

BIOGRAPHICAL SKETCH

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NAME: Woods, Robert James

eRA COMMONS USER NAME (agency login): rjwoods

POSITION TITLE: Professor of Biochemistry & Molecular Biology

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Queen's University, Kingston, Ontario	BS	05/1985	Honors, Engineering Chemistry
Queen's University, Kingston, Ontario	PHD	05/1990	Theoretical and Synthetic Carbohydrate Chemistry
Laboratory for Molecular Modeling, University of North Carolina, Chapel Hill, North Carolina	Postdoctoral	07/1991	Extension of MM2 Force Field to Carbohydrates
Glycobiology Institute, University of Oxford, United Kingdom, Oxford	Postdoctoral	03/1994	GLYCAM/AMBER Force Field Creation, Application to Glycans and Carbohydrate NMR Studies
Institute for Biological Sciences, National Research Council of Canada	Term Scientist	12/1994	Carbohydrate Conformational Analysis by NMR and Simulation

A. Personal Statement

My research interest lies in deciphering the structural and energetic features that drive carbohydrate conformation and biological recognition, particularly with regard to protein-carbohydrate interactions of relevance to infectious diseases [1]. Our group is best known for the creation of the GLYCAM force field and online modeling tools (www.glycam.org) for modeling glycan 3D structure using the AMBER software suite [2]. My background is in carbohydrate synthesis and Chemical Engineering, which has enabled us to integrate experimental methods closely with the computational studies to engineer novel proteins with specificities for carbohydrates [3]. We routinely employ biophysical characterization techniques, such as protein crystallography, NMR spectroscopy, isothermal titration calorimetry, SPR, BLI, etc, and have collaborated productively on several mass spectrometry projects [1]. The synergy in my research between experiment and theory has been greatly assisted by the interdisciplinary interactions promoted within the Complex Carbohydrate Research Center at UGA, and has led to tangible benefits in terms of NIH-funded grants and patents. The students and researchers in my group receive exposure to both theoretical and experimental methods with the important opportunity to gain practical cross-training in each area. In 2007, together with Dr. Lori Yang, I spun-out a small business (Glycosensors and Diagnostics, LLC) to commercialize the computationally-guided engineering of carbohydrate-specific proteins for use in glycobiology [4].

Ongoing and recently completed projects that I would like to highlight include:

DMR-1933525

Woods (Co-PI w/ Maren Roman)

08/01/2020 – 01/31/2025

MIP: GlycoMIP - Automating the Synthesis Rationally Designed Glycomaterials

R01 GM13547301A1

Woods (PI)

07/01/2020 – 06/30/2024

Computational Tools to Aid the Design of Glycomimetic Agents

R24 GM136984

Woods (PI)

04/01/2020 – 03/31/2023

Transitioning GLYCAM-Web to a Self-sustaining Carbohydrate Modeling Service

Citations:

1. Zhao, P., Praissman, J.L., Grant, O.C., Cai, Y., Xiao, T., Rosenbalm, K.E., Aoki, K., Kellman, B.P., Bridger, R., Barouch, D.H., Brindley, M.A., Lewis, N.E., Tiemeyer, M., Chen, B., **Woods, R.J.**, Wells, L. (2020). Virus-receptor interactions of glycosylated SARS-CoV-2 spike and human ACE2 receptor. *Cell Host Microbe*, 28 (4), 586-601. PMID: PMC7386495
2. Kirschner K.N., Yongye, A.B. Tschampel, S.M., González-Outeiriño, J. Daniels, C.R., Foley, B.L. & **Woods, R.J.** (2008) GLYCAM06: a generalizable biomolecular force field. *Carbohydrates. Journal of Computational Chemistry*. 29(4), 622-55. PMID: PMC4423547
3. Wang, X., Hanes, M.S., Cummings, R.D., **Woods, R.J.** (2022) Computationally guided conversion of the specificity of E-selectin to mimic that of Siglec-8. *Proceedings of the National Academy of Sciences of the USA*, 119(41), e2117743119. PMID: PMC9564326
4. Saunders, M.J., **Woods, R.J.**, Yang, L. (2023). Simplifying the detection and monitoring of protein glycosylation during in vitro glycoengineering. *Scientific Reports*, 13, 567. PMID: PMC9834283

B. Positions, Scientific Appointments, and Honors

Positions and Scientific Appointments

2024 – Present	Distinguished Professor of Biochemistry and Molecular Biology, University of Georgia,
2020 – Present	Associate Director, GlycoMIP, an NSF Materials Innovation Platform
2020 – Present	Director of In-House Research, GlycoMIP, an NSF Materials Innovation Platform
2019 – Present	Chair, Glyco Advisory Group, National Center for Biotechnology Information (NCBI), USA
2010 – Present	Member, Biophysical Society
2007 – Present	Professor, Complex Carbohydrate Research Center and Department of Biochemistry and Molecular Biology, University of Georgia, USA
2007 – Present	President, Co-founder, Glycosensors and Diagnostics (d/b/a Lectenz Bio), LLC, USA
2008 – 2014	Professor, School of Chemistry, National University of Ireland, Galway, Ireland
2006 – 2007	Adjunct Professor, Department of Chemistry, National University of Ireland, Galway, Ireland
2009 – Present	Fellow, Royal Society of Chemistry
2008 – Present	Member, Faculty of Infectious Disease, University of Georgia
2008 – 2012	Leader, 3-D Structural Glycobiology Subgroup, Consortium for Functional Glycomics
2004 – Present	Member, Consortium for Functional Glycomics (Scripps)
2002 – 2007	Associate Professor, Complex Carbohydrate Research Center and Department of Biochemistry and Molecular Biology, University of Georgia, USA
1999 – Present	Member, Society for Glycobiology
1996 – Present	Adjunct Professor, Department of Chemistry, University of Georgia, USA
1995 – 2002	Assistant Professor, Complex Carbohydrate Research Center and Department of Biochemistry and Molecular Biology, University of Georgia, USA
1990 – Present	Member, American Chemical Society

Honors

2024	Distinguished Research Professor of Biochemistry, University of Georgia
2014	UGA Faculty Entrepreneur of the Year, University of Georgia

C. Contributions to Science

My career has been built on the creation and application of computational methods to expand our understanding of carbohydrate-protein recognition at the atomic level. I believe that these developments have benefited from close concurrent experimental studies within our team. My early training was as a synthetic carbohydrate chemist and chemical engineer, and I have always maintained an active experimental component to our research, which has helped to focus our theoretical developments firmly on real-world utility. The overarching goal of my work is to create and use computational methods to assist in the development of reagents to detect and hopefully treat disease.

1. The development of computational methods for modeling carbohydrates, glycoproteins, and carbohydrate-protein complexes
 - a. **Woods, R.J.**, Dwek, R.A., Edge, C.J. & Fraser-Reid, B. (1995). Molecular mechanical and molecular dynamic simulations of glycoproteins and oligosaccharides. 1. GLYCAM_93 parameter development. *Journal of Physical Chemistry*, 99(11), 3832-3846. DOI: 10.1021/j100011a061
 - b. Tessier, M.B., Demarco, M.L., Yongye, A.B. & **Woods R.J.** (2008). Extension of the GLYCAM06 biomolecular force field to lipids, lipid bilayers and glycolipids. *Molecular Simulation*, 34(4),349-363. PubMed Central PMCID: PMC3256582
 - c. Kirschner, K.N., Yongye, A.B., Tschampel, S.M., González-Outeiriño, J., Daniels, C.R., Foley, B.L. & **Woods R.J.** (2008). GLYCAM06: a generalizable biomolecular force field. *Carbohydrates. Journal of Computational Chemistry*. 29(4), 622-55. PMCID: PMC4423547
 - d. Nivedha, A.K., Makeneni, S., Foley, B.L., Tessier, M.B. & **Woods R.J.** (2014). Importance of ligand conformational energies in carbohydrate docking: sorting the wheat from the chaff. *Journal of Computational Chemistry*, 35(7), 526-39. PubMed Central PMCID: PMC3936473
2. Integration of modeling methods with sparse experimental data from sources such as NMR, MS footprinting, and glycan array screening
 - e. Gonzalez-Outeiriño, J., Glushka, J., Siriwardena, A. & **Woods R.J.** (2004). The structure and conformational behavior of sulfonium salt glycosidase inhibitors in solution: a combined quantum mechanical NMR approach. *Journal of the American Chemical Society*, 126(22), 6866-7. PMCID: PMC1386731
 - f. DeMarco, M.L. & **Woods, R.J.** (2009). Atomic-resolution conformational analysis of the GM3 ganglioside in a lipid bilayer and its implications for ganglioside-protein recognition at membrane surfaces. *Glycobiology*, 19(4), 344-55. PMCID: PMC2733776
 - g. Grant, O.C., Smith, H.M., Firsova, D., Fadda, E. & **Woods R.J.** (2014). Presentation, presentation, presentation! Molecular-level insight into linker effects on glycan array screening data. *Glycobiology*, 24(1), 17-25. PMCID: PMC3854501
 - h. Poor, T.A., Jones, L.M., Sood, A., Leser, G.P., Plasencia, M.D., Rempel, D.L., Jardetzky, T.S., **Woods, R.J.**, Gross, M.L. & Lamb, R.A.. (2014). Probing the paramyxovirus fusion (F) protein-refolding event from pre- to postfusion by oxidative footprinting. *Proceedings of the National Academy of Sciences of the USA*, 111(25), E2596-605. PMCID: PMC4078851
3. Define the origin of glycan specificity in carbohydrate – protein complexes
 - a. Kadirvelraj, R., Gonzalez-Outeiriño, J., Foley, B.L., Beckham, M.L., Jennings, H.J., Foote, S., Ford, M.G. & **Woods R.J.** (2006). Understanding the bacterial polysaccharide antigenicity of *Streptococcus agalactiae* versus *Streptococcus pneumoniae*. *Proceedings of the National Academy of Sciences of the USA*, 103(21), 8149-54. PMCID: PMC1472444
 - b. Martin, J.C., Fadda, E., Ito, K. & **Woods R.J.** (2014). Defining the structural origin of the substrate sequence independence of O-GlcNAcase using a combination of molecular docking and dynamics simulation. *Glycobiology*, 24(1), 85-96. PMCID: PMC3854502

- c. Lak P., Makeneni, S., **Woods, R.J.** & Lowary T.L. (2015). Specificity of furanoside-protein recognition through antibody engineering and molecular modeling. *Chemistry*, 21(3), 1138-48. PMID: PMC4286510
- d. Krishnamurthy, V.R., Sardar, M.Y., Ying, Y., Song, X., Haller, C., Dai, E., Wang, X., Hanjaya-Putra, D., Sun, L., Morikis, V., Simon, S.I., **Woods, R.J.**, Cummings, R.D. & Chaikof, E.L. (2015). Glycopeptide analogues of PSGL-1 inhibit P-selectin in vitro and in vivo. *Nature Communications*, 6, 6387. PMID: PMC4423566

Complete List of Published Work in MyBibliography:

<http://www.ncbi.nlm.nih.gov/sites/myncbi/robert.woods.1/bibliography/44326537/public/?sort=date&direction=descending>