



## Breaking pseudo-symmetry in multiantennary complex Nglycans using lanthanide-binding tags and NMR pseudocontact shifts

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Molecular recognition is of vital significance for life. In terms of biological coding and translating signals into cellular effects, glycans have gained a particula status, owing to their unsurpassed coding capacity and widespread presence of receptors (lectins) to read the encoded information.<sup>[1]</sup> In this context, we herein present a novel NMR approach to individually monitor the behavior of each arm, A and B, of N-glycans (Scheme 1) and thereby provide a global perspective of their conformational and interaction features in solution.



Scheme 1. Nonasaccharide derivative studied in this work. The 1–3 and 1–6 arms attached to the  $\beta$ -mannose unit are labeled as A and B, respectively.

The use of the lanthanide tag has permitted to break the inherent pseudo-symmetry of the NMR spectra of the identical branches, revealing that the T-shaped gg rotamer at the Man $\alpha$ 1-6Man junction is the major one in solution, with minor contributions of other backfolded geometries.<sup>[2]</sup>

In addition, the recognition of this nonasaccharide by human galectin-3 has been studied. In this line, the novel methodology employed has permitted the characterization of the binding epitopes of the symmetrical N-glycan, showing that both arms are involved in the recognition of human galectin-3.<sup>[2]</sup>

<sup>[1]</sup> Gabius, H.-J.; André, S.; Jiménez-Barbero, J.; Romero, A.; Solís, L. Trends Biochem. Sci, 2011, 36, 298-313.

<sup>[2]</sup> Canales, A.; Mallagaray, A.; Pérez-Castells, J. Boos, I; Unverzagt, C.; André, S.; Gabius, H.-J.; Cañada F.J.; Jiménez-Barbero, J. Angew Chem. Int. Ed. 2013, 52, 1-6.