CARBOHYDRATES FOLDAMERS AND ASSEMBLIES

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Natural biopolymers have inspired the development of synthetic analogues – i.e. foldamers – capable of adopting defined conformations and forming programmable three-dimensional architectures. These compounds are mainly based on peptides and nucleic acids, that are well understood at the molecular level. In contrast, the complexity of carbohydrate synthesis and structural analysis have prevented access to synthetic carbohydrates capable of adopting defined geometries. In the Delbianco group, we synthesize well-defined carbohydrates to understand how the primary sequence affects conformation and aggregation [1,2].
Building on this fundamental knowledge, we present the rational design and synthesis of glycans adopting stable secondary structures, challenging the common belief that glycans are not capable of folding due to their flexibility. For example, by combining natural glycan motifs, we created a glycan hairpin, a secondary structure not present in nature [3]. Moreover, we designed glycan sequences that assemble into programmable supramolecular architectures, from fibers and particles to hydrogels [4]. Analogous to how the discovery of peptide-based foldamers launched a new field, we anticipate that carbohydrate foldamers and assemblies may find applications in areas across materials science, biology, and catalysis [5,6].

References:

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