

Introduction to Glycans



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Rosetta Workshop
Meiler Lab



In this introduction:

- Glycans Overview**
- Functions in the Cell**
- Glycan Chemistry**



Glycans Overview:



Biomolecules in the cell:

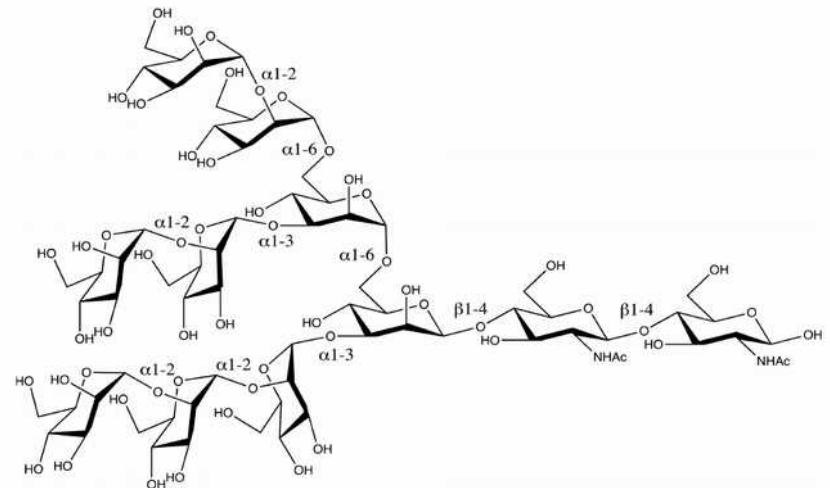
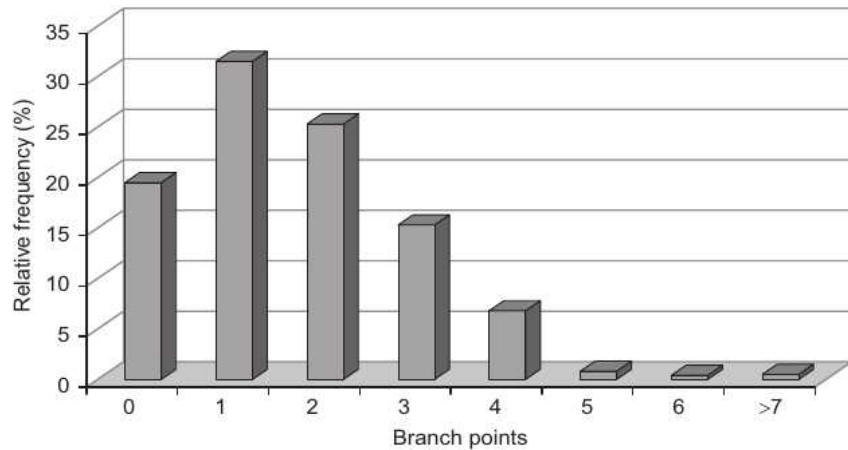
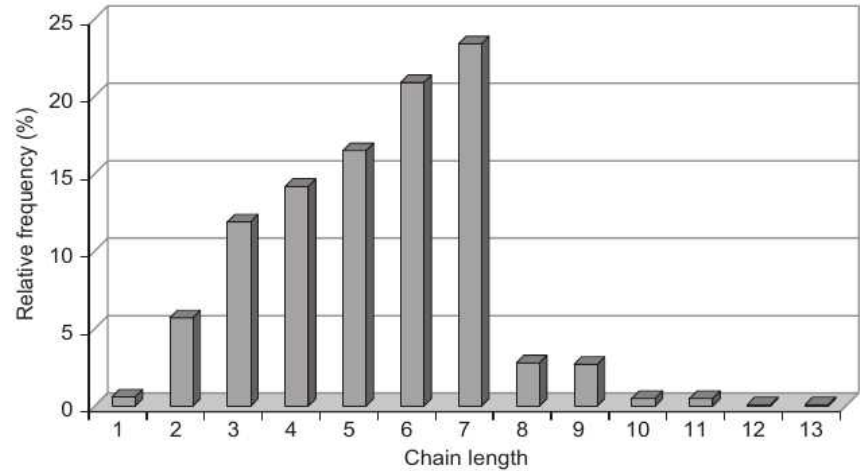
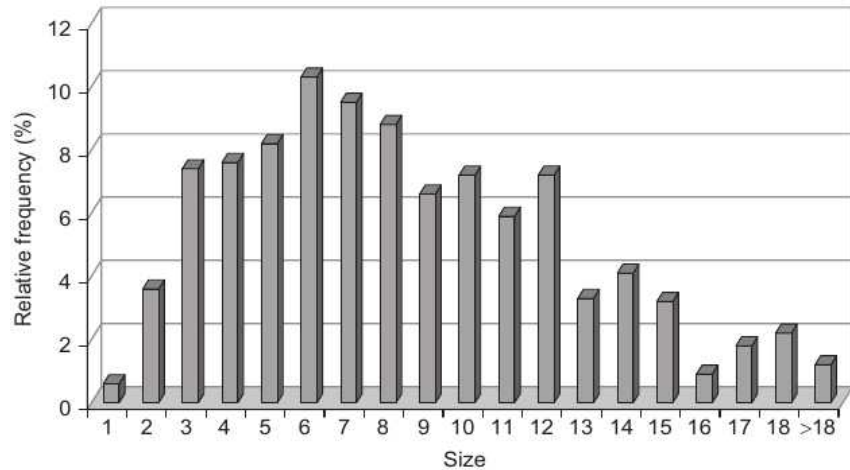
Peptides —→ Proteins
Nucleotides —→ DNA/RNA
Lipids —→ Membranes
Carbohydrates —→ Glycans

Numbers of different oligomers			
Oligomer size	Nucleotides	Peptides	Carbohydrates
1	4	20	20
2	16	400	1360
3	64	8,000	126,080
4	256	160,000	13,495,040
5	1024	3,200,000	1,569,745,920
6	4096	64,000,000	192,780,943,360

(Werz DB, 2007)



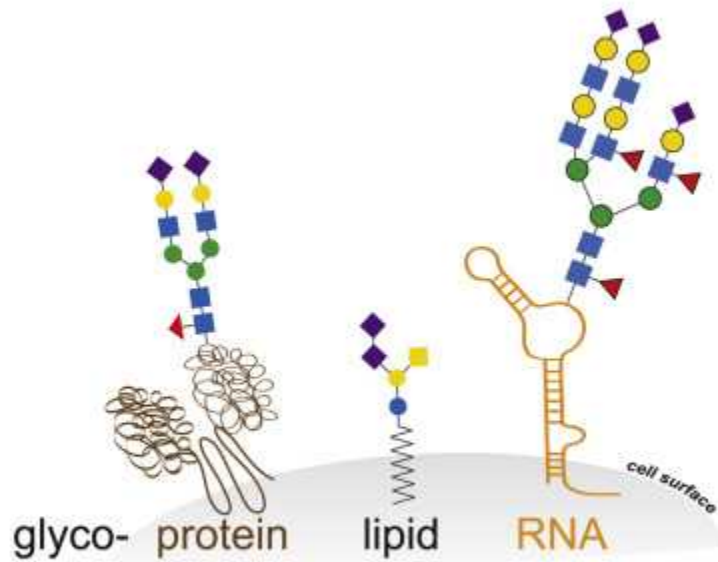
Glycan's complexity:



(Werz DB, 2007; Woods RJ, 2018)



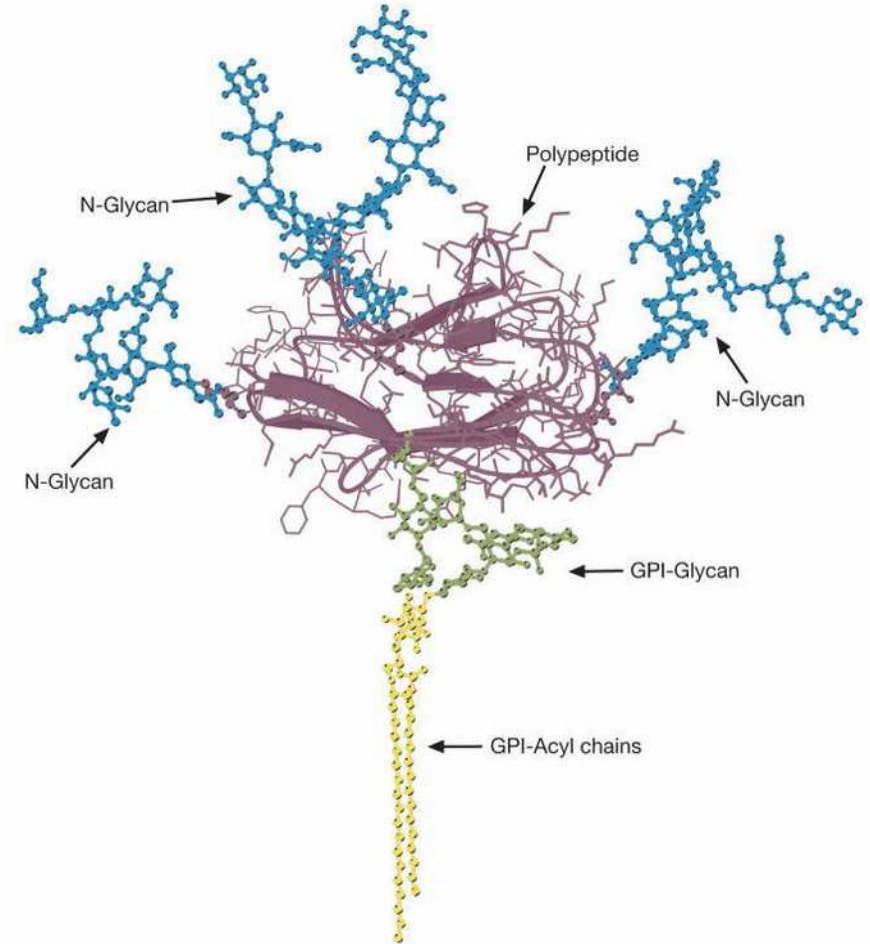
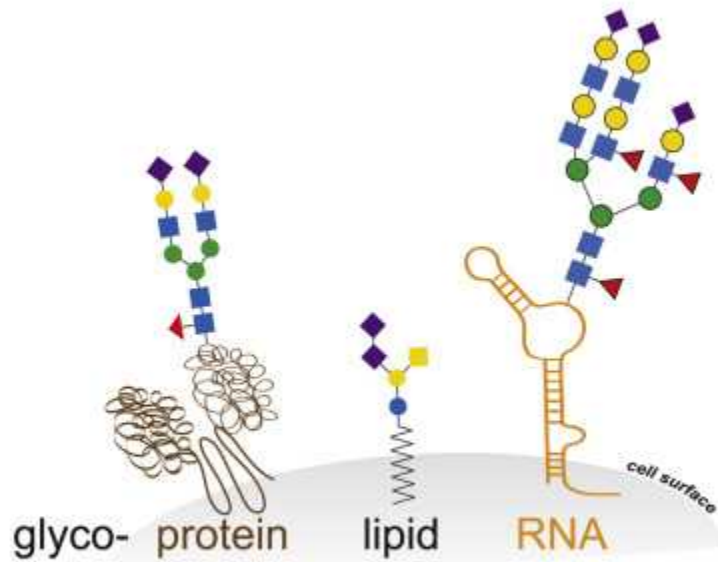
Glyco-what??



(Flynn RA, 2021)



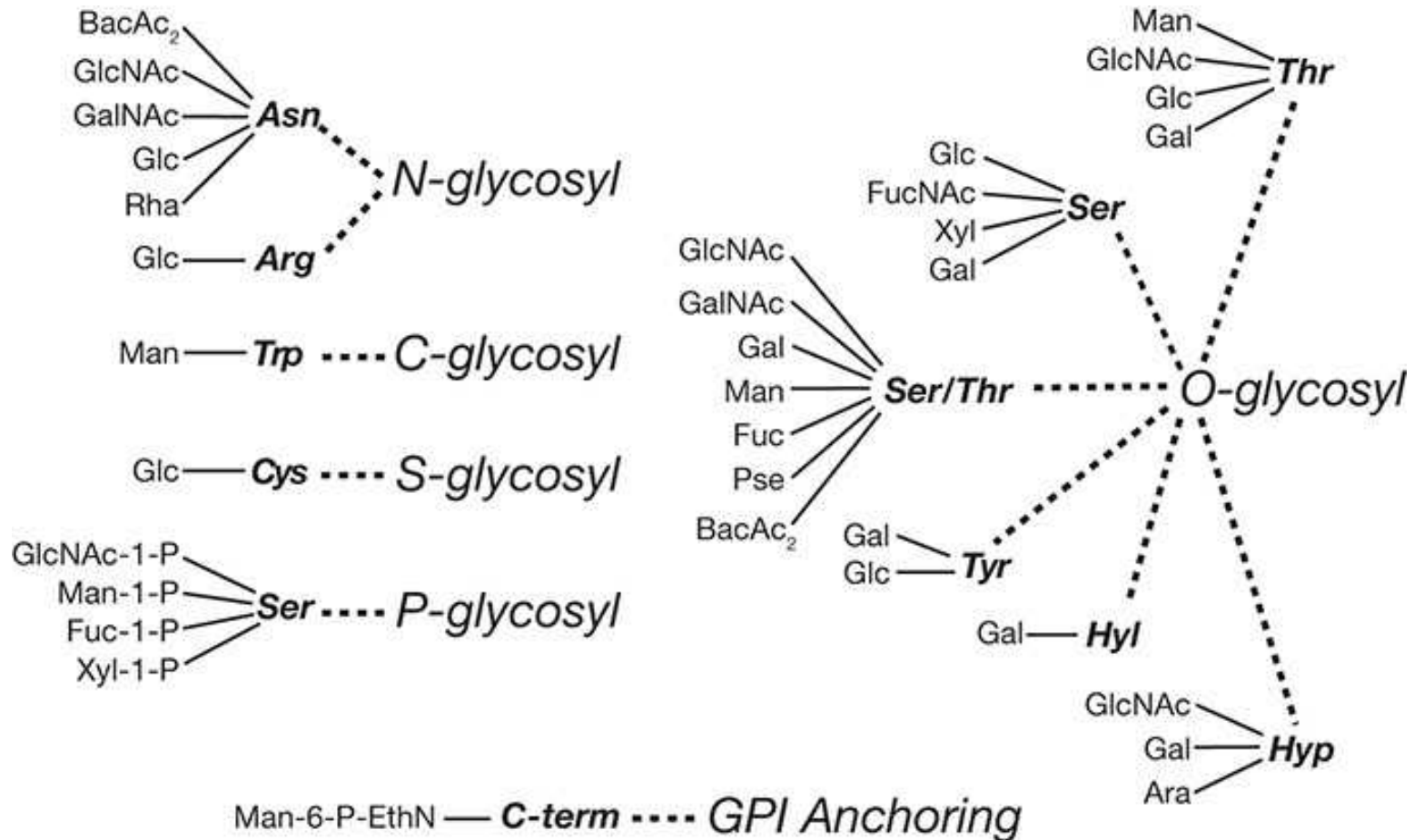
Glyco-what??



(Flynn RA, 2021; Varki A, 2017)



Glyco-protein connections:



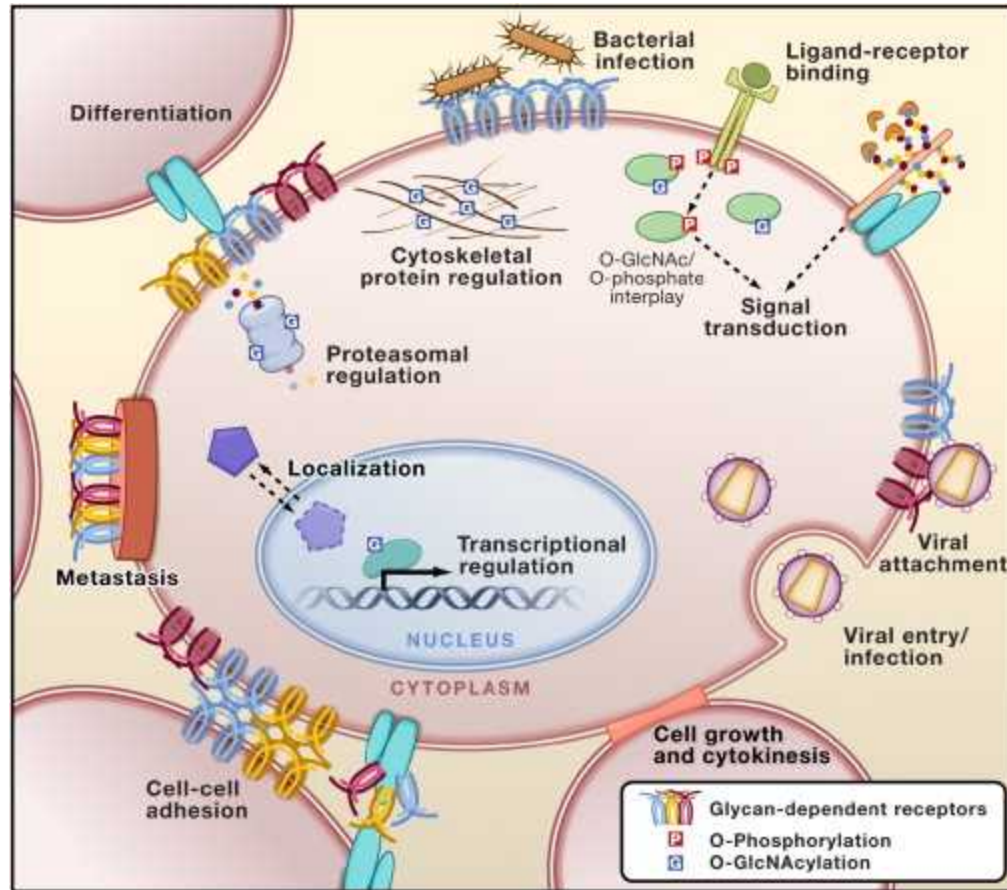
(Varki A, 2017)



Functions in the Cell:



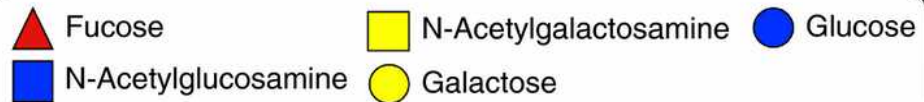
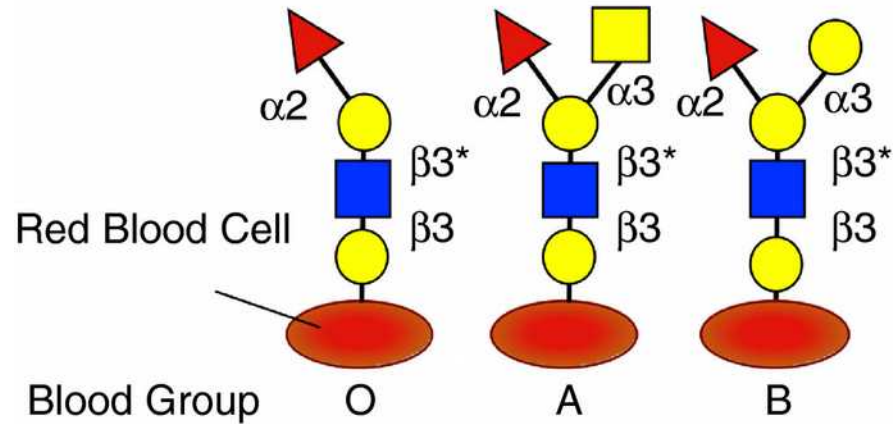
Functions in the Cell:



(Hart GW, 2010)



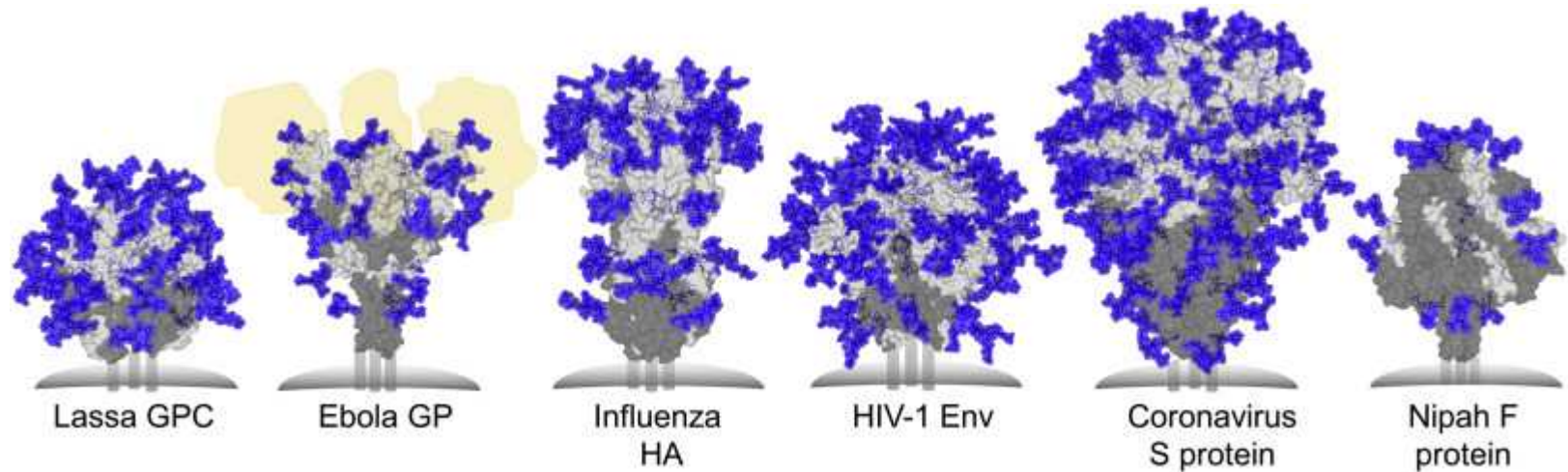
Blood type:



(Lee-Sundlow MM, 2020)



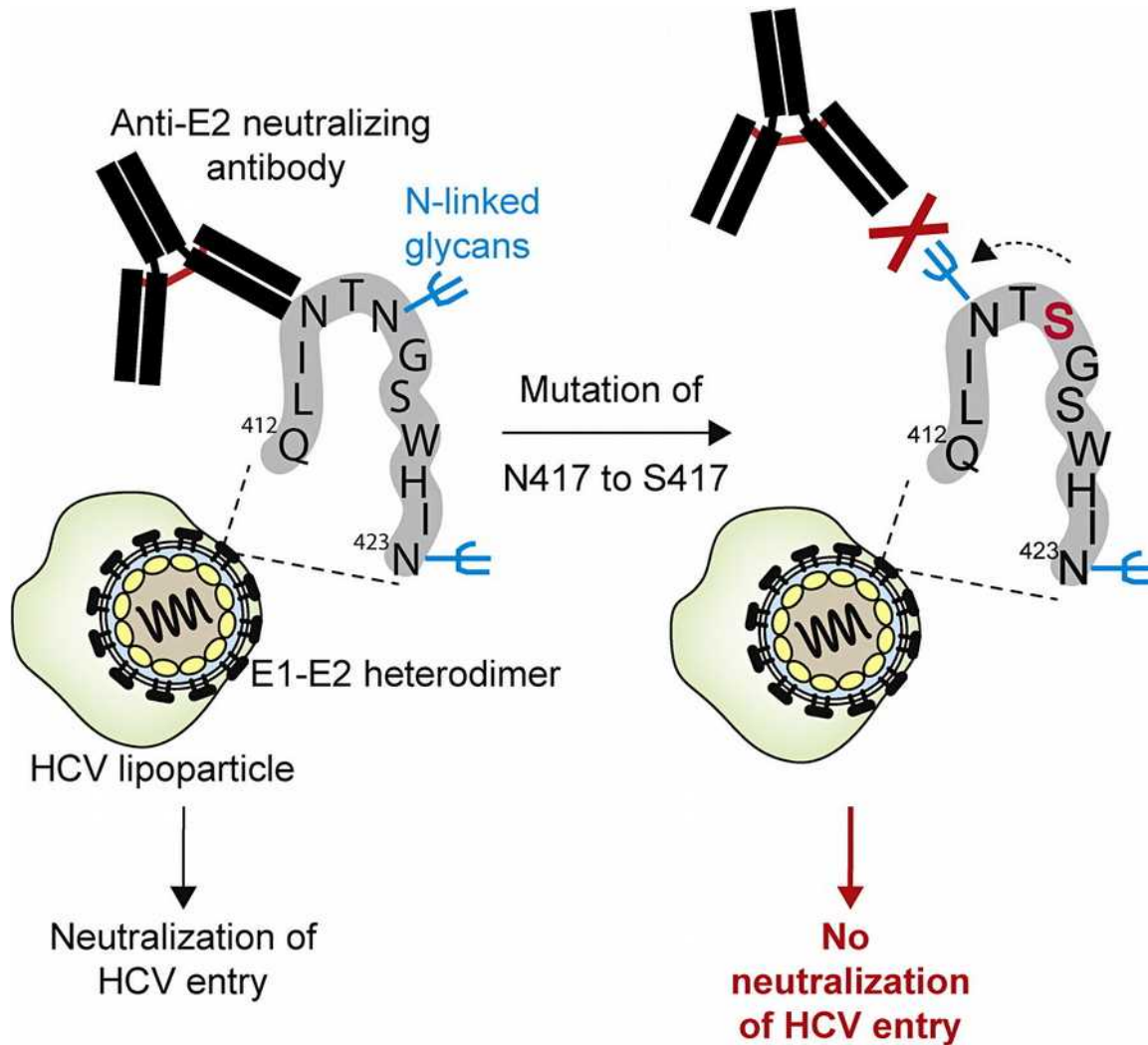
Glycan Masking in Viral Escape:



(Watanabe Y, 2019)



Glycan Masking in Viral Escape:



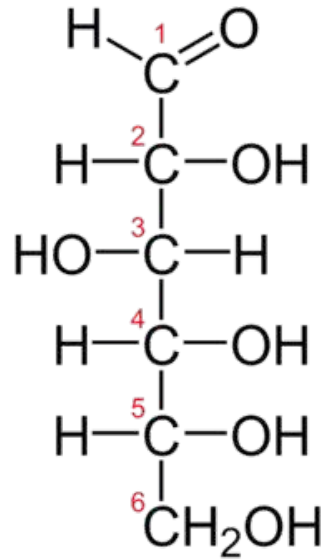
(Pantua H, 2013)



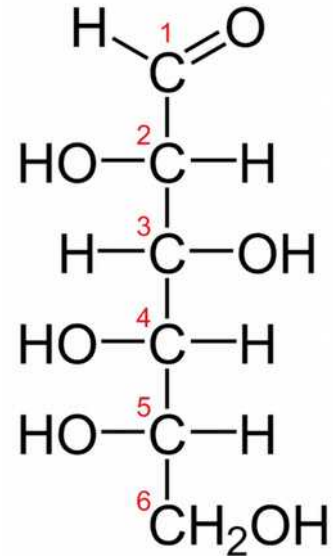
Glycan Chemistry:



Enantiomers:



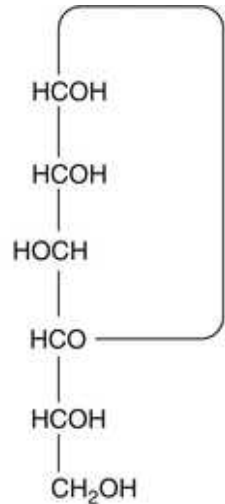
D-glucose



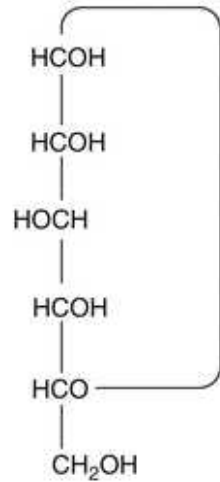
L-glucose



Cyclic Monosaccharides:



α -D-Glucofuranose

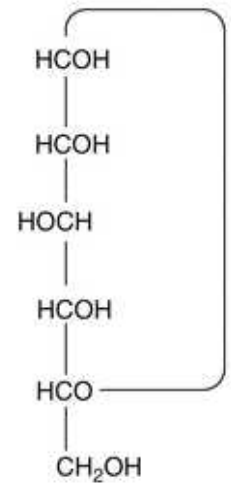


α -D-Glucopyranose

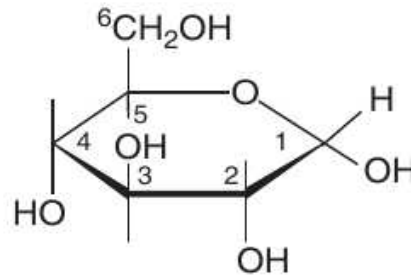


(Horton D, 2013)

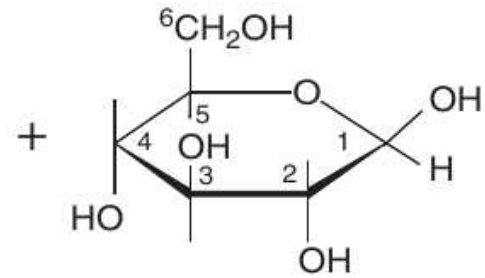
Cyclic Monosaccharides:



α -D-Glucopyranose



α -D-glucose

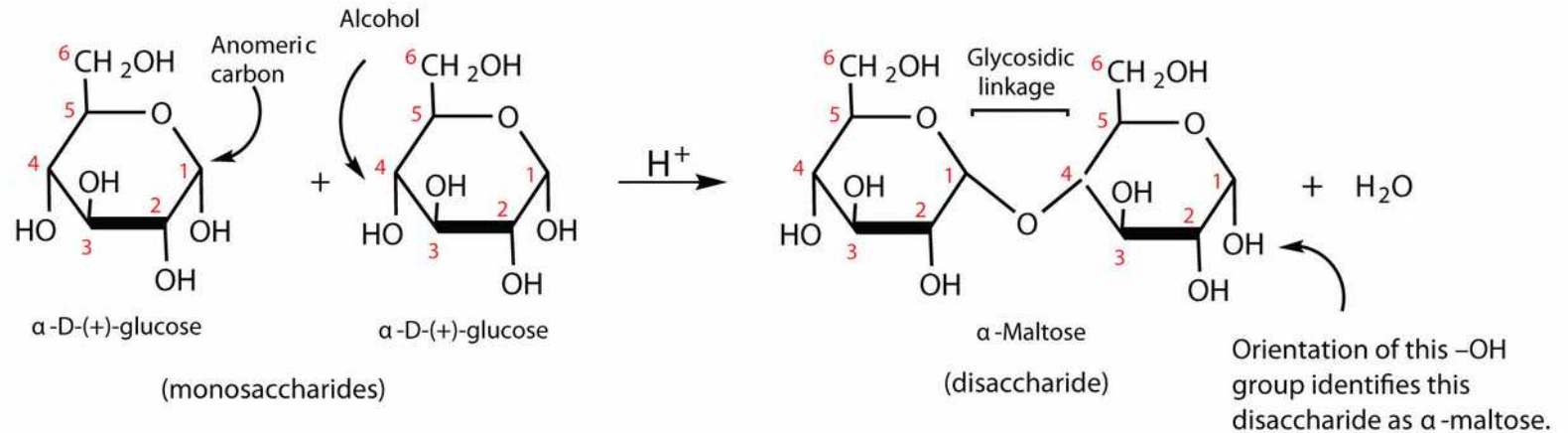


β -D-glucose

(Horton D, 2013; Stylianopoulos C, 2013)



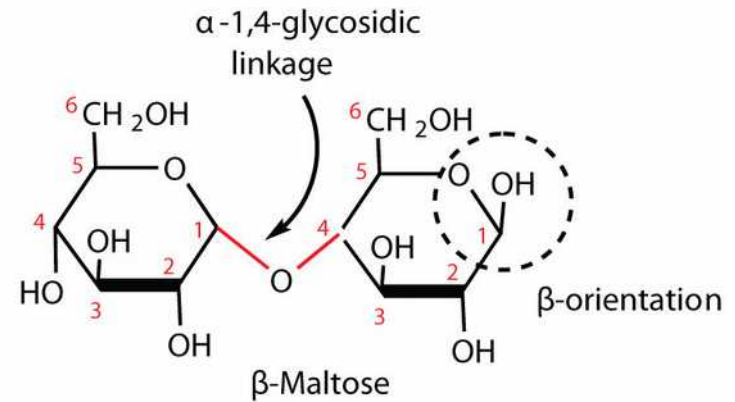
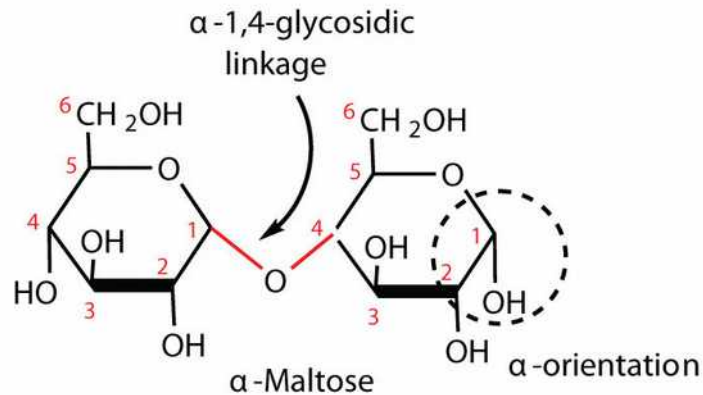
Linkage:



(<https://chem.libretexts.org/@go/page/45987>)



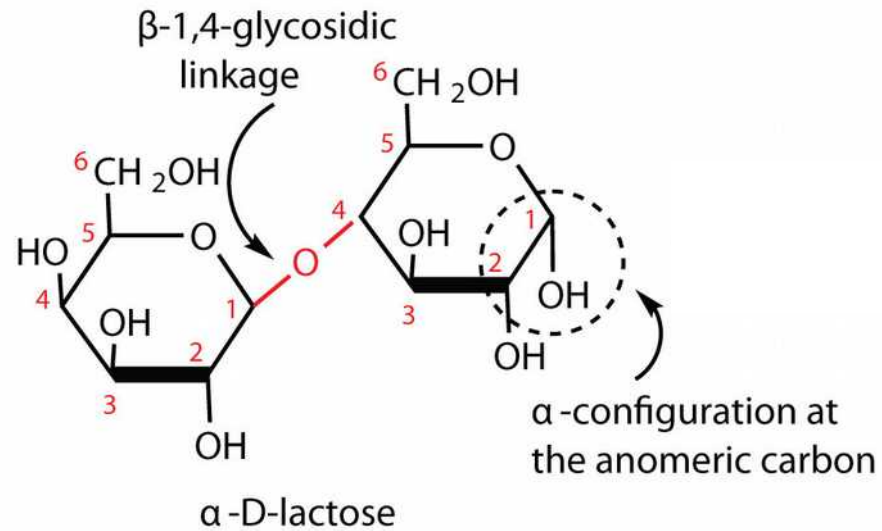
α -1,4 glycosidic linkage:



(<https://chem.libretexts.org/@go/page/45987>)



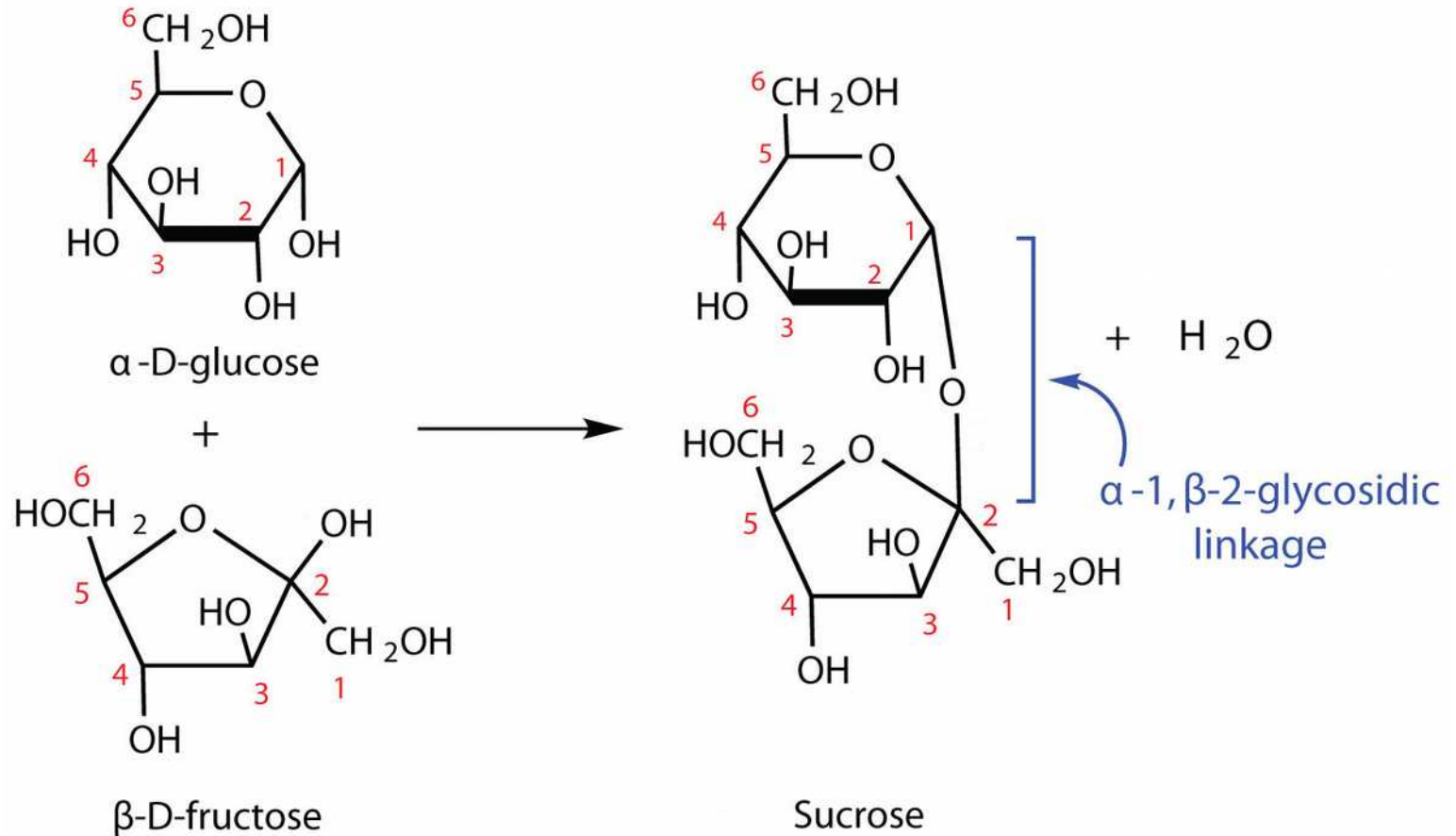
β -1,4 glycosidic linkage:



(<https://chem.libretexts.org/@go/page/45987>)



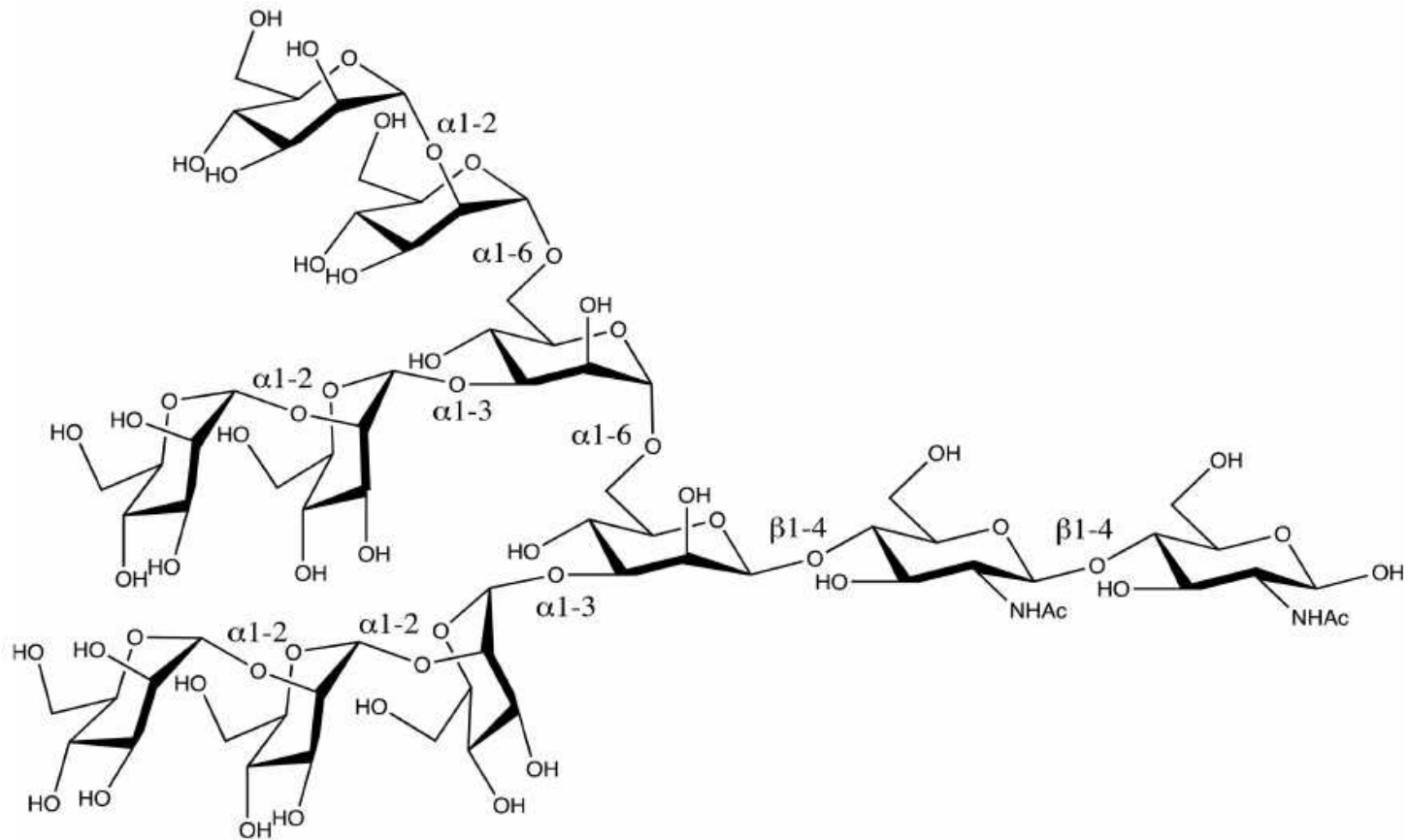
α -1, β -2 glycosidic linkage:



(<https://chem.libretexts.org/@go/page/45987>)



Longer glycan chains:

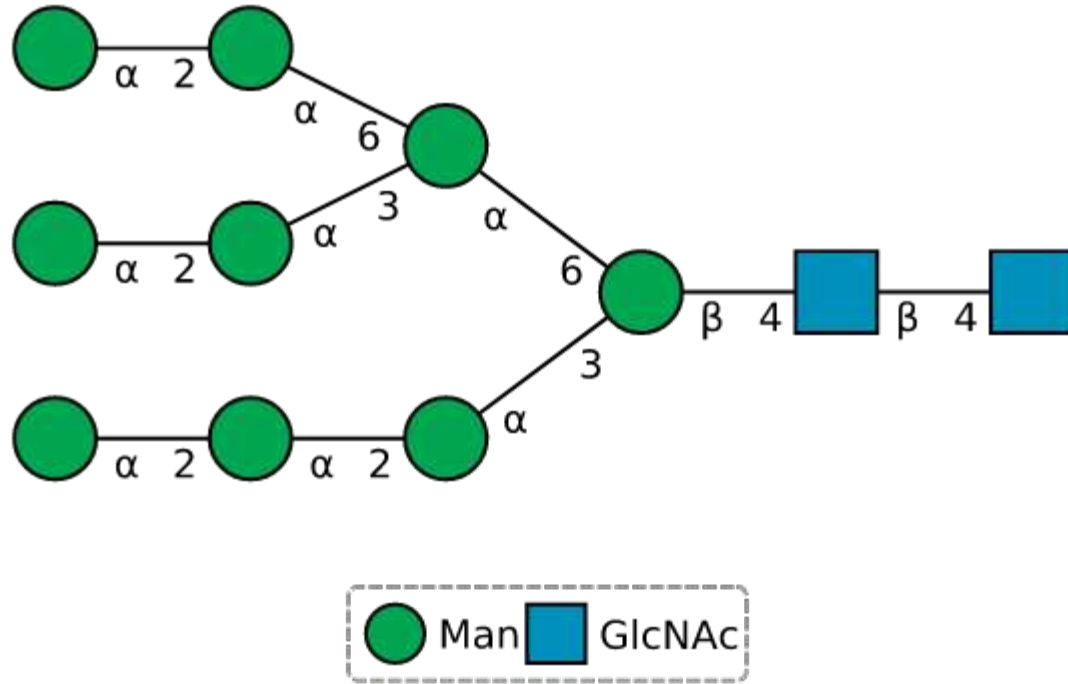


α -D-manno-hexopyranosyl-(1 \rightarrow 2)- α -D-manno-hexopyranosyl-(1 \rightarrow 2)- α -D-manno-hexopyranosyl-(1 \rightarrow 3)-[α -D-manno-hexopyranosyl-(1 \rightarrow 2)- α -D-manno-hexopyranosyl-(1 \rightarrow 3)-[α -D-manno-hexopyranosyl-(1 \rightarrow 2)- α -D-manno-hexopyranosyl-(1 \rightarrow 6)]- α -D-manno-hexopyranosyl-(1 \rightarrow 6)]- β -D-manno-hexopyranosyl-(1 \rightarrow 4)-2-acetamido-2-deoxy- β -D-gluco-hexopyranosyl-(1 \rightarrow 4)-2-acetamido-2-deoxy-D-gluco-hexopyranose

(Woods RJ, 2018)



Longer glycan chains:



$\text{Man}_9\text{GlcNAc}_2$



Next Video:

Glycans in Rosetta

