Carbohydrate-Protein interactions by NMR

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Nowadays it is becoming evident that carbohydrates play a central role in multitude of biological recognition events at different stages, from atomic to organism and species level. Isolate monosaccharides usually do not display very high binding affinities, however they have huge possibilities, compared to other biomolecules, to form different oligo- or polymeric carbohydrates that notably improve their binding properties. This structural diversity, together with the particular geometrical properties of glycosidic bonds and the polyhydroxylated nature of carbohydrates, confers them an extraordinary potential to act, in a very selective fashion, as one of the binding partners in essential biomolecular recognition processes.

The low (10^2-10^3 M^{-1}) to medium-high range (10^7-10^8 M^{-1}) of binding constants between carbohydrates and other biomolecules make those systems very suitable for applying NMR techniques developed to study non-covalent ligand-receptor systems in fast exchange. With this NMR methodological arsenal on hands and in order to study several recognition events were carbohydrate are involved, we have applied some techniques based on the large difference in molecular size between the free and the bound states of observed ligands, i. e. Transferred NOESY, STD, DOSY. We have been able to detect binding events in the case of weak interactions (glyconanoparticles) and furthermore, to get deeper structural information on the conformation, geometrical adaptability and epitope mapping of carbohydrates (and glycomimetics) interacting with different proteins as glycosidase enzymes or lectins.

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