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Fifth Annual

THE BIOPROCESSING SUMMIT

Practical Solutions for Today's Laboratory Challenges

August 19-23, 2013 • Renaissance Boston Waterfront Hotel, Boston, MA

The **Leading** BioProcess Meeting

CONCURRENT PROGRAMS

August 19-20

Optimizing Cell Culture Technology

Facilities for Manufacturing Biologics

Higher-Order Protein Structure

Overcoming Formulation Challenges

August 21-22

Optimizing Cell Line Development

Scaling Up & Down with Optimized Bioreactors

Rapid Methods to Assess Quality & Stability of Biologics

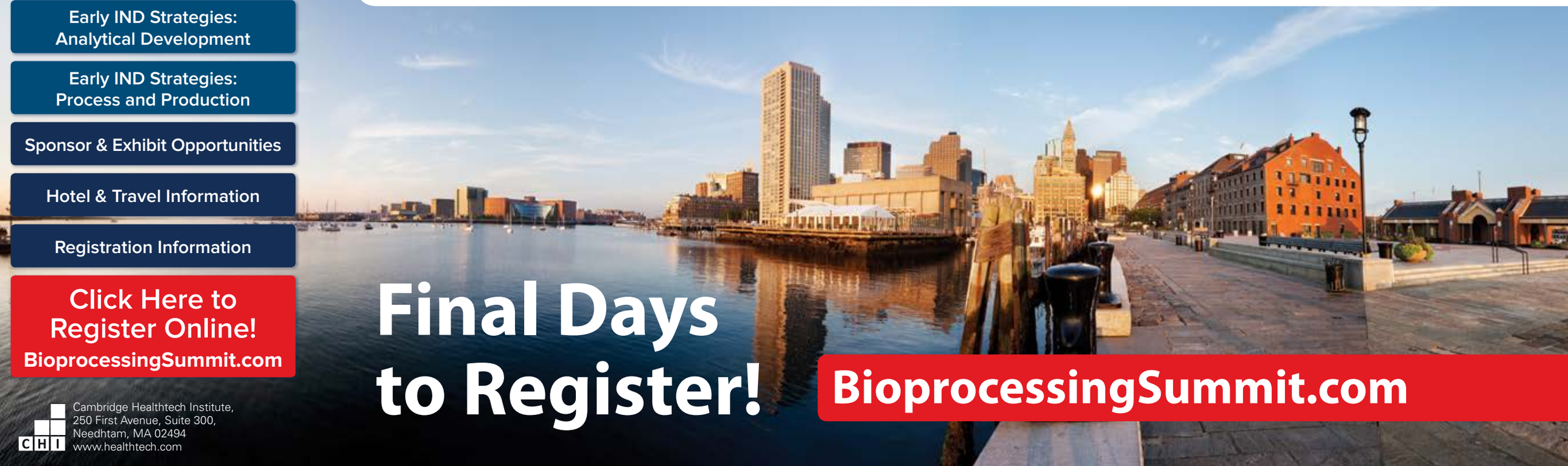
High-Concentration Protein Formulations

August 22-23

Early IND Strategies: Analytical Development

Early IND Strategies: Process and Production

New! Three Cambridge Healthtech Training Seminars! Cambridge Healthtech Training SEMINARS



Final Days to Register!

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The Bioprocessing Summit brings together international leaders to discuss today's bioprocess issues from cell line selection to manufacturing. The Summit provides practical details in a relaxed, congenial atmosphere that promotes information exchange and networking.

This leading bioprocess meeting is hosted in Boston each summer along the lively and cosmopolitan harbor waterfront with its restaurants, cafes, museums and art galleries, and within easy reach of historical sites, Faneuil Hall and the famed North End.

Conference-at-a-Glance

Monday Morning, August 19	Pre-Conference Short Courses*				
Monday Afternoon, August 19	Optimizing Cell Culture Technology	Facilities for Manufacturing Biologics	Higher-Order Protein Structure	Overcoming Formulation Challenges	
Tuesday Morning, August 20					
Tuesday Afternoon, August 20					
Tuesday Evening, August 20	Dinner Short Courses*				
Wednesday Morning, August 21	Optimizing Cell Line Development	Scaling Up & Down with Optimized Bioreactors	Rapid Methods to Assess Quality & Stability of Biologics	High-Concentration Protein Formulations	One-Day Cambridge Healthtech Training Seminar*
Wednesday Afternoon, August 21					
Thursday Morning, August 22					2 Concurrent One-Day Cambridge Healthtech Training Seminars*
Thursday Afternoon, August 22	Early IND Strategies: Analytical Development		Early IND Strategies: Process and Production		
Thursday Evening, August 22	Dinner Short Course*				
Friday Morning, August 23	Early IND Strategies: Analytical Development		Early IND Strategies: Process and Production		
Friday Afternoon, August 23					

*Separate registration required

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Short Courses*

**Separate Registration Required*

MONDAY, AUGUST 19| 8:30 - 11:30 AM

8:00 am Short Course Registration and Morning Coffee

SC 1: Optimizing Media – Achieving Super Soup

To grow mammalian cells, researchers need to provide an optimal *in vitro* environment. The key feature of successful cell growth is the culture medium. 'Achieving Super Soup' requires finesse and know-how in order to combine the right ingredients at the right times under the right conditions to achieve high titers. This workshop will provide a foundation for optimizing cell culture media presented by real-world experts who will also tailor a portion of the course to fit concerns and challenges faced by the workshop participants.

- Feed strategies
- Media formulation
- Oxygen
- Providing optimal conditions
- Process optimization
- Analytical tools
- Increasing cell densities
- High-throughput protocols

Yuan Wen, Ph.D., Process Science Manager, Life Technologies
Yao-Ming Huang, Ph.D., Principal Engineer, Biogen Idec
Karlheinz Landauer, Ph.D., COO, Operative Departments, Celonic AG
Martin Jordan, Ph.D., Scientist, Biotech Process Sciences - Medium Development, Merck Serono SA
Steven Chamow, Ph.D., Biopharmaceutical Consulting, Chamow & Associates, Inc.
Brian Posey, Product Development Manager, Corning Life Sciences

SC 3: Sub-Visible Particle Analysis in Protein and Viral Formulations

The need to monitor, measure and control sub-visible particulates in biopharmaceutical formulations has been emphasized in recent publications and comments by regulators. Some of these particulates can be highly transparent, fragile and unstable. In much of the size range of concern, a practical measurement method with adequate sensitivity and repeatability has been difficult.

- Overcoming the issues inherent in high-concentration formulations and container-closure systems
- Understanding the latest tools, technologies and methodologies
- Development and qualification of a method or complementary methods for sub-visible particle counting for a high concentration protein formulation
- How to ensure that the resulting method is robust, reproducible, and suitable for use in Analytical R&D and QC environment

Danny Chou, Ph.D., Senior Research Scientist, Biologics Development, Gilead Sciences, Inc.
Marina Kirkitadze, Ph.D., MBA, Deputy Director, Head, Biophysics and Conformation Unit, Biochemistry Platform Analytical R&D North America, Sanofi Pasteur Ltd.

SC 4: Strategies for Development of Analytical Specifications

This short course will discuss the strategies for development of analytical specifications and in assuring quality of a biotherapeutic drug product. Course will also cover FDA guidance and expectations, and addressing out-of-specification (OOS) results in a timely and productive fashion.

- Defining and setting up analytical specifications
- Statistical approaches to setting analytical specifications
- Selection of analytical assays to include in specifications
- Determining specifications based on critical quality attributes
- Handling of OOS results and and how these occurrences can be minimized
- Identification and investigation of critical deviations or a failure of a batch to meet its specifications or quality standards
- Quality assurance system to ensure corrective and preventative action plans for OOS results follow-up

Jonathan Basch, Senior Scientist, Process Development Analytics and Commercial Support, Bristol Myers Squibb Co.
Jichao Jay Kang, Ph.D., Director, Analytical & Formulation Development, Laureate Biopharmaceutical Services

TUESDAY, AUGUST 20 | 6:00 - 9:00 PM

5:15 pm Dinner Short Course Registration

6:00 - 9:00 pm Dinner Short Courses

SC 5: *E.coli* Innovations

Escherichia coli has proven its worth as a protein expression platform. Currently, *E.coli* is not viewed so much as an 'alternative' platform, but as a viable choice for achieving high-level expression of human genes and protein at a reasonable cost. This Dinner Short Course will explore strategies for successfully producing protein in *E.coli*, including:

- Host cell engineering to improve product quality
- Development of protein expression assays
- Development and optimization of protein purification processes
- Automating high-throughput protein expression and purification
- Scaling up production

David P. Humphreys, Ph.D., Director, Antibody Biology, UCB-New Medicines
Trevor Hallam, Ph.D., Chief Scientific Officer, Sutro Biopharma, Inc.

SC 6: Accelerated Stability Testing of Biologics

This short course will aim to guide the researcher in designing studies for accelerated stability testing of biologics. The course will begin with basic underlying concepts governing protein drug product stability, and focus on design principles for meaning stress and accelerated stability testing of not only the protein of interest but also of excipients and primary packaging components. Strategies to handle complexities arising from their interactions will also be discussed.

- Attributes of a successful protein drug product
- Modes of protein degradation: conformational stability, colloidal stability and chemical stability
- Chemical degradation reaction
- Real-time/accelerated/stress stability testing: rational design of stability conditions
- Stressors for evaluating protein stability
  - o Temperature: Arrhenius and non-Arrhenius kinetics
  - o pH: coupled effects of pH and buffers
  - o Interface: effects of protein stability: solid/liquid, liquid/liquid and liquid/gas
  - o Oxidizers
- Developing predictive and correlative tools: utility, desired features and examples
- Excipients
  - o Degradation mechanisms
  - o Impact on protein stability
  - o Factors to consider during stress/accelerated testing
- Primary packaging
  - o Accelerated stability testing
  - o Extractable/leachables

Yatin R. Gokarn, Ph.D., Narotam Sekhsaria Distinguished Professor of Chemical Engineering, Institute of Chemical Technology, Mumbai, India

THURSDAY, AUGUST 22 | 6:00 - 9:00 PM

5:15 pm Dinner Short Course Registration

6:00 - 9:00 pm Dinner Short Courses

SC 7: Transient Protein Production in Mammalian Cells

This short course will introduce both the fundamental concepts and technologies needed to establish transient protein production in mammalian cells. This will allow for the rapid generation of milligram to gram quantities of secreted or intracellular recombinant proteins for therapeutic, functional, and structural studies. The course will combine instruction and case studies in an interactive environment. What you will learn:

- A brief overview and comparison of protein expression systems
- An in-depth introduction to mammalian transient expression systems
- Examination of the key elements necessary for the establishment of a mammalian transient production system
- Scaling transient protein production to accommodate a wide range of recombinant protein requirements
- Optimizing the transient protein production process
- Tools and strategies for purification of transiently expressed proteins
- Methods of evaluation of purified proteins from transient expression

Henry C. Chiou, Ph.D., Senior Manager, Molecular Biology, Life Technologies Corporation
Dominic Esposito, Ph.D., Director, Protein Expression Laboratory, SAIC-Frederick, Inc.
Krista Johnson, MSc, Research Scientist, Alexion Pharmaceuticals

Cambridge Healthtech
Training SEMINARS*

WEDNESDAY, AUGUST 21 | 8:00 AM - 5:00 PM

Preparation of a Successful Initial IND Application

Bruce K Burnett, Ph.D., RAC (US, EU), Director, Regulatory Affairs, Duke University

This course will provide a broad overview of the entire Investigational New Drug (IND) application process, and it is designed for individuals involved in any aspect of the drug development process including R&D, manufacturing, clinical and regulatory. Attendees will review all of the filing components that are required for a successful initial IND application, with specific emphasis on:

- IND-enabling preclinical safety studies
- Manufacturing information for a Phase 1 investigational drug or biologic
- Clinical protocol, Informed Consent, and Investigator Brochure
- Required FDA forms 1571, 1572, and 3674
- PDUFA requirements for electronic submissions using the CTD format
- Meetings with FDA including Pre-IND meeting and meetings to discuss Clinical Hold issues
- Registration with ClinicalTrials.gov

Dr. Burnett brings over 25 years of experience in the pharmaceutical industry involving research and development, scientific affairs, quality control/assurance, and regulatory affairs. He came to Duke from AlphaVax, where he last served as Vice President of Quality and Regulatory Affairs. He has also held both regulatory and quality positions at Biogen Genetics Institute, and Serono. Dr. Burnett received his undergraduate degree in chemistry from the University of California, San Diego and his PhD in chemistry/biochemistry from MIT working in the laboratory of Nobel Laureate Dr. Har Gobind Khorana. Dr. Burnett's regulatory experience includes working on license applications that have resulted in the US approval of Tysabri (natalizumab), Amevive (alefacept), Neumega (oprevelkin, IL-11) and Benefix (coagulation Factor IX). He has also been responsible for preparing and submitting multiple initial INDs to CBER or CDER, preparing for many pre-IND and End of Phase 2 meetings, and leading numerous teleconferences with the Agency reviewers.

THURSDAY, AUGUST 22 | 8:00 AM - 5:00 PM

Introduction to Protein Characterization Technologies for Biologics Development

Christine P. Chan, Ph.D., Senior Manager, Technology Development, Genzyme Corporation

This course covers the fundamentals of protein structural analysis using modern biochemical and biophysical technologies. Analytical methods commonly used for CMC analytical characterization, release and stability studies of biotechnology products are reviewed with practical examples. Application considerations from early-phase development to commercialization are also discussed.

- Introduction to protein structure and post-translational modifications
- Protein chemistry techniques: capillary electrophoresis and HPLC, enzymatic methods and peptide mapping, mass spectrometry
- Biophysical characterization: spectral methods, light scattering, calorimetry, analytical ultracentrifugation, plus aggregation, subvisible and visible particles analysis.
- Binding and cell-based potency assays, activity assays, impurity analysis
- Bioprocess impact on product quality, conducting forced degradation studies
- ICH guidance documents, testing strategy through the product lifecycle, process control strategy considerations

Christine Chan is a protein biochemist with broad experience in the biopharmaceutical industry, including prior experience at Sandoz Pharmaceuticals and Merck & Co., Inc. She specializes in the analysis of recombinant products produced from mammalian cells for vaccines and biologics development. She has extensive hands-on experience with classical protein chemistry methods including Edman sequencing, amino acid analysis and protein purification, as well as capillary electrophoresis, mass spectrometry and biophysical methodologies. She is experienced in enzymatic assays, immunoassays as well as cell-based assays. Dr. Chan obtained her Ph.D. from the University of California-Davis and did postdoctoral work at the Howard Hughes Medical Institute at the University of Washington on growth factor signal transduction and protein phosphorylation.

Introduction to Biopharmaceutical Upstream and Downstream Separation, Clarification and Purification Processes

A. Mark Trotter, Development Manager, Life Sciences Purification Technology, 3M Purification, Inc.

This instructional program will review the major upstream and downstream technologies and applications used to produce biomolecular drug products, e.g., mAbs, vaccines, and genetic therapeutics. From the bioreactor/fermenter off load to the final dosage formulations, each process step will be examined with regard to technology, equipment/instrumentation and typical applications. These processes include depth filtration, tangential flow filtration (TFF), chromatography steps (both up and downstream), and viral clearance processes. The class will provide insights into the basic unit operations with focus on equipment and application.

- Basic concepts of clarification and purification
- Upstream and downstream unit operations for clarification and purification
- Review of various process steps in these applications
- Technology and equipment used with each unit operation: depth, tangential flow and final filtration steps, basic chromatographic and viral clearance processes
- Relationship with other unit operations
- Scale-up considerations

Mark Trotter has twenty-five years experience in biopharmaceutical industries, from work in pharmacologic research as project leader to field sales, and technical service director. This extensive background is coupled with an in-depth regulatory knowledge that supports his expertise in process validation. He completed his post-graduate studies at Long Island University, C.W. Post College, earning his MS in Medical Microbiology and continuing on for his MBA in Finance. He is considered a subject matter expert in upstream to downstream processes. He has published numerous technical articles, book chapters and has contributed editorial comment on these subjects.

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MONDAY, AUGUST 19

OPTIMIZING CELL CULTURE PROCESSES

1:00 pm Chairperson's Opening Remarks
Alan Dickson, Ph.D., Director, Centre of Excellence in Biopharmaceuticals (COEBP); Professor, Institute of Biotechnology, University of Manchester

» 1:10 OPENING KEYNOTE PRESENTATION:

Optimizing Cell Culture Production Processes – Trends, Challenges and Opportunities
Thomas Ryll, Ph.D., Director, Cell Culture Development, Biogen Idec, Inc.

Today many of the fundamental challenges of cell culture technology have been solved and industry leaders have developed platform process formats that deliver high productivity and product titers in the 5 g/L range consistently for antibodies. However, significant challenges and opportunities still exist and demand attention in order to further improve speed to clinic, process consistency and product quality control for example. The presentation will highlight challenges and opportunities in these fields and use case studies to elucidate trends and potential solutions.

1:45 Increasing Production Capacity of a Legacy Product through Process Improvements
Yuval Shimoni, Ph.D., Principal Engineer, Manufacturing Sciences, Bayer HealthCare LLC

The implementation of post-licensure process improvements in the biopharmaceutical industry can benefit patients and drug manufacturers alike. This talk will demonstrate how an identified change (e.g., to the cell culture medium/process) can be successfully taken from proof-of-concept, through scale-up, to demonstration of feasibility; it will further illustrate the scope and complexity of implementing the change in commercial manufacturing in order to realize significant benefits, such as increased production capacity compared with the current legacy process.

2:15 Automated Assessment of Cell Aggregation in Culture
Agata Villiger-Oberbek, Ph.D., Process Associate Scientist, Commercial Cell Culture Development, Genzyme Corporation, a Sanofi Company

Cell aggregation is a major issue during process scale-up and commercial manufacturing. Using a high-throughput model, we evaluated the performance of CHO cultures supplemented with an anti-clumping agent at different concentrations. To support this effort, we developed an ImageJ macro to determine the extent of cell aggregation. This tool has allowed a rapid and unbiased processing of large numbers of cell culture images, saving time and effort in our goal to assess the properties of the anti-clumping agent.

2:45 Refreshment Break

3:15 Top-Down versus Bottom-Up Design of Mammalian Cell Culture Media: Advantages and Disadvantages
Patrick Hossler, Ph.D., Senior Scientist III, Process Sciences, AbbVie Bioresearch Center

Two approaches were pursued for the refinement of our platform chemically-defined feed media. A top-down level approach utilized a novel media enrichment strategy. A bottom-up level approach utilized robotic liquid handling and high-throughput screening of media variants. Both approaches increased antibody titers in CHO cell lines at g/L levels. Product quality was not adversely affected, and in fact, it was found that select product quality attributes could be both fine-tuned and controlled. The advantages/disadvantages of these approaches will be discussed.

3:45 Challenges of Raw Materials in Mammalian Cell Cultures: A Case Study
Sofie Goetschalckx, Manufacturing Cell Culture Science Lead, Technology Division, Genzyme

The effect to implement new/replace existing raw material on the cell growth, productivity and product quality cannot be predicted and therefore, comprehensive assessments and small scale studies are required to evaluate the impact on new and established legacy processes. Throughout the case studies, approach and results will be presented in order to address potential risk, impact and remediation plans. Furthermore control strategy and additional areas of improvement in the management of risks will be discussed.

4:15 Small-Group Breakout Discussions

This session provides the opportunity to discuss a focused topic with peers from around the world in an open, collegial setting. Select from the list of topics available and join the moderated discussion to share ideas, gain insights, establish collaborations or commiserate about persistent challenges. Then continue the discussion as you head into the lively exhibit hall for information about the latest technologies.

5:15 Discussion Report-Outs

5:30 Grand Opening Reception in the Exhibit Hall with Poster Viewing

7:00 Close of Day

TUESDAY, AUGUST 20

8:00 am Morning Coffee

CULTURING CHO CELLS

8:25 Chairperson's Remarks
Yuval Shimoni, Ph.D., Principal Engineer, Manufacturing Sciences, Bayer HealthCare LLC

» 8:30 FEATURED PRESENTATION:

Karyotypic Profiling of Recombinant Gene Expression in Amplified CHO Cell Lines
Alan Dickson, Ph.D., Director, Centre of Excellence in Biopharmaceuticals (COEBP); Professor, Institute of Biotechnology, University of Manchester

This presentation will describe the heterogeneity and stability/instability of recombinant genes integrated into the chromosomes of CHO cell lines and is part of our developing understanding of CHO cell genomics. These data address the relationships between site of integration and expressibility and how genome structure changes in response to methotrexate amplification protocols.

9:00 Engineering a CHO Host for Improved Antibody Titer
Shirley Peters, Ph.D., Research Scientist, Protein Expression and Purification Group, UCB Celltech

A transient expression system has been developed at UCB. This system employs a number of culture conditions which have provided incremental increases to transient antibody yields. The most substantial impact on yield was observed when using a CHO host that was engineered to express exogenous XBP1-S and ERO1La. The generation of this CHO host (CHOS-XE) will be described and how this cell line and transient culture conditions have improved our antibody yields. Data will also be presented on the use of CHOS-XE in generating stable cell lines.

9:30 13C Metabolic Flux Analysis of an Industrial CHO Cell Culture
Jamey D. Young, Ph.D., Assistant Professor, Chemical and Biomolecular Engineering, Molecular Physiology & Biophysics, Vanderbilt University

Cell metabolism can vary considerably over the course of a typical fed-batch antibody production process. We performed 13C labeling experiments and metabolic flux analysis to characterize CHO cell metabolism during four separate phases of a fed-batch culture designed to closely represent industrial process conditions. Overall, we found that a highly oxidative state of metabolism corresponded with peak antibody production, whereas peak cell growth was characterized by a highly glycolytic metabolic state.

10:00 Increasing Viral Yields in the Corning HYPER (High Yield PERformance) Technology

Sponsored by CORNING

Kate Strathearn, Ph.D., Cell Applications Scientist, Corning Life Sciences

Producers of vaccines and other biologics have used traditional technologies for a number of years. Corning offers a new breakthrough technology which allows greater yields in a smaller footprint. The HYPER Technology platform utilizes a gas permeable film as

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an attachment surface, eliminating the requirement for an air gap found in traditional cell culture vessels.

10:15 Coffee Break in the Exhibit Hall with Poster Viewing

OPTIMIZING CELL CULTURE SYSTEMS

11:00 Implementing Metabolomics in Bioprocessing Applications

Ulrike Rennefahrt, Ph.D., Senior Research Scientist, Metanomics GmbH

The metabolism of cells changes drastically during fed-batch culture due to environmental adaptation and transition from exponential to stationary growth. Metabolamics was utilized to evaluate key metabolic features of two CHO cell lines with respectively low antibody expression. Intra- and extracellular metabolites were investigated and hypotheses will be shared how to improve productivity by optimizing media formulation, feeding strategy and metabolic engineering.

11:30 Unfolded Protein Response (UPR) During CHO Cell Production Culture

Zhimei Du, Ph.D., Senior Scientist, Amgen

A UPR-specific monitoring system was created that can be used to detect and quantify endogenous UPR activation levels in real-time during production. Using this monitoring system, it was found that recombinant cells differed in their UPR induction patterns. It also revealed that cell culture conditions can also alter UPR levels without recombinant protein expression. A discussion of how a production process can be rescued by controlling the UPR in a live growing culture will be addressed.

12:00 pm Accelerating the Scale-Up of Cell Lines Through the Use of Integrated Platforms

Sponsored by GE Healthcare Life Sciences

Peggy Lio, Ph.D., Director, Process Science & Cell Culture, GE Healthcare

The development of scalable processes for cell lines is often challenging and is influenced by many process parameters. Multiple rounds of experimental studies are typically required to optimize process scale-up conditions to maximize the performance and productivity of a lead clone thereby lengthening timelines significantly. This presentation will explore media and technology platform approaches aimed at simplifying and accelerating the timeline from clone to manufacturing.

12:30 Sponsored Luncheon Presentation
(Opportunity Available) **or Lunch on Your Own**

CELL CULTURE ANALYSIS

1:55 Chairperson's Remarks

Patrick Hossler, Ph.D., Senior Scientist III, Process Sciences, AbbVie Bioresearch Center

2:00 High-Throughput Total Sialic Acid Assay (HT-TSA)

Lam Raga Anggara Markely, Ph.D., Scientist I, Biogen Idec, Inc.

In order to optimize and consistently control the qualities of proteins produced in bioprocesses, a high-throughput method for measuring sialic acid content of the proteins (HT-TSA) is required. Here, we present an HT-TSA that can accurately, precisely, rapidly (70 min), and specifically analyze 80 crude culture samples in parallel. Moreover, we found that sample protein denaturation is crucial to ensure complete cleavage of sialic acid by sialidase. The HT-TSA can be used for many applications in cell line and bioprocess development.

2:30 Mammalian Cell Fluid Mechanics and Scale-Up/Scale-Down Considerations

Jeffrey J. Chalmers, Ph.D., Professor Department of Chemical and Biomolecular Engineering, The Ohio State University

Suspension animal cell culture is now routinely scaled up to bioreactors on the order of 10,000 liters and greater to meet commercial demand. However, the concern of the "shear sensitivity" of animal cells still remains, not only within the bioreactor, but also in the downstream processing. This presentation will mainly focus on publications from both academia and industry regarding the effect of hydrodynamic forces on industrially relevant animal cells, and on the general observation with respect to scale-up.

3:00 Evaluation of UV-C Treatment Technology for Viral Inactivation of Cell Culture Media

Lada Laenen, Ph.D., Managing Principal Scientist, Head, Cell Culture and Microbiology, Technology Division, Genzyme, a Sanofi Company

Although raw material testing should be considered part of the overall strategy in developing barriers against viral contamination, the current testing strategies are not always effective by themselves given limitation by sample size to be tested, sensitivity and specificity of the assay, etc. Cell culture media poses one of the highest risks, and for that reason, an innovative UV-C technology was applied for treating cell culture media. Cell culture evaluation studies have been completed demonstrating feasibility of this technology for implementation in biomanufacturing. Challenges and innovation of this approach will be discussed.

3:30 Refreshment Break in the Exhibit Hall with Poster Viewing

4:15 Controlling On-Chip Gas Partial Pressure

Samuel P. Forry, Ph.D., Research Chemist, Biosystems and Biomaterials Division, National Institute of Standards and Technology (NIST)

Gas partial pressures (e.g. O2, CO2) are critically important in biology. For cell-based assays, carbon dioxide is tightly maintained at 5% to mimic the *in vivo* environment, and differences in oxygen levels can lead to varying experimental outcomes. We have developed on-chip strategies to simultaneously modulate gas partial pressures and mitigate pervaporation. This has allowed us to demonstrate long-term, stopped-flow microfluidic cell culture without requiring the use of bulky and expensive cell culture incubators.

4:45 Matrix-Free 3D Cell Spheroid System for Bioprocessing and Nanomaterials Evaluation

Mark DeCoster, Ph.D., Associate Professor, Biomedical Engineering, Louisiana Tech University

We have established a novel matrix-free 3D cell spheroid system that permits growth and maintenance of normal cells, stem cells, and cancer cells. In addition to processing of soluble drugs, we are also using our 3D system to evaluate bioprocessing of micro- and nano-materials. We have measured binding and internalization of these materials as well as toxicity of nanomaterials. It is anticipated that 3D systems will provide new information for materials bioprocessing compared to traditional 2D cell culture systems due to differences in diffusion and cell-cell communication.

5:15 End of Day & Registration for Dinner Short Courses

6:00 Dinner Short Courses*

**Separate registration required*

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Exploring Today & The Future

MONDAY, AUGUST 19

STRATEGIES FOR FLEXIBLE FACILITIES

1:00 pm Chairperson's Opening Remarks
David M. Marks, Principal & Founder, DME Alliance Engineering Consultants

» 1:10 OPENING KEYNOTE PRESENTATION:

HHS Centers for Innovation in Advanced Development & Manufacturing
R. Thomas Warf, Senior Program Manager, Product Process Development Analysis, Influenza and Emerging Diseases Division, Biomedical Advanced Research and Development Authority (BARDA), Office of the Assistant Secretary for Preparedness and Response, U.S. Department of Health and Human Services
HHS/BARDA established in June 2012 three new Centers for Innovation in Advanced Development and Manufacturing to assist developers of biodefense medical countermeasures and produce vaccines and biological products in the event of an influenza pandemic or an emerging disease outbreak. The HHS Medical Countermeasure Review (2010) recommended the creation of the Centers as a strategic initiative to address the difficulty that biotech companies experienced in the development of biodefense medical countermeasures and to expand and modernize a more efficient domestic pandemic influenza vaccine manufacturing capability. The Centers are public-private partnerships that utilize novel flexible and nimble manufacturing approaches coupled to modern cell-, recombinant-, and molecular-based vaccine and biological product technologies. The Centers train scientists and technicians who will operate these facilities and meet the national need for more highly-skilled personnel for the biotech and pharmaceutical industries.

1:45 Flex-Facility Paradigms: Future Trends and Challenges for Multi-Product Biomanufacturing
David M. Marks, Principal & Founder, DME Alliance Engineering Consultants
A convergence of business drivers, regulatory constraints and emerging technologies is driving the evolution of new approaches to biomanufacturing process and facility design for improved flexibility, reliability and throughput. This presentation will explore the key concepts and enabling technologies for future facilities and suggest strategies for their implementation.

2:15 The Impact of Single-Use Technologies on Segregation, Campaigning and Product Changeover in Multiproduct Facilities
Trevor Deeks, Ph.D., Senior Director, Manufacturing Management Services
With the advent of single-use disposable systems for manufacturing, the campaign changeover has become much less difficult to demonstrate, and segregation is no longer an absolutely essential requirement in many cases. This has led to more flexible manufacturing facilities, which in turn is leading to lower facility investment costs at all stages of development. The impact of single-use technologies is illustrated with reference to some case studies involving vaccines and potent compounds.

2:45 Refreshment Break

3:15 Flexible Manufacturing
Sanjay B. Shah, Director & Head, Biologics Operations, Syngene International Ltd.
I will discuss how to best leverage today's flexible manufacturing solutions for clinical manufacturing or commercial launch with speed, precision and, of course, at lower cost. My talk will draw on actual operating experience, looking at what works best for BioPharma companies, particularly regarding implementing single-use technologies.

3:45 Flexible Biopharmaceutical Production Facilities
Scott Kaplan, Senior Director of Project Development, Pharmadule Morimatsu, Inc.
My presentation will identify the challenges of getting a new biomanufacturing facility through design, construction, and start-up in a timely manner, balancing the financial risks of committing to a capital project too early with those associated with not getting a treatment to market to help patients. I will present a solution, leveraging the advantages of single-use process equipment and modular design and fabrication, to streamline the delivery process while enhancing predictability and mitigating risk.

4:15 Small-Group Breakout Discussions
This session provides the opportunity to discuss a focused topic with peers from around the world in an open, collegial setting. Select from the list of topics available and join the moderated discussion to share ideas, gain insights, establish collaborations or commiserate about persistent challenges. Then continue the discussion as you head into the lively exhibit hall for information about the latest technologies.

5:15 Discussion Report-Outs

5:30 Grand Opening Reception in the Exhibit Hall with Poster Viewing

7:00 Close of Day

TUESDAY, AUGUST 20

8:00 am Morning Coffee

PROCESS IMPROVEMENTS

8:25 Chairperson's Remarks
Kim Wong, Ph.D., Director, Facilities & cGMP Support, Bioprocess Research & Development, Sanofi Pasteur Ltd.

» 8:30 FEATURED PRESENTATION:

Cleaning Process Development and Qualification for Biologics
Kim Wong, Ph.D., Director, Facilities & cGMP Support, Bioprocess Research & Development, Sanofi Pasteur Ltd.
Expectations of regulatory agencies of cleaning procedures include their development and validation in a similar manner as manufacturing processes. Cleaning process development should employ approaches such as risk analysis and QbD. Among the process parameters that may affect the suitability and performance of a cleaning method are equipment design, selection of cleaning agent, sampling methodology and supportive analytical methods.

9:00 Early-Phase Project Definition
David Bendet, AIA, LEED AP BD+C, Associate Principal, Senior Project Manager, Perkins+Will
At project initiation, when only a basic need exists, how can project teams quickly and accurately generate information about the physical project to facilitate the decision-making process and guide project definition? As an added challenge, financial constraints drive down project budgets while the need to provide energy-efficient, flexible, high-quality and technically demanding facilities continues to increase. This presentation will focus on innovative and analytical behaviors that teams can use to align goals and values to create highest value projects.

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www.healthtech.com

Inaugural

Facilities for Manufacturing Biologics

Exploring Today & The Future

9:30 Scale-Up and Automation of Manufacturing Processes – Early Stage Design for Manufacture

Jasmin Kee, Ph.D., Manager, Process Engineering, Organogenesis, Inc.

Cell therapy manufacturing processes have traditionally grown organically through translation of benchtop processes. In many cases, these processes are manually focused and have stages that may be unsuitable for large-scale production. This can lead to unnecessarily complex scale-up and automation solutions or subsequent development costs to redesign and revalidate the process. How can this issue be addressed? What factors should be considered to enable commercially viable manufacturing processes? When should design for manufacture be integrated in the product lifecycle?

10:00 Sponsored Presentation *(Opportunity Available)*

10:15 Coffee Break in the Exhibit Hall with Poster Viewing

11:00 Design and Implementation of a cGMP Manufacturing Facility for Production of Biologics using Open Cell Free Synthesis

Heidi J. Hoffmann, Ph.D., Senior Director, Manufacturing, Sutro Biopharma

Sutro Biopharma has developed a production platform utilizing open cell-free protein synthesis (CFPS) technology based on *E. coli* cell extract, and has commissioned a cGMP facility for production of protein therapeutics, including full-length assembled antibodies, alternate Ab scaffolds, and a wide range of other proteins. This presentation will discuss the design and retrofit of an existing cGMP facility for implementation of CFPS, including provisions for multi-product use and implementation of single-use technologies, as well as future plans for implementation of next generation processing.

11:30 DoE-Based Screening for Critical Process Parameters of Freezing and Thawing Proteins in a Pilot Freeze Container

Ulrich Roessl, Researcher, Products and Formulations, Research Center Pharmaceutical Engineering GmbH

A 700mL pilot freeze container was designed in close collaboration with Zeta Biopharma to enable efficient screening for optimal process conditions and composition of cosolutes at a scale where effects arise that are comparable to the industrial case. Process parameters that are most critical for the stability of a model protein are identified in a DoE screening approach and will be considered in scale-up and design of new industrial scale freeze containers.

12:00 pm Optimization of Filling Processes for Biologic Products

Rainer Saedler, Ph.D., Group Leader, NBE Formulation & Process Sciences, Drug Product Development, Abbvie GmH & Co. KG

Biologic products require special considerations regarding manufacturing conditions given their potential sensitivity against process related stress. Focusing on the filling of biologic drug solutions, the talk is aimed at providing a discussion of different equipment and process options, taking both output and product quality into account. Means to optimize the filling process, e.g. an overview of pros and cons of different filling equipment, and data on how to improve the filling process by using visualization of the process using high speed video footage will be presented.

12:30 Sponsored Luncheon Presentation *(Opportunity Available)* **or Lunch on Your Own**

OPTIMIZING FACILITY DESIGN

1:55 Chairperson's Remarks

David Bendet, AIA, LEED AP BD+C, Associate Principal, Senior Project Manager, Perkins+Will

2:00 Legacy Facilities & Next-Gen Bioprocessing

Eric Bohn, AIA, Principal, jacobs wyper Architects, LLP

Change is occurring rapidly in the biotech industry. Single use technology is displacing fixed stainless steel and established pharma companies are rushing to be part of the large molecule revolution. As a result biotech is confronting significant innovation in the design of their facilities. To stay vital now and into the future established facilities need to respond. This presentation discusses how to move beyond the expediencies of the immediate requirements for change and thereby ensure the long term viability of these legacy facilities.

2:30 Five Key Concepts for Making Bioprocess Production Space Effective Work Environments for People

Larry DiGennaro, AIA, LEED AP BD+C, Science Client Leader, BHDP Architecture

In this presentation I will explore the following five concepts, which will make people more effective regardless of the technology deployed: 1. Make the gowning and access to Personnel Protective Equipment covenant; 2. Encourage situational awareness; 3. Provide access to natural light; 4. Think about how people will accomplish non-production related tasks; 5. Carefully plan material and people flow simultaneously.

3:00 Outside the Box: Taking Innovation to the Next Generation of Biomanufacturing Facilities

Jeffrey Odum, Director, Operations, Biotech Global Lead, IPS

Biomanufacturing is being driven by strong business and regulatory forces to make significant changes. Innovation in the way facilities are conceptualized and designed is focusing on the need for speed and flexibility in both process development and manufacturing. This presentation will focus on concepts and technology tools that will define the next generation of biomanufacturing facilities.

3:30 Refreshment Break in the Exhibit Hall with Poster Viewing

MODULAR FACILITIES

4:15 The Autonomous Biomanufacturing Environment – Integration of the Manufacturing Environment into the Regulatory Horizon

R. Barry Holtz, Ph.D., President, G-Con, LLC

Flexible, portable, modular are all terms that have been used to define new approaches to biomanufacturing. It is important to define these terms and what they really mean in facilities design for biologics manufacture. The real challenge is to provide environments that are harmonized with new technologies in manufacturing, are capital sparing, and bring a new level of regulatory compliance to match the goals of Quality by Design, Design Space, and Continuous Manufacturing. The focus of this talk is systems integration in an environment that meets the flexibility, autonomy, portability and regulatory aspects of rapidly deployable facilities. CAPEX and OPEX need to be reduced as the biopharmaceutical manufacturing business moves forward. The regulatory pressure towards continuous manufacturing and continuous control makes an excellent basis to capitalize on new technology to make higher quality products at less cost.

4:45 Modularization in Biologics Manufacturing – Recent Trends and Developments

Pär Almhem, President, ModWave and President, ModularPartners

Camilla Sivertsson, Vice President, ModWave and Manager, ModularPartners

Modularization of biologics manufacturing processes and facilities has been around for a relatively long time. Recently, there has been an increased acceptance of modular concepts, and a wider range of modular solutions are being developed and marketed. This presentation discusses some of the latest developments in designing and building biologics facilities based on combinations of modular and single-use technologies for a global market. It will provide insight into how single-use technologies, modularization and standardization can help reduce risk, time and cost in projects, domestically and internationally.

5:15 End of Day & Registration for Dinner Short Courses

6:00 Dinner Short Courses*

**Separate registration required*

BACK

Cambridge Healthtech Institute,
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2nd Annual

Higher-Order Protein Structure

Characterization and Prediction

MONDAY, AUGUST 19

DESIGNING QUALITY IN BIOPHARMACEUTICALS: STRUCTURAL AND FORMULATION CONSIDERATIONS

(SHARED SESSION)

1:00 pm Chairperson's Opening Remarks
Sujit K. Basu, Ph.D., Senior Director, Drug Product Development, Shire Human Genetic Therapies

» 1:10 KEYNOTE PRESENTATION:
Current Trends and Challenges in Biologics Development
Palani Palaniappan, Ph.D., Vice President and Head, Biologics CMC, CMC Center, Millennium: The Takeda Oncology Company
Biologics development continues to evolve into newer territories. New modalities such as antibody drug conjugates, fusion proteins, fragments and others are growing in trend. New modalities bring new challenges and opportunities in ways CMC development is carried out including in areas of process, formulation and analytical development. Some recent experiences will be discussed.

» 1:45 FEATURED PRESENTATION:
Assessing Higher-Order Structure and Comparability of Protein Therapeutics – a Regulator's Perspective
Evi B. Struble, Ph.D., Pharmacologist, Center for Biologics Evaluation and Research, US Food and Drug Administration
In this talk, a discussion of factors that influence the structure of protein therapeutics during the production process as well as pertinent regulatory guidance to ensure quality and demonstrate comparability following manufacturing changes will be presented.

2:15 Probing Higher-Order Structure in Protein Pharmaceuticals Using Infrared and Raman Vibrational Optical Activity
Laurence A. Nafie, Ph.D., Distinguished Professor Emeritus, Department of Chemistry, Syracuse University
Vibrational optical activity (VOA), comprised of infrared vibrational circular dichroism (VCD) and Raman optical activity (ROA) have shown enhanced sensitivity to higher order structure (HOS) in proteins. Examples of the sensitivity of VOA to both protein secondary structure and HOS in proteins will be provided as a sensitive new tool for evaluating structural differences between original biopharmaceutical products and their biosimilars.

2:45 Refreshment Break

3:15 Characterizing the Higher-Order Structure (HOS) of Protein Drugs in the Biopharmaceuticals Industry
Steven Berkowitz, Ph.D., Principal Scientist, Analytical Development, Biogen Idec
This talk will initially focus its attention on the present capabilities and limitations of the most commonly used biophysical tools employed in the biopharmaceutical industry to characterize the HOS of protein drugs. Attention will then turn to those less commonly used biophysical tools that offer improved capabilities to better satisfy the needs of industry.

3:45 Hydrophobic and Electrostatic Interactions Impact the Drug-Like Properties of a Protein Solution
Ravi Chari, Ph.D., Senior Scientist, Pharmaceutics, AbbVie Bioresearch Center
In this study we investigated the unusual behavior of a protein formulation during solubility/stability studies. Both surface mutations and changes in formulation conditions were investigated to improve the drug-like properties, and thus the behavior, of the protein in solution. The underlying mechanism governing this behavior seemed due to hydrophobic interactions. Computer modeling was performed to further elucidate the mechanism.

4:15 Small-Group Breakout Discussions
This session provides the opportunity to discuss a focused topic with peers from around the world in an open, collegial setting. Select from the list of topics available and join the discussion to share ideas, gain insights, establish collaborations or commiserate about persistent challenges. Then continue the discussion as you head into the lively exhibit hall for information about the latest technologies.

5:15 Discussion Report-Outs

5:30 Grand Opening Reception in the Exhibit Hall with Poster Viewing

7:00 Close of Day

TUESDAY, AUGUST 20

8:00 am Morning Coffee

HIGHER-ORDER PROTEIN STRUCTURE: MECHANISM AND IMPACT

8:25 Chairperson's Remarks
Andria Skinner, Ph. D., Scientist, Formulation and Development, Regeneron Pharmaceuticals, Inc.

» 8:30 FEATURED PRESENTATION:
Protein Clustering and Viscosity
Thomas Laue, Ph.D., Professor, Biochemistry and Molecular Biology; Director, Biomolecular Interaction Technologies Center (BITC), University of New Hampshire
High concentration protein solutions can exhibit excessively high viscosity. The underlying cause of viscosity is momentum transfer, and the asymmetry of solution components is of great importance in determining momentum transfer. This talk will focus on how proximity energies can contribute to the formation of loose, asymmetric protein clusters that will result in high viscosity.

9:00 Examining Principles of Conformational Switching Using Engineered Proteins of Similar Sequence
Philip N. Bryan, Ph.D., Institute for Bioscience and Biotechnology Research and Department of Bioengineering, University of Maryland
Certain proteins can adopt different tertiary and quaternary structures as a result of minor perturbation. This fact has implications in a number of important areas including computational and structural biology, protein evolution, human disease, and the design of protein pharmaceuticals. We are examining basic principles sequence-structure relationships using designed proteins that are have different folds but are very similar in sequence. In this

NEXT

Present a Poster & Save!

Cambridge Healthtech Institute encourages attendees to gain further exposure by presenting their work in the poster sessions. To secure a poster board and inclusion in the conference materials, your abstract must be submitted, approved and your registration paid in full by July 19, 2013

- Your research will be seen by leaders from top pharmaceutical, biotech, academic and government institutes
- Your poster abstract will be published in the conference materials
- Receive $50 off your registration fee

simplified sequence space we explore mutational paths from one fold and function into another.

9:30 The Structural Characterization of IgG Particles Formed as a Consequence of Surface Interaction

Tatiana Perevozchikova, Ph.D, Researcher, nSoft Consortium, University of Delaware/ National Institute of Standards and Technology

Destructive association of biotherapeutics with various surfaces is one of the proposed mechanisms for induction of protein aggregation. Here we demonstrate how our preliminary findings on the interfacial properties of IgGs correlate with the structural information on particles formed upon desorption. Using multiple techniques — neutron reflectivity, CD, MFI and fluorescence — we reveal the consequence of protein adsorption/desorption on conformational dynamics of particle formation.

10:00 Sponsored Presentation *(Opportunity Available)*

10:15 Coffee Break in the Exhibit Hall with Poster Viewing

METHODS FOR CHARACTERIZATION OF HIGHER-ORDER PROTEIN STRUCTURE

11:00 Analysis of the Size, Shape, and Composition of Higher-Order Protein Structures

Lumelle A. Schneeweis, Ph.D., Senior Investigator, Protein Science & Structure, Bristol-Myers Squibb Company

Characterization of the size, shape, and composition of higher order protein structures often requires a combination of analytical methods for studying the oligomeric state of proteins. Static light scattering (SEC-MALS, AFFF-MALS), sedimentation velocity and equilibrium analytical ultracentrifugation, and less routine methods such as solution atomic force microscopy (AFM) have been used to study the oligomerization of protein conjugates and assemblies.

11:30 Hydrogen / Deuterium Exchange Mass Spectrometry: A Valuable Tool for Protein Higher-Order Structure Characterization

Roxana E. Iacob, Ph.D., Research Assistant Professor, Department of Chemistry and Chemical Biology, Barnett Institute, Northeastern University

Mass spectrometry (MS) has an important role to play in structural characterization of proteins. Hydrogen exchange (HX) MS has recently become more widely used in the biopharmaceutical industry for protein analysis. Recent advances that make the method accessible to all will be described along with examples of the application of HX MS to matters in the industry.

12:00 pm NMR Methods to Monitor Protein Aggregation and Monomer-Aggregate Interaction Kinetics at Atomic Resolution

Nicolas Fawzi, Ph.D., Assistant Professor, Department of Molecular Pharmacology, Physiology and Biotechnology, Brown University

High-resolution NMR techniques complement other tools by offering atomic resolution characterization of the aggregation of biopharmaceuticals directly in solution. Rapid, non-destructive measurements allow both the quantitation of soluble protein over time and the determination of the interaction kinetics of soluble species with aggregated material. New NMR methods can characterize the atom-by-atom structure and dynamics of these monomer-aggregate complexes.

12:30 Sponsored Luncheon Presentation *(Opportunity Available)* **or Lunch on Your Own**

HIGHER-ORDER STRUCTURE CHARACTERIZATION: FORMULATIONS STABILITY AND PROCESS DEVELOPMENT

1:55 Chairperson's Remarks

Daniel Some, Ph.D., Principal Scientist, Wyatt Technology Corp.

2:00 Higher-Order Structure Analysis for the Development and Trouble-Shooting Of Biopharmaceuticals

Gabriella Leo, Ph.D., Associate Researcher, Structural and Biophysical Characterization Laboratory, Analytical Development Biotech Products, Merck Serono

A detailed knowledge of the protein structure is a prerequisite for the development of biopharmaceuticals. The conformation of a protein determines its function and is largely defined through its primary structure, although it can also be significantly influenced by post-translational modifications (PTMs). In this talk, two different case studies will be presented in which the state-of-the-art analysis of higher-order structure is fundamental. The first one deals with the modification of specific amino acids resulting in a bioactivity-diminishing conformational change. The second one deals with an investigation on conformers of a therapeutical antibody initially detected by analytical ultracentrifugation.

2:30 Position Specific Effects of Chemical Composition on Protein Stability

Jennifer S. Laurence, Ph.D., Associate Professor, Department of Pharmaceutical Chemistry, University of Kansas

A protein's stability is determined by its chemical composition, environment and solution conditions. A study of how proteins are affected at the molecular level by intrinsic and extrinsic factors will be presented.

3:00 Application of High-Resolution NMR in the Characterization of Protein Therapeutics

John P. Marino, Ph.D., Leader, Biomolecular Structure & Function Group, National Institute of Standards and Technology

High-resolution NMR methods can yield spectral 'fingerprints' related to the structure of the bioactive form(s) of protein therapeutics at atomic resolution. This presentation will focus on methods for obtaining NMR spectral 'fingerprints' of protein therapeutics and how these 'fingerprints' can be used to establish consistency in drug manufacturing and for comparing a biosimilar to an innovator reference product.

3:30 Refreshment Break in the Exhibit Hall with Poster Viewing

4:15 Analytical Ultracentrifugation (AUC) as an Orthogonal Method to Characterize Protein Aggregation and Aligning AUC with other Aggregate-Sensitive Techniques

George Svitel, Ph.D., Senior Scientist, Process & Product Development, Amgen, Inc.

AUC is widely used orthogonal technique to analyze aggregation and regulatory agencies are increasingly requesting AUC data. AUC is able to detect aggregates not reported or under-reported by other techniques. Data show differences in aggregate levels in long-storage, in-process and accelerated degradation samples detected by various techniques. Combining AUC with other techniques opens a path to better understanding of aggregation pathways and mechanisms.

4:45 Orthogonal Particle Sizing Methods in Biopharmaceutical Development

Christopher Mensch, Scientist, Vaccine Drug Product Development, Merck Research Laboratories

Measuring size distributions of heterogeneous and dynamically changing particles in therapeutic protein and vaccine formulations is a challenging task that requires the use of multiple approaches. Examples of the application of various sizing methods, including micro-flow imaging (MFI), Nanosight, laser diffraction, flow cytometry, atomic force microscopy, dynamic light scattering and colloidal sedimentation velocity (LumiSizer) will be discussed.

5:15 End of Day & Registration for Dinner Short Courses

6:00 Dinner Short Courses*

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BACK

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August 19-20

Inaugural

Overcoming Formulation Challenges for Biopharmaceutical Development and Manufacturing

Optimizing Dosage Form and Process Development

MONDAY, AUGUST 19

DESIGNING QUALITY IN BIOPHARMACEUTICALS: STRUCTURAL AND FORMULATION CONSIDERATIONS (SHARED SESSION)

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5:30 Grand Opening Reception in the Exhibit Hall with Poster Viewing

7:00 Close of Day

TUESDAY, AUGUST 20

8:00 am Morning Coffee

STRATEGIC THINKING IN PROTEIN FORMULATION DEVELOPMENT

8:25 Chairperson's Remarks
Mark Yang, Ph.D., Director, Fill Finish Development, Commercial Process Development, Genzyme, a Sanofi Company

» 8:30 FEATURED PRESENTATION:
Accelerated and Forced Degradation Studies in Formulation Development and Stability
Nausheen Rahman, Ph.D., Director, Bioprocess Research and Development, Sanofi Pasteur Limited
Accelerated and forced degradation are an essential first tool for formulation development. However, the regulatory guidelines for forced degradation regarding biologics have few to no procedural instructions on how to approach forced degradation studies. In this talk, an overview of the methodology used to study forced degradation in vaccines will be provided along with examples for vaccine products which have not been highlighted previously.

9:00 Preformulation and Formulation Development Strategies for Injectable Biopharmaceuticals
Sujit K. Basu, Ph.D., Senior Director, Drug Product Development, Shire Human Genetic Therapies
This talk will discuss practical strategies with case studies on the effective design and use of preformulation and formulation development approaches for injectable biopharmaceutical drug products.

9:30 Extractables & Leachables (E&L) in Liquid Formulations of Biologics: Impact on Drug Product Quality and Safety Profile
Joël Richard, Ph.D., Vice President, Peptides, CMC & Engineering, Ipsen
E&L from the primary packaging components can contaminate liquid formulations of biologics. They leach from the surface of glass barrels or are extracted by the formulation from the rubber stoppers and plungers. They can interact with proteins, leading to chemical degradation, modification of their higher order structure or aggregation. These impurities may have a strong impact on quality attributes and immunogenicity profile of the protein formulations.

NEXT

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August 19-20

Inaugural

Overcoming Formulation Challenges for Biopharmaceutical Development and Manufacturing

Optimizing Dosage Form and Process Development

10:00 High-Throughput Screening for Developability and Stability of Biotherapeutics by Dynamic Light Scattering

Sponsored by WYATT TECHNOLOGY

John Champagne, Ph.D., Senior Applications Scientist, Wyatt Technology Corp.

Thermal stability, colloidal stability, aggregation and viscosity are key indicators for developability and long-term stability which can be addressed simultaneously by dynamic light scattering. This presentation describes how the DynaPro Plate Reader assesses these factors rapidly and effectively, analyzing hundreds of samples and conditions per hour.

10:15 Coffee Break in the Exhibit Hall with Poster Viewing

PREDICTIVE APPROACHES IN EARLY FORMULATION DEVELOPMENT

11:00 Controlling Lyophilization Process: Simulations and Modeling

Alina A. Alexeenko, Ph.D., Assistant Professor, School of Aeronautics and Astronautics, Purdue University

We present formulation and validation of a first-principles model of bio/pharmaceutical freeze-drying by coupling product attributes and equipment capabilities into a unified process analysis framework. Applications of the simulations for quantification of design space for different freeze-dryer configurations and product characteristics are discussed. The modeling can be used also for assessment of impact of process deviations on product quality attributes.

11:30 Prediction of Methionine Oxidation in Biologics during the Early Stage of Development through Structural Analysis

Yong Quan, Ph.D., Senior Research Investigator, Drug Product Science & Technology, Bristol-Myers Squibb Co.

Oxidation in the side chain of amino acids, most notably methionine, is one of the major chemical degradation pathways that affect the stability and sometimes efficacy of protein drugs during the product shelf life. We have investigated modeling approaches to identify methionine residues that would undergo oxidation through structural analysis to guide formulation strategies to mitigate the challenge.

12:00 pm Characterization Studies for Lyophilized, Biologic Formulations

Willow DiLuzio, Ph.D., Associate Director, Pre-Formulation and Formulation, Cambridge Biologics CMC Group, a CMC Center Department, Millennium: The Takeda Oncology Company

Characterization studies are crucial to gain a thorough understanding of lyophilized biologic formulations. A QbD approach to formulation characterization will be presented where Design of Experiments is used to development models for how manufacturing and formulation conditions impact product quality and stability. These predictive models can be used to define allowable ranges for manufacturing conditions and formulation parameters to ensure a robust drug product.

12:30 Sponsored Luncheon Presentation *(Opportunity Available)* **or Lunch on Your Own**

OPTIMIZATION STUDIES FOR BIOLOGICS FORMULATION AND PROCESS DEVELOPMENT

1:55 Chairperson's Remarks

Joël Richard, Ph.D., Vice President, Peptides, CMC & Engineering, Ipsen

2:00 Reconstitution of Highly Concentrated, Freeze-Dried Proteins: Impact of Processing Conditions and Formulation Variables

Bakul Bhatnagar, Ph.D., Principal Scientist, BioTherapeutics Pharmaceutical Sciences, Pfizer, Inc.

Long reconstitution times are encountered during development of high concentration freeze-dried protein formulations. Several empirical strategies have been adopted to reduce the reconstitution times by altering: processing variables, formulation variables, reconstitution diluent, and reconstitution method. The impact of processing conditions (ice nucleation temperature, conservative vs. aggressive drying) and phase behavior of formulation components on the reconstitution times will be described.

2:30 Acid-Base Relationships in Freeze-Drying: Stability Implications

Dushyant Varshney, Ph. D., Senior Project Manager, Novartis

Stability of freeze-dried formulations depends on various factors, including residual water content, global and local molecular mobility, crystallinity of lyoprotector and other excipients, retention of the native structure by protein molecules, and apparent solid-state acidity. Methods for measuring the apparent acidity in the frozen and freeze-dried materials are reviewed, and examples of relationships between the acidity and stability are discussed.

3:00 Foam Drying Feasibility for Biologics and Vaccines

David A. Thomas, Principal Scientist, BioTx Pharm. Science, Pfizer, Inc.

Foam Drying is an underutilized and poorly understood technique that has a number of potential advantages over freeze drying. This presentation will describe an evaluation of the feasibility of Foam Drying for vaccine suspensions and biologics. The quality parameters were compared with conventional freeze drying. Equipment and formulation considerations for implementing a foam drying cycle are also discussed.

3:30 Refreshment Break in the Exhibit Hall with Poster Viewing

STREAMLINING EARLY AND LATE STAGE DEVELOPMENT

4:15 Minimize the Risk in Process Transfer by Streamlining the Early and Late Stage Formulation Development

Mark Yang, Ph.D., Director, Fill Finish Development, Commercial Process Development, Genzyme, a Sanofi Company

Excipient sourcing, vendor qualification, container/closure selection, and regulatory compliance may not be as important for early formulation development, but they can present huge challenge for late stage process development and transfer activities. The importance of streamlining the development process, developing a robust formulation, and ensuring its compatibility with the fill finish process will also be discussed with case studies.

4:45 Overcoming Challenges in Process Development of Biologics: Some Case Studies

Kishore Ravuri, Ph.D., Group Leader, Late-Stage Pharmaceutical and Processing Development, Biologics Europe, F. Hoffmann-La Roche Ltd.

Process development of mAbs poses many challenges especially in high concentrated formulations and in new formats. It is of importance that formulation development takes into consideration aspects of processability and manufacturability to ensure an efficient commercial production of the mAb. This presentation focuses on aspects of process development which can pose potential challenges. A QbD based approach to process development ensures maximum risk mitigation as wells as a robust process development. Some recent case studies are presented illustrating how some challenges in process development were overcome with this approach.

5:15 End of Day & Registration for Dinner Short Courses

6:00 Dinner Short Courses*

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BACK

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5th Annual

Optimizing Cell Line Development

Enhancing Expression

WEDNESDAY, AUGUST 21

7:45 am Registration & Morning Coffee

CELL LINE DEVELOPMENT

8:15 Chairperson's Remarks

Arnaud Poterszman, Ph.D., Research Director, Integrated Structural Biology, Institute de Génétique, et de Biologie Moléculaire et Cellulaire (IGBMC), CNRS

» 8:20 OPENING KEYNOTE PRESENTATION:

Achievements, Challenges and Future of the Manufacture of Pharmaceutical Proteins with Animal Cells in Bioreactors

Florian M. Wurm, Ph.D., Professor, Chemistry Engineering & Cell Bio Lab, School of Life Sciences, Integrative Bioscience Institute, École Polytechnique Federale De Lausanne (EPFL), and Founder & CSO, ExcellGene SA

The g/L yield range for CHO-derived proteins has become standard today. Higher yield is no longer a true goal for today's development teams. However, more robust and more predictable processes, executed under reduced timeframes and established at a lower cost is essential, since an ever larger number of product candidates will require at least phase I/II evaluations. This talk will highlight key developments and will also give a view on the future of manufacturing in this field.

» 9:00 FEATURED PRESENTATION:

Rapid Generation of Stable CHO Pools and Clones

Yves Durocher, Ph.D., Senior Research Officer, Biotechnology Research Institute, National Research Council Canada

We will present data describing our new platform that allows the generation of stable CHO pools capable of producing up to 700 mg/L of monoclonal antibodies (Mab) in less than 30 days post-transfection. We believe that this platform is a viable alternative to large-scale CHO transfection when multi-gram quantities of r-protein candidates are needed for therapeutics development. As clones producing g/L quantities of Mab can be rapidly isolated from the pools, this also makes our platform very attractive for the manufacturing of biologics.

9:30 Case Study: Fast Cell Line and Process Development to Produce a Complex Novel IL2-Based Immunocytokine in High Quality

Ingo Gorr, Ph.D., Senior Scientist, Cell Culture Research, F. Hoffmann-La Roche

In this case study a fast but elegant strategy for cell line selection and development of a manufacturing process for a novel IL2-based immunocytokine for cancer therapy is presented. Here, only CLD, USP and DSP together are capable of reducing critical impurities. Intriguing strategies to achieve a high quality therapeutic protein in combination with accelerated timelines are highlighted.

10:00 Coffee Break in the Exhibit Hall with Poster Viewing

10:45 The Use of Bacterial Poison-Antidote Module for Efficient Antibiotic-Free Bioproduction in *E. coli*

Sponsored by DELPHI genetics

Benjamin Michel, Ph.D., Project Manager, Delphi Genetics SA

Delphi Genetics develops technologies which enable bioproduction without using antibiotics in line with the regulatory guidance (FDA, USDA and EMA). Moreover, these technologies permit an increase of yield (protein or pDNA) by avoiding a burden of energy due to expression of antibiotic resistance gene.

11:15 Optimizing Cell Line Development for Expression of Bispecific DART molecules: Case Studies

Valentina Ciccarone, Ph.D., Principal Scientist, MacroGenics, Inc.

Dual Affinity Re-Targeting (DART) proteins are antibody-like therapeutic proteins that can target multiple different epitopes. These molecules have excellent product stability, optimal chain pairing, predictable antigen-recognition, and enhanced half-life *in vivo*. Several protein and cell line engineering strategies have been incorporated to achieve correct molecule assembly, high expression levels, and biological activity of these complex, multi-chain proteins. Data will be presented from case studies for the expression of two DART proteins with different structures and target specificities.

11:45 A CHO-M Cell Combinatorial Library for the Improved Selection of Recombinant Protein Production Clones

Sponsored by SELEXIS

Pierre-Alain Girod, Ph.D., CSO, Selexis

With some proteins, optimal productivity requires more than elevated transcription. Metabolic limitations, trafficking backlogs, improper folding and altered post-translational modifications can all effect output. Utilizing the CHO-M genome and transcriptome, we have engineered a combinatorial CHO cell library to address a broad range of these production bottlenecks.

12:00 pm Luncheon Presentation *(Sponsorship Opportunity Available)* **or Lunch on Your Own**

CHO CELL LINE OPTIMIZATION

1:55 Chairperson's Remarks

2:00 Impact of miR-7 Over-Expression on the Proteome of Chinese Hamster Ovary Cells

Paula Meleady, Ph.D., Senior Research Scientist and Programme Leader, National Institute for Cellular Biotechnology, Dublin City University

MicroRNAs play critical roles in the regulation of biological processes thus representing potential engineering routes towards enhancing desirable characteristics of mammalian cells for biopharmaceutical production. We have carried out quantitative label-free LC-MS/MS proteomic analysis of CHO cells following over-expression of miR-7, which we have found to alter growth and productivity of CHO cells. Understanding the cellular pathways involved in this phenotype might open the way to new strategies for bioprocess-relevant growth regulation.

2:30 Optimization of a Therapeutic Protein Expression Platform

Jianxin Ye, Ph.D., Principal Scientist, Merck Research Labs

In order to increase the efficiency of cell line development and improve yield, we have explored optimization of a CHO-based expression system. A combination of different approaches has been explored for this purpose, including host cell adaptation/selection, expression vector design, medium/feed optimization, automated cell culture system, etc. With the combination of these different approaches, an improved CHO expression platform was developed.

3:00 Application of Next-Generation Sequencing and Scale-Down Model on Stable CHO Line Development

Sheng Zhang, Ph.D., Senior Scientist, Process Sciences, Abbvie Bioresearch Center

In this case study, we successfully implemented the deep-well scale-down fed batch and the next-generation sequencing of transcriptome throughout the cell line development practice that ultimately led us to the best production clone expressing the correct recombinant mAb. By integrating these two powerful tools in our CLD platform, we demonstrated significantly improved efficiency of clone selection towards greater titer and less risk of product heterogeneity.

3:30 Refreshment Break in the Exhibit Hall with Poster Viewing

TRANSFECTION

4:15 The Isolation of CHO Cells Capable of High Transgene Amplification Rates

Jonathan Cacciatore, Ph.D., Research Scientist, Chemical Engineering and Biological Sciences, Columbia University

A widely used method for isolating Chinese hamster ovary (CHO) cell lines is the selection of clones that have undergone amplification of the transgene coding for the protein. This

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method is very time consuming and erratic. We employed a method that measures amplification rate at various genomic locations to identify a high-producing clone. We utilized site-specific recombination to target a gene coding for a marker protein into this genomic location and confirmed high gene amplification rate and protein secretion.

4:45 High-Throughput Transfection of Silencing RNA into 3D Cell Cultures
Susan Sharfstein, Ph.D., Associate Professor, Nanobioscience, Nanoscale Science and Engineering, University at Albany, State University of New York
The wealth of genome-sequence information and transcriptomic data generated by sequencing projects and microarray studies, has created a demand for high-throughput methods for annotating gene function. In this talk, I will describe high-throughput approaches for transfecting silencing RNA into culture mammalian cells using novel magnetic nanoparticles and high-throughput viral delivery approaches with an objective of understanding how process conditions affect cell physiology and recombinant protein production in culture mammalian cells.

5:15 Networking Reception with Exhibit & Poster Viewing

6:45 End of Day

THURSDAY, AUGUST 22

8:00 am Morning Coffee

CELL LINE TECHNOLOGIES

8:25 Chairperson's Remarks
Paula Meleady, Ph.D., Senior Research Scientist and Programme Leader, National Institute for Cellular Biotechnology, Dublin City University

8:30 An NS0 Case Study: The Influence of Cell Culture Medium on Phenotypic Stability
Eileen M. Higham, Ph.D., Scientist II, Process Cell Culture & Fermentation, MedImmune

9:00 Optimizing Transient and Stable Production Platforms for Antibodies and Other Proteins
Andreas Popp, Ph.D., Director, Protein Sciences; Head, Production, MorphoSys AG
MorphoSys has implemented versatile manufacturing platforms based on different mammalian cell lines. Our presentation will focus on expression strategies to supply antibodies, antibody fragments, antigens and tool proteins during discovery, pre-clinical and clinical phases of therapeutic antibody development. Case studies on optimization of a high throughput compatible expression platform for small scale production of purified Fab and IgG materials as well as approaches to manufacture difficult-to-express proteins will be presented.

9:30 Addressing Challenges for Expression and Purification of Human Multi-Protein Complexes Using the Baculovirus Expression System (BEVS)
Arnaud Poterszman, Ph.D., Research Director, Integrated Structural Biology, Institute de Génétique, et de Biologie Moléculaire et Cellulaire (IGBMC), CNRS
We present here recent advances for the production of multi-subunit complexes in the baculovirus expression system using human multi-subunit transcription factors as model systems: Vector development for parallel expression/co-expression screening, use of fluorescent proteins as infection makers, manipulation of the phosphorylation pattern and construct design for production of large of multi-subunit complexes.

10:00 Coffee Break in the Exhibit Hall with Poster Viewing

ANALYTICAL TECHNOLOGIES

10:45 High-Throughput Analytical Platforms for Cell Line and Process Development
Shashi Prajapati, Ph.D., Senior Scientist, Cell Culture Development, Biogen Idec, Inc.
Here we present various high-throughput (HTP) analytical platforms to facilitate rapid and parallel analyses of product quantity and quality using 96-well plate formats. These platforms include HTP protein quantitation followed by HTP protein purification and product quality analyses. With these analytical capabilities, we can assess product quality in the early stage of clone screening, as well as expedite the cell line and process development.

11:15 Vector Design Considerations for Monoclonal Antibody Production
Jan Schouten, Ph.D., Project Leader, BIO USP, Synthon BV
A key component of the manufacturing process for recombinant antibodies is the actual production cell line itself. The foundation for a high-producing cell line is laid at the very early stage of expression vector design. Key choices are made then which have an impact that lasts throughout the entire product life cycle. Therefore it is critically important to address the parameters that contribute to the most optimal expression levels. This presentation will focus on the contribution of codon optimization strategies, the choice of leader peptides and other vector features. Also, attention will be paid to the different approaches possible to evaluate vector improvements in their most relevant context.

11:45 New Dimensions in Bio-Microscopy: Non-Invasive Live Cell Tomography
Yann Cotte, Ph.D., Research Scientist, Microvision and Microdiagnostics Group, EPFL School of Engineering (École Polytechnique Fédérale de Lausanne)
Marker-free nanoscopy allows the ability to "see" the activity inside of a living cell in 3D. Using only harmless light, it enables observing the living cells label-free, non-invasively, and interference-free. The combination of holography with rotational scanning opens new dimensions for live cell monitoring. The cell's tomographic reconstruction allows measuring cellular processes with real-time kinetics down to sub-cellular scale. Since the cells are not manipulated to introduce a label, it gives the possibility to measure the response of authentic cell's physiological activity.

12:15 pm Luncheon Presentation *(Sponsorship Opportunity Available)* **or Lunch on Your Own**

1:00 End of Conference

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WEDNESDAY, AUGUST 21

7:45 am Registration & Morning Coffee

SCALING UP & DOWN

8:25 Chairperson's Remarks
Michael Butler, Ph.D., Professor, Microbiology, University of Manitoba

» 8:30 OPENING KEYNOTE PRESENTATION:

Scale-Up of an Allogeneic Cell Therapy Product Using Single-Use Systems
Ravinder Bhatia, Ph.D., Associate Director, Pharmaceutical Development and Manufacturing Sciences, Janssen Research & Development

One of the major challenges with cell therapy products is the development of a robust and scalable process to produce the product for clinical trials and commercialization. Currently, numerous technologies are available for the scale-up of an allogenic cell therapy product in static (e.g., T-flasks and cell factories) and/or suspension (e.g., microcarriers, bioreactor type) cultures. The selection of a platform to expand cells (upstream process) should be made based on criteria such as clinical and commercialization requirements of the product, product stability, process scalability and implementation in manufacturing. In this presentation, a case study will be presented on process development and scale-up of an allogeneic human somatic cell therapy product using single-use technologies.

9:00 Scale-Dependent and Scale-Independent Parameter Considerations for Scale-Up / Scale-Down of Bioreactors
Kumar Dhanasekharan, Ph.D., Associate Director, Process Sciences & Technology (Biologics), Genzyme – A Sanofi Company

In this presentation, general principles and considerations of how to scale up and scale down scale-independent parameters such as bioreactor pH, pCO2, and scale-dependent parameters such as power per unit volume, impeller speed, etc. are discussed along with examples to illustrate key points. The benefits of the outlined approach include less trial and error, leading to rapid development of small-scale models. Scale-down model qualification using statistical approaches including multivariate methods are also discussed.

9:30 Solving Scale-Up and Manufacturing Issues of Fusion Proteins
Stefan Schmidt, Ph.D., Vice President, DSP, Rentschler Biotechnology

Strategies in the context of fusion proteins are summarized, highlighting approaches such as perfusion vs. fed batch processes and utilization of disposable equipment or DoE to accelerate process development and production for clinical applications. Here selected case studies are presented that demonstrate how to overcome the typical difficulties such as absence of a traditional platform technology, low titer, lack of an affinity matrix, tendency to aggregate, etc. Additionally, practical advice will be given regarding what parameters to consider when optimizing the "manufacturability" of a novel molecule.

10:00 Coffee Break in the Exhibit Hall with Poster Viewing

10:45 Strategies in Bioreactor Scale-Down Model Development and Characterization
LiYing Yang, Ph.D., Scientist, Manufacturing Sciences & Technology, MedImmune

Bioreactor scale-down model development and characterization becomes an essential element in process development and commercialization in the QbD paradigm. In this presentation, key strategies in bioreactor scale-down model development and characterization will be discussed. A 4-Liter bioreactor scale-down model was developed for the 15,000-Liter commercial scale bioreactor. Mass transfer characterization studies were conducted, from which the results were summarized and utilized to guide scale-down model development / characterization. Case studies will be presented to demonstrate the suitability of the 4-L scale down model for multiple mammalian cell culture processes.

11:15 Using Small-Scale Studies to Optimize Process Operational Parameters for Scaling to Commercial Scale in a Cost- and Time-Efficient Manner
Tim Lee, Ph.D., Senior Biopharm Consultant, Biomanufacturing, Latham Biopharm Group

This presentation focuses on using microbioreactor technology to determine fermentation conditions without having to perform multiple bioreactor experiments at the 2L to 200 L scale. The purpose is to optimize and finalize culture conditions at a small scale while keeping large-scale manufacturing facility and equipment constraints in mind for smoother process transfer. Small-scale studies include optimizing and finalizing key process parameters like oxygen transfer coefficient, temperature, pH, biomass production during production.

11:45 Impact of Disposable Technology on Bio-Manufacturing Landscape *Sponsored by* CORNING
Richard Eglen, Ph.D., Vice President & General Manager, Corning Life Sciences

One of the key trends in bio-manufacturing is the move from the production of small molecule drugs to biologics and cellular therapies. In this environment, single-use technology platforms are a key enabler for increasing productivity and reducing costs. Here we discuss the benefits of disposable solutions.

BIOREACTOR INNOVATIONS

1:55 Chairperson's Remarks
Stefan Schmidt, Ph.D., Vice President, DSP, Rentschler Biotechnology

2:00 Process Development of High Cell Density Fermentations using a Miniature Bioreactor in Conjunction with Ultra Scale-Down Cell Recovery Tools
Frank Baganz, Ph.D., AMIChemE, Senior Lecturer, The Advanced Centre for Biochemical Engineering, University College London

The use of miniature bioreactors that are scalable is highly desirable to accelerate bioprocess development. This presentation will focus on a prototype 25 mL miniaturised stirred tank bioreactor (MSBR) that has been characterized to assess its potential to grow high cell density cultures. Results from fed-batch fermentations using Fab' producing *E. coli* at matched power inputs demonstrated that the MSBR can accurately scale-down the performance of 20L and 75L STRs in terms of growth and Fab' production as well as shear sensitivity and centrifugation performance of the harvest material. The conjoint use of the MSBR with ultra scale-down mimics to rapidly develop bioprocesses will be discussed.

2:30 Applications of Imaged Capillary Isoelectric Focussing Technique in Development of Biopharmaceutical Glycoprotein-Based Products
Richard Rustandi, Ph.D., Principal Scientist, Vaccine Analytical Development, Merck & Co.

CE-based methods have increasingly been applied to the analysis of a variety of different types of proteins. One of those techniques is imaged capillary isoelectric focusing (icIEF), a method that has been used extensively in the field of protein-based drug development as a tool for product identification, stability monitoring, and characterization. It offers many advantages over the traditional labor intensive IEF slab gel method and even standard cIEF with on-line detection technologies with regard to method development, reproducibility, robustness, and speed. Here, specific examples are provided for biopharmaceutical glycoprotein products such as mAbs, erythropoietin (EPO), and recombinant Fc-fusion proteins, though the technique can be adapted to many other therapeutic proteins.

3:00 Trends in Large-Scale Commercialization of Bioprocesses
Kalib Kersh, Analyst, Bio-Based Materials and Chemicals, Lux Research

This talk provides a survey of fermentation capacity of technologies currently being commercialized, using numerous examples. I will draw upon primary research and literature to review relevant

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bioreactor innovation. By monitoring more than 100 companies each year in Bio-Based Materials and Chemicals alone, Lux has a broad perspective on scale-up trends and how that matches with production abilities and market realities. Developers will get a sense of current time-to-market benchmarks and which technologies are getting commercial traction.

3:30 Networking Refreshment Break

ANALYZING QUALITY

4:15 A Novel Dielectrophoretic (DEP) Cytometer to Monitor CHO Cultures

Michael Butler, Ph.D., Professor, Microbiology, University of Manitoba

A prototype dielectrophoretic (DEP) cytometer has been developed to analyze individual CHO cells subjected to a radiofrequency actuator in a narrow bore capillary. Cell samples during the course of a bioreactor run show distinct shifts in the dielectric properties corresponding to loss of cell viability. Early apoptotic events can be identified followed by discrete sub-populations of cells that progress through apoptosis. The sub-populations can be correlated with alternative measurements by fluorescent markers and a cell population-based capacitance probe.

4:45 Extractable Protocol and Vendor Expectation Document Standardization Efforts from BPOG Working Group

Ken M. Wong, Senior Scientist, Specialty Analytical, Center for Extractables and Leachables, Merck & Co., Inc.

The extractable protocol standardization was designed to ensure all Single-Use (SU) vendors will perform their extractable studies in a consistent manner (hence, shorten decision-making processes with the resulted relevant extractable data by end users). Rationales will be provided to support the proposed extractable parameters based on surveys of biopharma BPOG member companies and shared knowledge. Update on possible adaption of this standard extractable protocol with BPSA supplier members will be provided.

5:15 Networking Reception with Exhibit & Poster Viewing

6:45 End of Day

THURSDAY, AUGUST 22

8:00 am Morning Coffee

SINGLE-USE TECHNOLOGIES

8:25 Chairperson's Remarks

Ken M. Wong, Senior Scientist, Specialty Analytical, Center for Extractables and Leachables, Merck & Co., Inc.

8:30 A Novel Seed Train Process Using High Density (HD) Cell Banking, Disposable Wave Bioreactor and Alternating Tangential Flow (ATF) Perfusion Technologies

Benjamin Wright, Process Engineer, Genzyme Corporation, a Sanofi Company

9:00 Scale-Up of a Fed-Batch Process in a Single-Use Bioreactor for the Expression of Monovalent Hemagglutinins, Components of the Flublok Vaccine

Nikolai Khramtsov, Ph.D., Associate Director, Upstream Development, Product Realization Department, Protein Sciences Corporation

We developed a fed-batch process for increasing the productivity of rHA in 2L glass bioreactors, and scaled the process first to 10L in stainless steel units, and later to 200L in single-use bioreactors (SUB). We observed a twofold increase in rHA productivity by the fed-batch process compared to the batch process. We will present data on cell growth, pH, and accumulation of metabolites during the cell growth and protein production phase, and expression profiles obtained in batch and fed-batch processes at 2, 10 and 200L scales.

9:30 Predictable Process Optimization with a Scale-Down System for Large Scale Bioreactors - from 5 ml to 2500 Liter in Disposable Bioreactors

Maria J. De Jesus, Ph.D., COO & Vice President, Process Sciences, ExcellGene SA

Mammalian suspension cells achieved highest volumetric yields in fully controlled stirred bioreactors, but failed in "scale-down" in the past. Most simple scale-down systems do not provide enough oxygen and also result in insufficient CO2 stripping, for example spinners or shake flasks. Orbital shaking of cylindrical vessels, initially executed with 50 ml "TubeSpin bioreactors," has now been scaled to 2500 L. The talk shows that profound understanding of engineering and biology provides un-used opportunities in manufacturing.

10:00 Coffee Break in the Exhibit Hall with Poster Viewing

10:45 Characterization of Mixing Efficiency to Ensure Process Equivalence

Ludovic Peeters, Scientist, New Product Development, GSK Vaccines

GlaxoSmithKline Vaccines's cell culture department selected and implemented a Single-Use Bioreactor technology in their process development facilities. One important technology selection criteria was the design equivalence between stainless steel and single-use bioreactors. But are the mixing conditions in the single-use bioreactors really equivalent to stainless steel? This presentation will try to answer this question by comparing results from detailed mixing characterization of both technologies.

11:15 Single-Use Scaling Considerations for Optimizing Bioreactor Performance

Mark McElligott, Partner and Principal Process Engineer, Process Design Solutions

Scaling optimization considerations from a technical, quality and supply-chain perspective will be discussed utilizing case study material. Being prepared with the tools to buy down risk for scaling cell culture processes will save time through removing delays that are not commonly experienced with traditional SS systems. Strategies for control over the degree of flexibility will be covered, including success through effective collaboration between the SU vendor and the end-user, as well as, with an effectively written TQA to support SU product development.

11:45 Disposable Bioprocess Technologies used in Early Development of Sandoz Biosimilars

Matjaž Tisu, Senior Scientist, Sandoz Biopharmaceuticals

Due to its benefits, the disposable bioprocess technology has been recognized as a future alternative to the established traditional reusable technology for development and production of biopharmaceuticals. Strategy, rationale and approach for implementation of small scale disposable bioreactors in early development of biosimilars will be presented. Testing and qualification of disposable systems from different suppliers, including a high-throughput micro-bioreactor system will be shown. The presentation will also include case studies on different proteins (mAb, fusion proteins…) demonstrating comparable performance and product quality in single use bioreactors.

12:15 pm Luncheon Presentation: Application of Single Use Bioreactors for Culturing Adherent MDCK Cells for Virus Production

Sponsored by EMD Millipore

Michael McGlothlen, Manager, Upstream Process Innovation Center, EMD Millipore

The Mobius® CellReady bioreactor product platform incorporates novel disposable technologies that provide optimal performance for suspension mammalian cell culture. Here we show the utility of EMD Millipore's 3L and 50L Mobius® CellReady single use bioreactors for the cultivation of adherent mammalian cells on microcarriers. Cytodex3® and Solohill® collagen microcarriers were first tested in a mixing study to assess feasibility. We evaluated the normalized mixing speed required in the 3L and 50L to achieve a suspension of the microcarriers and enable growth of the cells.

1:00 End of Conference

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Inaugural

Rapid Methods to Assess Quality & Stability of Biologics

Improving Prediction and Screening

WEDNESDAY, AUGUST 21

7:45 am Registration & Morning Coffee

REGULATORY CONSIDERATIONS FOR ASSESSING BIOPHARMACEUTICAL STABILITY

8:25 Chairperson's Remarks
Paul Bigwarfe, Jr., Ph.D., Director, Analytical Sciences, Industrial Operations and Product Supply, Regeneron Pharmaceuticals, Inc.

» 8:30 KEYNOTE PRESENTATION: Modern Analytical Techniques for Biologics Impurity Analysis for Meeting the Regulatory Challenges
Jianmei Kochling, Ph.D., Director, Quality Control Technical Services, Genzyme, a Sanofi Company
Impurity characterization is an important aspect throughout product development and life-cycle management. Strategies for impurity characterization such as when to use modern analytical techniques vs. conventional techniques should be well balanced in order to achieve analytical goals and meet regulatory challenges.

9:00 Regulatory Considerations and Expectations for Assessing Quality and Stability of Biologics
Malgorzata Norton, MS, Biologist, Office of Blood Research and Review, Center of Biologics Evaluation and Research, US Food and Drug Administration
An overview of regulatory considerations for stability assessment and handling of results will be discussed. Case-studies demonstrate the use of various methods for investigating and resolving stability issues.

HIGH-THROUGHPUT SCREENING AND ASSAY DEVELOPMENT

9:30 Fluorescence-Based High-Throughput Methods for Rapid Evaluation of Protein Physical and Chemical Instabilities
Vishal C. Nashine, Ph.D., Senior Research Investigator, Drug Product Science & Technology, Bristol-Myers Squibb Co.
Selection of formulation composition often requires rapid turnaround while the quantity of drug substance is generally limited during the early phase clinical studies. In such cases, material sparing, sensitive, and rapid methods are valuable analytical tools for initial screening of solution conditions. Here, we describe high-throughput methods to assess two major instabilities commonly observed during development of biologics.

10:00 Coffee Break in the Exhibit Hall with Poster Viewing

10:45 High-Throughput Screening to Assess Biophysical Properties of Therapeutic Proteins in Early Development
Martin Lemmerer, Principal Scientist, Integrated Biologics Profiling, Novartis, Inc.
During candidate selection, limited material is available for biophysical characterization. We assess and pick winners in a high-throughput manner by utilizing automated liquid handling.

11:15 Standardized Assays for Rapid Assessment of Potency: The Key to Success
Michael G. Tovey, Ph.D., INSERM Director, Research, Laboratory of Biotechnology and Applied Pharmacology, ENS-Cachan, Villejuif, France
Biological activity is an essential quality attribute that serves as a link to clinical efficacy. Conventional assays may be inadequate to detect differences in stability resulting from a change in manufacturing. A validated standardized cell-based assay platform has been developed that allows quantification of drug potency within 2 hours and that reduces assay variation to a minimum as illustrated by case studies for different biologics.

11:45 Analysis of Protein Structure to Optimize Candidate Screening, Formulations and Process Development
Sponsored by forteBIO, A Division of Pall Life Sciences
Yamuna Dasarathy, Ph.D., MBA, Director, Marketing, Pall Life Sciences
Multiple biophysical analytical techniques are imperative to the investigation of the structural stability of proteins. This approach, when combined with the capability for rapid, high-throughput measurements using micro sample volumes, provides a powerful tool for biopharmaceutical development. Applications include screening of candidate molecules, formulations and optimization of purification conditions for downstream processing

12:00 pm Sponsored Luncheon Presentation *(Opportunity Available)* **or Lunch on Your Own**

RAPID METHODS FOR PROTEIN STABILITY ASSESSMENT (SHARED SESSION)

1:55 Chairperson's Remarks

» 2:00 FEATURED PRESENTATION: Measuring and Increasing Protein Stability and Solubility
C. Nick Pace, Ph.D., Distinguished Professor, Department of Molecular and Cellular Biology, Texas A&M
This talk will critically discuss the methods used to measure protein stability and review what has been learned recently about the forces stabilizing proteins. Presentation will also cover the best methods for making proteins more stable, including improving the charge distribution and beta-turns on the surface. Finally, we will discuss a new approach for making proteins more soluble.

2:30 High-Throughput Tools for Predicting Aggregation, Viscosity and Solubility of Proteins and mAbs
Yatin R. Gokarn, Ph.D., Narotam Sekhsaria Distinguished Professor of Chemical Engineering, Institute of Chemical Technology, Mumbai, India
This presentation will highlight the utility of colloidal stability-based HT screening tools for predicting aggregation propensity, and viscoelastic properties of mAbs.

3:00 Continuous High-Throughput Monitoring of Protein Formulation Stability Using SMSLS (Simultaneous Multiple Sample Light Scattering)
Wayne F. Reed, Ph.D., Professor of Physics and Engineering Physics, Department of Physics, Tulane University
SMSLS provides quantitative monitoring on the stability, states of aggregation or degradation, in real time, simultaneously, for many independent samples. It also allows equilibrium properties, such as thermodynamic virial coefficients to be measured and related to kinetics of non-equilibrium processes. Results from case studies on monoclonal antibodies illustrate this approach. Related hydrodynamic data deepen the connection between kinetics and equilibrium properties.

3:30 Networking Refreshment Break

4:15 Characterizing Protein Behavior at High Concentration in Complex Solutions by Static Light Scattering
Michael S. Marlow, Ph.D., Staff Scientist, Protein Biochemistry, Regeneron Pharmaceuticals, Inc.
Protein therapeutics typically exceeds the high concentration threshold resulting in thermodynamic non-ideality, which complicates reliable estimation of critical properties from measurements made dilute conditions. This presentation will discuss the utility of light scattering techniques in bridging the dilute–high concentration regimes as well as providing insight regarding both the nature of the molecular interactions and the impact of formulation components.

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Inaugural

Rapid Methods to Assess Quality & Stability of Biologics

Improving Prediction and Screening

4:45 Comparison of Methods for Characterizing Subvisible Particles Using Manufactured Particles and Microfluidics
Richard Cavicchi, Ph.D., Physicist, Bioprocess Measurements Group, National Institute of Standards and Technology
We use microfabricated particles of precise dimensions to compare sizing methods using commercially available equipment. A microfluidic system combines photographic measurements of particles (including fluorescent images) with electrical measurements of the particle volume via the Coulter Principal. The talk will show how non-spherical reference particles reveal differences in the reported information from commercial instruments.

5:15 Networking Reception with Exhibit & Poster Viewing

6:45 End of Day

THURSDAY, AUGUST 22

8:00 am Morning Coffee

APPROACHES FOR ANALYTICAL ASSESSMENT OF BIOPHARMACEUTICAL QUALITY

8:25 Chairperson's Remarks
Jennifer F. Nemeth, Ph.D., Principal Scientist, Biologics Discovery Program Leader, Biologics Research, Janssen Research & Development, LLC

8:30 Assessment of Vaccine Components and Recombinant Monoclonal Antibody Stability Using Biophysical Methods
Marina Kirkitadze, Ph.D., MBA, Deputy Director, Head, Biophysics and Conformation Unit, Biochemistry Platform Analytical R&D North America, Sanofi Pasteur Ltd.
Secondary and tertiary structure of protein vaccine components and mAbs, as well as particulate formation is examined using a combination of various biophysical methods. These methods are applied at various stages of manufacturing that includes purified bulk concentrate and formulated product. Examples will be presented showing how a characterization package is used to assess process changes, stability, and lot comparability.

9:00 Methods and Approaches for Early Stability Assessment of Potential Biotherapeutics to Support Manufacturability
Patrick Flanagan, Senior Research Associate, BioFormulations Department, Genzyme Corporation, a Sanofi Company
An understanding of protein stability for a series of potential biotherapeutic candidates is essential when assessing manufacturability. Such knowledge can identify candidates best suited to move into development or detect degradation issues which need to be addressed before such a transition can occur. This talk will focus on approaches and challenges in obtaining an early assessment of protein stability.

9:30 Analysis of Sub-Visible Particulates in Antibody-Maytansinoid Conjugates
Praval Shah, Analytical Associate III, Analytical and Pharmaceutical Sciences, ImmunoGen, Inc.
Antibody-Maytansinoid Conjugates (AMCs) are administered intravenously and sub-visible particulate (SVP) levels need to meet compendial specifications. The relatively large volume requirement of the compendial light obscuration method (USP<788>) limits its use in early stage development. This presentation will focus on the evaluation of reduced injection volume light obscuration method for quantifying sub-visible particulates in AMC samples for early stage development.

10:00 Coffee Break in the Exhibit Hall with Poster Viewing

10:45 Streamlining the Process for the Automated Assessment of Post-Translational Modifications in Biotherapeutics
Jennifer F. Nemeth, Ph.D., Principal Scientist, Biologics Discovery Program Leader, Biologics Research, Janssen Research & Development, LLC
A semi-automated system was previously developed that incorporates HPLC-MS and data-dependant acquisition experimental data with repurposed commercial proteomics software. This system was designed to facilitate the identification and delta change of defined post-translational modifications in stability-stressed samples of candidate biotherapeutics. Here we report on the development of new activities and processes to streamline the method, and to reduce the number of software programs required to achieve reproducible, automated results.

» 11:15 FEATURED PRESENTATION:

Introducing Rapid Analytical Techniques into the Commercial Quality Control Laboratory
Paul Bigwarfe, Jr., Ph.D., Director, Analytical Sciences, Industrial Operations and Product Supply, Regeneron Pharmaceuticals, Inc.
Emerging technologies require much more effort to implement into a routine quality control laboratory. The design space of the analytical method should be characterized to predict the failure modes and variability of the assay over the course of different analysts executing the assay over many years. Examples such as SEC-UPLC and microchip based gel electrophoresis will be discussed.

11:45 Utilization of Process Analytical Technology (PAT) to Replace Fractionation in A GMP Manufacturing Setting
Stacey Williams, Associate Scientist, Process Development, Amgen, Inc.
PAT utilization and implementation in a GMP manufacturing settings allows for real time decisions that will have a positive impact on product yield and quality while reducing labor requirements and production delays. This union between real time analytics and manufacturing is the new future.

12:15 pm Sponsored Luncheon Presentation *(Opportunity Available)* **or Lunch on Your Own**

1:00 End of Conference

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The **Intro-Net** offers you the opportunity to set up meetings with selected attendees before, during and after this conference, allowing you to connect to the key people that you want to meet. This online system was designed with your privacy in mind and is only available to registered session attendees of this event.

BACK

2nd Annual

High-Concentration Protein Formulations

Overcoming Challenges in Stability and Aggregation

WEDNESDAY, AUGUST 21

7:45 am Registration & Morning Coffee

FORMULATION AND DELIVERY APPROACHES FOR HIGH-CONCENTRATIONS PROTEIN FORMULATIONS

8:25 Chairperson's Remarks

Dhananjay Jere, Ph.D., Group Leader, Early-Stage Pharmaceutical Development & GLP Supplies, Biologics Europe, F. Hoffmann-La Roche Ltd.

» KEYNOTE PRESENTATIONS:

8:30 Challenges in Developing High-Concentration Protein Formulations

Donna L. Luisi, Ph.D., Senior Principal Scientist, Pharmaceutical Research & Development, Pfizer, Inc.

There are many challenges faced in the development of high protein concentration formulations. An important aspect of this is managing the viscosity behavior. My talk will focus on modulating the solution conditions by varying solution pH, ionic strength and excipient composition.

9:00 Optimizing the Colloidal Stability of Protein Formulations

Thomas Laue, Ph.D., Professor, Biochemistry and Molecular Biology; Director, Biomolecular Interaction Technologies Center (BITC), University of New Hampshire

The colloidal stability of high-concentration protein formulations is central to preventing aggregation and avoiding high viscosities. The colloidal properties are electrostatic in origin, and may be manipulated by changing solvent conditions. This talk will focus on how to select solvent properties that will optimize colloidal stability.

9:30 A Three-Tiered Approach for the Development of a High Concentrated Protein Formulation

Thomas Pohl, Ph.D., Senior Scientist, Research & Development, SuppreMol GmbH

Therapeutic proteins can be formulated at high strength either as a liquid, can be lyophilized and reconstituted or can be prepared as microcrystalline suspensions. These complementary approaches are exemplified for a relevant therapeutic protein - and pros and cons of each approach are discussed. Additionally the applicability of analytical tools for the characterization of high concentrated formulations is discussed.

10:00 Coffee Break in the Exhibit Hall with Poster Viewing

10:45 High-Concentration Formulation Development of a Monoclonal Antibody: The Challenge of Converting a IV Formulation to a Sub-Q Formulation That is Both Stable and Easily Administered

Danny Chou, Ph.D., Senior Research Scientist, Biologics Development, Gilead Sciences, Inc.

Development of high-concentration monoclonal antibody formulation is a significant challenge and often necessitates a thorough evaluation on a case-by-case basis. The purpose of this presentation is to share some insights from an effort to use the rational approach to evaluate a monoclonal antibody candidate with respect to both physical and chemical properties that may impact one's ability to convert an IV formulation to a SC formulation that can be easily administered in a market-competitive configuration.

11:15 Enabling High-Concentration Protein Compositions

Jan Jezek, Ph.D., CSO, Development, Arecor Ltd.

The strong trend in the biopharmaceutical industry toward concentrated protein products requires new approaches to stabilization to be developed. Presented will be case studies demonstrating novel formulation principles allowing development of liquid protein compositions with superior stability profiles at high-concentrations, with a focus on the control of aggregation as well as other quality attributes such as fragmentation and viscosity.

11:45 Characterization of Self-Association at High Concentration by the Calypso® CG-MALS System

Sponsored by WYATT TECHNOLOGY

Daniel Some, Ph.D., Principal Scientist, Wyatt Technology Corp.

Protein-protein interactions impact the viscosity and stability of biotherapeutics formulated at high concentrations. One of the few techniques capable of measuring and analyzing these interactions is composition-gradient multi-angle light scattering (CG-MALS). We describe the Calypso CG-MALS system and explore some key applications.

12:00 pm Sponsored Luncheon Presentation *(Opportunity Available)* **or Lunch on Your Own**

RAPID METHODS FOR PROTEIN STABILITY ASSESSMENT (SHARED SESSION)

1:55 Chairperson's Remarks

» 2:00 FEATURED PRESENTATION:
Measuring and Increasing Protein Stability and Solubility

C. Nick Pace, Ph.D., Distinguished Professor, Department of Molecular and Cellular Biology, Texas A&M

This talk will critically discuss the methods used to measure protein stability and review what has been learned recently about the forces stabilizing proteins. Presentation will also cover the best methods for making proteins more stable, including improving the charge distribution and beta-turns on the surface. Finally, we will discuss a new approach for making proteins more soluble.

2:30 High-Throughput Tools for Predicting Aggregation, Viscosity and Solubility of Proteins and mAbs

Yatin R. Gokarn, Ph.D., Narotam Sekhsaria Distinguished Professor of Chemical Engineering, Institute of Chemical Technology, Mumbai, India

This presentation will highlight the utility of colloidal stability based HT screening tools for predicting aggregation propensity, and viscoelastic properties of mAbs

3:00 Continuous High-Throughput Monitoring of Protein Formulation Stability Using SMSLS (Simultaneous Multiple Sample Light Scattering)

Wayne F. Reed, Ph.D., Professor of Physics and Engineering Physics, Department of Physics, Tulane University

SMSLS provides quantitative monitoring on the stability, states of aggregation or degradation, in real time, simultaneously, for many independent samples. It also allows equilibrium properties, such as thermodynamic virial coefficients to be measured and related to kinetics of non-equilibrium processes. Results from case studies on monoclonal antibodies illustrate this approach. Related hydrodynamic data deepen the connection between kinetics and equilibrium properties.

3:30 Networking Refreshment Break

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4:15 Characterizing Protein Behavior at High-Concentration in Complex Solutions by Static Light Scattering
Michael S. Marlow, Ph.D., Staff Scientist, Protein Biochemistry, Regeneron Pharmaceuticals, Inc.
Protein therapeutics typically exceeds the high-concentration threshold resulting in thermodynamic non-ideality, which complicates reliable estimation of critical properties from measurements made dilute conditions. This presentation will discuss the utility of light scattering techniques in bridging the dilute–high-concentration regimes as well as providing insight regarding both the nature of the molecular interactions and the impact of formulation components.

4:45 Comparison of Methods for Characterizing Subvisible Particles Using Manufactured Particles and Microfluidics
Richard Cavicchi, Ph.D., Physicist, Bioprocess Measurements Group, National Institute of Standards and Technology
We use microfabricated particles of precise dimensions to compare sizing methods using commercially available equipment. A microfluidic system combines photographic measurements of particles (including fluorescent images) with electrical measurements of the particle volume via the Coulter Principal. The talk will show how non-spherical reference particles reveal differences in the reported information from commercial instruments.

5:15 Networking Reception with Exhibit & Poster Viewing

6:45 End of Day

THURSDAY, AUGUST 22

8:00 am Morning Coffee

OVERCOMING CHALLENGES IN AGGREGATION AND STABILITY

8:25 Chairperson's Remarks
Steven Shire, Ph.D., Consultant; Formerly Genentech, Inc.

8:30 The Role of Dipole Moment in Governing Solution Properties in High-Concentration Antibody Solutions
Devendra (Davy) S. Kalonia, Ph.D., Professor of Pharmaceutics, Department of Pharmaceutical Sciences, University of Connecticut
Aggregation and viscosity in high-concentration protein solutions can be related to attractive protein-protein interactions. A non-uniform charge distribution on the molecular surface can result in a significant dipole moment. This talk will discuss the dipole moment calculation, experimental measurement and relation to solution viscosity for a number of monoclonal antibodies.

9:00 Effects of Protein Charge Anisotropy on Mechanism and Kinetics of Native State Aggregation
Daniel Seeman, Researcher, Dubin Research Group, Department of Chemistry, University of Massachusetts-Amherst
"All proteins aggregate but each in its own way" may apply to unfolding aggregation, but when short-range interactions no longer dominate, native state aggregation can be subject to some general rules. The basis of strategies to suppress or inhibit aggregation depends on interventions appropriate to aggregation mechanism and kinetics.

DELIVERY APPROACHES FOR HIGH-CONCENTRATION PROTEIN FORMULATIONS

» 9:30 FEATURED PRESENTATION:

An Alternative Method for Manufacturing High-Concentration Monoclonal Antibody Formulations for Subcutaneous Delivery
Steven Shire, Ph.D., Consultant; Formerly Genentech, Inc.
The high-concentration poses a challenge for manufacturing using standard tangential flow filtration due to the viscosity restrictions during the ultrafiltration / diafiltration unit operation. An alternative approach was investigated where bulk drug substance was concentrated by performing bulk lyo in disposable Lyoguard trays, followed by reconstitution with lower volume than used in the filling of the trays. Formulation studies were conducted to reduce post-reconstitution hypertonicity and viscosity, while maintaining product quality.

10:00 Coffee Break in the Exhibit Hall with Poster Viewing

10:45 A Special Intraocular Contemplation for New Format Antibody Formulations
Dhananjay Jere, Ph.D., Group Leader, Early-Stage Pharmaceutical Development & GLP Supplies, Biologics Europe, F. Hoffmann-La Roche Ltd.
Development of protein products to target ocular diseases requires special considerations from the molecular designing aspect and also from the formulation, stability, and regulatory aspect. The protein intended to stay in eye has to be compatible and stable in the intraocular environment. This manuscript describes key development aspects of antibody formulation to make it apt for the intraocular application.

11:15 Challenges in Developing Biologics Device Combination Products: Are They Technical or Regulatory or Both?
Shuxia Zhou, Ph.D., Research Scientist, Drug product Development, Janssen Pharmaceuticals, Johnson & Johnson LLC
Combination products with integrated high-concentration product in device are highly market competitive due to demanded dosing convenience. However, developing these products is challenging because of difficulty in developing & manufacturing high-concentration formulation, device design, final product assembly and unclear regulatory requirements. The talk focuses on the strategy in addressing regulatory expectations for a combination product with a new device.

11:45 Talk Title to be Announced
Speaker to be Announced

12:15 pm Sponsored Luncheon Presentation *(Opportunity Available)* **or Lunch on Your Own**

1:00 End of Conference

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Inaugural

Early IND Strategies: Analytical Development

Optimizing the Selection and Performance of Preclinical Analytical Studies

THURSDAY, AUGUST 22, 2013

1:55 pm Chairperson's Remarks
Dingjiang (Dean) Liu, Ph.D., Fellow Scientist, Formulation Development Regeneron Pharmaceuticals, Inc.

» 2:00 FEATURED PRESENTATION
Analytical Strategies for Early IND Filings of PET Imaging Agents as Potential Companion Diagnostics
Mei May Zhu, Ph.D., Senior Scientist, Analytical Development-Biologics, Millennium: The Takeda Oncology Company
More and more biopharmaceutical companies have started in house efforts to establish drug-companion diagnostic co-development towards better personalized medicine. Imaging tools are one of the commonly explored diagnostic technical platforms and are particularly useful for hard-to-assess tissues such as tumor or brain. This presentation will provide examples on CMC challenges and define analytical testing strategies supporting the early IND filing of positron emission tomography (PET) imaging agent drugs as potential companion diagnostics for cancer treatment.

DEVELOPABILITY ASSESSMENT IN THE DISCOVERY-DEVELOPMENT HANDOFF

2:30 Developability Assessment from a Drug Product Perspective
Dingjiang (Dean) Liu, Ph.D., Fellow Scientist, Formulation Development, Regeneron Pharmaceuticals, Inc.
Developability assessment has become an important part of candidate selection process for protein drug development. During the assessment study, the critical properties of the drug candidates, such as stability, solubility and viscosity, are evaluated. This ensures the risks associated with the selected candidate for bulk production, drug product manufacturing and drug delivery are understood and minimized. This presentation will focus on developability assessment of monoclonal antibody drug candidates from the perspectives of drug product development and delivery. Three case studies will be presented to highlight the common issues observed during developability assessment. An efficient harmonized approach in selecting the best molecule for clinical development and commercialization will be discussed.

3:00 High-Throughput Screening for Selection of Candidates for Successful Technical Development
Amitabha Deb, Ph.D., Fellow, Integrated Biologics Profiling Group, Novartis Pharma
High-throughput strategies to support candidate selection at preclinical stage will be discussed. During profiling activities, the approach to guide candidate selection process focuses on key characteristics of the molecule to assure stability, safety and efficacy. To assure the selected molecule matches standard platform process, 'compatibility with DS & DP Platform Processes' is tested. Case studies will be presented on mAbs and non-mAbs to elaborate further on molecular profiling activities. It helps to identify resource-intensive molecules and brings 'process research' to the area of early candidate development.

3:30 Refreshment Break in the Exhibit Hall with Poster Viewing

4:15 Case Study: Comparative Signature Diagrams as a Tool to Aid Comparability and Developability of Protein Therapeutics
Vidyashankara Iyer, Ph.D., Scientist, Formulation Sciences, MedImmune
Combination products that contain more than one protein (therapeutic proteins and vaccine antigens) can be difficult to develop due to the possibility of protein-protein interactions. Developability assessments of such products require tools to identify and characterize such interactions efficiently. Comparative signature diagrams (CSDs) are pictorial representations of statistically significant differences between two data sets that fingerprint one molecule or a combination of molecules. This presentation covers the concept of CSD and their uses in comparability and developability of protein therapeutics and combination products.

4:45 Analytical Support for a New IND Submission
Xiaoyang Zheng, Ph.D., Staff Scientist II, Genzyme (Sanofi)
Effective analytical support is critical to the evaluation of safety, efficacy, purity, and product consistency of a new therapeutic and the optimization of its process development. Examples will be presented of the analytical characterization used to support IND submissions for complex glycoprotein and protein conjugate candidate molecules. This talk will focus on the strategies used to assess critical quality attributes, as well as the use of characterization knowledge to optimize the production process and better understand the degradation profile at an early stage in development.

5:15 End of Day & Registration for Dinner Short Courses

6:00 Dinner Short Courses*
** Separate registration required*

FRIDAY, AUGUST 23, 2013

8:00 am Continental Breakfast in the Exhibit Hall

EARLY ANALYTICAL CHALLENGES FOR EMERGING THERAPEUTICS

8:55 Chairperson's Opening Remarks
Debra Meyer, BS, Senior Principal Scientist, Analytical Research and Development, Pfizer

9:00 IND Process for a Biosimilar Product
Judy Chou, Ph.D., Vice President, Research & Development, Tanvex Biologics

9:30 Strategies and Challenges in Bioassay Development for ADCs vs mAbs
Debra Meyer, BS, Senior Principal Scientist, Analytical Research and Development, Pfizer
A number of therapeutic monoclonal antibodies (mAbs) have been approved over the past 25 years, mainly for oncology and inflammatory indications. In oncology, mAbs are often used in combination with traditional cytotoxic drugs to enhance efficacy. A relatively new class of therapeutic compounds for oncology is antibody drug conjugates (ADCs), in which a cytotoxic drug is covalently conjugated to a mAb. ADCs are designed to facilitate the targeted delivery of cytotoxic drugs to tumors while minimizing systemic toxicity. Each component of an ADC is important to achieve efficacy with minimal toxicity so the ability to evaluate the potency of this multi-component compound in bioassays is critical. The complex structure and mechanism of ADCs requires a strategy that involves bioassay approaches for both the mAb (target binding) and the drug (cytotoxic activity). Using case studies, this presentation will describe the strategies and challenges of bioassay development and characterization for early stage ADCs in comparison to those for mAbs.

10:00 Women's Health Reports Series
Gaya Ratnaswamy, Associate Director, Analytical & Formulation Development, Agensys
This presentation will focus on the challenges of analytical method development and characterization for ADCs in comparison with that of mAbs using case studies. Strategies for the analytical development for early stage versus late stage will be presented.

10:30 Coffee Break in the Exhibit Hall with Poster Viewing

HIGH-THROUGHPUT AND MINIATURIZED ASSAYS

11:00 High Throughput Analytical and Miniaturized Assays Used for the Testing of Mannose, a Critical Quality Attribute
Susan Callahan, Ph.D., Senior Associate Scientist, Amgen
With the aims of process efficiency and cost saving in biopharmaceutical companies nowadays, companies are moving towards high throughput and miniaturized assays to meet analytical needs with accuracy, precision, and speed. Many technological improvements/breakthroughs in robotics and instrumentation have been made recently which have allowed for enhancements in the analysis of critical quality attributes. This presentation will

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Early IND Strategies: Analytical Development

Optimizing the Selection and Performance of Preclinical Analytical Studies

focus on the evolution of glycan analysis from traditional methods to the most recent breakthroughs in high throughput and miniaturized assays.

11:30 Miniaturizing ELISA Assays for Process Development Support in 384 Well Format

Matthew Troutman, Research Biochemist, Vaccine Bioprocess R&D, Merck

Analytical methods serving early biological pharmaceutical candidates have historically served as bottlenecks in process and formulation development. In addition, earlier development initiatives in the pharmaceutical industry have resulted in increased sample counts and reduced data turn-around time requirements. In reaction to this common problem and increasing demand, ELISAs for process monitoring and development have been migrated to a 384-well from the traditional 96-well platform. Platforms have been developed for routine testing, reagent screening and automated Design of Experiments.

CASE STUDIES OF CRITICAL ASSAYS IN PRECLINICAL DEVELOPMENT

12:00 pm Testing Strategy to Ensure the Removal of Raw Materials as Process-Related Impurities in Bioprocesses

Anil Raghani, Ph.D., Principal Scientist, Process and Product Development, Amgen

While most raw materials used for the manufacturing of biological products are considered safe, some of these components may result in undesirable process-related impurities in final drug products. In this presentation, the application of a risk-based approach to determine the clearance testing requirement of process reagents will be discussed. Case studies of the application of prior knowledge acquired at the process design phase to the testing strategy will be presented.

12:30 Sponsored Presentation *(Opportunities Available)*

1:00 Sponsored Luncheon Presentation *(Opportunity Available)* **or Lunch on Your Own**

EARLY FORMULATION DEVELOPMENT

1:55 Chairperson's Opening Remarks

Danny Chou, Ph.D., Senior Research Scientist, Biologics Development, Gilead Sciences

2:00 A Rational Strategy to Stabilize Early Stage Biologic Candidates to Enhance Developability and Enable Successful Transfer from Research into Development

Danny Chou, Ph.D., Senior Research Scientist, Biologics Development, Gilead Sciences

The goal of this presentation is to describe a platform approach to identifying the optimal solution conditions that can stabilize biologics candidates in the discovery/candidate selection stage in a high throughput fashion, whereby, using a very limited amount of protein and commonly available equipment, the development team can assist the drug discovery team in candidate selection and re-engineering of molecules prior to transition into full-scale development.

2:30 Early Formulation Development Studies for Candidate Selection of Peptide Therapeutics

Tanvir Tabish, Ph.D., Associate Director, Early Formulation, Ipsen, Sweden

The Early Formulation Development group forms a link between the Research and Development organizations of Ipsen and assists the Research groups in selecting a developable candidate that could be transitioned to Development. The Early Formulation group takes part in lead identification, lead optimization and candidate selection followed by transfer of the lead candidate to Development. The aim is to rapidly develop a formulation for PK and *in vivo* efficacy studies in animal models to assist with candidate selection. My presentation will illustrate, with examples, the studies that are performed to accomplish this strategy.

COMPARABILITY STUDIES

3:00 Comparability Analysis in Early Development

Francis Poulin, Ph.D., Scientist II, Genzyme Corporation

Transfer of clinical manufacturing to a new site prior to IND filing can trigger comparability assessments. We developed a multi-tiered strategy to identify differences that can impact mAb CQAs including purity, structure, affinity for target, deamidation, potency, and charge and oligosaccharide profiles. With limited process experience at this stage, selecting representative lots from each site and understanding assay performance are critical to setting comparability criteria. Our strategy is designed to bridge data derived from materials produced at both sites.

SCALE-UP AND TECHNOLOGY TRANSFERS IN PRECLINICAL DEVELOPMENT

(SHARED SESSION BETWEEN *ANALYTICAL DEVELOPMENT* AND *PROCESS AND PRODUCTION*)

3:00 Challenges and Considerations for Preclinical Comparability Studies

Kazumi Kobayashi, Ph.D., Director, CMC Analytical Development, Biogen Idec

3:30 Rapid Production of Biologics in Emergency-Use Response: A Progress Report

Dale Cumming, Ph.D., Chief Science Officer, International Consortium on Anti-Virals, Canada

Anti-viral antibodies are ideal agents in responding to sudden outbreaks of infectious disease if available to patients within months of an outbreak. Accomplishing this goal requires employing cutting-edge GMP bioprocessing technologies and evolving an emergency-use framework with regulatory authorities. We have now completed several "live fire" exercises demonstrating progress in producing multi-gram quantities of anti-influenza antibodies within months and have commenced discussions with regulators.

4:00 End of The Bioprocessing Summit

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Inaugural

Early IND Strategies: Process and Production

Preclinical Process Development to Support Regulatory Filings, Toxicology and Clinical Supply

THURSDAY, AUGUST 22, 2013

1:55 pm Chairperson's Remarks
Susan Dana Jones, Ph.D., Vice President and Senior Consultant, BioProcess Technology Consultants, Inc.

» 2:00 KEYNOTE PRESENTATION
Developing Products for Rare Diseases: Strategies for Early Phase Process Development
Joanne Beck, Ph.D., Vice President, Process Development, Shire Human Genetic Therapies
Early clinical development for rare diseases follows an accelerated path rather than the traditional development path of consecutive Phase I, II and III clinical trials. This presentation will focus on process development strategies implemented to deal with challenges specific to early drug development for rare diseases. The complexity of the products, the inability to rely on highly productive production and analytical platforms, the small number of clinical batches, and accelerated development timelines demand that we understand the relationship between drug structure, function, and manufacturing process from early on and continue to learn even after the products have gained market approval.

CASE STUDIES OF EARLY PROCESS DEVELOPMENT

2:30 Using Early Material Generation to Assess Manufacturability of Biologic Candidates
Jennitte Stevens, Ph.D., Principal Scientist, Therapeutic Discovery, Biologics, Amgen
Understanding potential manufacturing issues early on in the candidate selection process can help eliminate candidates that will present issues in cell line and process development downstream. I will discuss the use of transient and CHO pool material to gain early insight into manufacturability of different types of biologics (antibody and non-antibody molecules as well as bispecfics), and what quality attributes can and cannot be predicted from these expression systems.

3:00 Early Process Development and Clinical Production of an IL-1 Therapeutic Inhibitor
Kathryn Golden, MS, Scientist II, Protein Production and Analytics, Eleven Biotherapeutics
Early fermentation and purification process development efforts of an IL-1 therapeutic inhibitor were aimed at reducing the levels of product related species in the final drug substance. The processes were transferred to a contract manufacturing organization and used to produce material for toxicology and clinical trials in dry eye disease. Further process improvements were implemented for Phase 2 production by combining in-house process development efforts, technology transfer and effective management of CROs and CMOs. Various strategies and techniques were utilized to ensure rapid and successful timelines from molecule selection to an IND filing and the clinic.

3:30 Refreshment Break in the Exhibit Hall with Poster Viewing

4:15 Engineering Product Quality into Early Development Activities
Susan Dana Jones, Ph.D., Vice President and Senior Consultant, BioProcess Technology Consultants, Inc.
Generating a quality target product profile (TPP) before initiating product development is an effective way insure that the product performs as intended. Glycosylation, multimer formation, or other quality attributes defined in the TPP can be selected for at all stages of early development. This talk will present two case studies in which target quality attributes for a new biopharmaceutical product were used to drive final candidate selection during discovery or final clone selection in early development.

4:45 Evaluation of Upstream Cell Density Control Strategies for a Continuous Biopharmaceutical Manufacturing Process
Seul Bae, Process Engineer, Genzyme Corporation

5:15 End of Conference Day & Registration for Dinner Short Course

6:00 Dinner Short Course*

9:00 Close of Day
** Separate registration required*

FRIDAY, AUGUST 23, 2013

8:00 am Continental Breakfast in the Exhibit Hall

HIGH-THROUGHPUT AND AUTOMATED TECHNOLOGIES TO REDUCE TIMELINES FOR MATERIAL PRODUCTION

8:55 Chairperson's Opening Remarks
Shara Dellatore, Ph.D., Lead, Preclinical and Clinical Characterization, Merck & Co.

9:00 Monoclonal Antibody on Demand (MOD) Platform: Increasing Access to the Clinic with a Low Cost, Low Volume Manufacturing Process
Jeffrey Salm, Ph.D., Senior Principal Scientist, BioTherapeutics Research and Development, Pfizer
A new mAb development and manufacturing paradigm is proposed that eliminates process development and right-sizes the scale of manufacturing to match initial FIH studies needs. Extensive platform knowledge and historical data were used to design the process so that it would be applicable to a broad subset of mAbs. The impact of the process on late stage development and product lifecycle will also be considered.

9:30 Optimizing Throughput in Pilot Scale Single-Use Systems
Robert J. Steininger II, MS, Senior Vice President, Manufacturing, Acceleron Pharma
Making complicated proteins in sufficient quantity to enable early preclinical and clinical studies is a potential stumbling block for small start-up companies. Acceleron has chosen use single use technology (SUT) to quickly explore a family of proteins that have potential in a number of clinical applications. In choosing this path, the company has created a SUT based platform process that serves both the needs of research and development for protein supply.

TECHNOLOGIES AND ISSUES IMPACTING PRECLINICAL PROCESS DEVELOPMENT

10:00 Preclinical Process Development in Biologics - Challenges and Concerns
Amardeep Bhalla, Ph.D., Principal Scientist, Vaccine Research, Early Development, Pfizer

10:30 Coffee Break in the Exhibit Hall with Poster Viewing

11:00 Using Early Results to Identify and Set CQAs
Shara Dellatore, Ph.D., Lead, Preclinical and Clinical Characterization, Merck & Co.
Merck's quality by design (QbD) approach utilizes early identification of potential critical quality attributes (pCQAs) to drive process and analytical development. Early identification of pCQAs enables targeted process definition prior to pre-clinical safety assessment and Phase 1 clinical supply manufacturing. This approach minimizes risk of identifying additional quality attributes during later-phase process development or scale-up. Early pCQAs are informed by hypothesized mechanism of action, sequence and modeling predictions of "hot spots", and targeted forced degradation and short-term stability characterization data. Understanding these unique properties of the protein is useful for efficient process development. A case study will be presented highlighting a three month process development effort for pre-clinical safety assessment supply for an IgG1 monoclonal antibody. To meet target ranges for two pCQAs (charge impurity and glycan profile), the originally developed process was fine tuned. Strategic use of pCQAs to inform early development decisions is

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a proven strategy to identify and meet product requirements in the preclinical space to save time, resources and money in the later, often more costly, clinical space.

11:30 Quality by Design Considerations in Purification Process Development
Yiming Yang, Senior Scientist, Purification Process Development, Shire HGT
Quality by Design (QbD) is a concept of building quality into the process and product in a systematic, science, and risk based manner. QbD principles were used in developing a late phase purification process to produce a therapeutic protein. Practical considerations for the QbD implementation were discussed. A case study is presented to better explain the QbD considerations and implementation. The case study described a design of experiment (DoE) study to define design space for the purification process. Also, a process control strategy was developed to better control the process performance and product quality.

12:00 pm BioProduction and Formulation Patents - Opportunities and Challenges for Biotherapeutic Development
Paul Calvo, Ph.D., Director, Biotechnology/Chemical Group, Sterne, Kessler, Goldstein & Fox
Bioprocessing intellectual property provides a valuable opportunity to enhance patent life that cover a biotherapeutic. Recent activity and changes in the patent system greatly impact the ability to commercialize compositions used in manufacturing biologics, as well as the manufacturing processes themselves. The changes and their implication for bioproduction commercialization strategies will be discussed.

12:30 Scaling from the Bench to Biomanufacturing: Large Scale CHO Transient Transfection Using Flow Electroporation
Sponsored by MaxCyte
James Brady, Ph.D., Director, Technical Applications, MaxCyte, Inc.
Flow electroporation (FEP) streamlines antibody development by enabling large scale transient gene expression (TGE) directly in CHO cells, eliminating the need to change cell backgrounds during scale up to biomanufacturing. FEP is fully scalable and produces antibody titers >1g/L with optimization and can also be used to rapidly generate high yield stable cell lines.

1:00 Sponsored Luncheon Presentation *(Opportunity Available)* **or Lunch on Your Own**

1:55 Chairperson's Remarks
Erinc Sahin, Research Investigator II, Bristol-Myers Squibb

SCALE-UP AND TECHNOLOGY TRANSFERS IN PRECLINICAL DEVELOPMENT

2:00 Developing a Robust Technology Transfer
Erinc Sahin, Research Investigator II, Bristol-Myers Squibb
Technology transfer, by definition, is an activity where key information and know-how is exchanged between two groups with the goals of high repeatability of processes as well as high quality and comparability of end products. It is also an activity that clearly shows the importance of clear expectations, targeted data collection, and organized communication. This presentation will be discussing some approaches that can be employed during biopharmaceutical formulation and drug product development to facilitate an efficient technology transfer between functional groups from multiple disciplines.

2:30 Scale-Down Modeling in Early Process Development
Shuang Chen, Ph.D., Senior Scientist, Pfizer
In this case study (an E.coli expressed protein), the downstream recovery and purification processes include cell harvest, cell lysis, inclusion body (IBs) recovery and wash, solubilization and refolding, and chromatography based purification. We have demonstrated through repeated production scale runs at the 2000 L oxidation scale that process performance can be well predicted from the lab-scale results. The scale-down modeling approach taken in early process development successfully predicts the scale-up of the downstream unit operations.

3:30 Monitoring and Control in Pilot Scale Biologics Production
Seongkyu Yoon, Ph.D., Assistant Professor, Chemical Engineering, MA BioManufacturing Center, University of Massachusetts, Lowell
Biologics manufacturers are facing challenges during scale-up due to lot-to-lot variations of critical raw material, lack of appropriate measurements of intermediate process parameters, and even inappropriate analytical test methods of final product quality attributes. The presentation will illustrate how to characterize production data in different scales and conduct comparability study. Characterization and comparability are done under multivariate statistical framework. Correlation models built with bench scale data are used for addressing different scale data. The same framework can be used for continuous process validation as well as for product/process transfer.

3:30 Rapid Production of Biologics in Emergency-Use Response: A Progress Report
Dale Cumming, Ph.D., Chief Science Officer, International Consortium on Anti-Virals, Canada
Anti-viral antibodies are ideal agents in responding to sudden outbreaks of infectious disease if available to patients within months of an outbreak. Accomplishing this goal requires employing cutting-edge GMP bioprocessing technologies and evolving an emergency-use framework with regulatory authorities. We have now completed several "live fire" exercises demonstrating progress in producing multi-gram quantities of anti-influenza antibodies within months and have commenced discussions with regulators.

4:00 End of The Bioprocessing Summit

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Discounted Room Rate: $219 s/d
Discounted Cut-off Date: July 22, 2013

Please make your reservation online or call the hotel directly to reserve your sleeping accommodations. You will need to identify yourself as a Cambridge Healthtech Institute conference attendee to receive the discounted room rate with the host hotels. Reservations made after the cut-off date or after the group room block has been filled (whichever comes first) will be accepted on a space-and-rate-availability basis. Rooms are limited, so please book early.

TOP REASONS TO STAY AT THE RENAISSANCE HOTEL:

- Take advantage of the $219 group rate!
- Complimentary wireless internet access in guest rooms
- No Commute, since meeting takes place at hotel
- Lots of new restaurants within walking distance. The Seaport is the up-and-coming area of Boston!
- CHI staff on-site to assist you with any "challenges" or requests you need assistance with at host hotel

Flight Discounts:

Special discounts have been established with American Airlines for this conference:

- Call 1-800-433-1790 (authorization code **8283BG**).
- Go online at www.aa.com (enter **8283BG** in promotion discount box).
- Contact our designated travel agent, Rona Meizler at 1-617-559-3735 or rona.meizler@protravelinc.com

Car Rental Discounts:

Special discount rentals have been established with Hertz for this conference.

Make your reservation online or call Hertz directly at 800-654-3131 and reference our Discount Number 04KL0004

Lead Sponsoring Publications:

Bio·IT World | GEN Genetic Engineering & Biotechnology News | nature | Science AAAS | The Scientist Magazine of the Life Sciences

Sponsoring Publications:

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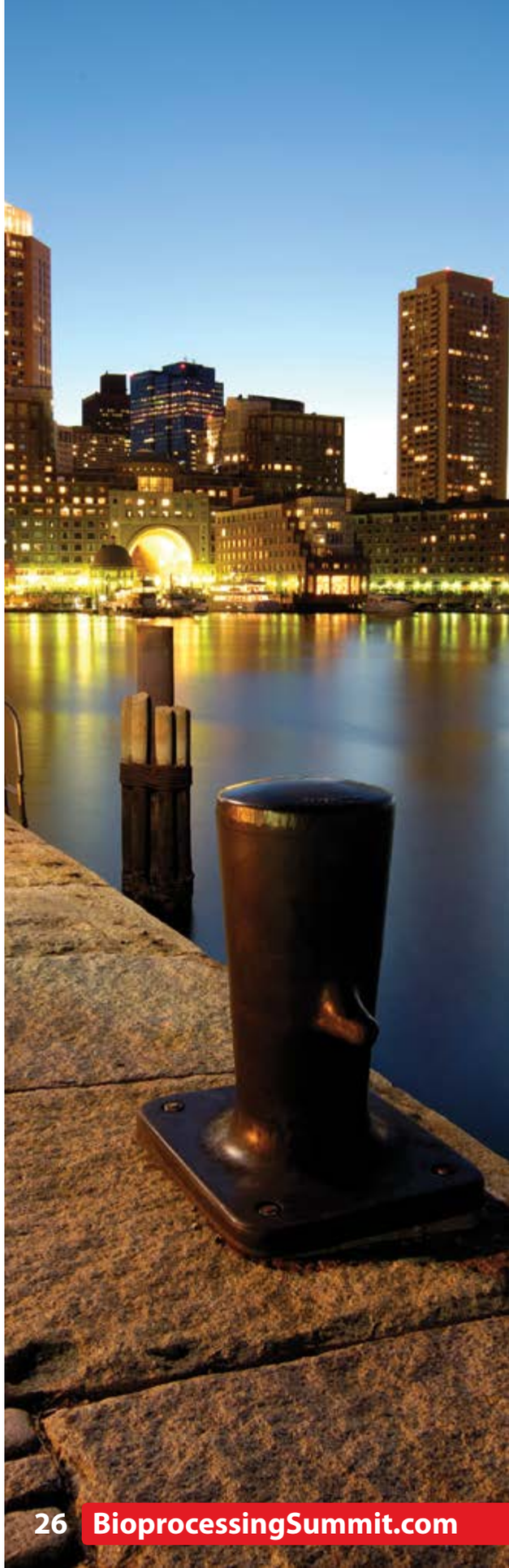

Click Here to Register Online!
BioprocessingSummit.com

How to Register: BioprocessingSummit.com

reg@healthtech.com • P: 781.972.5400 or Toll-free in the U.S. 888.999.6288
Please use keycode 1381F when registering

SHORT COURSES

	Commercial	Academic, Government, Hospital-affiliated
Single Short Course	$595	$345
Two Short Courses	$895	$645
Three Short Courses	$1095	$745

SHORT COURSE SELECTIONS: Please refer to page 3 for short course choices

CAMBRIDGE HEALTHTECH TRAINING SEMINARS - Visit https://chidb.com/register/2013/bpd/reg.asp for pricing information

CONFERENCE PRICING

PREMIUM PACKAGE - BEST VALUE! *(Includes access to all conferences Monday-Friday. Excludes short courses and training seminars.)*

Registrations after July 19, 2013 and on-site	$3095	$1445

STANDARD PACKAGE *(Includes access to 2 conferences. Excludes short courses and training seminars.)*

Registrations after July 19, 2013 and on-site	$2545	$1275

BASIC PACKAGE *(Includes access to 1 conference. Excludes short courses and training seminars.)*

Registrations after July 19, 2013 and on-site	$1825	$775

CONFERENCE SELECTIONS:

Monday-Tuesday, August 19-20	Wednesday-Thursday AM, August 21-22	Thursday PM - Friday, August 22-23
T1: Optimizing Cell Culture Technology	T5: Optimizing Cell Line Development	T9: Early IND Strategies: Analytical Development
T2: Facilities for Manufacturing Biologics	T6: Scaling Up & Down with Optimized Bioreactors	T10: Early IND Strategies: Process and Production
T3: Higher-Order Protein Structure	T7: Rapid Methods to Assess Quality & Stability of Biologics	
T4: Overcoming Formulation Challenges	T8: High-Concentration Protein Formulations	

CONFERENCE DISCOUNTS

POSTER DISCOUNT ($50 Off) Poster abstracts are due by **July 19, 2013**. Once your registration has been fully processed, we will send an email containing a unique link allowing you to submit your poster abstract. If you do not receive your link within 5 business days, please contact jring@healthtech.com.* *CHI reserves the right to publish your poster title and abstract in various marketing materials and products.*

REGISTER 3 - 4th IS FREE: Individuals must register for the same conference or conference combination and submit completed registration form together for discount to apply.

GROUP DISCOUNTS: Discounts are available for multiple attendees from the same organization. For more information on group rates contact David Cunningham at +1-781-972-5472

If you are unable to attend but would like to purchase the Bioprocessing Summit CD for $750 (plus shipping), please visit BioprocessingSummit.com.
Massachusetts delivery will include sales tax.

ADDITIONAL REGISTRATION DETAILS

Each registration includes all conference sessions, posters and exhibits, food functions, and access to the conference proceedings link.

Handicapped Equal Access: In accordance with the ADA, Cambridge Healthtech Institute is pleased to arrange special accommodations for attendees with special needs. All requests for such assistance must be submitted in writing to CHI at least 30 days prior to the start of the meeting.

To view our Substitutions/ Cancellations Policy, go to http://www.healthtech.com/regdetails

Video and or audio recording of any kind is prohibited onsite at all CHI events.

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