

Introduction to Glycomic and Glycoproteomic Analysis

August 10-12, 2020

Monday, August 10, 2020

8:45 a.m. - 9:00 a.m.

Introduction and Welcome

Dr. Parastoo Azadi

9:00 a.m. - 10:30 a.m.

Lecture –*“Overview of Glycoprotein Structures, Biosynthesis and Function”*

Dr. Kelley Moremen

10:30 a.m. - 10:45 a.m. -

Break

10:45 a.m. – 11:30 a.m.

Lecture –*“Introduction to Glycomics and Glycopeptide Analysis”*

Dr. Parastoo Azadi

11:30 a.m. – 12:00 p.m.

Lab Exercise Discussion – Glycomics

N-glycan and O-Glycan Release

Permethylation

Dr. Asif Shajahan/Dr. Nitin Supekar

12:00 p.m. – 1:00 p.m. – Lunch

1:00 p.m. – 1:45 p.m.

Lab Exercise discussion – Glycopeptide Analysis and Glycoproteomics

Protease and Enzymatic Treatments

Chromatography and Instrument Settings

Data Considerations

Dr. Asif Shajahan/Dr. Nitin Supekar

2:00 p.m. – 3:30 p.m.

Lecture – *“Regulation of Notch Signaling with Glycosylation”*

Dr. Robert Haltiwanger

3:30 p.m. – 4:00 p.m.

Break

4:00 p.m. – 5:00 p.m.

Lecture – *“Glycans Linked to Lipids and Lipid Precursors”*

Dr. Michael Tiemeyer

Tuesday, August 11, 2020

8:45 a.m. – 9:00 a.m.

Morning Zoom Discussions

9:00 a.m. – 10:00 a.m.

Lecture – *“Introduction to Glycomics and Glycopeptide Analysis”*

Dr. Parastoo Azadi

10:00am – 10:30am

Break

10:30a.m.- 12:00 p.m.

Laboratory Demos: Glycomics Analysis by MALDI-TOF and ESI-MS

MALDI-TOF Profiling

Direct Infusion – Mass Spectrometry

MS/MS and MSn Methods

Laboratory – Glycomics Analysis by Mass-Spectrometry – Data Interpretation

Manual Interpretation

Glycoworkbench Software

Dr. Asif Shajahan/Dr. Nitin Supekar

12:00 p.m. – 1:00 p.m. – **LUNCH**

1:00 p.m. – 2:30 p.m.

Laboratory Demos: Glycopeptide and Glycoproteomics Analysis by LC-MS

MALDI-TOF of Glycopeptides
Chromatography Considerations
MS/MS and MSn Methods

Laboratory – Glycopeptide Analysis by Mass-Spectrometry – Data Interpretation

Databases - Uniprot, MS-Prospector, NetNGlyc, NetOGlyc
Manual Interpretation
Software Assisted Analysis

Dr. Asif Shajahan/Dr. Nitin Supekar

2:30 p.m. – 3:30 p.m.

Break/Zoom “Open Office”

3:30 p.m. – 5:00 p.m.

Lecture – *“Bacterial Glycoproteins”*

Dr. Christine Szymanski

Wednesday, August 12, 2020

8:45 a.m. – 9:00 a.m.

Morning Zoom Discussions

<Mass Spectrometry Module>

9:00 a.m. – 10:30 a.m.

Lecture – *“Glycomics & Glycoproteomics”*

Dr. Lance Wells

10:30 a.m. - 10:45 a.m.

Break

10:45 a.m. – 12:00 p.m.

Lecture – *“High Throughput Glycomics and Glycoproteomics with MicroPermethylation”*

Dr. Asif Shajahan

12:00 p.m. – 1:00 p.m. – **LUNCH**

<NMR Module>

1:00 a.m. – 3:00 p.m.

Lecture – *“Introduction to NMR of glycoproteins and carbohydrates”*

Dr. John Glushka

OR

<Molecular Modeling Module>

Lecture – *“Molecular Modeling”* (check for breakout options)

Dr. Lachele Foley

Instructors:



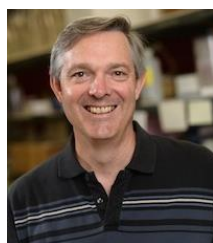
Dr. Parastoo Azadi - Dr. Parastoo Azadi received her B.Sc. in Chemistry in 1987 from University of North London, UK and her Ph.D. degree in biochemistry in 1991 from Imperial College of Science and Technology, University of London, studying structural characterization of carbohydrates and glycoproteins 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. Kelley Moremen - Dr. Moremen received his B.S. in Biology and Chemistry (1978) from Dickinson College and his Ph.D. in Molecular Biology (1984) from Vanderbilt University and a pursued postdoctoral training at the Massachusetts Institute of Technology. In 1991, Dr. Moremen joined the faculty of the Complex Carbohydrate Research Center at the University of Georgia where he is now Professor in the Department of Biochemistry and Molecular Biology. Dr.

Moremen has chaired the Glycobiology Gordon Research Conference, served as President, member of the Board of Directors, and Secretary of the Society for Glycobiology. He presently directs efforts on an NIH funded multi-investigator 'Resource for Integrated Glycotechnology', is a senior investigator on the NIH-funded 'National Center for Biomedical Glycomics', and is a lead Principal Investigator or Senior Investigator on eight additional grants from the NIH and Department of Energy. He has served on editorial boards of Journal of Biological Chemistry, Glycobiology, and Glycoconjugate Journal, numerous NIH grant review panels, and Scientific Advisory Boards of four biotech companies. In 2014 Dr. Moremen was appointed the Distinguished Research Professorship in Biochemistry and Molecular Biology at the University of Georgia and has a total of 10 patents and over 150 peer-reviewed publications. In 2018, he launched the biotech startup, Glyco Expression Technologies, Inc., that is located in the UGA Innovation Gateway.



Dr. Robert Haltiwanger - Dr. Haltiwanger received his B.S. in Biology (1980) and Ph.D. in Biochemistry (1986) from Duke University. He went on to do postdoctoral work at Johns Hopkins University School of Medicine, and took his first independent position as an Assistant Professor in the Department of Biochemistry and Cell Biology at Stony Brook University (1991). He rose through the ranks to full Professor and served as Chair of that Department for 8 years. He moved to the CCRC in 2015 as the GRA Eminent Scholar in Biomedical Glycosciences. He has served as President of the

Society for Glycobiology, Chair of the Glycobiology Gordon Conference, and currently serves as Editor-in-Chief of the journal *Glycobiology*.



Dr. Michael Tiemeyer - Dr. Tiemeyer received his B.A. in biology in 1982 and his Ph.D. in neuroscience in 1989 from The Johns Hopkins University. He was a Helen Hay Whitney postdoctoral fellow in developmental neurobiology at the University of California at Berkeley. Prior to joining the CCRC faculty, Dr. Tiemeyer was a faculty member in cell biology at Yale University School of Medicine and Director of Biochemical and Clinical Analytics and New Methods Development at Glyko/Biomarin, Inc.



Dr. Christine Szymanski - Dr. Szymanski has been exploring bacterial glycomics for more than two decades, working on food pathogens since the early 1990s, with a particular emphasis on *Campylobacter jejuni*. She combines her expertise in food safety and animal health with novel therapeutic diagnostic platforms developed during her postdoctoral fellowship at the Naval Medical Research Center vaccine program (1996-2000), the key findings while employed at the National Research Council of Canada (2000-2008), and the translational advances during her tenure as an Alberta Innovates Technology Futures Scholar at the University of Alberta (2008-2016). She was the first to demonstrate that bacteria are capable of N-glycosylating proteins and is now exploiting these systems to create glycoconjugate vaccines and oral therapeutics through recombinant expression in *Escherichia coli*. Dr. Szymanski was also the first to demonstrate that viruses specific for bacteria express proteins that can be used as novel therapeutics in addition to their recognized diagnostic value. These viruses (bacteriophages) are the most abundant biological entity on earth (10³¹) and are therefore a limitless resource for exploitation, especially in the area of glycomics.



Dr. Lance Wells - Dr. Wells received his B.S. in Chemistry, with a minor in Psychology, in 1991 from the Georgia Institute of Technology, and after spending two years working at the Microchemical Facility, his Ph.D. in Biochemistry and Molecular Biology in 1998 from the Emory University School of Medicine. A postdoctoral research fellowship at the Johns Hopkins School of Medicine in Biological Chemistry followed, which was supported by a National Research Service Award from the National Cancer Institute of the NIH. Dr. Wells joined the CCRC in August of 2003.



Dr. Asif Shajahan - Dr. Shajahan has about 10 years of experience in the structural characterization of glycoproteins using state-of-the-art high-resolution mass spectrometry (MS). He completed his Ph.D. in 2014 where he worked in the interface of chemistry and biology by developing glycoconjugates for the glycoengineering of brain glycans (across BBB) in mice models. He joined CCRC, University of Georgia, in 2015 and have been doing characterization of glycoproteins by both glycomics and glycoproteomics. He has contributed to over 80 projects on the structural characterization of mammalian, plant, algal, insect and bacterial origin glycoconjugates from both academic and industrial researchers. He is also performing research for the development of novel methods which enables rapid but comprehensive glycosylation profiling. He is training and mentoring undergraduate students and other junior postdoctoral trainees at CCRC and also involved as an instructor for the annual hand-on training courses held at CCRC on MS based glycomics and glycoproteomics. He is currently working as an Assistant Research Scientist at CCRC.