Chemical glycobiology of sulfation

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Abstract:
Sulfation is a powerful glycan modification that alters charge, conformation, solubility, and enzyme recognition. It controls microbial access to carbon in marine and gut ecosystems. However, the precise molecular logic has remained difficult to understand due to the synthetic and analytical challenges associated with sulfated glycans. Recent advances in synthesis and chemical glycobiology tools now make it possible to resolve these structure–function relationships with molecular precision.

In this talk, I will describe the automated glycan synthesis and chemical probe development that now enable molecular-level analysis of these biomolecules. This includes: (i) automated synthesis of fucoidan oligosaccharides used to profile enzyme and antibody recognition;[1] (ii) activity-based glycan FRET probes that visualise glycan turnover in complex microbiomes;[2] (iii) synthesis and NMR-guided discovery of a sulfated diatom mannan that selects for specific *Bacteroidota* through a four-enzyme cascade;[3] and (iv) efforts to drug glycan sulfatases implicated in inflammatory bowel disease.[4]

Together, these examples demonstrate how chemical glycobiology can be used to decode glycan sulfation.

References:
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2. *J. Am. Chem. Soc.* 2025, 147, 29, 25799–25805
3. bioRxiv. 2025 https://doi.org/10.1101/2024.07.03.601839
4. *Proc Natl Acad Sci U S A*. 2025, 122 (28) e2414331122