Mass Spec 2024: Practical Applications of Mass Spectrometry in the Biotechnology Industry

Schedule

Tuesday, 10 September, 2024

07:00-08:30 Lower Level Registration

Registration for Mass Spec Short Course Only

Registration for Short Course and Exhibitors only. Registration will close at 15:00. Registration will be located on the Lower Level.

07:30-08:30 Linden Oak

Rise and Dine: Breakfast for Mass Spec Short Course

Enjoy breakfast, coffee, and networking before the short course!

08:30-12:00 Linden Oak

Short Course Session I: Fundamentals of Mass Spectrometry in the Analysis of Protein Therapeutics

Chris Chumsae
Short Course

Session Chair: Chris Chumsae, *Bristol-Myers Squibb Company*

This introductory course will provide an overview of the fundamentals of Mass Spectrometry, including the history of Mass Spectrometry, terminology, data interpretation and sample handling. We will include a discussion on modes of operation (parent versus fragment ion analysis), components of a current MS system, and selected applications of Mass Spec as it applies to protein analysis in the biotechnology industry. A discussion on software (basic interpretation and operation) will be presented along with a hardware discussion (strengths for various applications). A limited discussion on small molecule analysis will be presented.

12:00-13:00 Linden Oak

Mass Spec Munchtime

A variety of boxed lunches will be served. Take this time to eat lunch and reflect on morning session learnings and takeaways.

13:00-16:30 Linden Oak

Short Course Session II: Applications of Mass Spectrometry to Characterize Biotherapeutics

Andrew Mahan, Richard Rogers
Short Course

Session Chairs: Andrew Mahan, *Johnson & Johnson Innovative Medicine* and Richard Rogers, *Umoja Biopharma*

The afternoon session will focus on practical industrial uses of Mass Spectrometry in the analysis of protein therapeutics as well as in Cell and Gene Therapy. The specific topics will be Intact Mass Analysis, Structural MS, Host Cell Protein ID and Peptide Mapping and Multi-Attribute Method and protein post translational modifications: detection and quantitation. The discussions will be driven by industry leaders. Two interactive segments will cover live data analysis demos of both Intact and Reduced Mass Analysis as well as Peptide Mapping Data Analysis in variety of vendors software products. This course will review the role MS has in newer therapeutic modalities such as multi-specific, antibody-drug conjugates, cell and gene therapy (AAV, oligonucleotides). Additionally, there will be sections covering mass spec techniques which evaluate protein structure such as hydroxy radical foot-printing, cross-linking, hydrogen-deuterium exchange, top down and middle down methods and ion mobility. The increasing use of Native MS in the analysis if mis-paired Multispecifics as well as investigation of non-covalent interaction will be covered. The 2nd part of the afternoon session focuses on Multi-Attribute Method (MAM), MS in QC, PTM quantitation as well as Sequence Variant Analysis and the role of MS in Cell Line Selection.

Wednesday, 11 September, 2024

07:30-08:30 Foyer E-H

Registration for Mass Spec 2024 & HOS 2024

Registration will close at 17:00

07:30-08:30 Salon E

Rise & Dine: Breakfast

Start the day off right with breakfast and coffee.
Breakfast will be served until 09:00am Eastern

08:30-08:45 Salon F-H

CASSS Welcome & Mass Spec Introductory Comments

Frances Namuswe

Session Chair: Frances Namuswe, *CDER, FDA*

08:45-09:45 Salon F-H

Keynote I: Integration of Mass Spectrometry into ADC Release and Stability Method Development and Process-to-Product Characterization

Frances Namuswe
Keynote Presentation

Session Chair: Frances Namuswe, *CDER, FDA*

Keynote Speaker: John Valliere-Douglass, *Pfizer, Inc.*

John Valliere-Douglass is a Senior Director of Analytical Sciences at Pfizer. John received a B.Sc. degree in Biochemistry from Western WA University in 1997 and has worked in the biotechnology industry for 27 years in various roles involving the use of mass spectrometry for antigen discovery and biotherapeutic protein characterization. In 2011, John became the mass spectrometry core group leader at Seagen (now Pfizer) where he built a team of scientists that focused on advancing ADC characterization and providing high-throughput process-analytical support with mass spectrometry. In 2022, John became the head of Analytical Sciences where he continues to oversee release and stability method development and further integration of mass spectrometry into early development and characterization of ADCs. Over the course of his career, John has been involved with the CASSS-MS conference on the organizing committee and as a conference co-chair and has authored or co-authored more than 30 publications covering various aspects of protein, antibody and ADC characterization with mass spectrometry.

09:45-10:45 Salon E

Sip & See: Posters and Exhibits

Attendees are welcome to grab a cup of coffee, network and learn with their fellow attendees, and explore the exhibit hall.

Posters are located on the lower level in the Forest Glen room.

10:45-12:00 Salon F-H

Session I: Molecular Design, Developability and Biotransformation

Jason Rouse, Christopher Yu

Session Chairs: Jason Rouse, *Pfizer, Inc.* and Christopher Yu, *Genentech, a Member of the Roche Group*

Session Description:
Mass spectrometry (MS) plays a pivotal role in the earliest stages of biotherapeutics development with respect to molecular design, developability and biotransformation. First, LC-MS characterization of multiple, early constructs in the 'molecular design' phase confirms that the intended molecule with the full-length sequence and expected posttranslational modifications was indeed expressed by the cell line and isolated by the purification process. For candidate molecules, 'developability' encompasses both predictive and experimental measures of physicochemical properties (including pharmacokinetics [PK]), which collectively enable selection of the optimal construct for more straightforward early- and late-stage product and process development, as well as clinical development (accounting for clinical indication, dosage, and administration route). As part of developability, stability studies combined with LC-MS/MS and biological activity measurements allow for early elucidation of structure-function relationships, in addition to the identification of potential sequence liabilities for subsequent engineering. Lastly, 'biotransformation', as monitored by LC-MS/MS, provides insight on how the molecular structure may change during in vivo circulation (after administration) to cause either a gain or loss of function (and/or altered circulating half-life). Biotransformation of therapeutic glycoproteins can involve protease fragmentation, glycosidase re-modelling, and increased deamidation, isomerization, oxidation, and glycation, in addition to removal of particular isoforms by certain receptors.

Session Speakers:

Intact Mass Characterization of Multi-Specific Therapeutic Antibodies
Kalie Mix, *Sanofi*

Antibody A In Vitro Biotransformation/Succinimide Characterization in Human Plasma by Immunoaffinity Purification (IA) – LC-MS and LC-MS/MS
Mei Han, *Merck & Co., Inc.*

Immunocapture Based LC/MS Investigation of Different Glycoform Clearance of a Biotherapeutic mAb in Human Serum
Jayanta Kishor Chakrabarty, *Boehringer Ingelheim*

12:00-12:20 Salon E

Mini-Break: Grab Lunch for Technical Seminars

Please grab lunch from the Exhibit Hall in Salon E and return to Salon F-H for Technical Seminars.

12:20-12:50 Salon F-H

Lunch and Learn Technical Seminar presented by SCIEX

12:50-13:00 Salon F-H

Mini-Break

Short Break to transition speakers.

13:00-13:30 Salon F-H

Lunch and Learn Technical Seminar presented by GenNext Technologies, Inc.

13:30-13:45

Stretch Break

Take this time to stretch, grab a beverage or visit the exhibit hall as we refresh the general session room.

13:45-15:00 Salon F-H

Session II: Mass Spectrometry in Cell & Gene Therapy

Richard Rogers, Christopher Yu
Keynote Presentation

Session Chairs: : Rich Rogers, *Umoja Biopharma* and Chris Yu, *Genentech, A Member of the Roche Group*

Mass spectrometry (MS) has emerged as a powerful analytical tool in the field of cell and gene therapy. As these therapies continue to revolutionize medicine, understanding their complex processes and ensuring consistent product quality become critical objectives. In this session, we explore how MS-based analytical technologies are advancing our understanding and the manufacturing of cell and gene therapy drug products.
Session Speakers:

A Novel In-Vitro Expression LC/MS/MS Assay for mRNA Vaccine Characterization
Olga Friese, *Pfizer, Inc.*

Characterising Viral Vectors for Gene Therapy using Mass Spectrometry on Different Levels
Jonathan Bones, *NIBRT*

Enabling Biopharmaceutical Applications of Electrostatic Linear Ion Trap Charge Detection Mass Spectrometry (ELIT-CDMS)
Rebecca D'Esposito*, Waters Corporation*

15:00-15:45 Salon E

Sip & See: Posters and Exhibits

Attendees are welcome to grab a cup of coffee, network and learn with their fellow attendees, and explore the exhibit hall.

Posters are located on the lower level in the Forest Glen room.

15:45-17:25 Salon F-H

Session III: Joint MS/HOS Plenary Session: Mass Spec Technologies in HOS / Comprehensive Toolboxes for Complex Problems

Frances Namuswe

Session Chair: Frances Namuswe, *CDER, FDA*

Have a case study where mass spectrometry was used along with biophysical techniques or vice versa? Consider submitting your abstract to the joint CASSS MS and HOS session! For presentations at this session, the CASSS HOS and MS organizing committees are looking for examples of complimentary applications of various MS and HOS techniques to characterize complex systems and elucidate all types of structures. Bring your story of how HOS techniques and MS can solve challenging problems together!

Session Speakers:

Radical Protein Footprinting in Stabilized Whole Blood
Joshua Sharp, *University of Mississippi*

Characterization and Mechanistic Insights into the Formation of a mAb Hetero-Clipped Dimer
Joseph Valente, *Bristol-Myers Squibb Company*

Charge Detection Mass Spectrometry for Stoichometry and Assembly
Martin Jarrold, *Indiana University*
Advancements in Subzero Temperature Chromatography for HDX-MS
Kyle Anderson, *National Institute of Standards and Technology (NIST)*

17:25-19:00 Salon E

Mix & Mingle Joint Reception

Please join us for a joint Reception with the Higher Order Structure attendees.

Thursday, 12 September, 2024

07:30-08:30 Foyer E-H

Registration for Mass Spec and HOS

Registration will close at 17:00

07:30-08:30 Salon E

Rise & Dine: Breakfast

Breakfast will be available until 9:00.

08:30-09:30 Salon F-H

Diverse Voices: Breakfast Session

Diversity is not a *color.* It is who is represented in the workplace, research, and society. Examples include gender diversity, age diversity, ethnic diversity, physical ability and neurodiversity.
Equity: Fair treatment for *all people* resulting in equality. The unique circumstances of each person is considered, treatment is adjusted accordingly to ensure the end result is equal.
Inclusion: *How* the workforce experiences the workplace and to what degree organizations embrace *all* employees and enable them to make meaningful contributions. Inclusive cultures ensure that all voices are heard.

Session Speakers:

Penny Peterson, *Tolmar, Inc.*
Cynthia Ziwawo, *Indiana University*
Geoffrey Hutchinson, *University of Washington*
Olubukola Abiona, *NIH-Oxford*

09:30-10:15 Salon E

Sip and See: Posters & Exhibits

10:15-11:30 Salon F-H

Session IV: New Technologies, Approaches, and Methods

Ingo Lindner, Hillary Amber Schuessler

Session Chairs: Ingo Lindner, *Roche Diagnostics GmbH* and Hillary Schuessler, *Merck & Co., Inc.*

Session Speakers:

Advanced MS-based Technologies to Tackle Characterization Challenges of Complex Formats and New Modality Biotherapeutics
Feng Yang*, Genentech, A Member of the Roche Group*

High-throughput Screening Strategies to Characterize Protein Conjugation
Anumita Saha, *Merck & Co., Inc.*

Use of Multi-Attribute Methods for In-Process Monitoring and Quality Control of Complex Biologics
Anita Liu, *Merck & Co., Inc.*

11:30-11:50 Salon E

Mini-Break: Grab Lunch for Technical Seminars

Grab lunch from the Exhibit Hall in Salon E and return to Salon F-H for Technical Seminars

11:50-12:20 Salon F-H

Lunch and Learn Technical Seminar presented by Thermo Fisher Scientific

12:20-12:30 Salon F-H

Mini-Break

Short break to transition speakers.

12:30-13:00 Salon F-H

Lunch and Learn Technical Seminar presented by Agilent Technologies, Inc.

Session Speaker:

Strategies for Expedited Characterization of Higher Order Structure: Microdroplet Reactions Coupled to Ion Mobility with Collision Induced Unfolding and Electron Capture Dissociation.
Thomas Walker, *Agilent Technologies, Inc.*

13:00-14:15 Salon F-H

Session V: Multispecifics and ADCs Characterization

Chris Chumsae, Frances Namuswe

Session Chairs: Chris Chumsae, *Bristol-Myers Squibb Company* and Frances Namuswe, *CDER, FDA*

Session Speakers:

Glyco-Analysis of a Glycoengineered VHH-Radioligand Therapy Designed for Improved Biodistribution
David Bush, *Novartis*

Characterization of ADCs in Serum and Formulation Buffer
Tun Liu, *Johnson & Johnson*

Development of Novel Chromatographic and Mass Spectrometric Techniques for Characterizations of BsAbs and ADCs
Fengfei Ma, *Merck & Co., Inc.*

14:15-14:45 Salon E

Sip & See: Poster & Exhibits

14:45-15:45 Salon F-H

Session VI: Next Generation Investigator Awards

Richard Rogers, Sarah Rogstad

Session Chairs: Richard Rogers, *Umoja Biopharma* and Sarah Rogstad, *CDER, FDA*

Session Description:
The future of our field is heavily dependent on innovative science from new and upcoming researchers. The Next Generation Investigator (NGI) session will showcase the cutting edge work of three very talented early career scientists. We look forward to learning what these next generation investigators have been working on to advance applications mass spectrometry.

Session Speakes:

Proteoform Specific Microheterogeneity Assessment of Biopharmaceuticals Using a Modified Orbitrap Tribrid Mass Spectrometer
Corentin Beaumal, *NIBRT, National Institute for Bioprocessing Research*

Middle-down Approach Using Proton Transfer Charge Reduction Enables Unambiguous Drug-Payload Localization in Cys-linked Antibody Drug Conjugates
Linda Lieu, *University of Oklahoma*

A Novel Mass Spectrometry-Based Footprinting Method for RNA Higher Order Structure
Natashia Yang, *Washington University in St. Louis*

15:45-16:30 Salon F-H

Session VII: MS Trends in Regulatory Research, Review, and Standard

Frances Namuswe, Sarah Rogstad

Session Chairs: Sarah Rogstad, *CDER, FDA,* and Frances Namuswe, *CDER, FDA*

Panelists:

Jinhui Zhang, *CDER, FDA*
Trina Mouchahoir, *NIST,*
Michael Strader, *CBER, FDA*
Kevin Carrick, *US Pharmacopeia*

16:30-17:30 Strathmore A/B

Roundtable Session

Table 1 - New Mass Spec Methods to Tackle New Biotherapeutic Challenges
Table 2 - Best Practices for Elucidating Antibody Drug Conjugate Molecules by MS
Table 3 - Multi-Attribute Method (MAM) in Development vs. MAM in QC
Table 4 - Best Practices of Extended Characterization Mass Spec Methods
Table 5 - Mass Spec for Higher Order Structure in Biologics Development
Table 6 - Methodologies to Assess / Predict Formulation and In Vivo Stability of Novel Modalities
Table 7 - MS of RNA and Oligonucleotides: Characterization and Quantitation of PQAs
Table 8 - Timing and Frequency of Forced Degradation and Variant Characterization Studies
Table 9 - Best Practices for Predicting, Elucidating and Monitoring Hotspots by MS
Table 10 - Challenges and Obstacles to True Belonging in the Workplace

17:30-19:00 Salon E

Exhibitor Reception

Join our exhibitors in Salon E for our reception!

Friday, 13 September, 2024

07:30-08:30 Foyer E-H

Registration for Mass Spec

Registration will close at 14:00

07:30-08:30 Salon E

Rise & Dine: Breakfast

Breakfast is available until 9:00

Start the day off right with breakfast and coffee.

Today is the last day of Mass Spec 2024. Are you ready?

08:30-09:30 Salon F-H

Keynote II: Technology for Rapid Peptide Mapping with Direct Infusion Mass Spectrometry

Keynote Speaker: Joshua J. Coon, *University of Wisconsin-Madison*

Joshua J. Coon is a Professor of Chemistry and Biomolecular Chemistry at the University of Wisconsin-Madison and the Thomas and Margaret Pyle Chair at the Morgridge Institute for Research. Coon earned his B.S. degree at Central Michigan University and received his Ph.D. at the University of Florida in 2002. At Florida, Coon studied ambient ionization processes under the guidance of Professor Willard Harrison. From 2003 to 2005 he was an NIH postdoctoral fellow with Professor Donald Hunt at the University of Virginia. During his time at Virginia he, with Hunt and John Syka, coinvented electron transfer dissociation (ETD). Coon's research program at Wisconsin is focused on all aspects of biomolecular mass spectrometry.

09:30-10:30 Salon E

Sip & See: Posters & Exhibits

Attendees are welcome to grab a cup of coffee, network and learn with their fellow attendees, and explore the exhibit hall.

Posters are located on the lower level in the Forest Glen room.

10:30-11:45 Salon F-H

Session VIII: MAM for Product & Process Characterization & Quality Control

Ingo Lindner, Da Ren

Session Chairs: Ingo Linder, *Roche Diagnostics GmbH* and Da Ren, *BioTherapeutics Solutions*

Session Speakers:

USP Standards and Tools to Establish System Readiness and Facilitate Implementation of the Multi-Attribute Method
Sheila Mugabe, *US Pharmacopeia*

Development of LCMS MAM Methods for Protein and Oligonucleotide Therapies
Serena Wu, *Regeneron Pharmaceuticals, Inc.*

Towards the Global Approval of MAM Testing Strategy
Joseph Mulholland, *Johnson & Johnson*

11:45-12:00 Salon E

Mini Break: Grab Lunch for the Technical Seminar

Grab lunch on the way to the technical seminar.

12:00-12:25 Salon F-H

Lunch and Learn Technical Seminar presented by Waters Corporation

12:25-13:05 Salon F-H

Lunch

13:05-14:20 Salon F-H

Session IX: Multi-Omics in Process Development

Chris Chumsae, Andrew Mahan

Session Chairs: Chris Chumsae, *Bristol-Myers Squibb Company* and Andrew Mahan, *Johnson & Johnson Innovative Medicine*

Session Speakers:
Application of Multi-Omics Analysis to Enhance Upstream Bioprocessing Understanding
Amr Ali, *AbbVie*

Deep Proteomic Profiling of the CHO Cells Reveals Correlates of Runaway Lactate
Joshua Justice, *Johnson & Johnson*

Targeted Metabolomic Analysis of mAb producing CHO cells: Impact of Bioprocess Conditions on CHO Cell Metabolism and Lactate Runaway
Nandakumar Madayiputhiya, *Bristol-Myers Squibb Company*

14:20-14:35 Salon F-H

Mass Spec 2024 Poster Award

14:35-14:50 Salon F-H

Closing Comments & Invitation to Mass Spec 2025

Andrew Mahan