8:50-9:10 AM *Systems biology study of structure and evolution of genome-based metabolic networks*
A.P. Zeng, GBF - German Research Centre for Biotechnology, Germany

9:10-9:30 AM *A computational framework for the discovery of novel biochemical pathways*
Vassily Hatzimanikatis, Northwestern University, Evanston, IL

9:30 – 10:00 AM **Break**

10:00 – 11:30 AM **Session 3**
SYSTEMS BIOLOGY: EXPERIMENTS AND
COMPUTATIONS

Session Chairs: Greg Stephanopoulos, MIT, Boston, MA; Vassily Hatzimanikatis, Northwestern University, Evanston, IL

Description: This session will focus on methods and demonstration of their use for generating associations among parts of cellular organization and function. A key objective is to discover such associations that suggest testable hypotheses that would be non obvious in the absence of a systems approach to data analysis. Methods for association discovery include (a) balances of all type (metabolite, redox, energy where appropriate, etc.); (b) correlational methods (such as multivariate analysis, PLS, nonlinear PLS, multiple

Sunday, July 20, 2003 cont'd...

regression analysis, etc.); (c) computational pattern discovery approaches. Such methods are already being applied to DNA-microarray data, flux data, metabolic profile data from GC-MS and will be useful for the analysis of future proteomic data, as well.

10:00-10:30 AM *Beyond expression – extracting meaning from microarrays*
John Quackenbush, TIGR, Rockville, MD

10:30-10:50 AM *Functional genomics approaches for examining polypeptide and carbohydrate processing in hyperthermophilic microorganisms*
Robert M. Kelly, North Carolina State University, Raleigh, NC

10:50-11:10 AM *Metabolic and evolutionary engineering of microbial fitness in the era of genomics*
Ryan T. Gill, University of Colorado, Boulder, CO

11:10-11:30 AM *Of parts and relationships: Pattern discovery at work*
Isidore Rigoutsos, IBM, Yorktown Heights, NY

11:30 – 1:00 PM **Lunch**

1:00- 2:30 PM **Posters I**

2:30-4:10 PM **Session 4**
NANOTECHNOLOGIES AND
MICROFLUIDICS
Session Chairs: Annelise Barron, Northwestern University, Evanston, IL; Andrea Chow, Caliper Technologies

Description: Assays and sensors based on nanoscale control of matter are often well suited to implementation in advanced microfluidic devices. Some recent examples include the manipulation, mobilization, and controlled interaction of cells, particles, and molecules using optical tweezers, the patterning of microfluidic channel surfaces at the nanoscale to control fluid flow and mixing, and electrophoretic control of DNA hybridization on microfluidic chips. Research at the interface between microfluidics and nanotechnology promises to enable a new generation of advanced devices for biosensing and cell/molecule sorting and separation, and may also offer powerful new tools for the study of important problems in biology.

2:30-3:00 PM *Micro- and nanofluidic devices for chemical and biochemical experimentation*
J. Michael Ramsey, Oak Ridge National Laboratory, Oak Ridge, TN

Sunday, July 20, 2003 cont'd...

- 3:00-3:30 PM** *Dynamic holographic optical tweezers: Transforming mesoscopic matter with light.*
David G. Grier, University of Chicago, Chicago, IL
- 3:30-4:00 PM** *The stretching and relaxation dynamics of DNA*
Harvey Blanch, University of California, Berkeley, CA
- 3:50-4:20 PM** *Microfluidic tools for protein crystallization and other screening studies*
Paul Kenis, University of Illinois, Urbana-Champaign, IL
- 4:20 – 4:50 PM** **Break**
- 4:50 – 5:50 PM** **Session 5**
COMPLEXITY, BIODIVERSITY AND ENVIRONMENTAL BIOTECHNOLOGY
Session Chairs: Jay D. Keasling, University of California, Berkeley, CA; Gerhard Frey, Diversa
- Description:** Over the last few years, studies on microbial diversity and the expansion of the sequenced microorganisms have resulted in a vast expansion of the known gene and organismal diversity. There are tremendous opportunities to utilize this diversity for the production of new materials, enzymes, and drugs and for bioremediation. This session will focus on the science and applications of microbial and genetic diversity.
- 4:50 – 5:10 PM** *Plasmid diversity in an industrial wastewater bioreactor reveals extensive recombination and transposition*
Michael Bramucci, DuPont, Wilmington, DE
- 5:10 – 5:30 PM** *Bioprospecting down the toilet: harvesting polyphosphate kinase diversity from activated sludge*
Katherine McMahon, University of Wisconsin, Madison, WI
- 5:30 – 5:50 PM** *The effect of DNA shuffled rubisco enzymes on the carbon metabolism of a photosynthetic bacterium*
Ranjan Patnaik, CODEXIS, Redwood City, CA
- 7:30** **Bus Departure for dinner at University of Colorado Memorial Center (Walking directions are included separately)**
- 7:45 – 10:00 PM** **Dinner at the U. Colorado Memorial Center (UMC)**

Monday, July 21, 2003

6:45 – 8:00 AM **Breakfast**

8:00-9:30 AM **Session 6**
PROTEOMICS

Session Chairs: Kelvin H. Lee, Cornell University, Ithaca, NY; Kathy Champion, Genentech, San Francisco, CA

Description: The genome-wide analysis of biological systems is aided by high throughput screening technologies and there is significant effort in the academic and industrial settings towards analysis of complex mixtures of proteins. This session will include presentations on the application of existing technologies and emerging technologies for proteomics.

8:00-8:30 AM *A global protein view provided by new proteomics and mass spectrometry technologies*

Joseph A. Loo, University of California, Los Angeles, CA

8:30-9:00 AM *Quantitative proteomic and transcriptomic profiling during the fermentation process in pleiotropic Bacillus subtilis mutants*

Alfred L. Gaertner, Genencor International Inc., Palo Alto, CA

9:00-9:30 AM *Metabolic engineering of Escherichia coli based on transcriptome and proteome profiling*

Sang Yup Lee, KAIST, Korea

9:30 – 10:15 AM **Plenary 2**
Engineering of the protein secretion machinery
George Georgiou, University of Texas, Austin, TX

10:15 – 10:45 AM **Break**

10:45-12:15 PM **Plenaries 3 and 4**
Theme: CELL ENGINEERING THROUGH THE DISRUPTION OF GENE FUNCTION

Chairs: George Georgiou, University of Texas, Austin, TX; Vasantha Nagarajan, Dupont, Wilmington, DE

Description: In recent years advances in the ability to rapidly create cells in which the function of one or more genes has been selectively disrupted by genomic, interference RNA or chemical genetic strategies has revolutionized areas such as drug discovery, cell engineering and the global analysis of biological function. Presenters in this session will discuss some of the most promising strategies for the reversible or irreversible

Monday, July 21, 2003 cont'd...

disruption of gene function and their application to biochemical engineering and to the elucidation of complex biological functions.

- 10:45 – 11:30 AM** **Plenary 3**
Gene disruption by group II introns ('Targetrons')
Alan Lambowitz, University of Texas, Austin, TX
- 11:30 – 12:15 PM** **Plenary 4**
Using transposons to probe gene structure and function
Nancy Craig, Johns Hopkins University, Baltimore, MD
- 12:30 – 2:30 PM** **Box Lunch and Posters II**
- 2:30 – 4:00 PM** **Workshops and Tutorials**

- 1** ***Microfluidics and nanotechnology for high-throughput genomics and proteomics***
Annelise Barron, Northwestern University, Evanston, IL; Andrea Chow, Caliper, Mt. View, CA

Research groups in industrial, academic, and national laboratories are working to create ever more complex and integrated "lab on a chip" (LOC) technologies. One major application area for LOCs is in biosensing and bioseparations, as applied to genomics and proteomics. Nanotechnology-based assays and fluid mobilizing schemes are being built into the the newest experimental devices. This workshop will provide an update on some of the latest advances at the interface between nanotechnology and microfluidics, towards improved high-throughput genomic and proteomic analyses.

Microfluidic systems for high-throughput bioseparations and screening (10 mins. + Discussion)
Andrea Chow, Caliper Technologies

Microfluidic tools for protein crystallization and other screening studies (10 mins. + Discussion)
Paul Kenis, U. of Illinois, Urbana-Champaign

Making microfluidic devices practical for high-throughput DNA sequencing (10 mins. + Discussion)
Annelise Barron, Northwestern University

Micro- and nanofluidic devices for chemical and biochemical experimentation (10 mins. + Discussion)
J. Michael Ramsey, Oak Ridge National Labs

Monday, July 21, 2003 cont'd...

2 *Stem Cells & Cell Therapies*

Madhusudan Peshwa, Dendreon, Seattle, WA; Peter Zandstra, University of Toronto, Toronto, Canada

The workshop session on Stem Cells & Cell Therapies will focus on translational issues with developing and advancing 'product' concepts with such therapies. The objective being to bring out the challenges in moving these technologies through pre-clinical, clinical and toward commercial development. In achieving of the objectives, the workshop will attempt to outline the academic / research focus needed for process and product engineering as well as for technical expertise needed to develop 'non-conventional' tools for isolation and culture of cells as well as for product characterization, validation and comparability.

Introduction (5 mins)

Scientific Overview (10 mins)
Peter Zandstra, University of Toronto

Business Overview (10 mins)
Jeff Gimble, Duke University Medical Center, NC

Engineering Challenges (10 mins)
Madhusudan Peshwa, Dendreon Corp, Seattle, WA

Tools / Platforms (10 mins)
TBD

Discussion (45 mins)

3 *Scale up/scale-down & high throughput screening issues*

Sadettin Ozturk, Centocor, Malvern, PA; Vijay Yabannavar, Chiron, Emeryville, California

In this workshop, we want to explore how to improve the development processes to bring targets to the markets rapidly and cost-effectively. Can we offer any systematic approaches to high throughput screening in target identification by using data-base mining, proteomics and cell engineering? How to speed up the cell line creation for the targets? Can we purify and characterize the molecules at the early stage? How to optimize the process of process optimization so that we can balance the efforts and the outcome? Is there an advantage in using modular approach or platform technologies? While we have experienced presenters discussing some approaches, we encourage the audience to participate in lively discussion as to what really works in practice.

Introduction (5 min)
Sadettin Oztruk, Centocor; Vijay Yabannavar, Chiron

High throughput screening for biocatalysts (10 min)
David Robinson, Merck, Rahway, NJ

Industrial viewpoint on high throughput screening for clone selection and media evaluation (10 min)
Sigma Mostafa, Eli Lilly, Indianapolis, IN

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High speed expression optimization, process monitoring and protein analysis using retentate chromatography-mass spectrometry (10 min)

Tom Bronzert, CIPHERGEN, Fremont, CA

Biochemical engineering approaches to fast track process development (10 min)

Amine Kamen, NRC, Montreal, Canada

Panel discussion with audience participation (45 min)

4 *Proteomics and Protein Analysis: Methods & Technologies*

Kelvin H. Lee, Cornell University, Ithaca, NY; Kathy Champion, Genentech, San Francisco, CA

This workshop will build upon the Proteomics session held on Monday and be an informal set of discussions and presentations intended to 1) provide a venue wherein biochemical engineers can learn about the various technologies used in current proteomics studies (e.g. LC and MALDI mass spectrometry, de novo sequencing by MSMS, 2DE, MDLC), 2) provide a venue wherein biochemical engineering can learn about emerging technologies (protein arrays, microfluidic devices), and 3) discuss issues related to the application of proteomics technologies to a variety of problems.

Together with some of the participants in the session, we hope to initiate a discussion wherein the audience can bring to the table a broad range of issues that range from detailed specific questions (e.g. "look at this 2D gel, why does it have so much speckling?") to broad perspectives on the future (e.g. "will MALDI MSMS really have an impact in answering biological questions?"). The workshop will last as long as there are topics being forwarded by the audience.

Introduction: Overview of Proteomics Approaches

Kelvin H. Lee, Cornell University

Discussion

4:00 PM

Free afternoon and evening (dinner on your own)

Tuesday, July 22, 2003

6:45 – 8:00 AM **Breakfast**

8:00 – 9:40 AM **Session 7**
NOVEL VACCINES

Session Chairs: John Aunins, Merck, West Point, PA;
Richard Willson, University of Houston, Houston, TX

Description: The first 'gene therapy' and scientific vaccination may be considered to have occurred simultaneously over 200 years ago, when Dr. Edward Jenner used a cowpox vector to express immunogenic genes in vivo that protected recipients against smallpox disease. Gene therapy and vaccination efforts today utilize a wide variety of delivery vehicles, not only Jenner's vaccinia, but also many which are unusual entities with respect to the classical vaccine industry and the newer recombinant biopharmaceutical industry alike. Examples range from recombinant vaccine viruses and bacteria, to virus-like protein particles, to nucleic acids and their complexes with natural and synthetic materials. Although it is well recognized that utilization of these vectors in the clinic entails varied and complex issues, it is less recognized that manufacturing them is complex as well. This session will focus on engineering aspects of product development, process development, stabilization, manufacturing, analytical and biological characterization, and quality control.

8:00 – 8:30 AM ***Vaccine discovery via systematic identification and synthetic delivery***

Kathryn Sykes, MacroGenics Inc., Dallas, TX

8:30 – 8:50 AM ***Protein engineering problems at the heart of biomedical applications***

K. Dane Wittrup, MIT, Boston, MA

8:50 – 9:10 AM ***Enabling patient-specific vaccines with cell-free protein synthesis***

Jim Swartz, Stanford University, Palo Alto, CA

9:10 – 9:40 AM ***Are vaccines safe?***

Paul A. Offit, The Children's Hospital of Philadelphia, Philadelphia, PA

9:40 – 10:10 AM **Break**

10:10 -12:10 PM **Session 8**
STEM CELL BASED CELL AND TISSUE ENGINEERING

Session Chairs: Peter W. Zandstra, University of Toronto, Toronto, Canada; Jeff Gimble, Duke University Medical Center, NC

Tuesday, July 22, 2003 cont'd...

Description: Human adult and embryonic stem cells have the potential to serve as a source of cells for multiple therapeutic and industrial (e.g., drug screening) applications. The underlying biology of stem cell systems makes the development of robust bioprocesses capable of capitalizing on their potential particularly challenging. This session will cover recent advances in the control stem cell responses and emphasize the impact of bioengineering approaches on the design of novel stem cell - based technologies.

10:10 – 10:40 AM ***Skeletal Stem Cells in Regenerative Medicine***
Pam G. Robey, National Institutes of Health, Bethesda, MD

10:40-11:00 AM ***Stromal cell mimic for presentation of hematopoietic stem cell adhesion molecule ligands***
William M. Miller, Northwestern University, Evanston, IL

11:00-11:20 AM ***Sonic hedgehog regulates adult neural stem cell proliferation in vitro and in vivo***
David Schaffer, University of California, Berkeley, CA

11:20 – 11:40 AM ***Human embryonic stem cells: Reliable production and controlled differentiation***
Ramkumar Mandalam, Geron Corp., Menlo Park, CA

11:40 – 12:10 PM ***Regenerative medicine—A new paradigm for healthcare***
Alan Smith, Cognate Therapeutics, Baltimore, MD

12:10 – 1:30 PM **Lunch**

1:30 – 2:15 PM **Amgen Award Lecture**
From the earliest Archaea to the latest arrays: Old and new prospects for biochemical engineering
Douglas S. Clark, University of California, Berkeley, CA

2:30-4:20 PM **Session 9**
PROTEINS
Session Chairs: Marc Ostermeier, Johns Hopkins University, Baltimore, MD; Wayne Coco, Tanox Inc., Houston, TX

Description: The ability to engineering proteins with desired properties is limited by our current understanding of the relationships between protein sequence, protein structure and protein function. This session will highlight emerging topics and recent successes in both the understanding and engineering of protein form and function. Experimental and computational approaches to these topics will be included.

2:30-3:00 PM ***Developing the biocatalyst of the future - screening-based***

Tuesday, July 22, 2003 cont'd...

directed evolution of proteins

Ulrich Kettling, DIREVO Biotech AG, Cologne, Germany

3:00-3:20 PM

In silico prescreening of protein hybrids in directed evolution experiments

Costas D. Maranas, Pennsylvania State University, University Park, PA

3:20-3:40 PM

Efficient peptide ligand isolation using bacterial display

Patrick Daugherty, University of California, Santa Barbara, CA

3:40-4:00 PM

Phage display as a novel discovery platform for engineering biocatalysts

Andrew E. Nixon, Dyax Corporation, Cambridge, MA

4:00-4:20 PM

Engineering approaches to combating protein aggregation

Anne Robinson, University of Delaware, Newark, DE

4:20 – 6:00 PM

Break & Posters II (continued)

6:00– 7:20 PM

Session 10

NEW TRENDS IN INDUSTRIAL BIOPROCESSING

Session Chairs: Barry Buckland, Merck, West Point, PA; Matt Croughan, MIT, Boston, MA

Description: This session will showcase industrial bioprocessing examples including microbial fermentation, cell culture, purification and bioconversion.

6:00-6:20 PM

Automated microscale bioprocessing for the parallel evaluation of biocatalyst and process options

Gary L. Lye, University College London, London, England

6:20-6:40 PM

Approaches to improve antibody fragment expression in Escherichia coli

Dana Andersen, Genentech, San Francisco, CA

6:40-7:00 PM

Development of purification and fractionation of recombinant DNA derived proteins in a single step on the basis of protein size and charge using the novel Gradiflow technology

Peter Gray, University of New South Wales, Sydney, Australia

Tuesday, July 22, 2003 cont'd...

7:00-7:20 PM

Improved l-Threonine production with Escherichia coli
Thomas Hermann, Degussa, Germany

7:45

Bus Departure for dinner at U. Colorado Memorial Center (UMC; Walking directions are included separately)

8:00 – 10:30 PM

Banquet dinner: U. Colorado Memorial Center (UMC)

Wednesday, July 23, 2003

7:00 – 8:30 AM **Breakfast**

8:30 – 10:30 AM **Session 11**
DISCUSSION: THE FUTURE OF
BIOCHEMICAL ENGINEERING & THE NEXT
BIOCHEMICAL ENGINEERING
CONFERENCE

Session Chairs: Chairs of BioChE-03 & BioChE-05.

10:30 AM **Closing & Departure**

11:00 – 1:00 PM **Working Lunch: For members of Advisory
Board, Scientific Committee and Industrial Board
ONLY**