Single molecule nanopore sensing of glycosaminoglycans

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Sequencing of polysaccharides is lagging behind compared to the very advanced situation for the two other major families of bio-polymers, nucleic acids and proteins, for which effective methods of structural analysis have been available for decades. The need for such methods is particularly felt for bioactive polysaccharides and among them glycosaminoglycans (GAGs).

GAGs are highly sulfated linear polysaccharides that play a dominant role in the communication of cells with their environment [1]. Comprising of disaccharide units, GAGs present an extraordinary structural complexity due to their non-template driven biosynthesis that results in their chemical heterogeneity and a broad diversification of structure.

Faced with this situation, a powerful solution is provided by the single-molecule detection and characterization based on the translocation through nanopores. This technique has been applied to GAGs by exploiting the confinement properties of the aerolysin nanopore. Heparin, chondroitin sulfate, dermatan sulfate, heparosan and hyaluronic acid saccharides were analyzed and distinguished, showing that aerolysin nanopore can detect and characterize GAGs with various sulfate patterns, osidic bonds and epimers of uronic acid residues [2].

The results of the study show for the first time the detection and resolution of different sequences of GAGs according to the different modifications distributed along the chains. The discrimination of the building blocks of GAGs is an essential step towards a sequencing pathway for these polysaccharides.

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