Recovery of Biological Products IX

American Chemical Society, Division of Biochemical Technology

Engineering Foundation

Co-chairs

Stuart E. Builder, Strategic Biodevelopment, USA
Charles L. Cooney, Massachusetts Institute of Technology, USA
Inger Mollerup, Novo Nordisk A/S, Denmark

Chateau Whistler Resort, Whistler, British Columbia, Canada
23-28 May, 1999

Sunday, 23 May

Keynote Adress

Global Drug Development - What about the Future Risks, Regulations and Returns?
Stuart Walker, Centre for Medicines Research, UK

Monday, 24 May

First Steps

Session chairs

Jürgen Friedle, TosoHaas, GmbH, Germany
Edward Cole, Genzyme Corporation, USA

Expanded Bed Adsorption of Human Serum Albumin from Very Dense Yeast Suspensions or Sterilizable Fluoride Modified Zirconia
Michael Flickinger and Ashim Mullick, University of Minnesota, USA

Clarification of Yeast Lysates: Evaluation of Various Membrane Technologies
Shishir Gadam, W. Manger, R. Mesquita-Fuentes, K. Odom, M. Kosinski and A. Lee, Merck & Co., Inc., USA

Controlled Protein Crystallisation from Clarified and Concentrated Fermentation Broths
Carsten Jacobsen, Novo Nordisk, Denmark and Mike Hoare, University College London, UK

Ultrafiltration of 6000 l/h Antibiotic Fermentation Broth
Ole Jentoft Olsen, Ib Rasmussen and Jorgen Nielsen, DSS Danish Separation Systems, Denmark

Chemical Reactions - Intended and not

Session Chairs

Steven Cramer, Rensselaer Polytechnic Institute, USA
Charles Olson, Bayer Corporation, USA

Dream on - an Affinity System Without Cleavage Problems
Georges Belfort, David W. Wood, Victoria Derbyshire, Wei Wu and Marlene Belfort, Rensselaer Polytechnic Institute, USA

Purification of Human TNF (hTNF) and Human Growth Hormone (hGH) by Aminopeptidase Cleavage of Polyhistidine Tagged Precursors Purified by IMAC on Conventional or Expanded Beds
John Pedersen, Conni Lauritzen and S0ren Weis Dahl, Unizyme Laboratories, Denmark

Processing and Protein Engineering Considerations for Use of Canola for Recombinant Protein Production
Charles E. Glatz, Chenming Zhang, Yun Bai and Zivko L. Nikolov, Iowa State University, USA

Dealing with Real and Potential Infectious Agents

Session Chairs

Leonard Hayflick, University of California San Francisco, USA
Dane Zabriskie, Biogen, Inc., USA

Viral Safety Evaluation of Biotechnology Products Derived from Cell Lines of Human or Animal Origin: ICH viral Safety Guideline
Takao Hayakawa, National Institute of Health Services, Japan

Application of Microwave Technology for Virus Inactivation in Biopharmaceutical Products
Joachim Walter, Boehringer Ingelheim Pharma KB, Germany

Control of Adventitious Agents in Biopharmaceutical Manufacturing: Testing vs. Process Validation
Arindam Bose and Sam Guhan, Pfizer Central Research, USA

Tuesday, 25 May

Bioseparations at the Molecular Level

Session Chairs

Milton Hearn, Monash University, Australia
Abraham Lenhoff, University of Delaware, USA

New Affinity Adsorbents for the Purification of Glycosylated Biopharmaceuticals
Chris R. Lowe and Uma D. Palanisamy, University of Cambridge, UK

Affinity Purification of Proteins Using Ligands Deduced from Combinatorial Peptide Libraries
Ruben Carbonell, North Carolina State University, USA

Development of an Affinity Ligand for Purification of a Recombinant Protein Using Phage Display
Brian Kelley, James Booth, Suresh Vunnum, Molly Tannatt, Richard Trevino, Richard Wright, Priscilla Jennings and Jeff Deetz, Genetics Institute, Jinan Yu, Daniel Potter and Tom Ransohoff, Dyax Corporation, USA

The Structural Impact of Bioseparation Operations on Target Proteins
Todd Przybycien, Carnegie Mellon University, Samir Sane, Elyse Shapiro and Steven Cramer, Rensselaer Polytechnic Institute, USA

Purification Methods: Alternatives to Chromatography

Session chairs
Howard Chase, University of Cambridge, UK
Jill Myers, Biogen, Inc., USA

Nucleation Control Self-Nucleating Bulk Protein Crystallisers
Michael R. Johns, Sean M. Dalziel and Edward T. White, University of Brisbane, Australia

Dean Vortices in Cross Flow Filtration from Laboratory to Manufacturing scale
Ralf Kuriyel, S. Dzengeleski, G. Belford, D. Kinzlmaier and S. Pearl, Millipore Corporation, USA

Selective Recovery of Nanoparticle Bioproducts from Cell Culture Extracts: Relevance to the Upscale Manufacture of Genetherapy Vectors Cell Culture
Andrew Lyddiatt, Genevieve Braas and Simon G. Walker, University of Birmingham, UK

Process Design, Simulation and Economics

Session chairs
Nigel Titchener-Hooker, University College London, UK
Scott Wheelwright, Calydon, Inc., USA

Accelerating the Commercialization of New Biotechnology Products - the Challenges of the Interfaces
Andrew Russell, Eli Lilly & Co., USA

A Fully Automated Small Scale Model of a Pilot Scale Purification Process for Recombinant Hemoglobin
Richard Blackmore and T. K. Belval, Baxter Hemoglobin Therapeutics, USA

Economic Modelling as a Tool for Development of Biopharmaceutical Processes
Aria Tavana, Biogen, Inc., USA

Optimization for Economical Separation of Biological Products
Zhi-Guo Su, National Key Laboratory of Biochemical Engineering, China

Wednesday, May 26

Chromatography

Session chairs
Ann Lee, Merck & Co., Inc., USA
Jörg Thömmes, University of Düsseldorf, Germany

Scanning Confocal Microscopy as a Probe of Mechanisms of Coupled Diffusion and Adsorption in Protein Ion-exchange Chromatography
S. R. Dziennik and Abraham Lenhoff, University of Delaware, USA

The Use of Modeling for Displacer Design and Comparision of the Performance of Chromatographic Materials
Steven Cramer, Venkatesh Natarajan, Abhinav Shukla, Khurram Sunasara and Sanchayita Ghose, Rensselaer Polytechnic Institute, USA

Use of Thiophilic Resins in the Purification of Monoclonal IgG
Alex Schwarz, Patrick Birch and Anna Nepomich, Nextran, Inc., USA

Engineering Challenges in the Large Scale Purification of HSA Using SMB Technology
Luuk A.M. van der Wielen, J. Houwing, L. Jacobs, H. A. H. Billiet and J. Pronk, Delft University of Technology, The Netherlands

Coping with the Output from Genomics

Session Chairs
Steven Chamow, Scios, Inc., USA
Joachim Walter, Boehringer Ingelheim Pharma KG, Germany

Affinity Purification of Proteins
Milton Hearn, Jiang Wei, Bim Graham and Rachel Daly, Monash University, and Leon Spiccia, Monash University Clayton, Australia

Strategies for Expressing, Isolating and Characterizing Novel Recombinant Proteins Identified Through Database Mining
Karen de Jongh, Linh Phan, Pam Shea and Anitra Wolf, Zymogenetics, Inc., USA

High Throughput Affinity Purification of Unknown Gene Products Expressed in S. Cerevisae
Alois Jungbauer, University of Agriculture, Forestry & Biotechnology, Austria

Thursday, 27 May

Industrial Case Studies

Session Chairs
John Curling, John Curling Consulting AB, Sweden
Helmut Sassenfeld, Immunex Corporation, USA

From Harvest to Purification: A Case Study in Process Integration and Direct Cost Analysis.
Joanne Beck, Darrell Lewis-Sandy, Randy Steinbrink, Brian Williamson and Ache Stockelman, Amgen, Inc., USA

Productions of a Monoclonal Antibody Conjugate Bioprocessing Challenges
Gary Forrest and P. David Robbins, Wyeth-Ayerst Research, USA

Rational Development of a Second Generation Production Process for Recombinant Human Interleukin-2
Brent Pollock, Anthony Hawrylechko, Pierre Dubord, A. Abdul-Wajid, Sandra Poole, Chris Knaack, Fred Jacobs and Mark Young, Biomira Inc., Canada

Purification and Characterization of Human Anti-TNF from the Milk of Transgenic Goats
Brian G. Turner, BASF Bioresearch Corporation, USA

Extraction and Purification Proteins from Transgenic Plants
Vikram Paradkar, Brad Garcia and Douglas Russell, Monsanto Company, USA

Optimization of E. Coli Inclusion Body Solubilization and Refold Process
Eleonor L. Scheider, Gordon D. Lew and Ronald O. Gillespie, Immunex Corporation, and Steve Waught, ICOS Corporation, USA

Design and Development of Ligands for Affinity Purification of rFVIIa
Inger Mollerup and Jesper Christensen, Novo Nordisk A/S, Denmark, Chris R. Lowe, Kenny Sproule and Paul Morrill, Institute of Biotechnology, Steve Burton, Jim Pearson and Tad Podgorski, ACL, UK

Workshop Sessions

Inter-Company Development Issues

Session Chairs
Jeff Baker, Eli Lilly & Co, USA
Duncan Low, Millipore Corporation, USA

The What, Why and When of Outsourcing
Duncan Low, Millipore Corporation, USA

Managing Technology Transfer
Kirk Hayenga, Covance Biotechnology Services, USA

Some Considerations Prior to Outsourcing Process Development or Manufacturing
Helmut Sassenfeld, Immunex Corporation, USA

Leveraging Biotech Skills for Non-Biological Products/Purposes

Session Chairs
Ken Taksen, Pfizer, Inc., USA
Sam Guhan, Pfizer, Inc., USA

Modelling Chromatographic Processes

Improved HETP Recovery in Diagonally Eluted Preparative Columns
Andrew Alaska, ProMetic Biosciences, Inc., USA

Modelling, Simulation and Optimization of Chromatographic Processes for Protein Purification
Juan Asenjo, C. Garrido, G. Olivares, B. A. Andrews, University of Chile, Chile

Dynamic Binding Capacity Model for a Protein A Resin
Harish Iyer, John Hanson, IDEC Pharmaceuticals Corporation, USA

Process Design in Expanded Bed Adsorption Starting from Real Fermentation Broth
Jan Feuser, J. Thömmes, A Karau, J. Walter, Boehringer Ingelheim Pharma KG and M. -R. Kula, Heinrich-Heine University, Germany

Modelling of Heparin Affinity Chromatographic Purification of rh-bFGF from an E. Coli High Density Cultivation
Gunnar Garke, W. -D. Deckwer, F.B. Anspach, Gesellschaft für Biotechnologische Forschung, Germany

Optimization of Gradient Elution Chromatography of Proteins by Short-Cut Methods
Shuichi Yamamoto, Yamaguchi University, Japan

Crystallisation

Novel Methods to Induce Nucleation and Crystal Growth
Allan Myerson, B. Garetz, A. Izmailov and A. Ulman, Polytechnic University, USA

Effect of Impurities on the Change in the Aspartic Acid Crystals
Tetsuya Kawakita, Ajinomoto Co., Inc., Japan

A Rational Approach to the Batch Production of Cross-linked Enzyme Crystals for Large Scale Biocatalysis
Jeetendra Vaghjiani, T. S. Lee, G. J. Lye and M. K. Turner, University College London, UK

The Effects of Temperature on Protein Crystallization
Meng Heng, Genencor International, Inc., uSa

New Chromatographic Media

Small, Non-porous Particles for Fluidised Bed Adsorption of Proteins
Simon Burton, University of Birmingham, UK

Magnetic Particle-based Protease Removal Using High Gradient Magnetic Separation Technology
Jürgen Hubbuch, Owen R. T. Thomas, Technical University of Denmark, Denmark

The Application of Zeolites in Downstream Processing of Biotechnological Products
Andreas Karau, ZW Wolfgang, H. Beste, A. Preuß, S. Stockhammer and W. Treffenfeldt, Degussa AG, Germany

Very High Density Matrices for Improved Dynamic Capacity and Productivity in Expanded Bed Adsorption
Morten Olander and Allan Lihme, Upfront Chromatography A/S, Denmark

Performance Evaluation of Zirconium Oxide Based Adsorbents for the Fluidized-Bed Capture of Mab
Nicolas Voute, Pierre Girot and Luc Guerrier, Biosepra, France

Process Economics and Modelling

Financially Based Modeling of Biomolecule Recovery Process Alternatives
Steven Baker, Scios Inc., USA

Optimization of Protein A chromatography Using Real-time Process Control and Process Modelling
Gregory Blank and R. Fahrner, Genentech, Inc., USA

Process Economic Aspects of RPC Purifications
Marlin Kinzey, M. Kraus, J. Fisher, J. Maikner and R. Rosen, Rohm & Haas, USA

How to Impact the Product Development Timeline Using Powerful Purification Tools
Rebecca Menapace, Gary McNeil and Tom Ransohoff, Dyax Corporation, USA

Application of Process Simulation Software to a Vaccine Manufacturing Process
Teri Shanklin and Mark R. Marten, University Maryland Baltimore, Keith Roper and P. K. Yegneswaran, Merck & Co., USA

Throughput Analysis, Debottlenecking and Economic Evaluation of Integrated Biochemical Process
Demetri Petrides, Intelligen, Inc., USA

Keynote Adress

Paradigm Lost
Frank Ollington, Genzyme Corporation, USA

Friday, 28 May

Making and Managing Process Changes

Session chairs
Robert Bridenbaugh, Megabios Corporation, USA
Stephen Drew, Merck & Co., Inc., USA

Not Well Characterized Biologics: the Yin and the Yang
Stephen Drew and William Adams, Merck & Co., Inc., USA

Pre-approval and Post-Approval Process Changes in Avonex (Interferon beta-1a)
Jill Myers, Biogen, Inc., USA

Evolution in an Emerging field: Changes in the Production of Gene Therapy Vectors
Morrey Atkinson, Targeted Genetics Corporation, USA

Process Development: Regulatory Decision Making
Robert Yetter, CBER, FDA, USA

New Recombinant Feedstocks and Techniques

Session chairs
Charles Glatz, Iowa State University, USA
David Thatcher, Cobra Therapeutics Ltd., UK

Plasmid DNA Manufacture at the Hundred Gram Scale
Robert Bridenbaugh, Megabios Corporation, USA

Production and Recovery of Protein Products in Transgenic Milk
Scott Fulton, Genzyme Transgenics Corporation, USA

Purification and Characterization of Adenovirus type 5 vectors for Gene Therapy
Erno Pungor, Elisabeth Lehmberg, Mei Tan, Spencer Tse, Maria Parkman, Joseph A. Traina, Michael T. McCaman, Pete Murakami and Eirik Nestaas, Berlex Laboratories, Inc., John A. Chakel and William S. Hancock, HP Laboratories, USA

Poster Sessions

Session chair
Maria-Regina Kula, Heinrich-Heine University, Germany

Ceramic Hydroxyapatite as a Polishing Step for Monoclonal Antibody Purification
Zafeer Ahmad, SmithKline Beecham, USA

Characterisation, Purification and Process Considerations of Cryophilic Proteases of Marine Origin
Barbara Andrews, M Salamanca, C. Barria, M. Mancilla and J.A. Asenjo, University of Chile, Chile, and M. Thaysen, Technical University of Denmark, Denmark

Transmission of Brain-Derived Neurotrophic Factor during Dean Vortexmicrofiltration of E.Coli Lysate Suspensions
Georges Belfort and Maarten Schutyser, Rensselaer Polytechnic Institute, Randall Rupp and Janusz Wideman, Regeneron Pharmaceuticals, Inc., USA

Evaluation of Novel Affinity Chromatography Ligands by Solid Phase Screening and Surface Plasmon Resonance
Annika Bergenstrahle and Yasuro Shinohara, Amersham Pharmacia Biotech AB, Sweden, Lakshmi Saraswat and Larry Hardy, ArQule Inc., USA

Qualifying an Alternative Ion Exchange Medium for Use in a Validated Manufacturing Process
Marc Better and Patrick Gavit, Xoma Corporation, USA

Rapid and Scalable Purification Process of Plasmids for Gene Therapy
Rama Bhikhabhai, Amersham Pharmacia Biotech, Sweden, M. Olliver and F. Blance, RPR Gencell, France

Hydrophobic Charge Induction Chromatography and Application to the Separation of Antibodies
Egisto Boschetti, Luc Guerrier, Biosepra, France

The Laboratory Mimicking of High Speed Industrial Centrifuges for the Recovery of Labile Biomaterials
Michael Boychyn, J. Maybury and M. Hoare, University College London, M. Bulmer and J. More, Bio Products Laboratory, UK

Virus Removal by Membrane based Filtration Systems
Harvey Brandwein and H. Aranha-Creado, Pall Corporation, USA

The Combination of Chromatography Reuse Validation and Characterization Studies Using Fractional Factorial Design
Timothy Breece and Charles Schmelzer, Genentech, USA

In-Bed Sampling during Expanded Bed Adsorption
Lynda Bruce, R. H. Clemmitt, H. A. Chase, University of Cambridge, UK

Annular Chromatograpy - a Method of Continuous Separation of Plasma Proteins
Andrea Buchacher, Gerhard Gruber, Horst Schwinn and Djuro Josic, Octapharma Pharmazeutika Produktionsges m.b.H., Austria

Development and Applications of Synthetic Ligand Affinity Adsorbents
Steven Burton, ProMetic BioSciences Inc., UK

Comparison of Different Types of Affinity Ligands for the Purification of Coagulation Factor Vila
Jesper Christensen and Inger Mollerup, Novo Nordisk A/S, Denmark, Chris Lowe, Paul Morrill and Kenny Sproule, University of Cambridge, Steve Burton, Jim Pearson and Tad Podgorski, ProMetic Biosciences, UK, Alois Jungbauer and Karin Amatschek, University of Agricultural Sciences Vienna, Austria

Cell Detachment in a Process for Positive Cell Selection
Clark K. Colton, Chase Orsello and Doug Lauffenberger, Massachusetts Institute of Technology, USA

Process Design for the Production of Recombinant Proteins in Transgenic Plants
Charles L. Cooney, Steve Griffiths, Tom Ransohoff and May Sun, Massachusetts Institute of Technology, USA

Analysis of the Thermal Stability of Plasma Proteins using Differential Scanning Calorimetry (DSC)
Germano Coppola, P. Gomme, P. Thomas, G. Bervanakis, J. Bertolini and N. Goss, CSL Bioplasma, Australia

Low Molecular Weight Displacers for Ion-Exchange and Hydrophobic Systems: Design and Application for Bioprocessing
Steven Cramer, Abhinav Shukla and Khurram Sunasara, Rensselaer Polytechnic Institute, USA

Large Scale Membrane Adsorbers
Wolfgang Demmer and Dietmar Nussbaumer, Sartorius AG, Germany

Automation of Process-Monitoring Assays
Pete DePhilips, Jacob Jaffe, James Lee and Robert Sitrin, Merck & Company, Inc., USA

Chromatographic Capture of Proteins from Milk
Mark Etzel and Heewon Yang, University of Wisconsin, Alisa D. Liten and Peter M. Moore, Amersham Pharmacia Biotech Inc., USA

Probing Conformational Changes during Protein Purification with Isotope Exchange
Erik Fernandez, Jennifer L. M. McNay, Scott A. Tobler and Stephen T. Chang, University of Virginia, USA

The Influence of Biomass on the Fluidisation and Bed Stability in Expanded Bed Adsorption of Proteins
Marcelo Fernández-Lahore, University of Düsseldorf, R. Kleef, M. -R. Kula and J. Thömmes, Heinrich-Heine-University, Germany

Preparation and Characterization of a New High Capacity Process Chromatography Medium
Sam Franklin, J. -L. Liao, W. -K. Lam, L. Cummings, R. Frost, C. Ordunez, K. Talmadge, T. Tisch, H. Chen and L. Olech, Bio-Rad Laboratories, USA

Improved Methods for, and Fundamental Studies of Preparative-Scale Chromatofocusing of Proteins
Douglas Frey, University of Maryland, USA

Novel Protein Refolding Techniques by Reversed Micelles
Masahiro Goto and Shintaro Furusaki, Kyushu University, Japan

Protein Capture Using Expanded-Bed and Packed-Bed Adsorption Columns: Comparative Benefits within the Overall Process
Jean-Francois Hamel, M.A. Mena, G. Schneider, J. Ho, S. Lew, J. Gommeaux, S. Liang, J. A. MacKay, H. V. Le and D. Ting, Massachusetts Institute of Technology, and A. Liten, Amersham Pharmacia Biotech Inc., USA

Experimental Characterization of Dispersion and Resolution in Membrane Adsorbers
Gary Henricksen, Yujing Yang and Mae Wu-Weis, Pall Corporation, USA

Large-scale GMP Manufacture of Staphylococcus Enterotoxin B (SEB)
Roger Hinton, N. Allison, R. Brehm, S. Harrison, J. Richards, P. Ridgeway and S. Osbourne, Centre for Applied Microbiology & Research, UK

Protein Fractionation by Gradient Ammonium Sulfate Precipitation
James T. Hsu, Lehigh University, and Yoichiro Ito, National Institutes of Health, uSa

Focusing Proteins without a pH Gradient
Cornelius Ivory and Zheng Huang, Washington State University, USA

A Stabilised non BSA-binding, HSA-binding Affinity ligand
Hans J. Johansson and Y. Shinohara, Amersham Pharmacia Biotech, S. Hober, M. Linhult, S. Gülich and M. Ulvhen, Royal Institute of Technology, Sweden

New, Monosized, Polymer Based Reversed Phase Chromatography Media for Preparative Purification of Biomolecules
Annika Karlsson, M. F. L0fsgaard, B. Forsberg and R. T. Kallstad, Amersham Pharmacia Biotech, Sweden

Engineered Factor X Fusions to Facilitate Production, Activation, Immobilization and Stability
Douglas Kilburn, M. M. Guarna, E. M. Kwan, A. B. Boraston and R. A. J. Warren, The University of British Columbia, Canada

Purification of a Synthetic Oligonucleotide with Polymeric Reversed Phase Resins
Michael Kraus, TosoHaas GmbH, Germany, J. R. Fisher, J. K. O'Donnel, R. E. Rosen, S. J. Iuliano, R. A. Picciotti and A. E. Pressley, TosoHaas, USA

Partitioning of Native and Unfolded Proteins in Aqueous Two-Phase System
Maria-Regina Kula, C. Rämsch, L. Kleinelanghorst, E. Knieps and J. Thömmes, Heinrich-Heine-University, Germany

Gaulin Homogenization: A Mechanistic Study
Russel Lander, W. Manger, M. Kosinski and A. Lee, Merck and Co., Inc., USA

Relation of Protein Structure to Interactions in Solution: Implications for Separations, Crystallization and Genomics
Abraham M. Lenhoff, R. C. Chang and D. Asthagiri, University of Delaware, USA

Investigation of Cell Separation Strategies in Pilot Scale: Continuous Centrifugation versus Expanded Bed Chromatography
Dirk Lütkemeyer, Hermann Tebbe, Steves Schmidt, Nicole Ameskamp and Jürgen Lehmann, University of Bielefeld, Germany

Affinity Chromatography - Process Scale Suitability and Media Optimization
John Maclennan, D. Potter and T. Ransohoff, Dyax Corp., USA

A Commercial Application of EBA in a Veterinary Pharmaceutical Production Development of Recombinant Epidermal Growth Factor Production Process Using Bacillus brevis
Akira Myiauchi and Hiroaki Takagi, Higeta Shoyu Co., Ltd., Japan

A Surface Plasmon Resonance Biosensor for Monitoring the Secretion of MI3 during the Bioprocessing of Insulin
Paul Morrill, Darrin M. Disley, Kenneth Sproule and Chrispher R. Lowe, Institute of Biotechnology, UK

Efficient and Robust Manufacturing of DNA for Gene Therapy and Vaccination
Markus Müller, Martin Schleef, Ruth Baier, Peter Moritz, Torsten Schmidt, Joachim Schorr and Martin Schleef, Qiagen GmbH, Germany

Design and Development of Peptide Epitopes and Mimotopes as Ligands for the Purification of Monoclonal Antibodies and Recombinant Antibody Fragments
Andrea Murray, R. G. Smith, K. Bradey, D. A. O'Sullivan and M. R. Price, Cancer Research Laboratories, University of Nottingham, UK

Practical Preparation of K-252a from a Fermentation Solution
Satoru Nagamura, Mitsutaka Kino, Kenzo Shono and Tetsuo Nishimura, Kyowa Hakko Kogyo Co., Ltd., Japan

Evaluation of Gel Permeation Chromatography at Large Technical Scale
Ralf Nendza, Amersham Pharmacia Biotech Europe GmbH, Joachim Walter and Monika Wislicenus, Boehringer Ingelheim, Germany

Purification of Me2+-binding proteins from milk by Expanded Bed Chromatography
Wim Noppe, Ignace Hanssens and Marcel DeCuyper, Katholieke Universiteit Leuven, Belgium

Improved Quality of Biopharmaceutical Proteins: Comparison of Expanded Bed Adsorption and Conventinal Capture
Franz Nothelfer and Joachim K. Walter, Boehringer Ingelheim Pharma KG, Germany

From Phage to Functional Affinity Ligand: Application of Combinatorics to Industrial Biorecovery
Deirdre O'Sullivan and Andrew Lyddiatt, University of Birmingham, UK

Scale-Down as a Tool for Process Synthesis in the Initial Stages of Protein Recovery from the Milk of Transgenic Animals
Lars Pampel, Peter Dunnill and Nigel J. Titchener-Hooker, University College London, and Mike Udell, PPL Therapeutics, UK

Complete Removal of N-Terminal Histidine Tags from Recombinant Proteins Using Engineered Aminopeptidases.
John Pedersen, Henrik Rasmussen, Conni Lauritzen and S0ren W. Dahl, Unizyme Laboratories, Denmark

Fast Separation of Small Molecules on Convective Interaction Media (CIM) supports
Ales Podgornik, Milos Barut, Janez Jancar, Ales Strancar and Tatiana Tennikova, BIA Separations d.o.o., Slovenia

Analysis and Use of Endogenous Nuclease Activities in Escherichia coli Lysates during the Primary Isolation of Plasmids for Gene Therapy
Duarte Miguel Prazeres, G. A. Monteiro, G. N. M. Ferreira and J. M. S. Cabral, Instituto Superior Tecnico, Portugal

Separation of Proteins by Preparative Continuous Annular Chromatography (P-CaC) with On-line UV-Monitoring
Adalbert Prior and J- Wolfgang, Prior Separation Technology, Austria, and O. Wolfbeis, University of Regensburg, Germany

Precipitation of Polysaccharides - Role of Electrostatic and Hydration Forces
Hari Pujar, Marshall Gayton and Ann Lee, Merck & Co., USA

Improved Inclusion Body Purification Using A Novel Polymeric Reversed Phase Material
Paul Ramage, Guy Benn, Rene Hemmig and Bernard Mathis, Novartis, Switzerland

Automation in a cGMP Pilot Plant: To be or not to be?
R. Andrew Ramelmeier, Timothy Kratzer and Douglas Seifert, Merck Research Laboratories, USA

Synthesis and Optimization of a Support for Immunoselection of Stem Cells
Jerald K. Rasmussen and Patrick L. Coleman, 3M, USA
Recovery of Aroma Compounds Produced by Micellial Culture Exploiting Aqueous Two-Phase Systems
Marco Rito-Palomares, Alejandro Negrete, Leobardo Serrano and Enrique Galindo, Centro de Biotecnología, Mexico

Production of Site-Specific MonoPEGylated Therapeutic Proteins. Issues Encountered in the Production of a 20 kDa PEG-linked Protein Dimer
Jim Seely and Carl Richey, Amgen Colorado, USA

Recovery and Purification of Recombinant Human Endostatin from Pichia pastoris
Joseph Shiloach, Beth Kaufman and Loc Trinh, NIH, USA

Kinetic Reaction Engineering as a Tool for Optimization and Reproducible Production of Polyethylene Conjugated Proteins
Ali Siahpush, Mike Mills and Jeff Hogan, Amgen, USA

Latest Regulatory Issues Affecting Recovery of Biological Products
Gail Sofer, MA BioServices, USA

Protein Purification Comparison of Chromatographic Ion Exchange Gels
Arne Staby and Inge Holm Jensen, Novo Nordisk A/S, Denmark

RP-HPLC in the Manufacture of Recombinant Human B-type Natriuretic Peptide (rhBNP)
Peter A. Stathis, Douglas Buckley and Steven Chamow, Scios Inc., and Norbert Palma, Biochemie GmbH, Austria

Rapid Protease Variant Purification and Scale-Up using Novel Hydrophobic Charge Induction (HCI) Chromatography
Landon Steele and Meng Heng, Genencor International, Inc., USA

Large Scale Production of Plasmid DNA for Non Viral Gene Therapy
David Thatcher, J. A. J. Hanak, A. G. Hitchcock, D. L. Varley, A. M. E. Weiss, W. A. Horler, G. Riley, R. Coweel, L. Peddie and G. S. Sharpe, Cobra Therapeutics Ltd., UK

Visualising Intraparticle Protein Transport in Porous Adsorbents by Confocal Microscopy
Jörg Thömmes, Thomas Linden and Anders Ljunglöf, Heinrich-Heine University of Düsseldorf, Germany

A Novel Method for Stabilization of Protein Domains
Mathias Uhlén, S. Hober, M. Linhult and S. Gülich, Royal Institute of Technology, Y. Shinohara and H. J. Johansson, Amersham Pharmacia Biotech, Sweden

Affinity Ligand Engineering Using Combinatorial Protein Chemistry
Mathias Uhlén, Per-Åke Nygren, Karin Nord, Elin Gunneriusson, Jenny Ringdahl, Sophia Hober, Stefan Ståhl and Marianne Hansson, Royal Institute of Technology, Sweden

Continuous Separation of Proteins by Annular Chromatography: Continuous Regeneration of DNA-Impurities
Andrea Uretschlager and Alois Jungbauer, Institute for Applied Microbiology, Austria

Pharmaceutical Production of Recombinant Human Acid a-glucosidase in the Milk of Transgenic Rabbits
Emile J. J. M. van Corven, Pharming, The Netherlands

Protein Purification using High Performance Tangential Flow Filtration
Robert van Reis, Jeffrey M. Brake, Ralf Kuriyel, John Charkoudian, Douglas B. Burns and Andrew L. Zydney, Genentech Inc., USA

Use of a Statistically Designed Set of Experiments for Both Development and Characterization of an Ion-Exchange Purification Step
William K. Wang, Eileen Wilson, Richard D. J. Chen, Alan R. Gardner, John C. Erickson, Paula J. Shadle and Paul R. McAllister, SmithKline Beecham Pharmaceuticals, USA

Plasmid and RNA Separations Using Compaction Agents
Richard Willson, J. Murphy and G. Fox, University of Houston, USA

Scale Down Study on a Novel Expanded Bed Adsorption Column
Elias Zafirakos and Allan Lihme, UpFront Chromatography A/S, Denmark

Expanded Bed Affinity Chromatography can be used to Purify Antibodies and Antibody Fragments from Mammalian or Bacterial Cell Systems
Gerardo Zapata, Robert Fahrner, Walter Galan, Brian Wagner and Greg Blank, Genentech, Inc., Inger Lagerlund, Amersham Pharmacia Biotech, Sweden

Study on Neutral Complex and Synergistic Extraction Systems for Macrolide Antibiotics
Li Zhou, Qin Feng, Baohao, Gu Xueqing and Dai Lingmei, Tsinghua University, People's Republic of China

High Resolution Size Exclusion Chromatography
Andrew Zydney and Manoj Menon, University of Delaware, Robert van Reis, Adeyma Arroyo, Genentech Inc., USA, Ingela Blomqvist, Christer Nilsson and Inger Lagerlund, Amersham Pharmacia Biotech, Sweden