

Carbohydrates Mono-Disaccharides & Polysaccharides 2015

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A. Task for student practical introduction for the use of Interactive Molecule viewers:

RasMac  RasMol  ChemScapemDL  MDLi  FireFox  MAGE4

<http://aris.gusc.lv/06Daugavpils/Engl/1Saccharid14LabContA.doc>

<http://aris.gusc.lv/ChemFiles/Saccharides/PolySaccharides/HyalurChondroitHeparKeratMucHTM/0GlycoProteinComponents.html>

Address: <http://aris.gusc.lv/ChemFiles/Saccharides/SSViewer/SSVFrameset.htm>.

Draw the retained saccharide molecules as well as projections of opened or hemiacetal and hemiketal structures.

at Display conditions: **Stick** (on Menu Stripe) **Ball & Stick** **Spacefill**

Atom Name	Symbol	Color	Valence Number
Carbon	C	Gray lightly or Black	4
Hydrogen	H	White	1
Oxygen	O	Red	2 (donor acceptor ligand up to 4)
Nitrogen	N	Bluish	3 + 1 (donor acceptor ligand up to 4)
Sulfur	S	Yellow	-2 , +6
Phosphor	P	Yellow Intensive dark	5 (& 3)
Sodium ion	Na+	Blue	+1 (coordination up to 6)
Magnesium ion	Mg2+	Green	+2 (coordination up to 6)
Calcium ion	Ca2+	Gray Dark	+2 (coordination up to 6)
Iron ion	Fe2+	Yellow Gray	+2 (coordination up to 6)
Iron ion	Fe3+	Yellow Gray	+3 (coordination up to 6)

Nature Journal
 publication of scientists
Corey, Pauling, Koltun
 for atomic modeling
Poly saccharide Backbone is
 $-O-\triangle-O-\triangle-O-\triangle-O-\triangle-O-$
 chain of monosaccharide \triangle glycoside
 $\triangle-O-\triangle$ bond
Inter molecular Forces active
Side groups:
Polar hydroxyl -OH
Hydrogen bonds:
 $-O-H \dots O <$
 carboxylic, sulfate & amine salt
salt bridges: $-OSO_3^- \dots H_3N^+$
 $-COO^- \dots H_3N^+$

<http://aris.gusc.lv/06Daugavpils/Research/33BloodGroupABO.doc>

IUPAC recommendations suggested by **Joint Commission on Biochemical Nomenclature (JCBN)** 1985 year rules for abbreviations and linkage use on saccharide units and its connections itself into Disaccharides, Trisaccharides, Oligosaccharides and Polysaccharides.

GalNAc, N-acetyl-D-galactosamine; **GlcUA**, D-glucuronic acid; **IdUA**, L-iduronic acid; **GlcN**, D-glucosamine; **GlcNAc**, N-acetyl-D-glucosamine; **GalN**, D-galactosamine; **Glc**, D-Glucose; **Gal**, D-galactose; **Man**, D-mannose; **ManN**, D-mannosamine; **Xyl**, D-xylose; **NeuAc**, N-acetyl-Neuraminic acid. **CPK** color scheme 1970

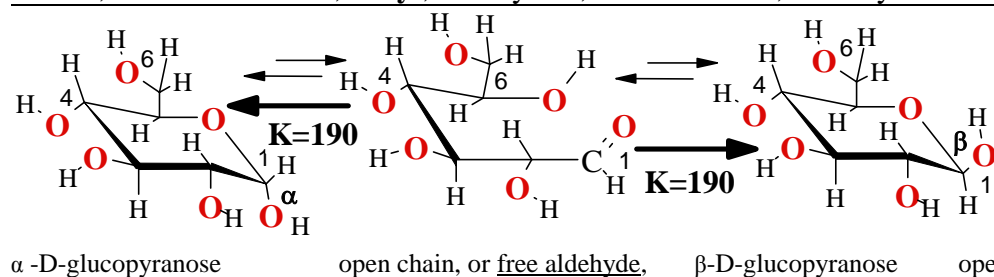


Figure I.1 The cyclic hemiacetal forms \leftrightarrow of D-glucose alpha α - and beta β - in equilibrium with open chain $K \geq 190$

α -D-glucose: mp 146°C [α]=+112°
 β -D-glucose: mp 190°C [α]=+19°

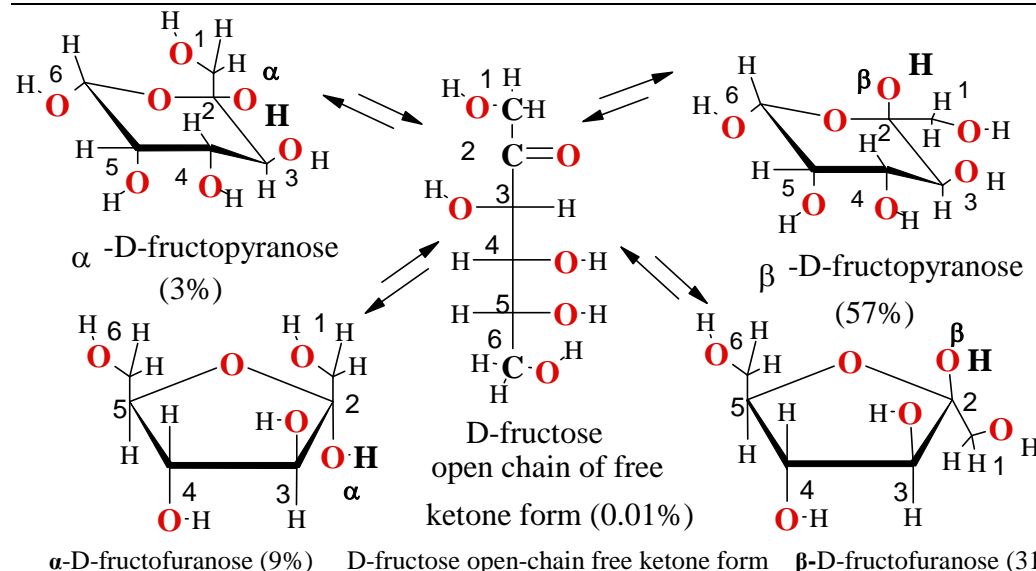


Figure I.2 The principal forms of D-fructose in equilibrium into aqueous solution. Show the opened chain D-Fructose and β -D-fructofuranose

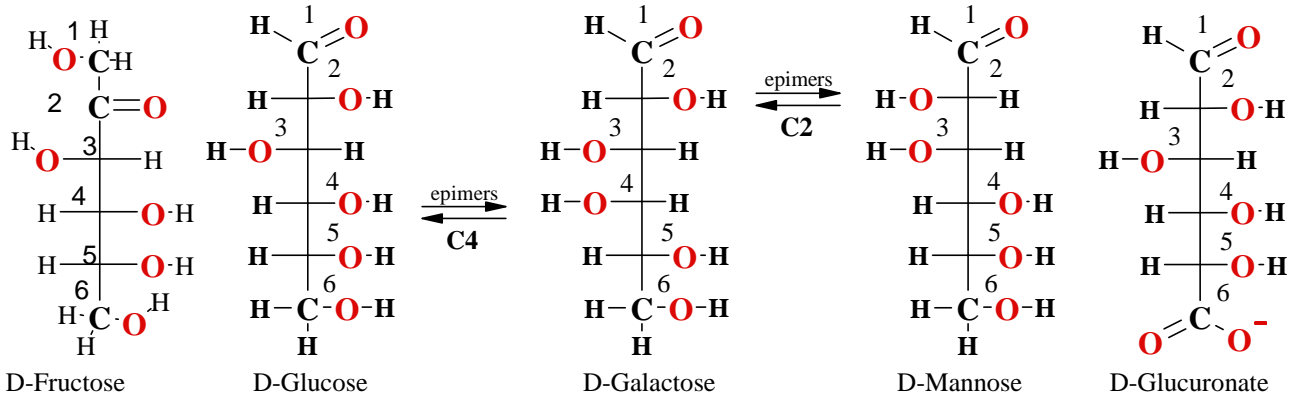
$K = [\text{Cyclic}]/[\text{open}] = 99,99/0.01 = 9999 = K$

Open chain fraction

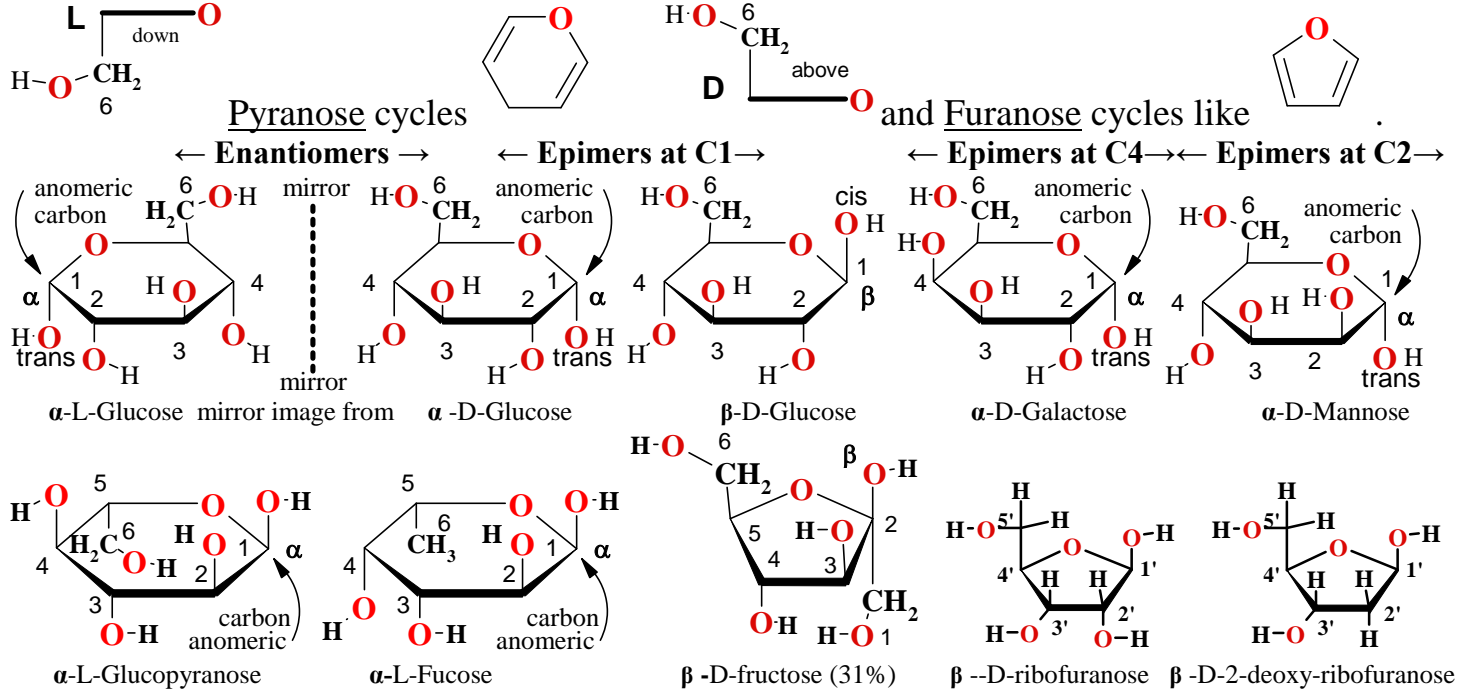
$w\% = 1/10000 * 100\% = 0.01\%$

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Opened chain free aldehyde monosaccharides presented by Fisher's projection

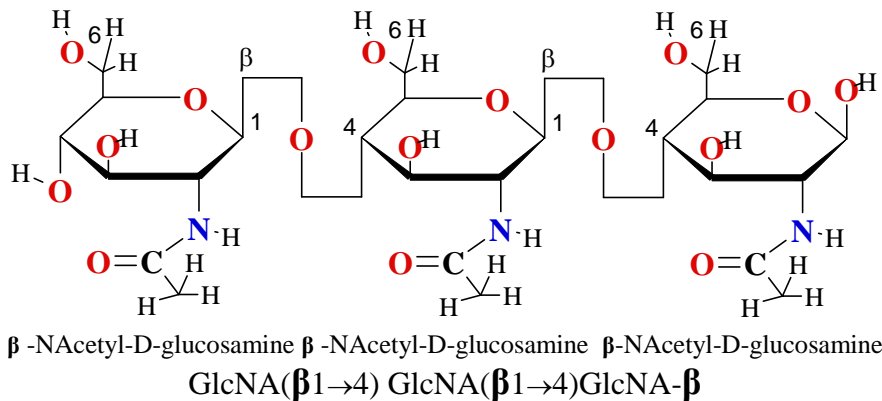


Cyclic hemiacetal or hemiketal monosaccharides presented by Haworth's projection

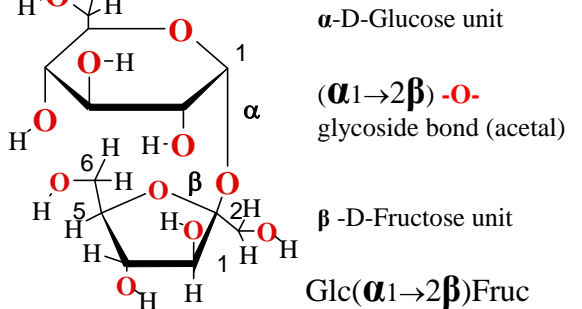


α-L-Fucose unit is linked ($\alpha 1 \rightarrow$) as side group on oligosaccharide chains in extra cellular space of human organism as **Immunological marker** for host molecular bodies recognition soon as non-host bodies - anti-genes binding and removing.

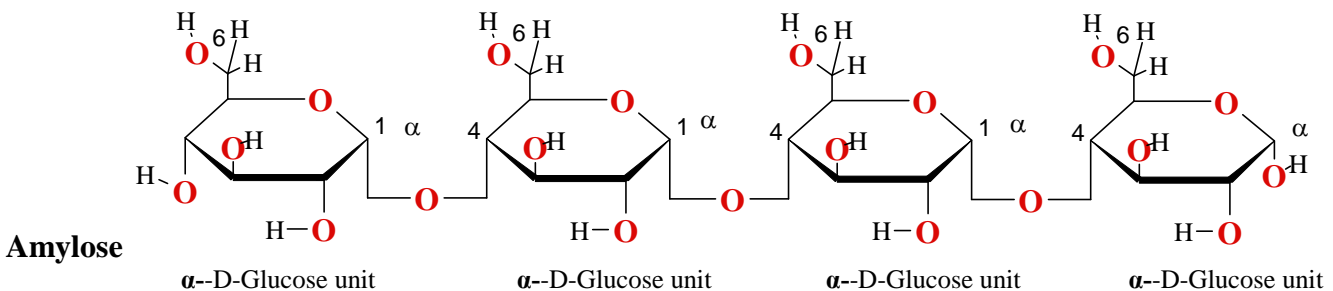
Chitin triose



Sucrose

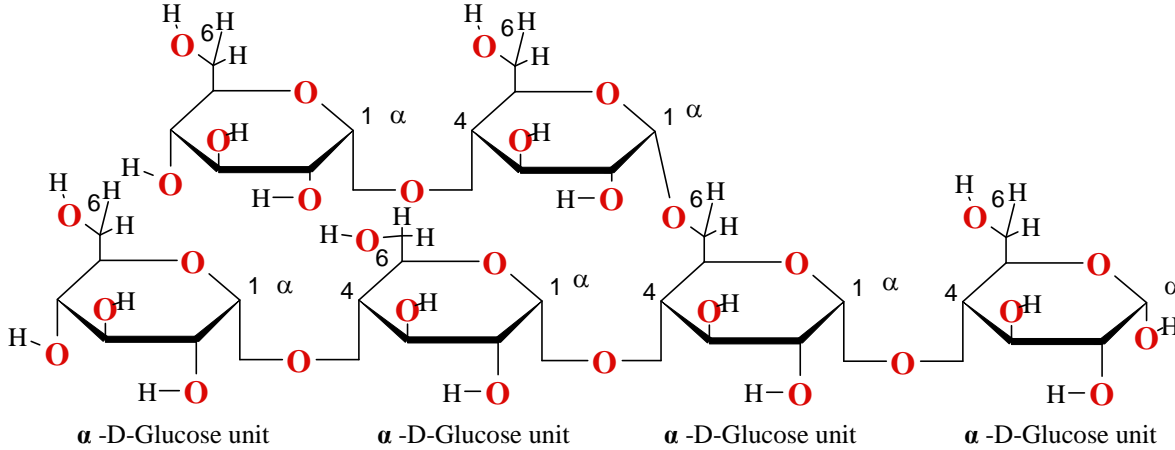


Haworth projections for connection-O-



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Haworth projections for connection **-O-Glc(α1→4)Glc(α1→4)Glc(α1→4)Glc-α**



Haworth projections for connection **-O-**

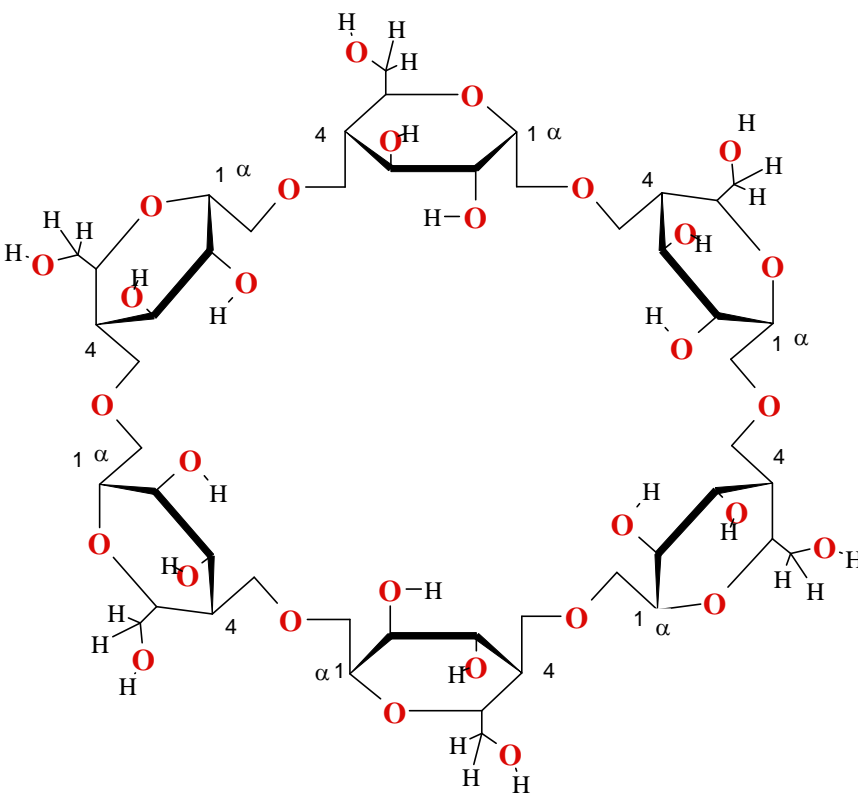
AmyloPectin

Glc(α1→4)Glc(α1→6)↓

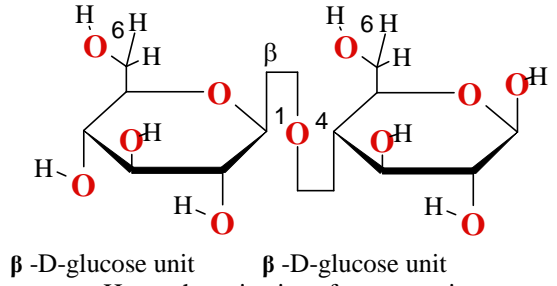
Haworth projections for connection

Glc(α1→4) Glc(α1→4)Glc(α1→4)Glc-α

Cyclo Hexa Amylose α-D-Glucose→α-D-Glucose→α-D-Glucose→



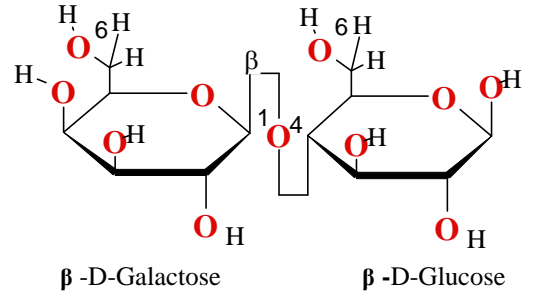
Cellobiose Glc(β1→4)Glc-β



Haworth projections for connection

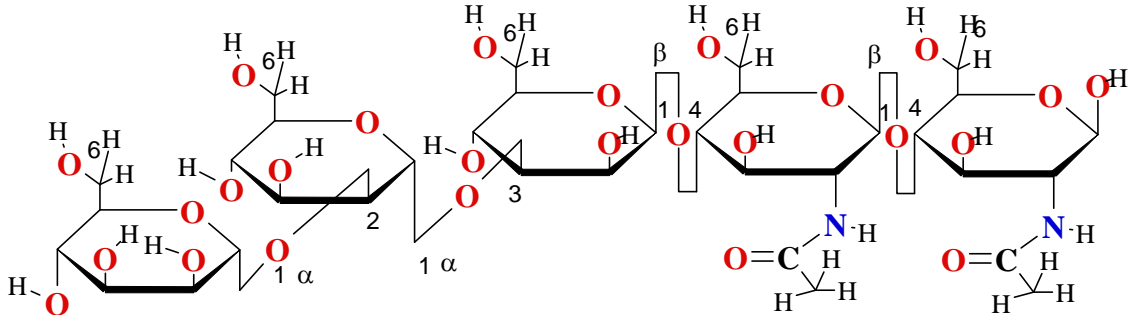
-O-

Lactose Gal(β1→4)Glc-β



**Glc(α1→4)Glc(α1→4)Glc(α1→4)
Glc(α1→4)Glc(α1→4)Glc(α1→4)**

α-D-Mannose α-D-Mannose α-D-Mannose β-NAcetyl-D-Glucosamine β-NAcetyl-D-Glucosamine



Mucin linear

Man(α1→2)Man(α1→3)Man(β1→4)GlcNAc(β1→4)GlcNAc-β

Mucin branched (forked) fragment

**α-D-Mannose α-D-Mannose β-N-Acetyl-D-Glucosamine
α-D-Mannose β-N-Acetyl-D-Glucosamine**

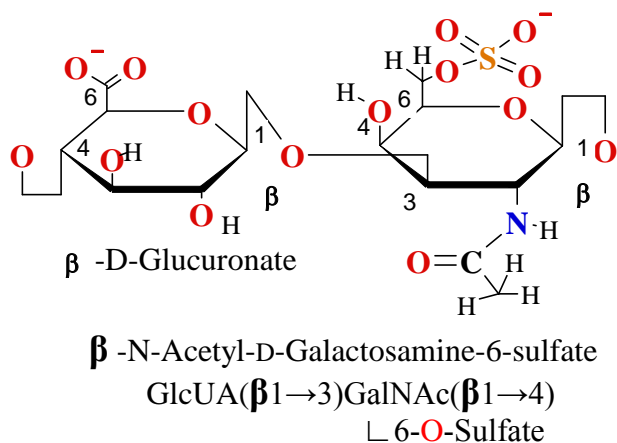
Man(α1→2)Man(α1→6) ↓

Haworth projections for connection **Man(α1→2) Man(α1→2)Man(α1→3)Man(β1→4)GlcNAc(β1→4)GlcNAc-β**

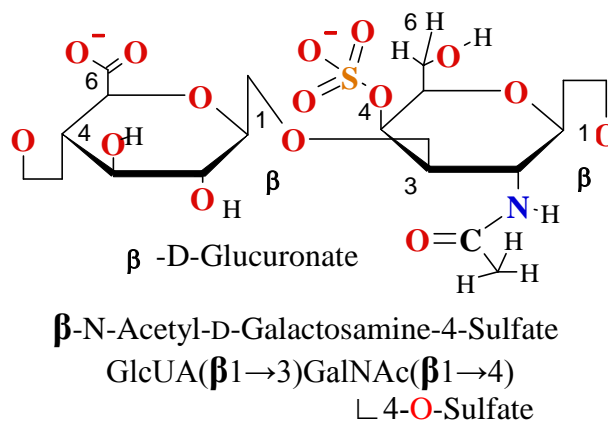
CarboHydrates Mono-Disaccharides & Polysaccharides 2015

Show the eight given disaccharide units of Proteoglycan components - only as Haworth projections!

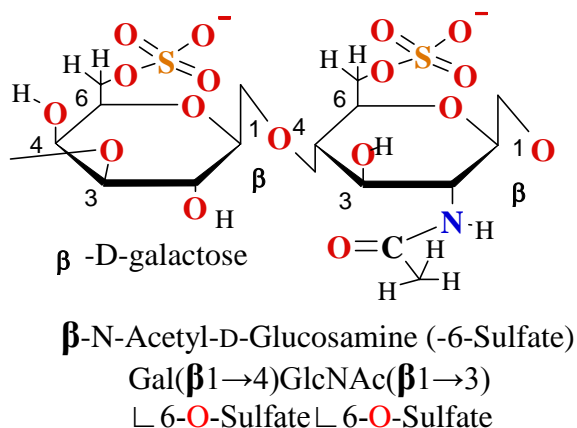
Chondroitin 6-sulfate



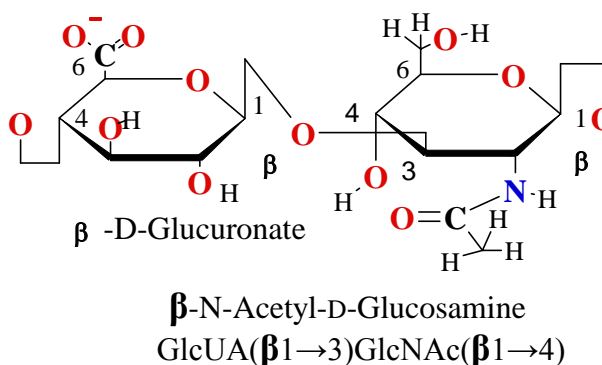
Chondroitin 4-sulfate



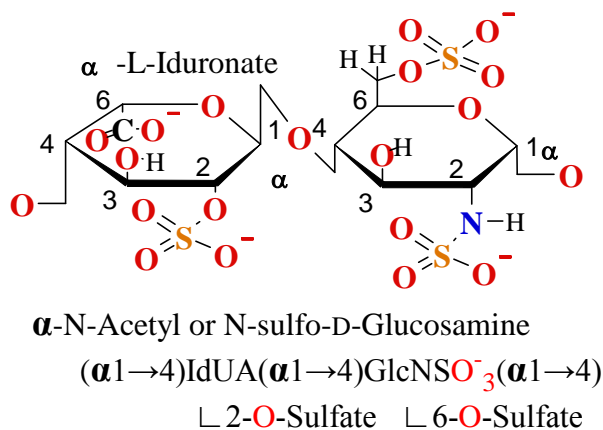
Keratan (6-Sulfate)



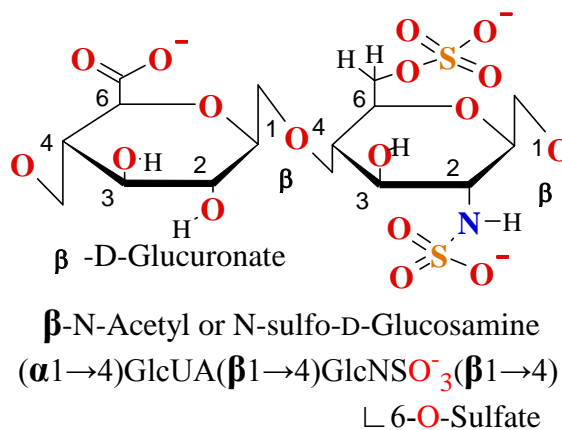
Hyaluronate 50000 units polysaccharide



Heparin



Heparan sulfate



Dermatan sulfate

