"Polysacchrides"

متعددة

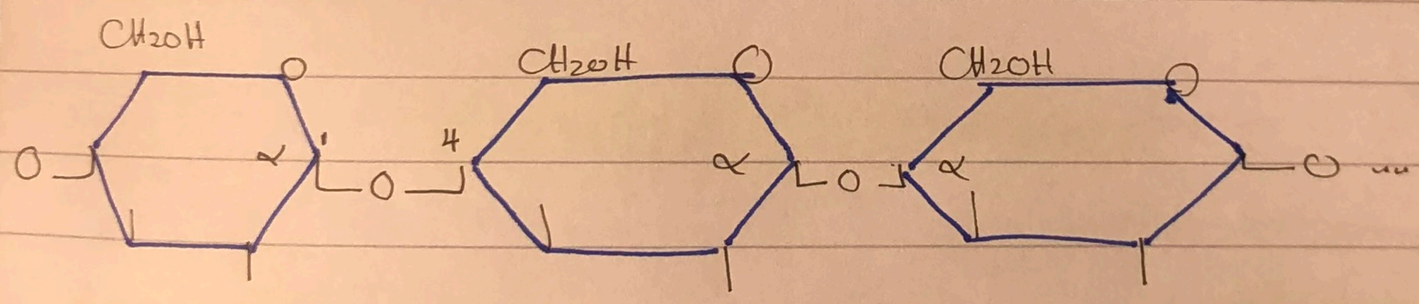
- "Glycans" =|> Polymeric molecules
  =|> long Chains of monosaccharides that bound Together via glycocidic bonds.

Polysacchrides ⇝ homo PolySacchrides =|> one type of monosaccharides
⇝ hetero PolySacchrides =|> more than one type " "

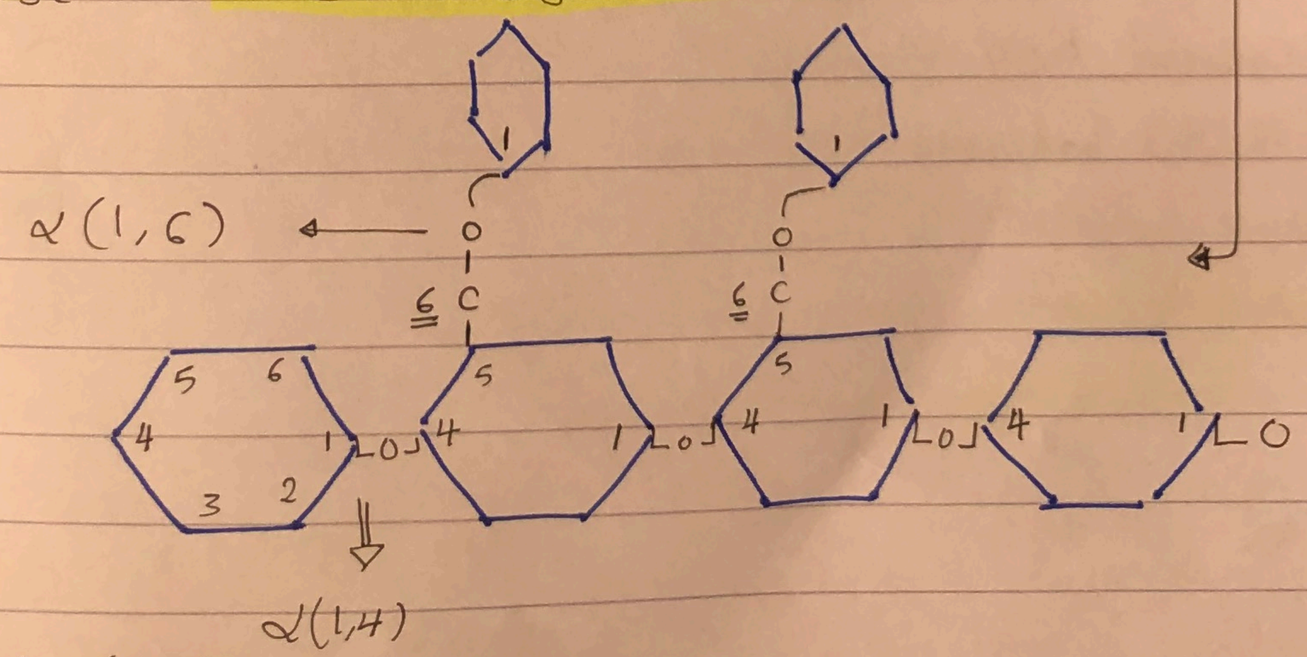
branched linear

=|> For storage " Starch – glycogen "
=|> ~~Fo~~ Structural "Cellulose , Chitin "
لحاء الشجر

- **Starch** : Storage PolySaechride in Plants "hollow helix"
  =|> glucose monomers "homoPolysacchride"
  =|>
  - 20% amylose "Soluble"
  - 80% amylopectin "inSoluble"



Amylose = α (1,4) glycocidic bonds.



عدد الـ α(1-6) =
عدد التفرعات

Amylopectin ⇒ α(1,4)
~~Amylopect~~ ⇒ α(1,6) only on the branch Point

(24-30)

- Digestion of Starch -

[1] Salivary amylase enzyme (in the mouth) randomly hydrolyses the $\alpha(1,4)$ bonds.

[2] oligosacchrides continues to the small intestine by Pancreatic amylase

[3] Further hydrolysis by

- α-glucosidase ⇓ Removes one glucose residue at time
- debranching enzymes ⇓ hydrolyzes $\alpha[1,6]$ bonds

[4] The produced monosacchrides are absorbed and transported to blood

- Storage Polysacchrides -

- Amylopectin
  - => in plants
  - => Branched every "(24 → 30)"
- Glycogen
  - => Animals and humans
  - => Highly branched (8-14)
  - => Found in skeletal muscle

up to { (1,2% of muscle mass) ; (10% of liver mass) ⇓ give glucose to organs

↳ Same glycobonding

" Synthesis & Breakdown of Glycogen "

- Tissues like brain cells need a Constant supply of blood Glucose for Survival. " all time "

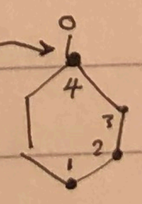
- Some tissues like liver, skeletal muscles stores glucose in a form that can be easily mobilized
  For example " Glycogen "

- glycogenesis :
  => blood glucose is high
  => بناء
- glycogenolysis:
  => To release glucose when blood glucose sugar is low
  "(normal is " 80-100 mg/dl)"

=> The balance between the need and availability is " metabolic hoeneostasis "

" Storage PolySacchrides "

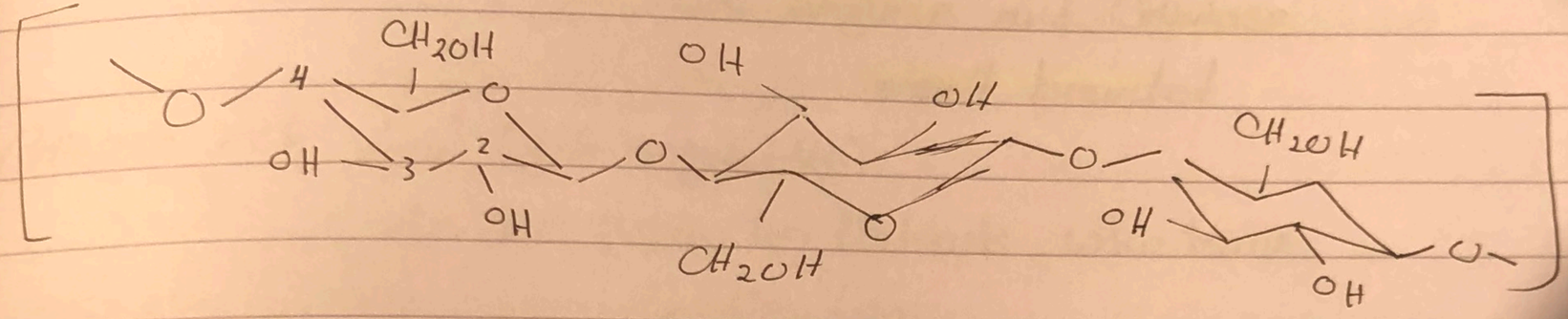
=> Branching in Glycogen & starch have non-reducing ends.



=> The main linear part have only one reducing ends.

"Structural Polysaccharides"

Cellulose: Structural component of plant cell walls
=> linear polymer of D-glucose
=> linked via β(1-4) glycosidic bonds



Cellulose

- The most abundant organic molecule
  => over half of the Carbon in biosphere

- So different from Starch architecturly.
  "hollow helix" due to it's β.

- Forms very long stright chains
  => Parallel chains interact with each other through H bonds

Herbivores & termites
=> Can digest Cellulose easily
=> They have the enzymes capable of Hydrolyzing the β(1-4) bonds

humans
=> Can't digest Cellulose
=> humans can digest α(1-4) bonds but not β(1-4).

الزائدة الدودية كانت مسؤولة قديمًا عن هضم β(1-4)، لكن مع تطور الإنسان توقفت عن العمل.

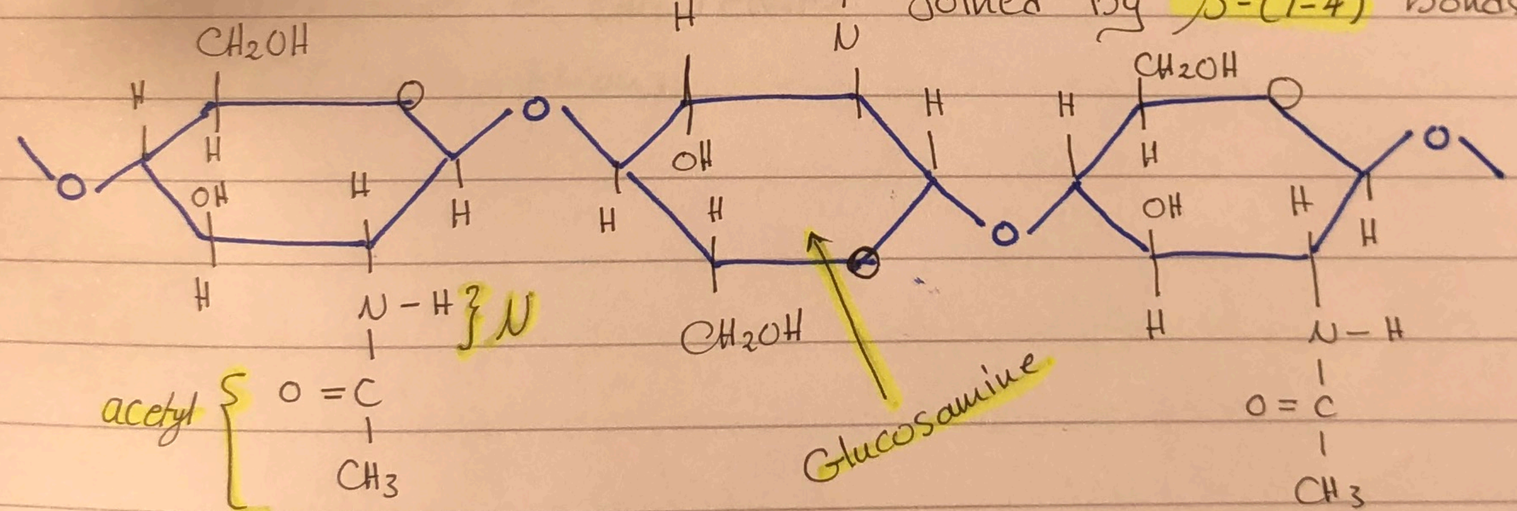
Structural Polysaccharides

The most branched ⇒ Glycogen
⇒ Amylopectin ← Then
⇒ Amylose and Cellulose aren't branched

Cellulose rich food (like vegetables)
⇒ are given to patients who have Constipation.

Chitin ⇒ homopolysacchride

⇒ The structural Component of the exoskeletons of invertebrates
⇒ Main Component of the Cell wall of fungi
⇒ long Chain Polymer ⇒ it's along Chain Polymer of N-acetyl -D- glucosamin joined by β-(1-4) bonds



⇒ N-acetyl group

⇒ It has Similar Structure to Cellulose
They only differ in the replacement of OH at C_2 of each monomer with acetyl amine group

" Structural Polysaccharides "

=1> "Chitosan"

=1> linear Polysaccharide Composed of Randomly disterbuted β-(1-4)-linked D-glucosamine → "deacetylated unit"
& N-acetyl-D-glucosamine → "acetylated unit"

=1> Produced Commercially

By deacetylation of Chitin " Shrimp shells are used " with alkali Sodium hydroxyl.

used For:

weight loss and obesity Treatment } Why?

Because it can reduce fat absorbtion.

" Heteropolysacchrides "

=1> Two or more different monosacchrides.
=1> associated with lipid or protein
⇓ ⇓
glycolipid glycoprotein.

=1> They are naturally found in Connective tissue
Cartilage tendous blood vessel walls

1 ■ Hyaluronic acid " Hyaluronate "

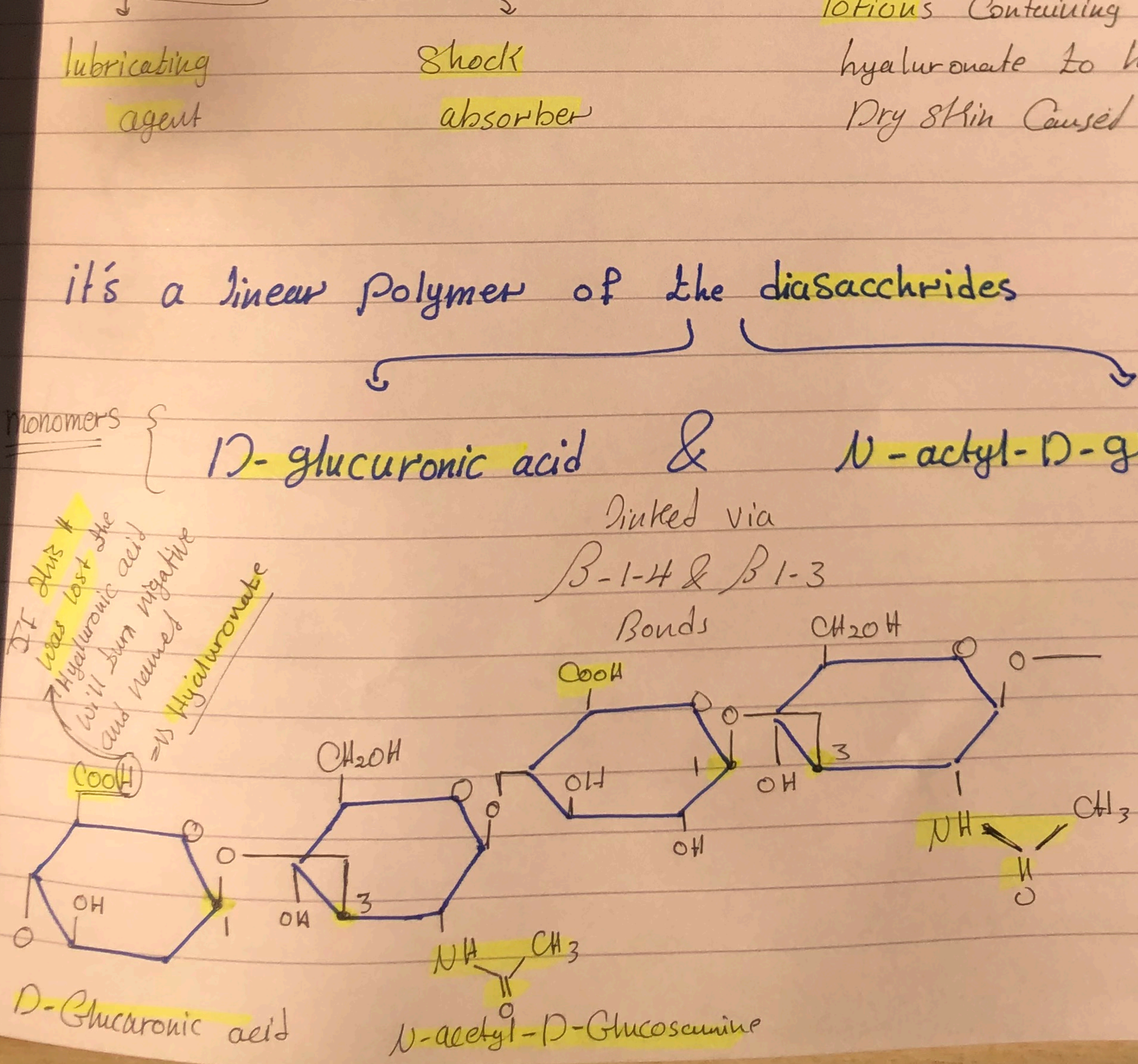
- major Component of joint fluid (Synovial fluid)
  - lubricating agent
  - shock absorber
- involved as tissue repair so, it's used as skin lotions Containing Sodium hyaluronate to help Dry skin Caused by eczema

it's a linear polymer of the diasacchrides

monomers { D-glucuronic acid & N-acetyl-D-glucosamine

linked via β-1-4 & β 1-3 Bonds

If glucose lost the Hyaluronic acid will turn negative and named =1> Hyaluronate



D-Glucaronic acid N-acetyl-D-Glucosamine

"HeteroPolySaccharides"

2 ◘ Sulfated heteroglycans

[1] Chondroitin Sulfate

[2] dermatan Sulfate

[3] Keratan Sulfate

[4] heparin

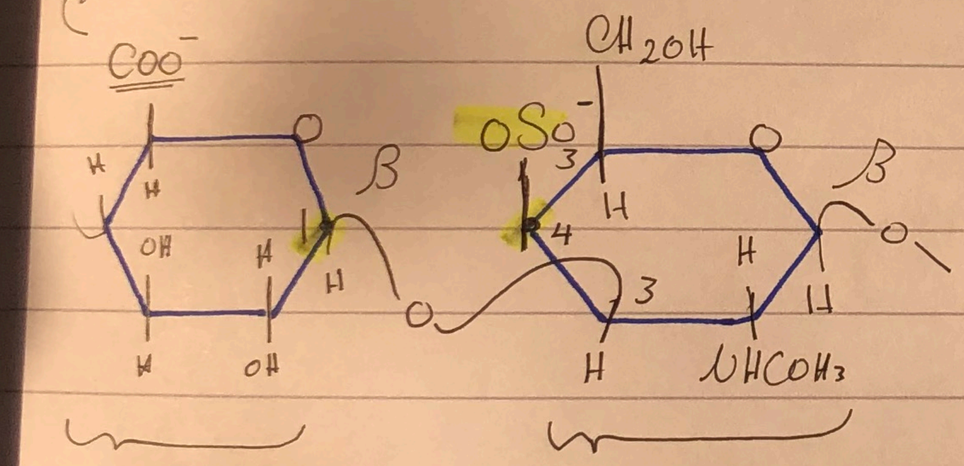
◘ Chondroitin-4 Sulfate & chondroitin-6-Sulfate (linear)

=1> unbranched Polymers

=1> Contains

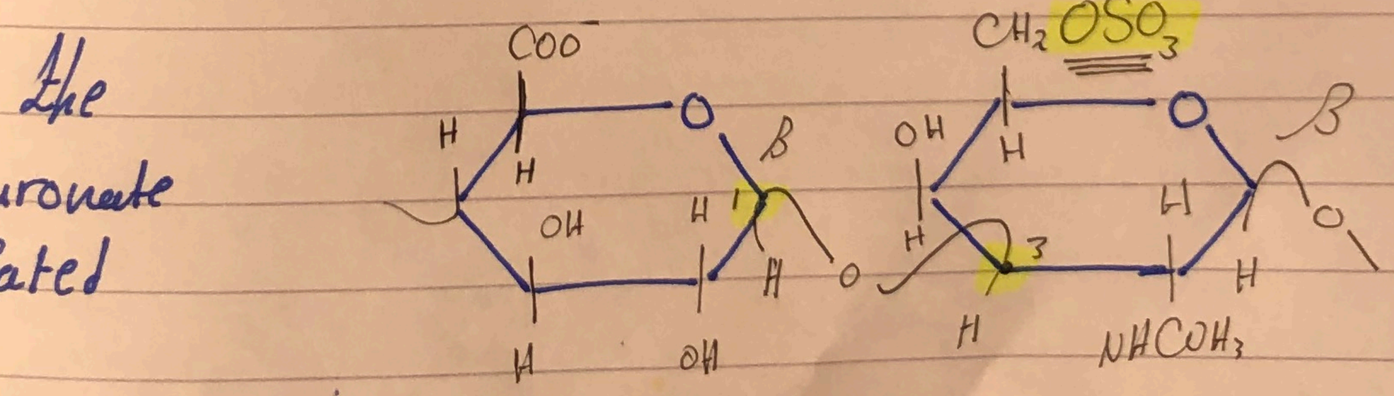
- D-glucaronic acid
  "D-Glucuronate"
- N-acetyl-D-Galactosamine

=1> OH Groups at position 4 or 6 bing Sulfated
↳ OSO_3^-



D-Glucuronate N-acetyl-D-Galactosamine
4-Sulfate

Note that the the D-Glucuronate isn't Sulfated



D-Glucaronate N-acetyl-D-galactosamine
-6-Sulfate.

" HeteroPolySacchrides "

Chondroitin Sulfate :

=I> Major Component of Cartilages

=I> Provide resistance to Compression

=I> loss of Choudroitin Sulfate Causes osteoarthritis

=I> Used as dietary Supplement to treat "

Commonly Sold with glucosamine.

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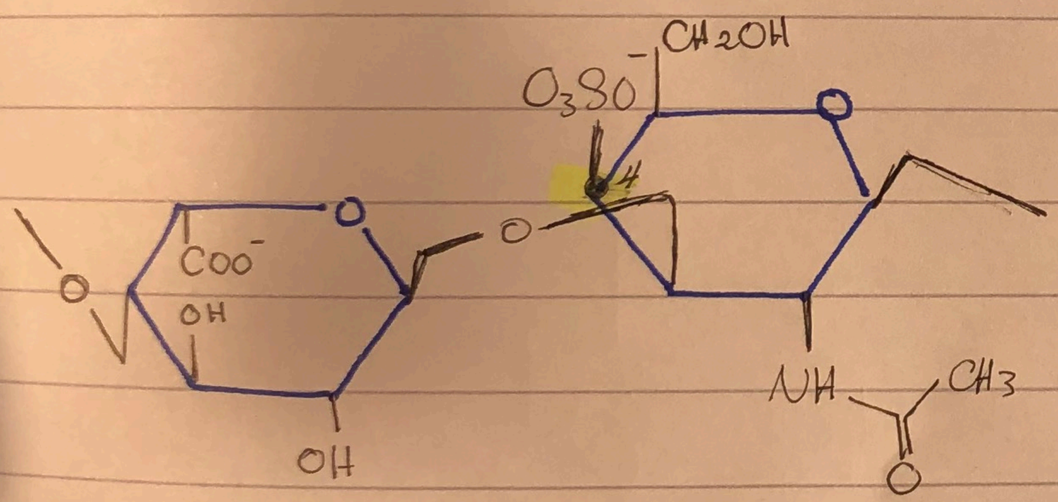
[2] Dermatan Sulfate:

=I> natural Poly Sacchride found in skin

=I> linear Polymer of diasaccharides

- 2- Iduronic acid
- N-acetyl-D-galactosamine-4-Sulfate



Dermatan Sulfate

L-Iduronate N-acetyl-D-galactosamine-4-Sulfate

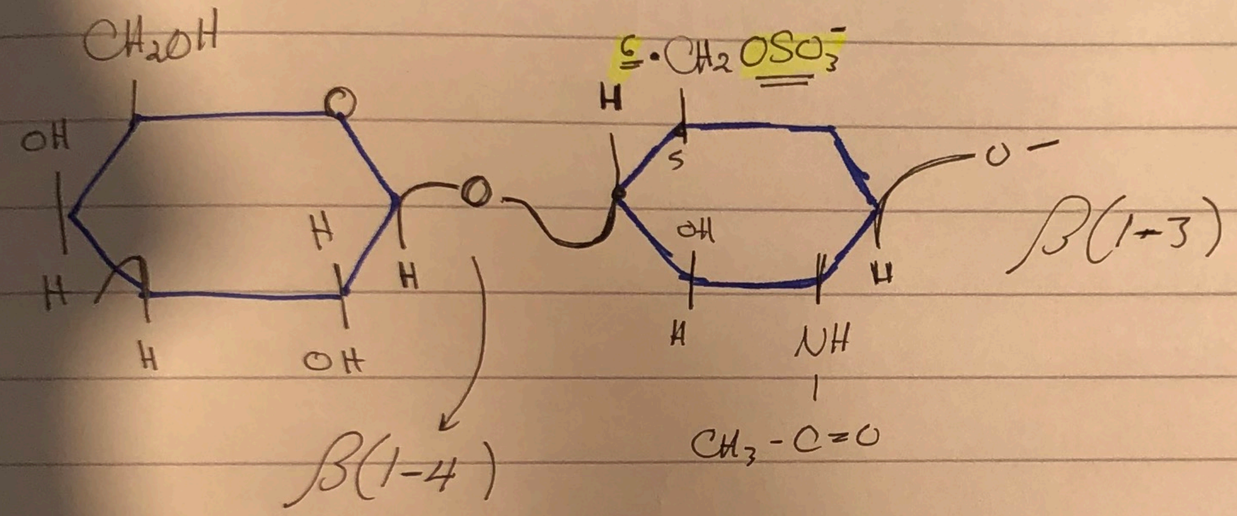
" HeteroPolysacchrides "

[4] Keratan Sulfate:

Keratan
=> Natural polysacchride found in bones & cartilage
=> Highly hydrated molecules
=> linear polymer repeating disacchride

Keratin => Protien

- D-galactose
- N-acetyl-D-glucosamine-6-Sulfate



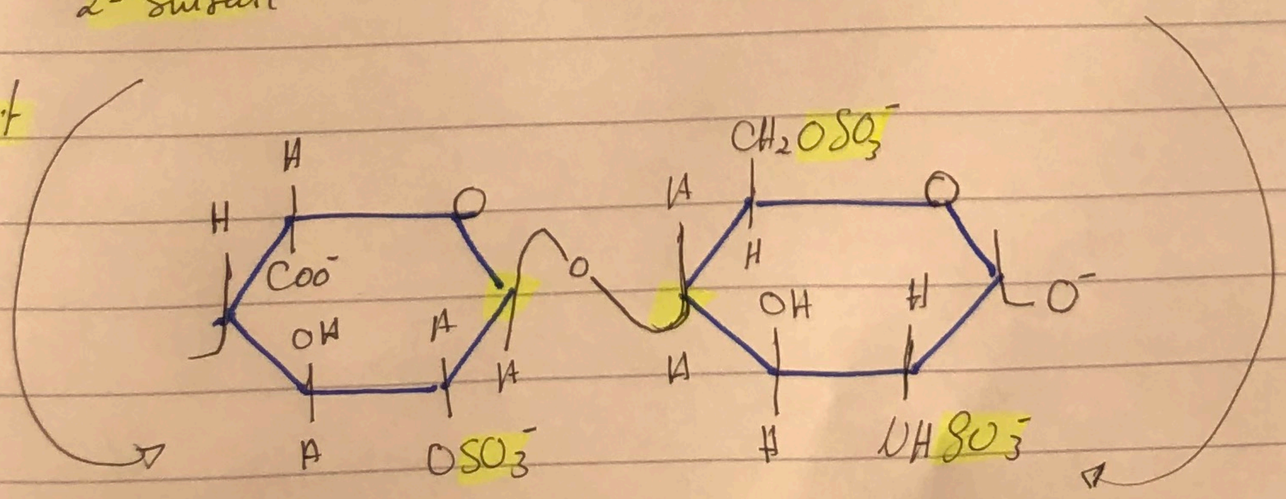
- D-galactose
- N-acetyl-D-galactosamine-6-Sulfate

[5] Heparin :

=> The most Highly Charged Polymer of any biological molecule
=> Complex mixure of linear PolySacchrides

one example is the Sulfated disaccharide unit

- ① L-Iduronate 2-Sulfate
- ② N-Sulfo-D-glucosamine-6-Sulfate



Varies in the degree of sulfation of it's sugar units.

=> Stored within the Secretory granules of mast Cells
=> Inhibits blood Clotting => injectable anticoagulant