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Analytica-2015: Advances in structural biology of glycosaminoglycans by 15N-NMR spectroscopy- Vitor H Pomin- Federal University of Rio de Janeiro

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With the recent developments to enhance sensitivity in solution NMR spectroscopy, such as the advent and spread of high magnet fields worldwide, cryoprobe technology, isotopic labeling techniques, and new combinations of 2D pulse sequences, a new direction in structural analysis of glycosaminoglycans (GAGs) by NMR spectroscopy has emerged. The current scope is the one more dedicated to the less sensitive amide 15N isotope of hexosamines rather than the commonly used anomeric and ring 1H- or 13C-resonances of uronic acids and hexosamines. Given that GAG types are basically classified upon their composing hexosamine types together with the variations of their sulfation patterns, 15N-related NMR studies on native GAGs, oligosaccharides or the different composing amino sugars have proved to be quite informative in both structural or dynamic point-of views, despite the low number of the resultant NMR signals. This in turn reduces significantly chemical shift degeneracy as at the same time facilitates spin/ structural assignments. This section is dedicated to cover the principal contributions made so far by solution 15N-NMR spectroscopy toward the progress of the structural biology of GAGs in the current glycomic age.

Despite the recent association of NMR with glycobiology, relevant results have ultimately appeared. Although carbohydrates posses high-order degrees of flexibility, and usually great structural complexity; NMR methods still seem quite able to elucidate the main structural characteristics and dynamic behaviors of the majority of glycans. Since NMR spectroscopy is currently the most advanced and powerful structural technique, despite its sensitivity issue, its contribution to the glycobiology's progress, and thus to the current glycomics' is profound. New NMR methods have been adjusted just for carbohydrate analysis, inclusively specific isotopic labeling protocols to overcome the sensitivity problem. Proton, carbon-13, nitrogen-15 by either one- or multi-dimensional NMR experiments, chemical shifts, scalar coupling constants, dipolar coupling constants, and NOE-through space connections of free or protein-bound carbohydrates comprise the principle NMR spectroscopy methods for glycobiology. Many other NMR techniques, such as saturation transfer difference and modified pulse sequence destined just to address glycobiology-related problems do exist, although not covered in this chapter. The main idea of carbohydrates as just energetically or structurally involved-molecules, has falling apart as many other vital functions of glycans, mostly in signaling events, have been unraveled along the past few years. And NMR spectroscopy is making an outstanding contribution for these big discoveries.

Biography

Vitor H Pomin (MS, PhD) is an Assistant Professor of Biological Chemistry, Biochemistry, Glycobiology, and NMR Spectroscopy at Institute of Medical Biochemistry Leopoldo de Meis, Federal University of Rio de Janeiro, Brazil, since May 2011. He pursued his undergraduate studies in Biological Sciences and graduate studies in Biological Chemistry at the same University. He received his Diplomas of Licentiate, MS, and PhD in 2003, 2005 and 2008, respectively. His MS and PhD were supervised by Prof. Paulo A S Mourão. After this period, he pursued a Post-doctorate experience at the Complex Carbohydrate Research Center, University of Georgia, United States, until April 2011, under the supervision of the Eminent Scholar of NMR spectroscopy Prof. James H. Prestegard. He has over 40 published articles in high-impact peer-reviewed journals, 11 book chapters, besides being editor of 6 academic/scientific books. He serves as an Editorial Member and frequent reviewer of many internationally recognized journals like Biopolymers, Carbohydrate Polymers, Biochimica et Biophysica Acta-General Subjects, Marine Drugs, Phytochemistry, the Journal of Biological Chemistry, Glycoconjugate Journals, ACS Biochemistry, Current Protein & Peptide Science, and others. He conducts research on glycobiology (especially sulfated polysaccharides), structural (glyco) biology and NMR spectroscopy.

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