

# Chem 452 - Lecture 7

## Carbohydrates

### 111109

Carbohydrates are one of the four major classes of biomolecules, which include the proteins, lipids and nucleic acids. In terms of total mass, carbohydrates make up the largest fraction of biomolecules in the biosphere. Carbohydrates have the basic chemical formula  $(CH_2O)_n$  and derive their diversity of structure from the the multiple stereoisomers that they can form. They play many important biological roles, including sources and storage forms of chemical energy, components of nucleic acids, and structural roles such as cell walls. They are also found covalently bonded to proteins and lipids, where they play important roles in cell-cell communication.

### Problem

Question:

Draw the structure of the  $\beta$ -anomer of the disaccharide formed by linking D-galactose to D-glucose using a  $\beta(1\rightarrow4)$  glycosidic bond.

( $\beta$ -D-galactopyranosyl-(1-4)- $\beta$ -D-glucopyranose)

Name a natural source for this disaccharide.

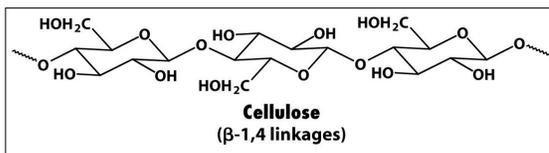
What is the more common name for this disaccharide?

Chem 452, Lecture 7 - Carbohydrates 2

### Complex Carbohydrates

+ Multiple monosaccharides can combine using glycosidic bonds to form **oligosaccharides** and **polysaccharides**

- **Cellulose** is a **homopolymer** of glucose joined by  $\beta$ -1,4 glycosidic bonds.

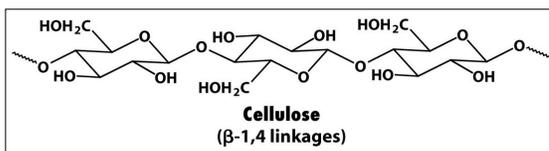


Chem 452, Lecture 7 - Carbohydrates

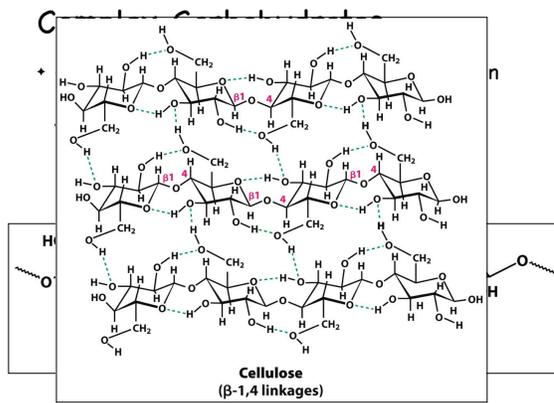
### Complex Carbohydrates

+ Cellulose is the most prevalent biomolecule in terms of mass

- It is very resistant to degradation.
  - Forms insoluble fibers
  - Few organisms have the enzyme (cellulase), required to hydrolyze the  $\beta$ -1,4 linkage



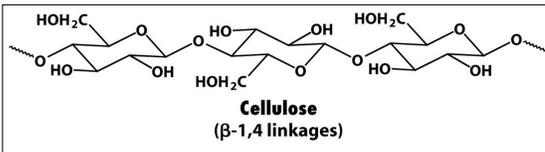
Chem 452, Lecture 7 - Carbohydrates



Chem 452, Lecture 7 - Carbohydrates

## Complex Carbohydrates

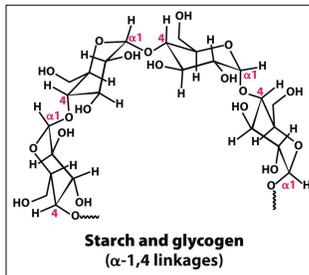
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Chem 452, Lecture 7 - Carbohydrates

## Complex Carbohydrates

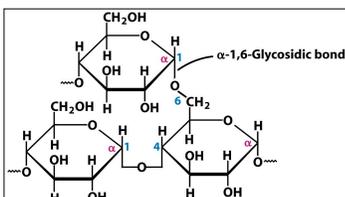
- + **Amylose (Starch)** is a **homopolymer** of glucose joined by  $\alpha$ -1,4 glycosidic bonds.



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## Complex Carbohydrates

- + **Amylopectin (another form of Starch)** and **Glycogen** are **homopolymers** of glucose joined by  $\alpha$ -1,4 glycosidic bonds, along with  $\alpha$ -1,6 branch points.

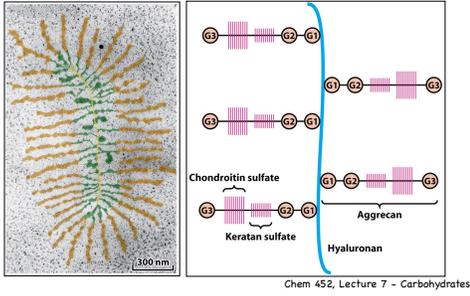


Chem 452, Lecture 7 - Carbohydrates



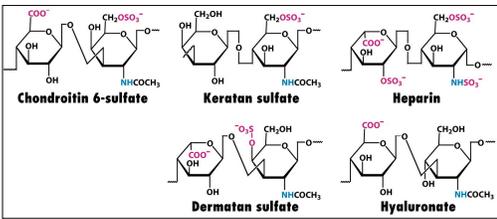
## Complex Carbohydrates

- + **Proteoglycans** are a combination of protein and oligosaccharides called **glycosaminoglycans**.



## Complex Carbohydrates

- + **Glycosaminoglycans** are highly charged and very hydrophilic



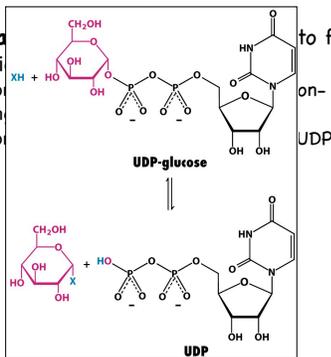
## Complex Carbohydrates

- + **Glycotransferases** are enzymes used to form glycosidic bond.
  - The monosaccharides are added to the non-reducing end.
  - The monosaccharides are activated with UDP

Chem 452, Lecture 7 - Carbohydrates

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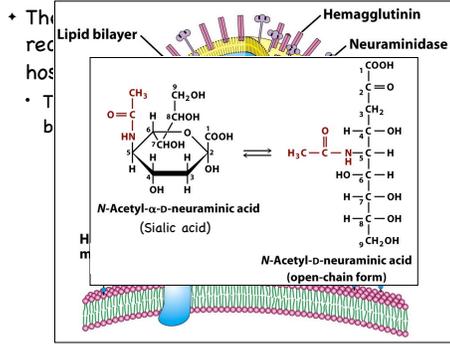






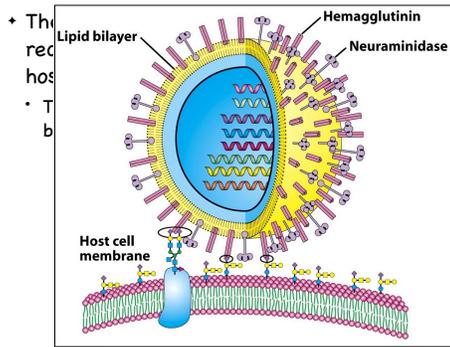


# Glycoproteins



Chem 452, Lecture 7 - Carbohydrates

# Glycoproteins



Chem 452, Lecture 7 - Carbohydrates

# Next up

+ Unit IV, Lecture 8 - Lipids and Cell Membranes  
(Chapter 12)

Chem 452, Lecture 7 - Carbohydrates 22