CRC 1449 Dynamic Hydrogels at Biointerfaces

FREIE UNIVERSITÄT BERLIN

Single glycans shape viscoelastic properties of a mucin-inspired peptide hydrogel

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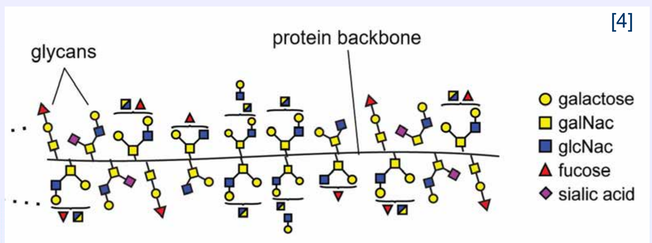
Introduction

The main component of mucus are mucins, highly glycosylated proteins.[1] Building relevant experimental models for mucins is hindered by their vast size, glycan content and structural complexity.[2] Biologic mucus samples differ strongly depending on the donor.[3]

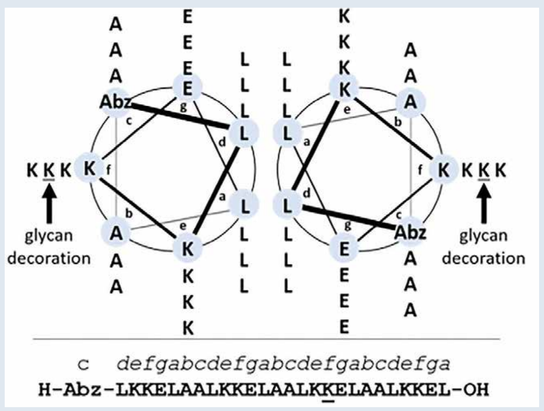


Aim

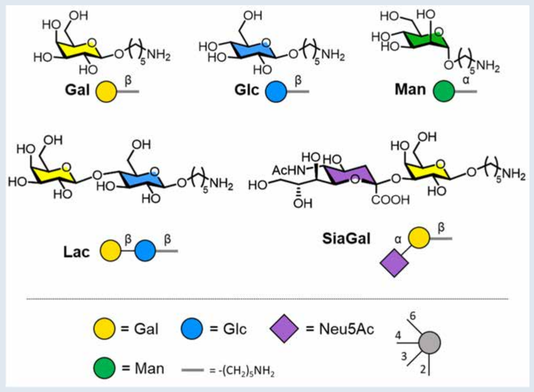
- Establish a simple and straightforward model for some key properties of mucus
- Systematically study the effect of glycan decoration on structure and viscoelastic properties
- Establish structure-property relations
- Identify key features for interactions with pathogens

Tool: A self-assembling peptide hydrogel scaffold for glycan-presentation

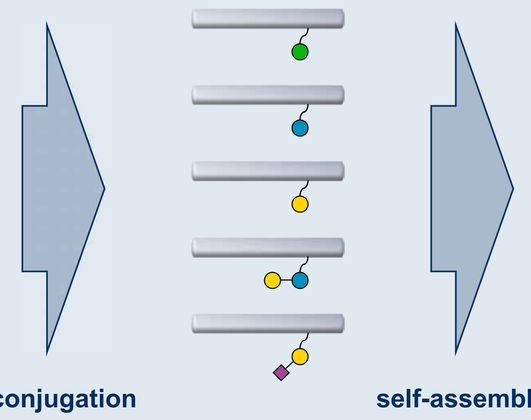
The peptide scaffold



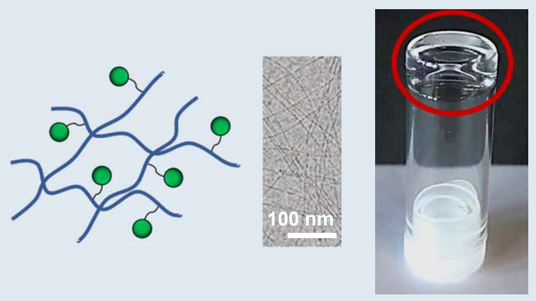
Glycan library



Glycopeptide library

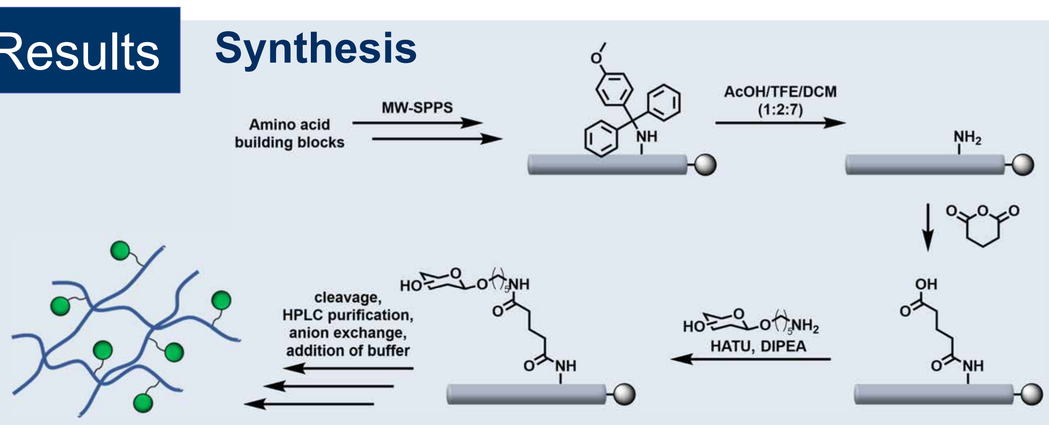


Mucin-like hydrogel



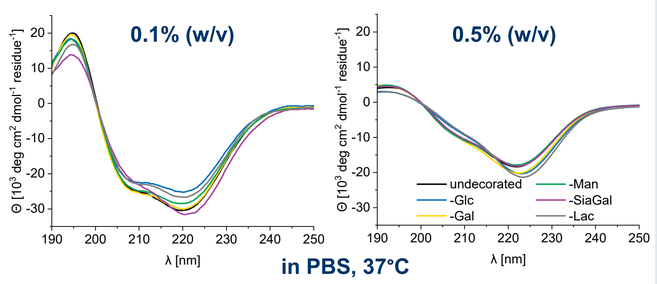
Results

Synthesis



Structural properties

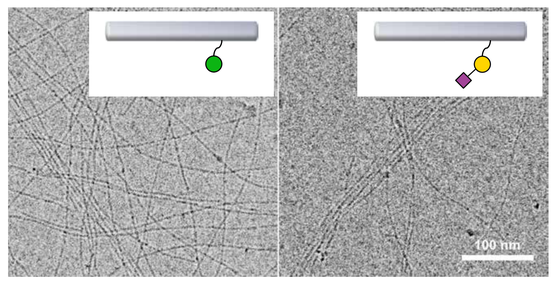
Circular dichroism



in PBS, 37°C

✓ Fibre formation with increasing concentration

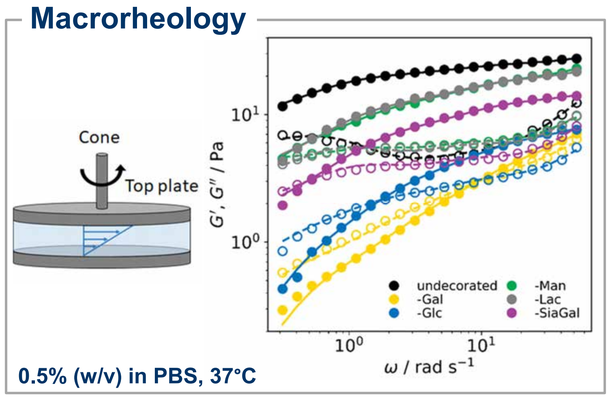
Cryo-TEM



✓ Fibre formation unhindered by glycans

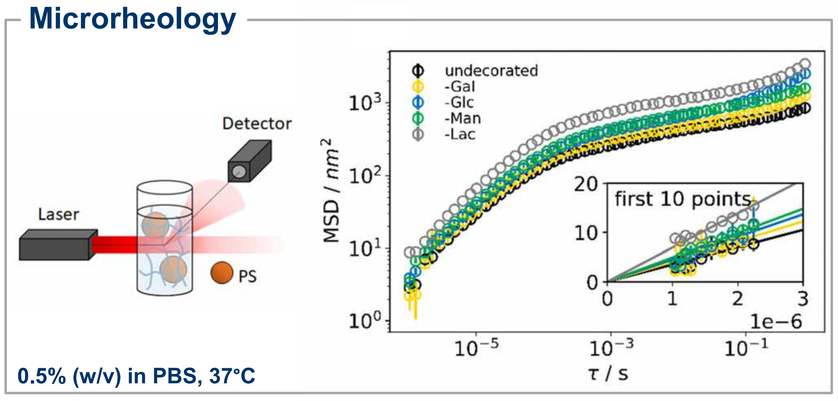
Mechanical properties

Macrorheology



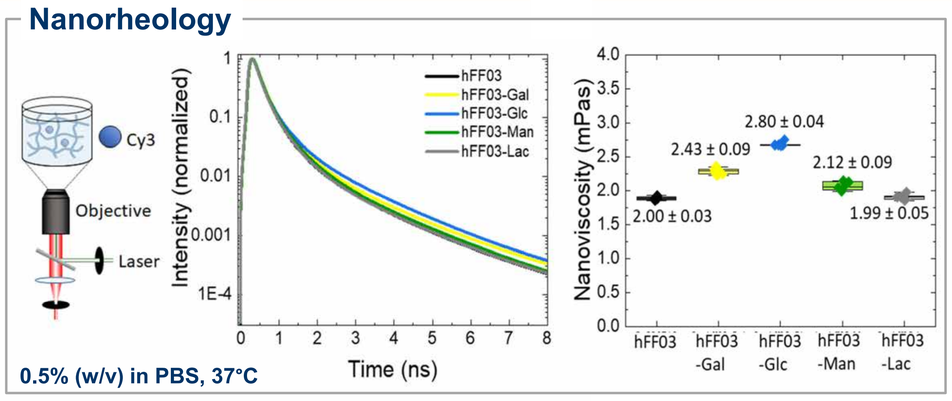
0.5% (w/v) in PBS, 37°C

Microrheology



0.5% (w/v) in PBS, 37°C

Nanorheology

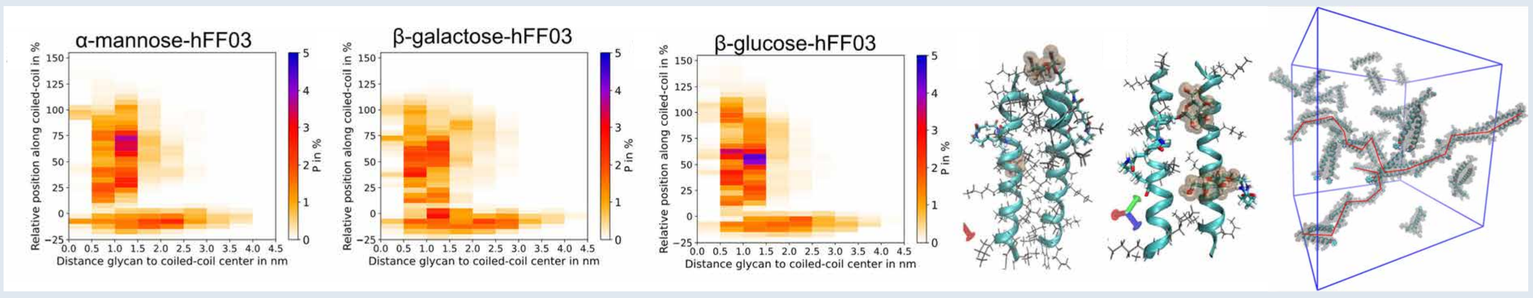


0.5% (w/v) in PBS, 37°C

✓ Rheology characterised over three techniques and length scales ✓ Rheology tuneable via glycan modification and pH ✓ Key properties (e.g. mesh size, G') comparable to native mucus[9]

Understanding the differences

- ✓ Hydrogel structure formation robust regardless of glycan
- ✓ Differences in viscoelastic behaviour depending on the glycan
- ✓ MD suggests importance of dynamic processes and the linker



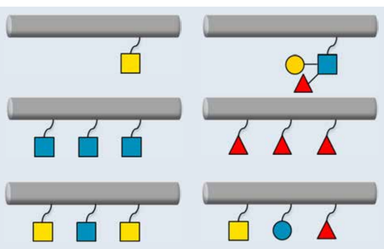
Outlook

Library expansion

Complex glycans

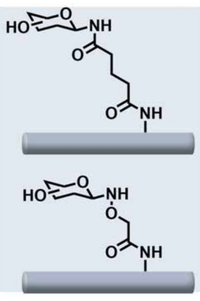
Multiple decoration

Mixed decoration



➢ Move closer to native mucus

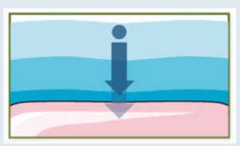
Determine the influence of the linker



➢ "Long" vs "short"

Interactions with surroundings

Particle permeation



Pathogen interaction

➢ Identify key features for interactions with pathogens

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