




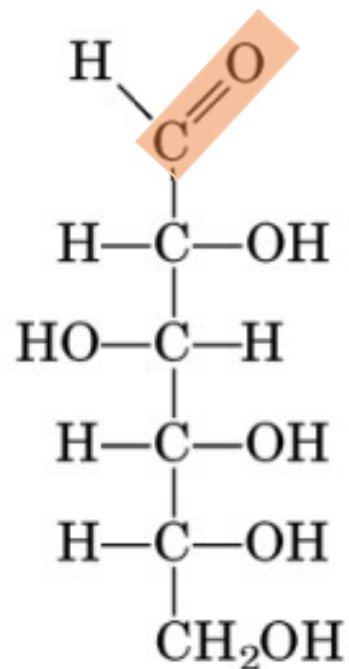
Carboidratos

Carlos Hotta

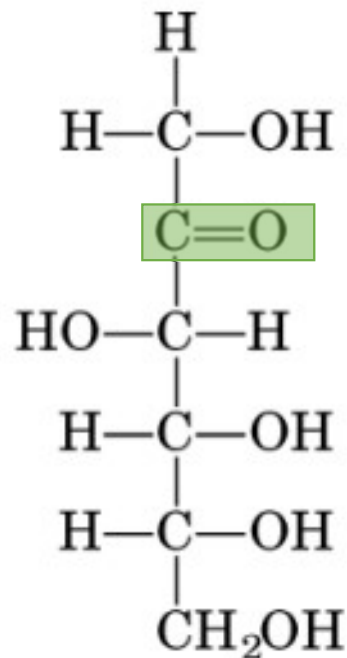
A detailed photograph of a variety of sweets and snacks arranged on a dark wooden surface. In the center, a glass of amber-colored beer with ice cubes is visible. Surrounding it are several donuts with different toppings like pink frosting and white sprinkles, scoops of pink ice cream, a bar of white chocolate, a bar of dark chocolate, a large rainbow lollipop, and various candies including M&M's and raspberries. The scene is well-lit, highlighting the textures and colors of the food.

Carboidratos são hidratos de carbono que geralmente seguem a fórmula $(\text{CH}_2\text{O})_n$

Carboidratos são **poliálcool-aldeídos** ou **poliálcool-acetonas**



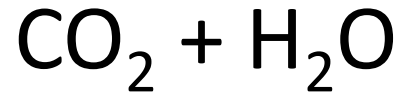
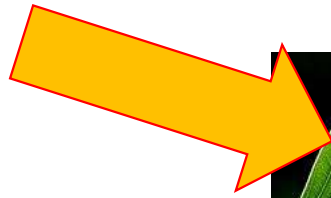
D-Glucose,
an **aldohexose**



D-Fructose,
a **ketohexose**

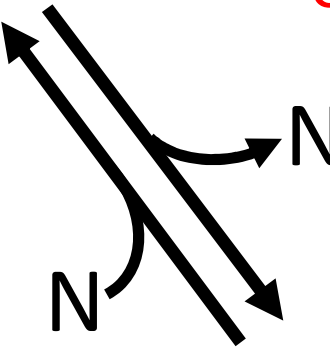
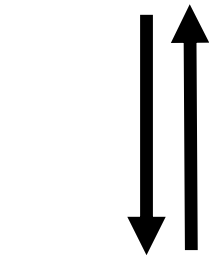
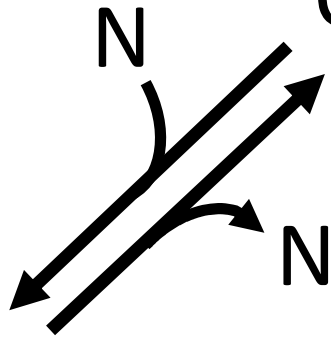
- Os carboidratos mais conhecidos têm 5 ou 6C
- Estrutura pode ser representada na **forma cíclica** ou na **forma linear**
- Podem conter N, S ou outras modificações

Carboidratos são produzidos durante a fotossíntese



Carboidratos formam a base do **metabolismo energético**

Carboidratos



Amino ácidos

Lipídeos

Nucleotídeos

Carboidratos são importantes na nossa alimentação



frutose



sacarose



“fibras”



“açúcar invertido”

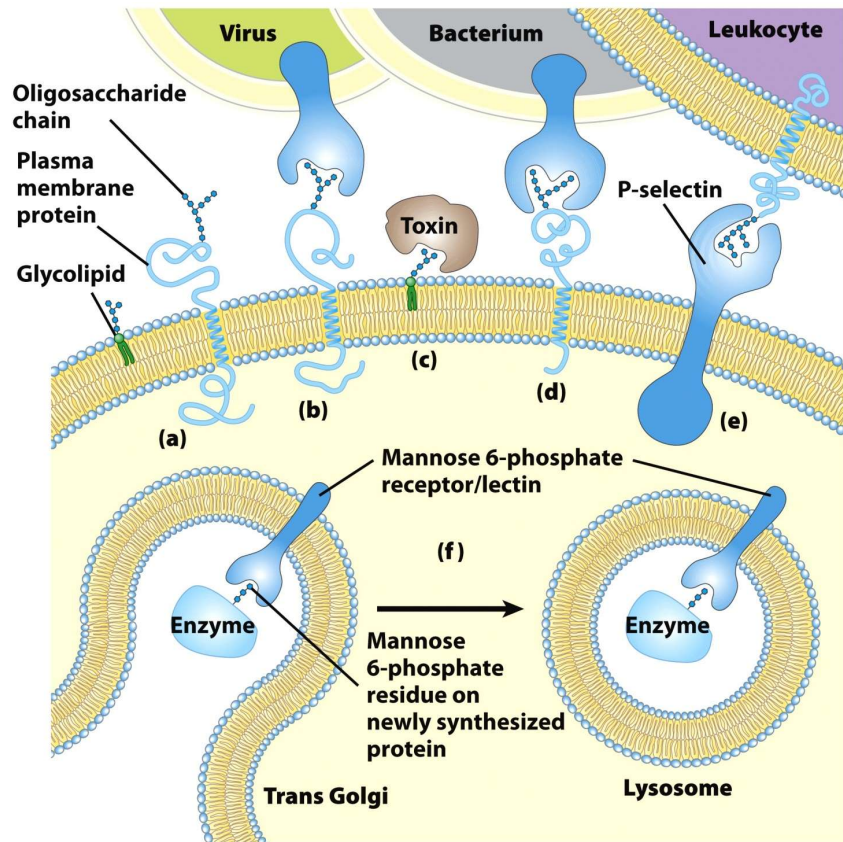


lactose



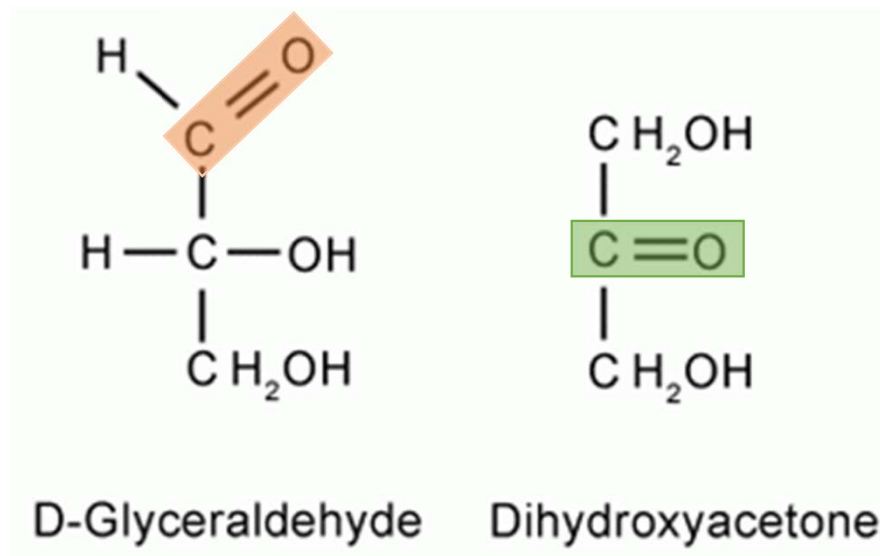
amido

Carboidratos podem fazer parte de proteínas e lipídeos



Glicoproteínas são importantes no processo de **adesão celular** e no **reconhecimento** de outras moléculas

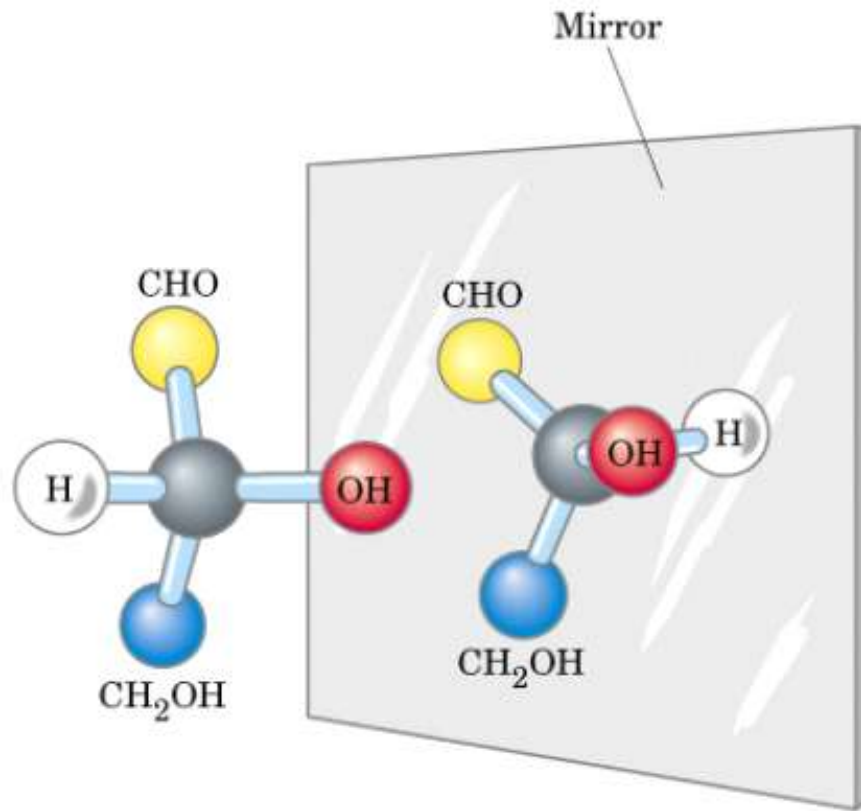
Carboidratos são **poliálcool-aldeídos** ou **poliálcool-acetonas**



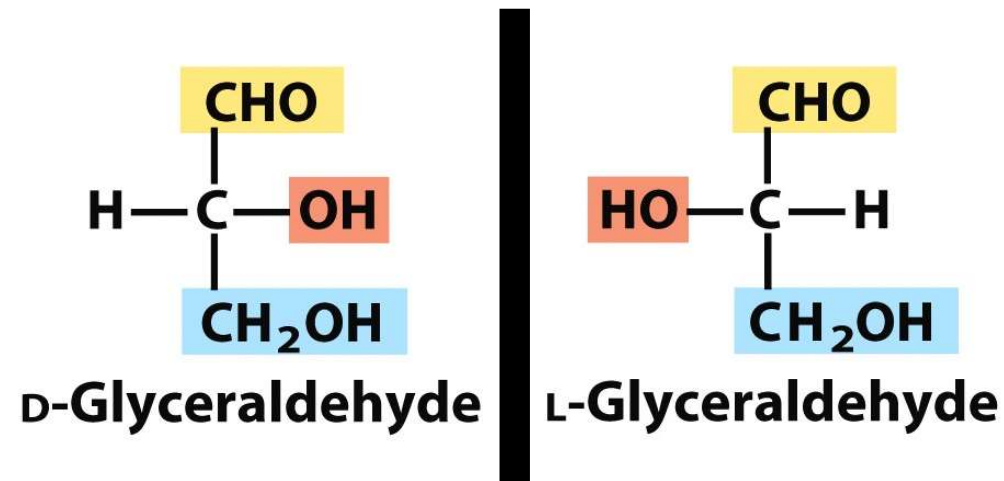
O gliceraldeído e a diidroxiacetona são **trioses** (3C), os carboidratos mais simples

- Fórmula geral:
 $(\text{CH}_2\text{O})_n$
- Estas moléculas são isômeros, pois possuem a mesma fórmula geral mas estruturas diferentes

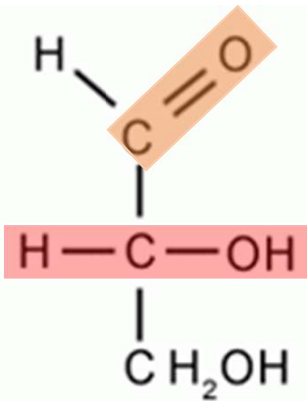
Carboidratos biológicos são geralmente destros



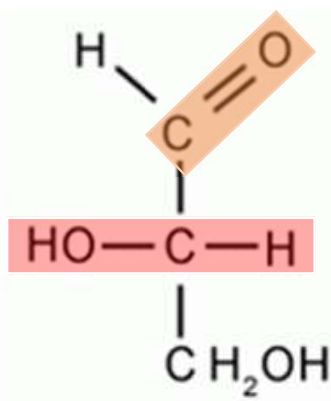
Ball-and-stick models



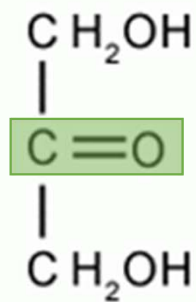
Isômeros de trioses



D-Glyceraldehyde



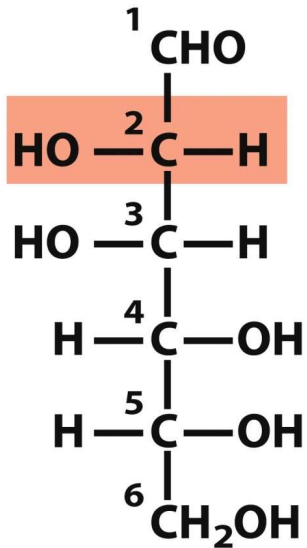
L-Glyceraldehyde



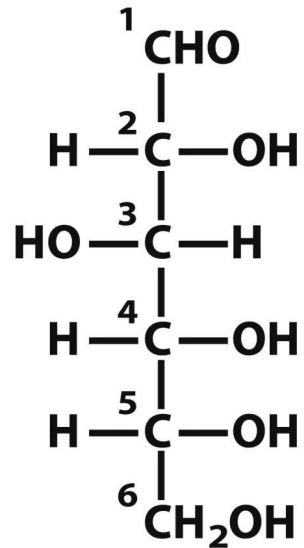
Dihydroxyacetone

- Temos três tipos de trioses: os isômeros óticos de **poliálcool-aldeídos** e uma **poliálcool-acetona**

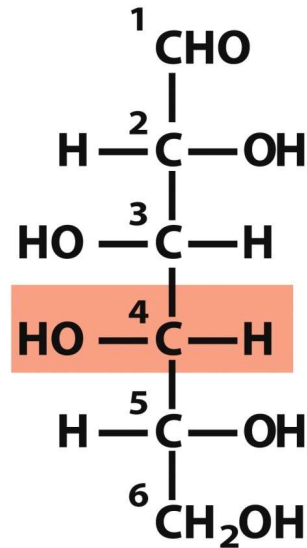
Carboidratos maiores podem possuir muitos isômeros



D-Manose
(epímero em C2)



D-Glicose

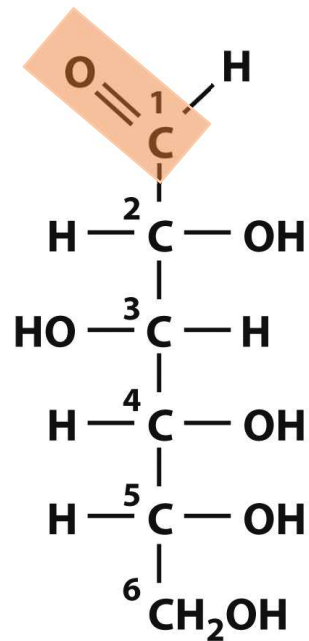


D-Galactose
(epímero em C4)

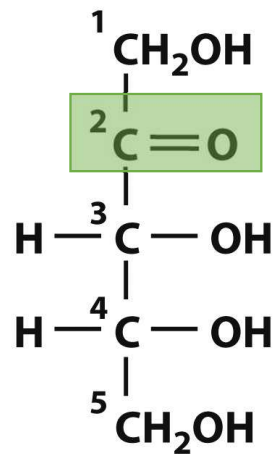
Epímeros são isômeros com apenas um centro quiral diferente

Enantiômeros possui todos os centros quirais diferentes (L-Manose, L-Glicose e L-Galactose)

Pentoses e hexoses são os carboidratos mais comuns



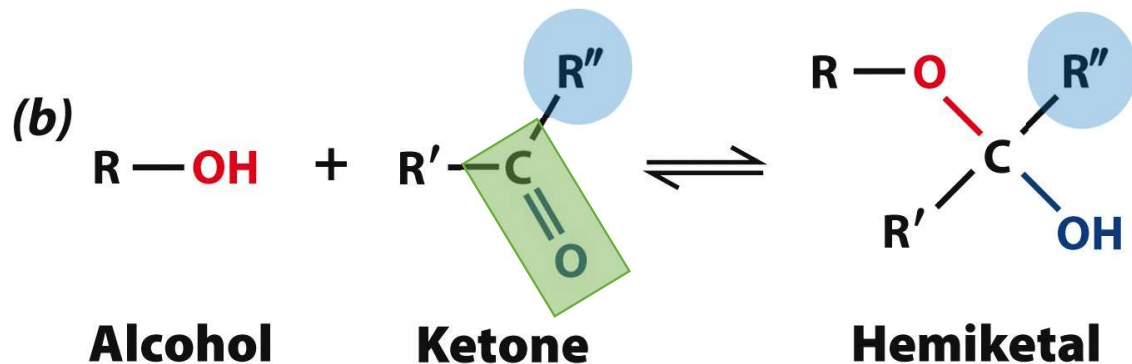
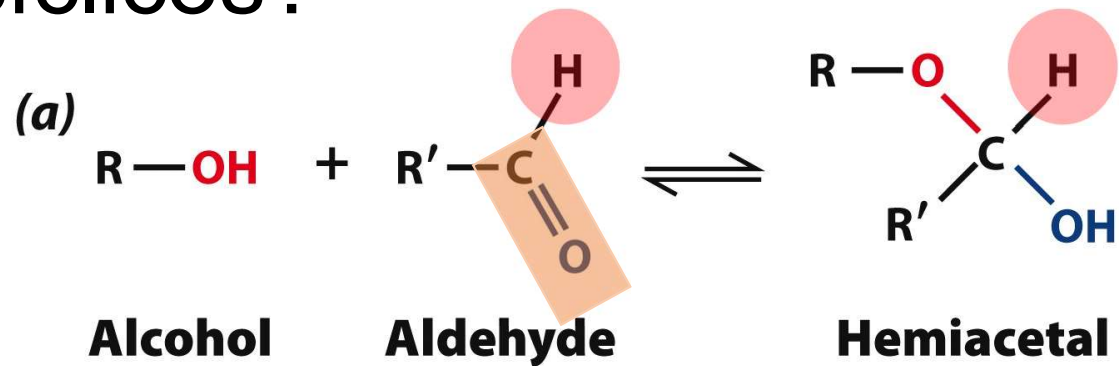
D-Glicose
6C



D-Ribulose
5C

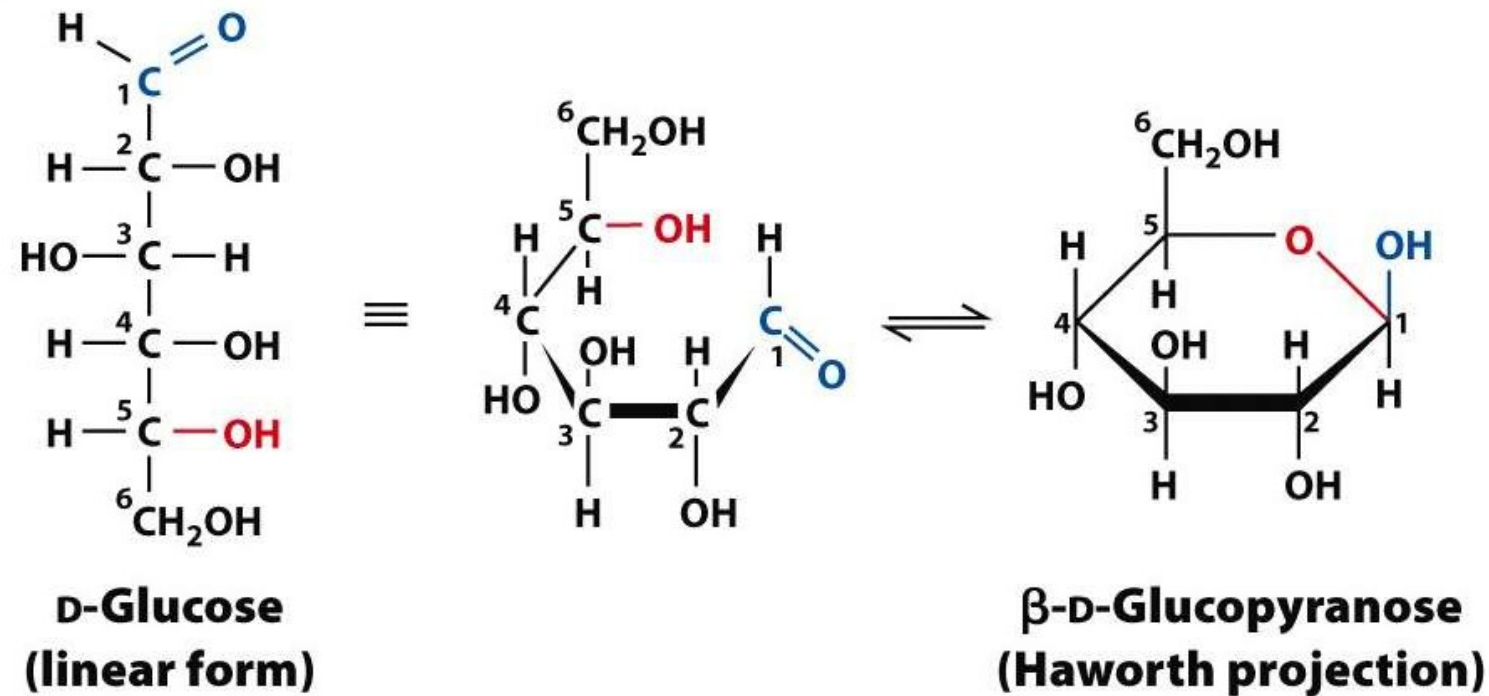
- A glicose é uma molécula central no nosso **metabolismo energético**
- A ribulose é um dos componentes dos **nucleotídeos**, que formarão DNA e RNA

Mas carboidratos não são cíclicos?



- A ligação =O pode reagir com um -OH, às vezes na própria molécula
- O hemiacetal e o hemiketal podem reagir novamente com um -OH

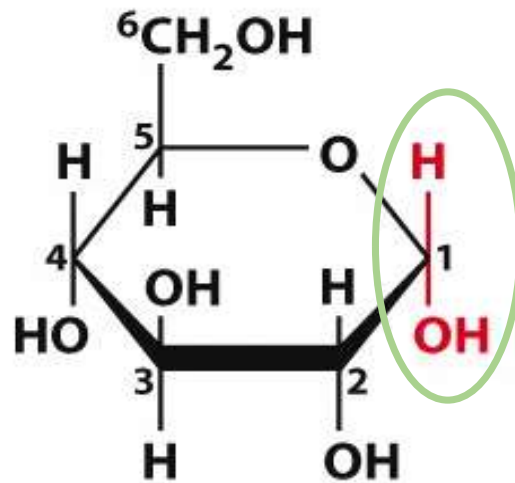
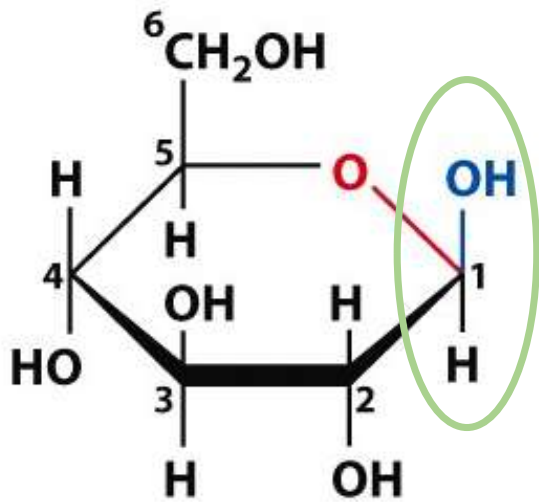
Mas carboidratos não são cíclicos?



Em solução aquosa, formas de 5C ou mais geralmente são **cíclicas**

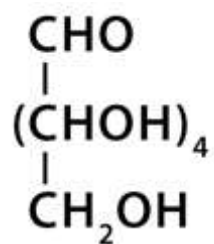
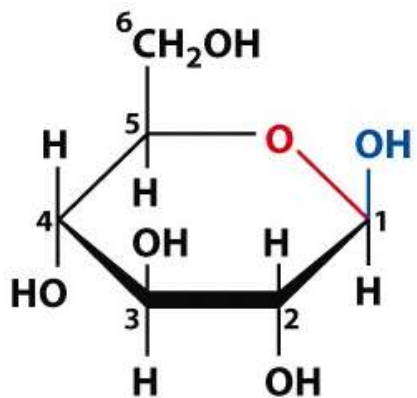
Anômeros

Podem adotar a forma α - (1/3) ou β - (2/3)
que se **convertem naturalmente**

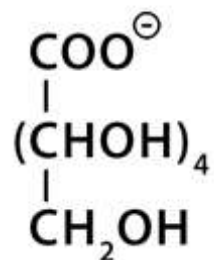


Carboidratos podem ser reduzidos

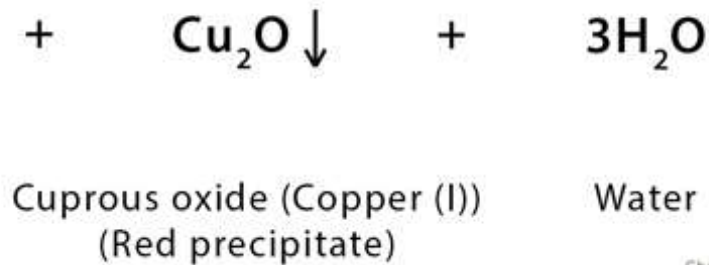
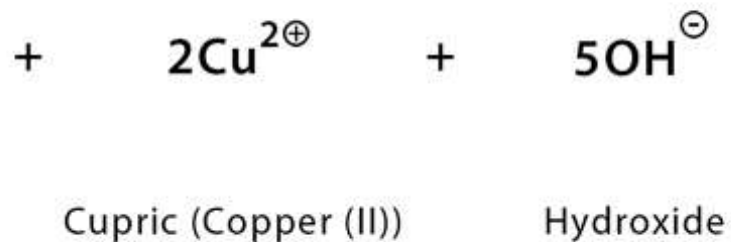
Reação de Fehling: Cu^{+1} produzido em condições alcalinas forma um precipitado vermelho de óxido cuproso



Glucose



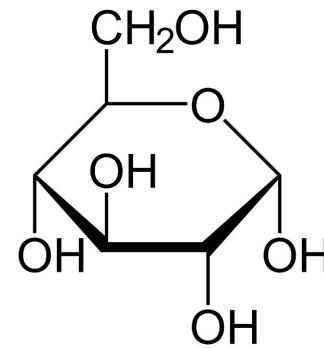
Carboxylate



Carboidratos podem se organizar em múltiplas unidades

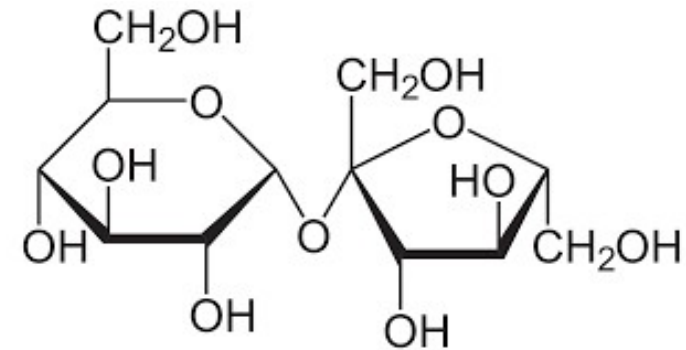
- Monossacarídeos (uma unidade)

ex: glicose, frutose, ribose

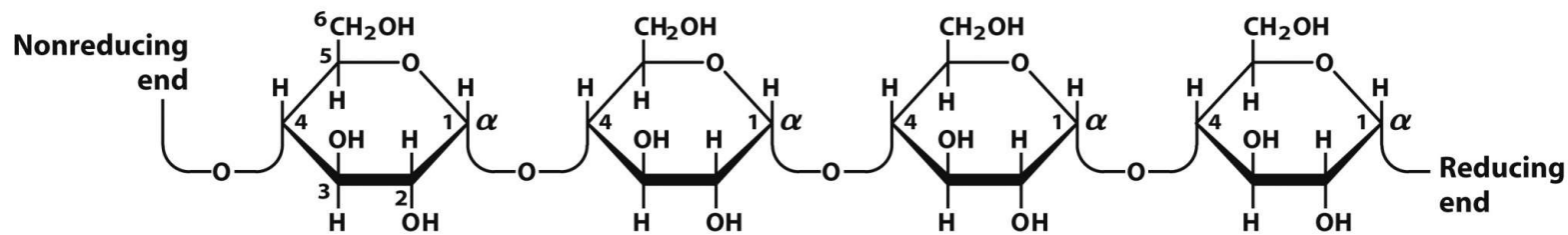


- Dissacarídeos (duas unidades)

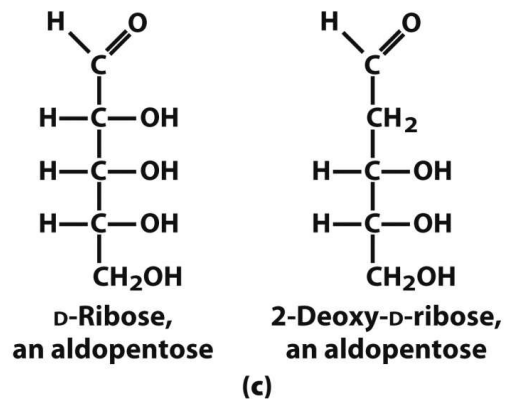
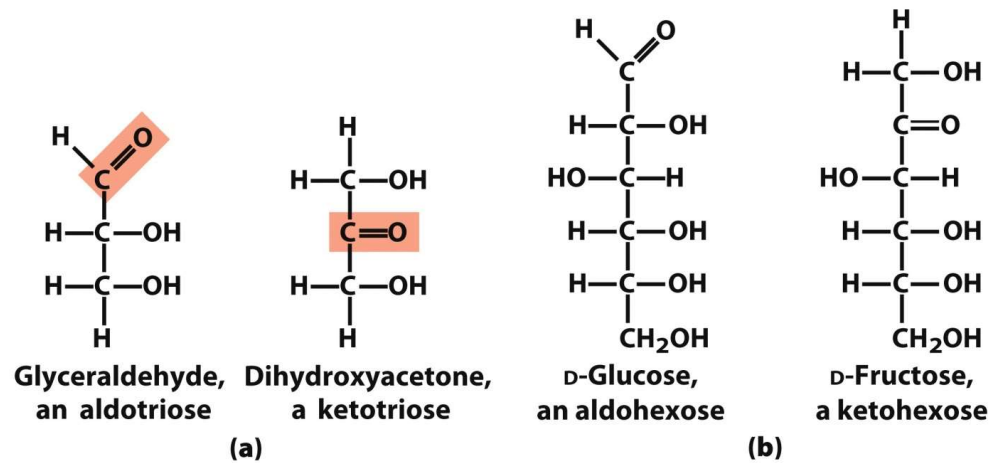
ex: sacarose, lactose



- Polissacarídeos (múltiplas unidades)

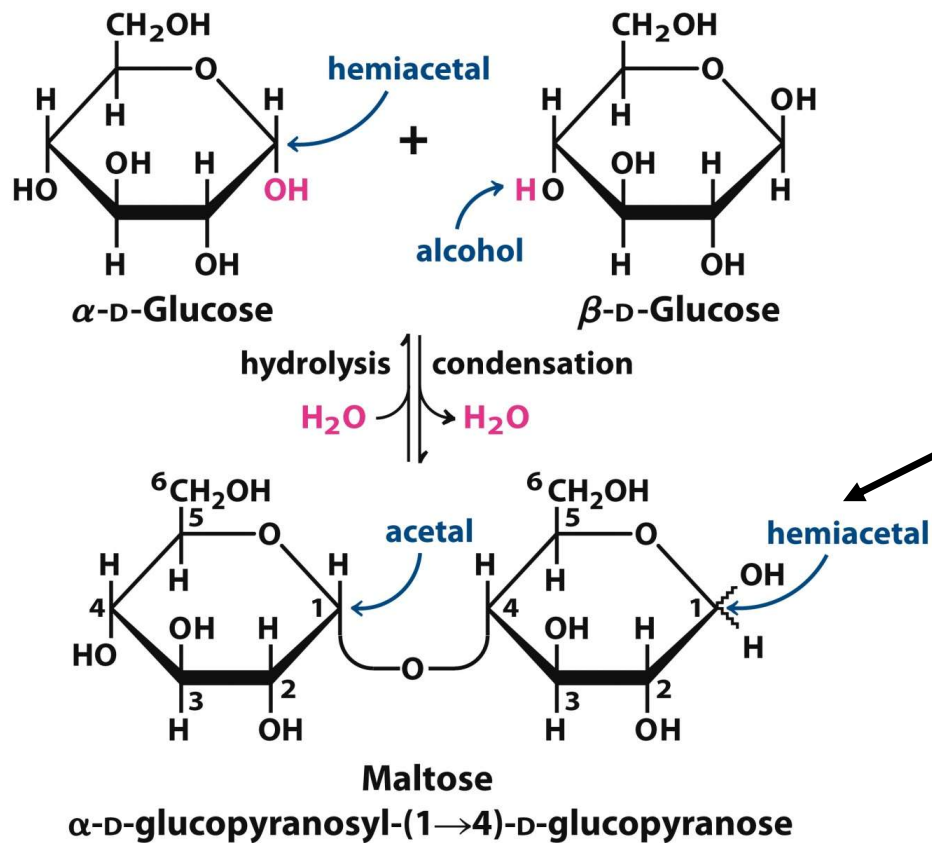


Monossacarídeos são a unidade básica dos carboidratos



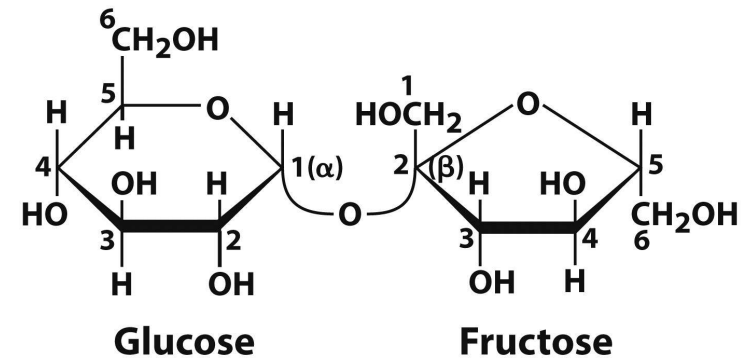
- São considerados açúcares redutores
- Acima de 5C, geralmente são cíclicos

Dissacarídeos possuem ligações O-glicosídicas

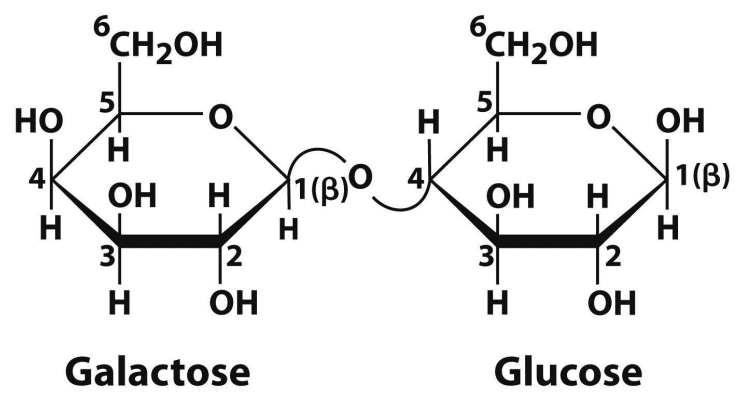


- Somente uma unidade é redutora
- Os dissacarídeos podem ser formados por diferentes unidades e diferentes ligações

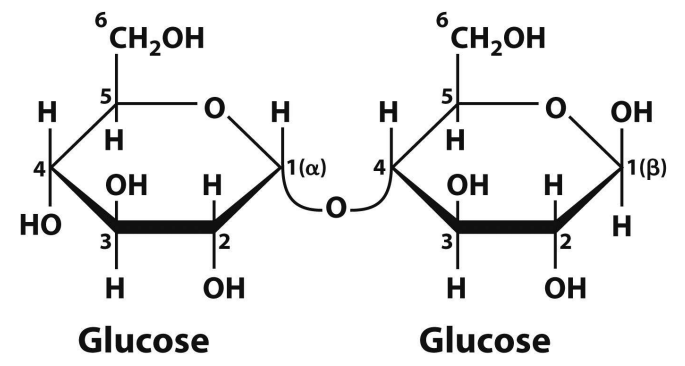
Os dissacarídeos possuem diferentes unidades e ligações



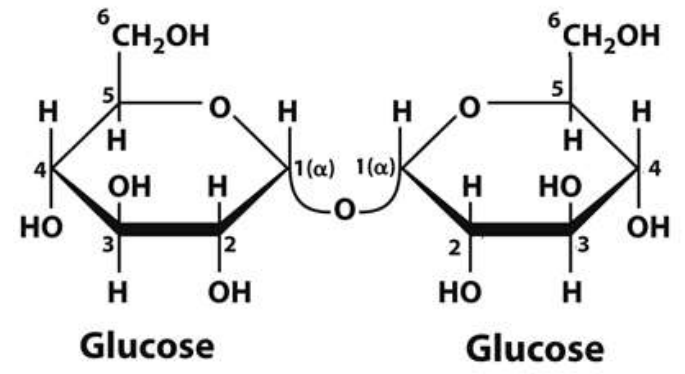
Sucrose



Lactose



Maltose

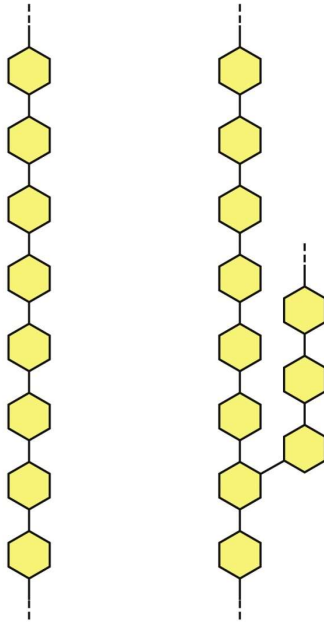


Trehalose

Polissacarídeos são formados por múltiplas unidades

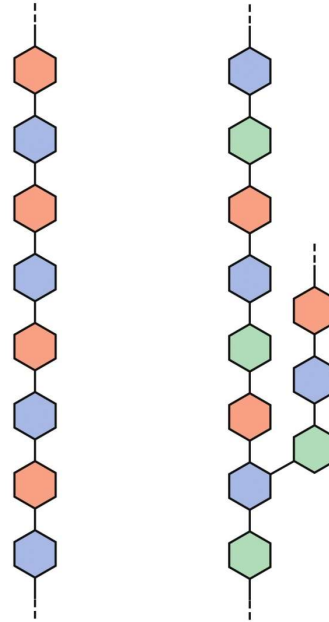
Homopolysaccharides

Unbranched Branched



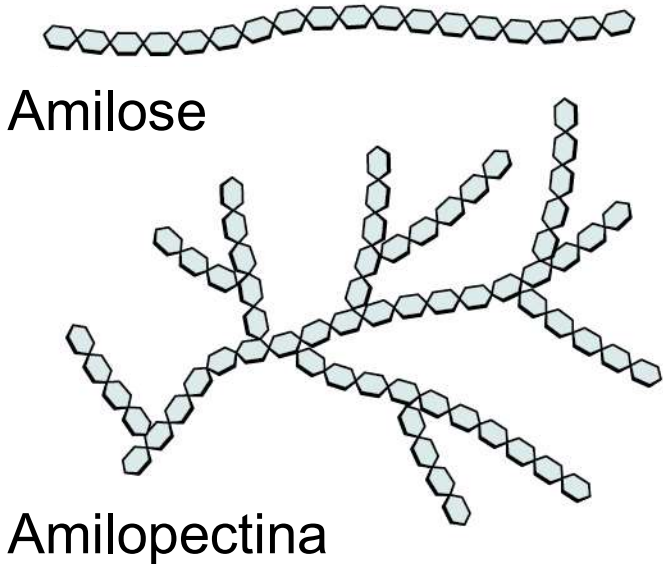
Heteropolysaccharides

Two monomer types, unbranched Multiple monomer types, branched



- É possível formar grandes polímeros de carboidratos
- Estes polímeros podem ser ramificados

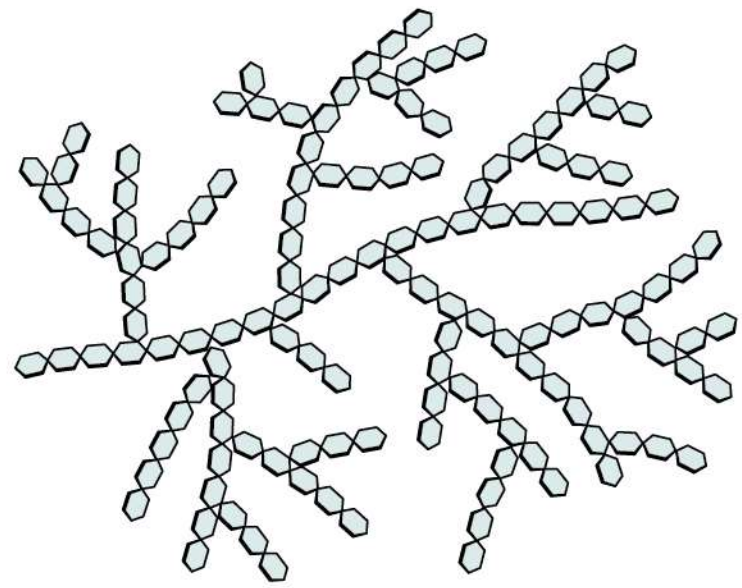
Polissacarídeos podem adquirir diferentes formatos



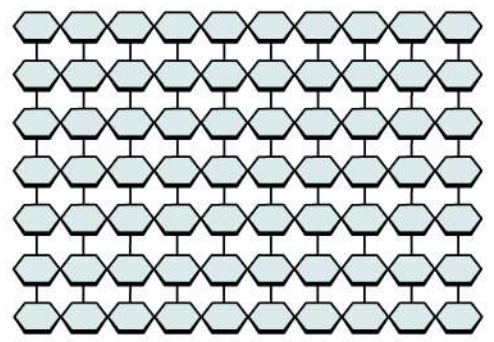
Amilose

Amilopectina

Amido

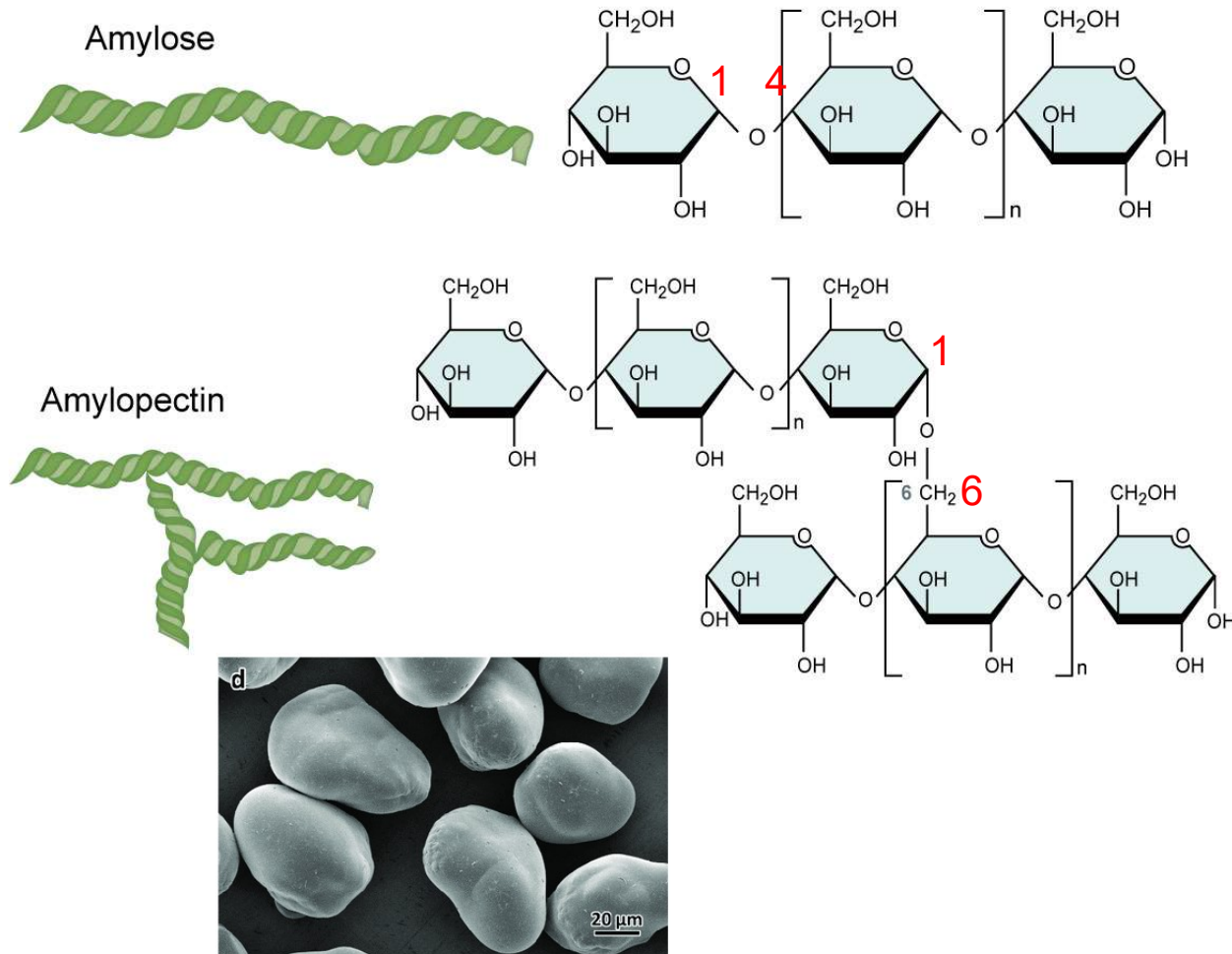


Glicogênio



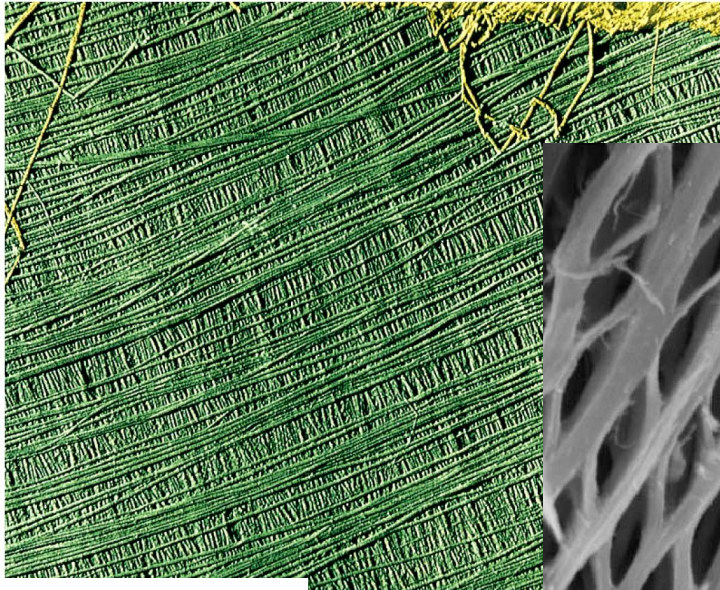
Celulose

Polissacarídeos de reserva

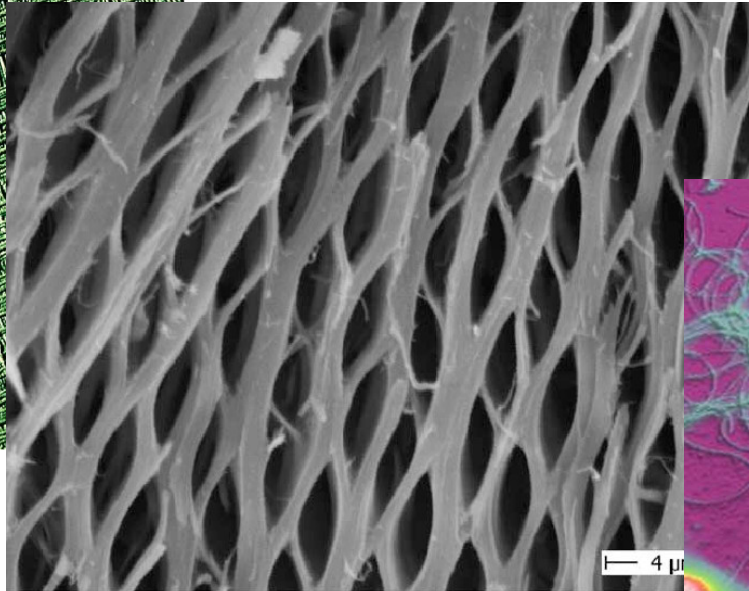
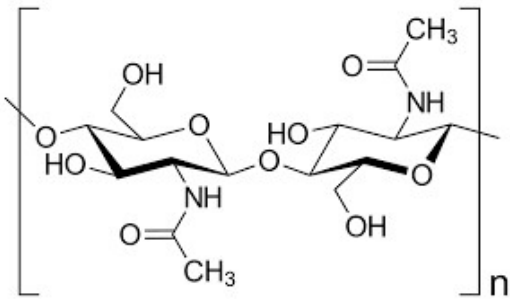


- Amido é uma mistura de **amilose** e **amilopectina**
- A amilose é feita de anéis de glicose ligados na forma α -1,4
- Amilopectina (plantas) e glicogênio (animais e fungos) são estruturas parecidas, com ligações α -1,4 e 1,6, no entanto, o **glicogênio é mais ramificado**

Polissacarídeos estruturais



Celulose



**Quitina
(exoesqueleto)**

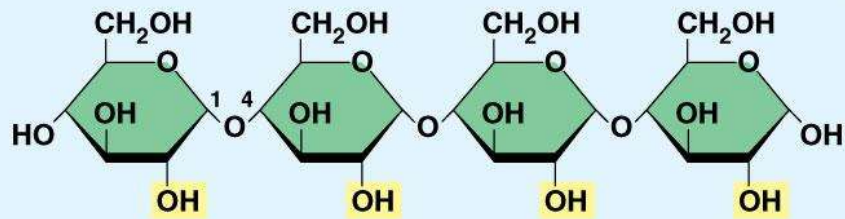
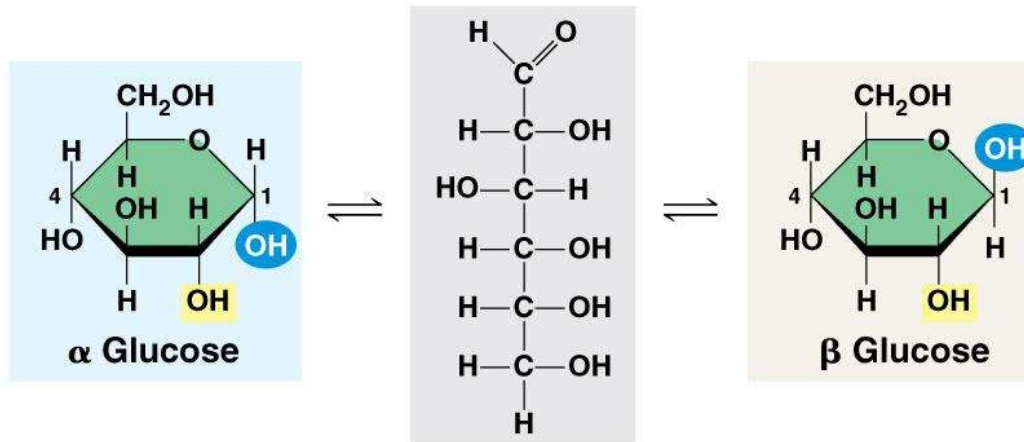


Peptidoglicano

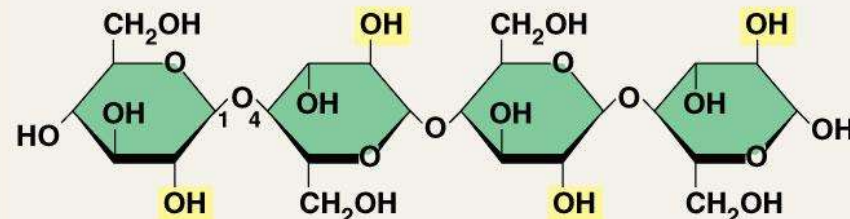
Polissacarídeos estruturais

A celulose não é ramificada, e é feita de ligação β -1,4

(a) α and β glucose ring structures



(b) Starch: 1–4 linkage of α glucose monomers



(c) Cellulose: 1–4 linkage of β glucose monomers

Polissacarídeos – parede celular

A parede celular de bactérias é feita de múltiplos carboidratos complexados com aminoácidos

