

## Analytical Techniques for Structural Characterization of Glycosaminoglycans

August 23-24, 2021

### Course Overview:

In this 2-day virtual course, participants will learn fundamental techniques for glycosaminoglycan (GAG) analysis via a combination of virtual demos, hands-on data interpretation, and lectures. Topics to be included are: Biological considerations of glycosaminoglycans, GAGs as biotherapeutics, isolation of GAGs from cells and tissue, and analysis of GAGs with chromatography, mass spectrometry, and NMR.

### Takeaways:

- Gain an introduction to glycosaminoglycans, including their status as potent biotherapeutics, and learn relevant analytical techniques
- Understand characterization techniques for GAG-based Drug Products, and GAG modification strategies
- Learn strategies to release, isolate, and analyze GAGs through a variety of methods including chromatography, mass spectrometry, plate assays, and NMR.
- Participants will experience hands-on data interpretation with provided example datasets.

### Preparation:

- This class is to be taken completely online
- We will provide a link to the platform on the day of the class
- This class requires a computer and strong internet connection
- Participants should be familiar with basic fundamentals of biochemical analysis.
- Access to Basic worksheet software (Excel, Google Sheets, Pages, etc)

## Instructors:



**Dr. Parastoo Azadi** - Dr. Parastoo Azadi received her B.Sc. in Chemistry in 1987 from University of North London, UK and her Ph.D. degree in Biochemistry in 1991 from Imperial College of Science and Technology, University of London, studying structural characterization of carbohydrates and glycoproteins by mass spectrometry under the supervision of Profs. A. Dell and H.R. Morris. Since 2001, Dr. Parastoo Azadi has been the Technical Director of Analytical Service and Training at the Complex Carbohydrate Research Center. The samples submitted for these types of analyses come from academic, government, non-profit organizations, and private companies throughout the United States and internationally.



**Dr. Christian Heiss** – Dr. Christian Heiss received his B.Sc. in Chemistry in 1991 from the University of Erlangen, Germany, and his Ph.D. in Organic Chemistry in 1999 from the University of Georgia. He serves as the Assistant Technical Director of Analytical Service and Training at the Complex Carbohydrate Center. He has written multiple papers on the analysis of carbohydrates, and established the expansion of the CCRC's analysis to glycosaminoglycans in 2006.



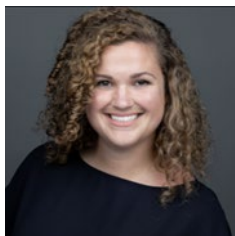
**Dr. Stephanie Archer-Hartmann** – Dr. Stephanie Archer-Hartmann received her B.Sc. in Chemistry in 2006 and her Ph.D. in Analytical Chemistry in 2012 from West Virginia University. She has spent more than 10 years working towards improvements for the analysis of carbohydrates, including the isolation, preparation, and analysis of glycosaminoglycans.



**Dr. Franklin Earl Leach** – Dr. Franklin Leach received his B.Sc. in Chemistry in 2001 from Mississippi State University, and his Ph.D. in Analytical Chemistry in 2011. He currently serves as an Assistant Professor at the CCRC.

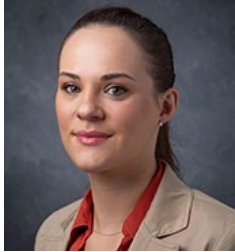


**Dr. Ryan Weiss** - Dr. Ryan Weiss received his B.S. in chemistry in 2008 at Point Loma Nazarene University in San Diego, CA. He then received his Ph.D. in chemistry in 2015 at the University of California, San Diego, under the supervision of Prof. Yitzhak Tor. He then moved to the Department of Cellular and Molecular Medicine at the University of California, San Diego, where he worked as a postdoctoral fellow in Prof. Jeffrey Esko's group. Dr. Weiss started his independent career as an assistant professor at the Complex Carbohydrate Research Center at the University of Georgia starting in January 2021. His current research interests include drug discovery and using genomic tools to understand the regulation of glycosylation in human diseases.



**Dr. Lauren Pepi** - Dr. Lauren Pepi received her B.A. (ACS certified) in Chemistry and Biology in 2015 from Assumption University (Worcester, MA) and her Ph.D. in Analytical Chemistry in 2020 from the University of Georgia under the direction of Dr. Jon Amster. Her Ph.D.

work focused on fundamental studies of tandem mass spectrometry of glycosaminoglycans. Lauren joined the Analytical Service and Training team at the end of 2020, where her research focuses on glycomic and glycoproteomic characterization of N- and O-glycans using mass spectrometry techniques. Lauren has experience using a wide range of mass spectrometers, including FT-ICR MS, Orbitrap MS, MALDI MS and Ion trap MS.



**Dr. Anne Gleinich** – Dr. Anne Gleinich received her M.Sc. equivalent in Biochemistry in 2014 from the Goethe University Frankfurt am Main, Germany, with a focus on Biophysical Chemistry. The Ph.D. in Medical Sciences – including extensive work via Surface Plasmon Resonance (SPR) technique – was conferred on her by the University of Warwick, United Kingdom, in 2019 and she joined the Analytical Service and Training at the Complex Carbohydrate Research Center in the same year. Her research centers around the glycomic and glycoproteomic characterization of N- and O-linked glycans using mass spectrometry techniques.

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## *Schedule*

### **Monday, August 23, 2021**

8:45 a.m. – 9:00 a.m.

Introduction and Welcome

Dr. Parastoo Azadi

9:00 a.m. – 10:00 a.m.

**Lecture** – “Analytical methods for the structural characterization of GAGs - Part 1”

Dr. Christian Heiss

10:00 a.m. – 11:00 a.m.

**Laboratory Discussion:** Isolation of GAGs from Tissue and Cells

Dr. Stephanie Archer-Hartmann

11:00 a.m. – 12:00 p.m.

**Lecture** – “Analytical methods for the structural characterization of GAGs - Part 2”

Dr. Christian Heiss

12:00 p.m. – 1:00 p.m. – **Lunch**

1:00 p.m. – 2:30 p.m.

**Laboratory Demos: Enzymatic Digestion Methods and Disaccharide Analysis**

- Enzymes and Digestion Protocols
- Introduction to SAX-HPLC
- Introductions to On- and Offline Labeling Protocols
- GAG Disaccharides – Data Analysis

Dr. Stephanie Archer-Hartmann

2:30 p.m. – 3:00 p.m.

Break

3:00 p.m. – 5:00 p.m.

Lecture – “Glycosaminoglycans in Biomedicine”

Dr. Ryan Weiss

**Tuesday, August 24, 2021**

8:45 a.m. – 9:00 a.m. - Zoom Room Opens

9:00 a.m. – 10:30 a.m.

**Lecture** – “Structural Analysis of GAGs by NMR”

Dr. Christian Heiss

10:30 a.m. – 11:00 a.m.

Break

11:00 a.m. – 12:00 p.m.

Lecture - Carbohydrates Drug Products and their Structures

Dr. Parastoo Azadi

12:00 p.m. – 1:00 p.m. – **Lunch**

1:00 p.m. – 2:30 p.m.

**Lecture** – “MS Analysis of GAGs”

Dr. Franklin Earl Leach

2:30 p.m. – 3:30 p.m.

**Laboratory Discussion: Characterization of GAGs by Size Exclusion Chromatography**

- SEC Basics
- Sample Protocol for GAG Separations
- Alt Protocol for Preparative GAG Separations
- Data Handling

Dr. Stephanie Archer-Hartmann

3:30 p.m. – 4:30 p.m.

Lecture - *Use of Surface Plasmon Resonance (SPR) to study protein – glycosaminoglycan interactions.*”

Dr. Anne Gleinich

4:30 p.m. – 5:00 p.m.

**Laboratory Discussion: Characterization Methods of GAG Drug Products and Low Molecular Weight Heparins**

Dr. Lauren Pepi