Bioquímica Geral
RFM0004

Carboidratos

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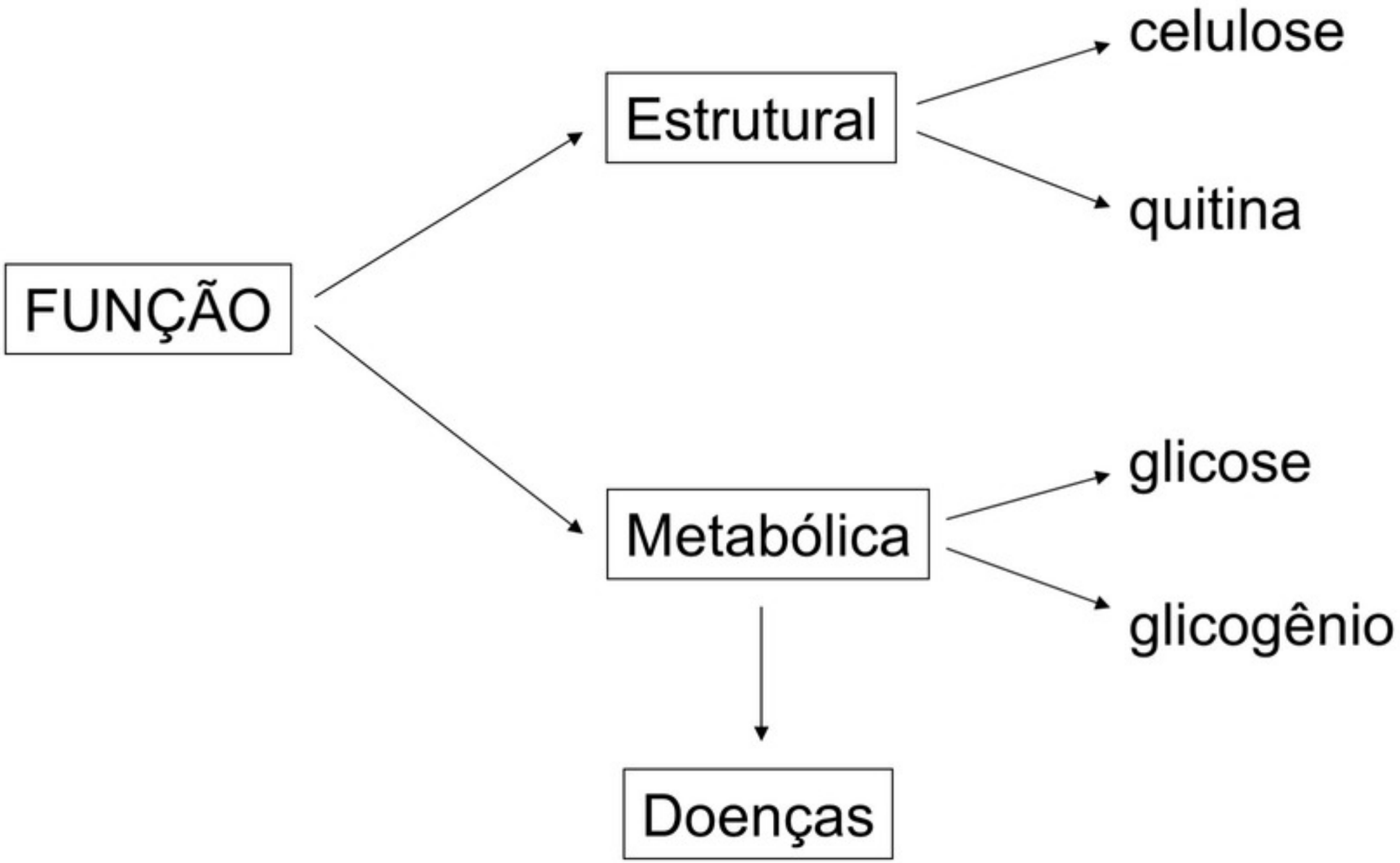
FMRP-USP

Chapter 11 Opener part 1
Biochemistry, Sixth Edition

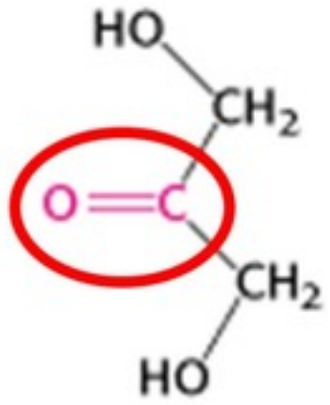
Collaborate!

Carboidratos

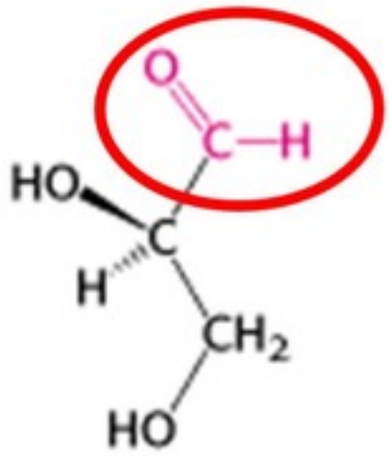
Importância



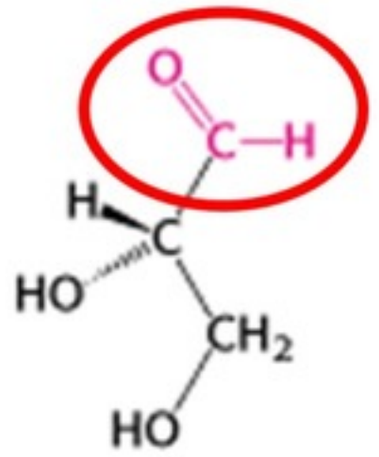
CARBOIDRATOS



Dihydroxyacetone
(a ketose)



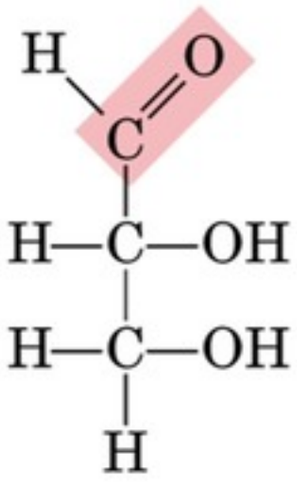
D-Glyceraldehyde
(an aldose)



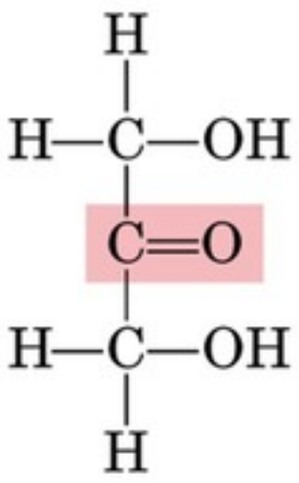
L-Glyceraldehyde
(an aldose)

- Por quê o nome cetose e aldose ?
- Por quê a diidroxiacetona não possui as formas D e L ?
- O que é um carbono assimétrico ?
- Quantos isômeros existem ?

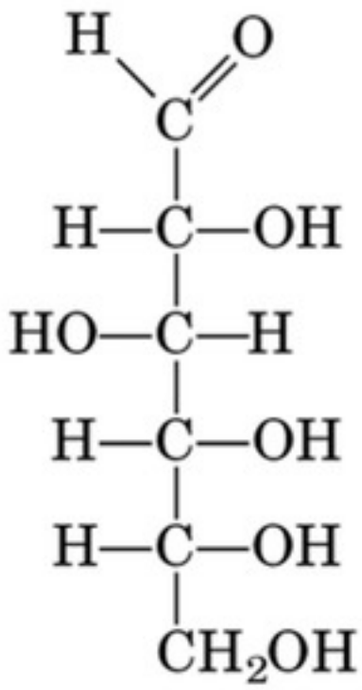
Aldoses e Cetoses



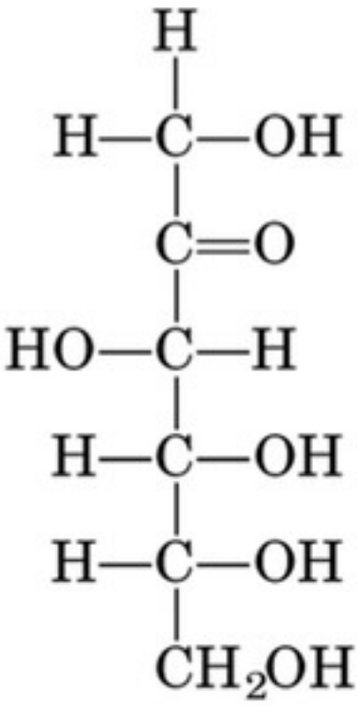
Glyceraldehyde, an aldotriose



Dihydroxyacetone, a ketotriose



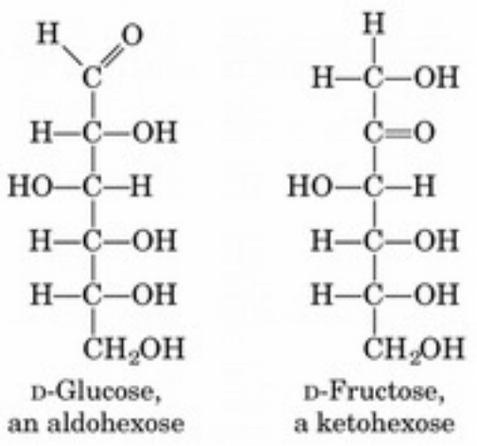
D-Glucose, an aldohexose



D-Fructose, a ketohexose

Qual a diferença entre uma cetose e uma aldose com relação ao número de carbonos assimétricos?

Open Ended Question

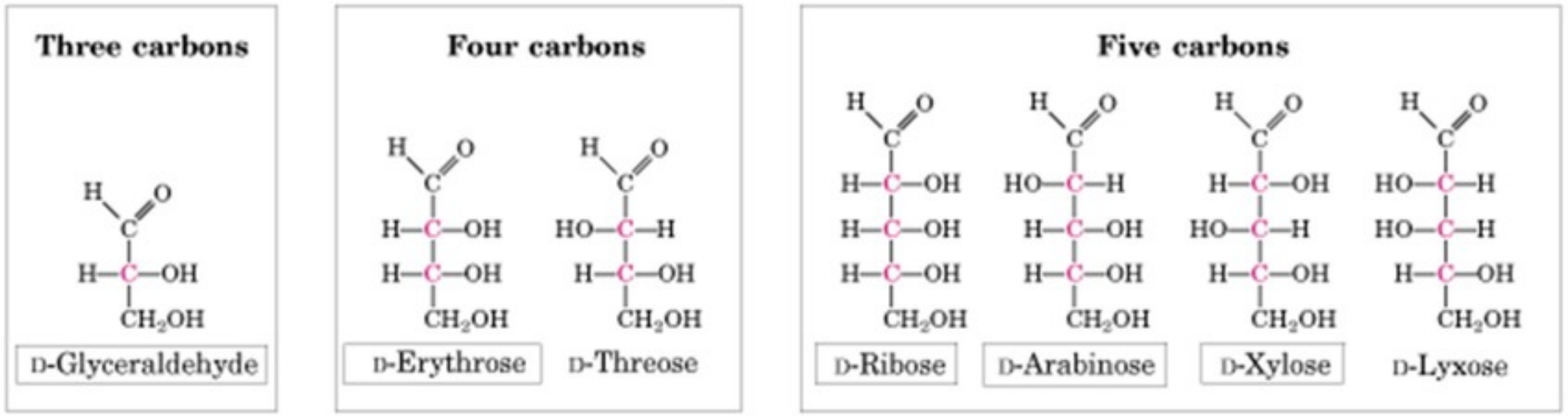


Qual é a diferença entre uma aldose e uma cetose em relação ao número de carbonos assimétricos?

Please enter your answer here.

Nomenclatura básica:

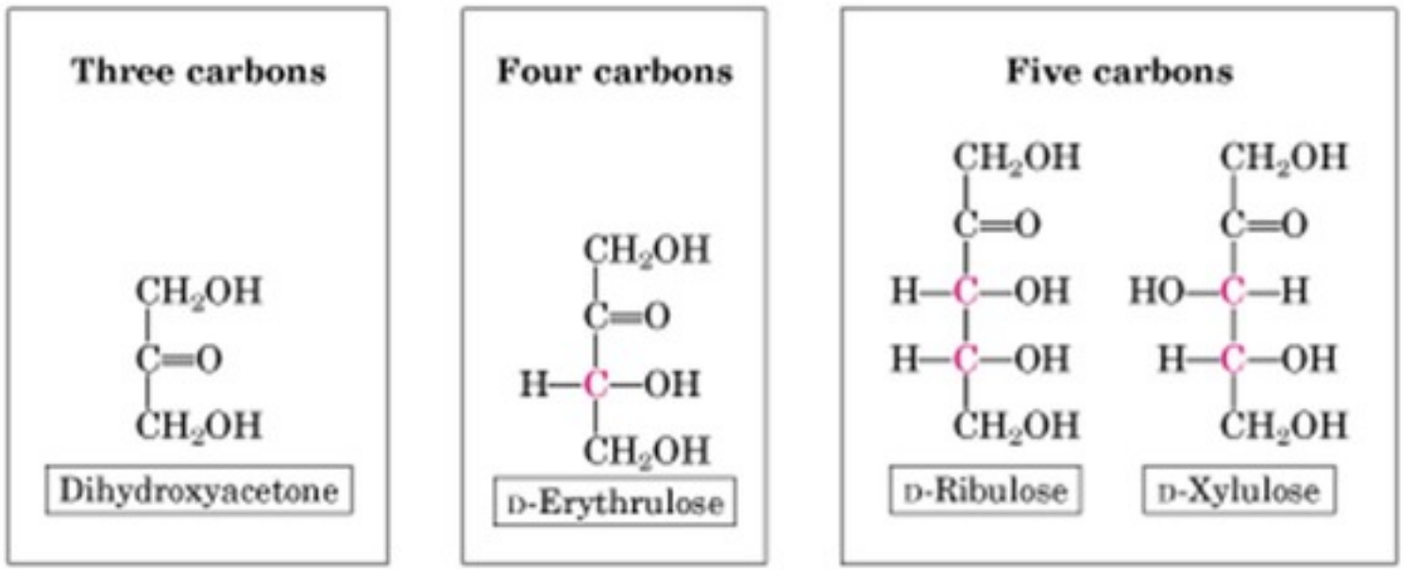
- **Trioses, tetroses, pentoses, hexoses.**



- **Existência de várias carbonos assimétricos, logo de vários isômeros.**

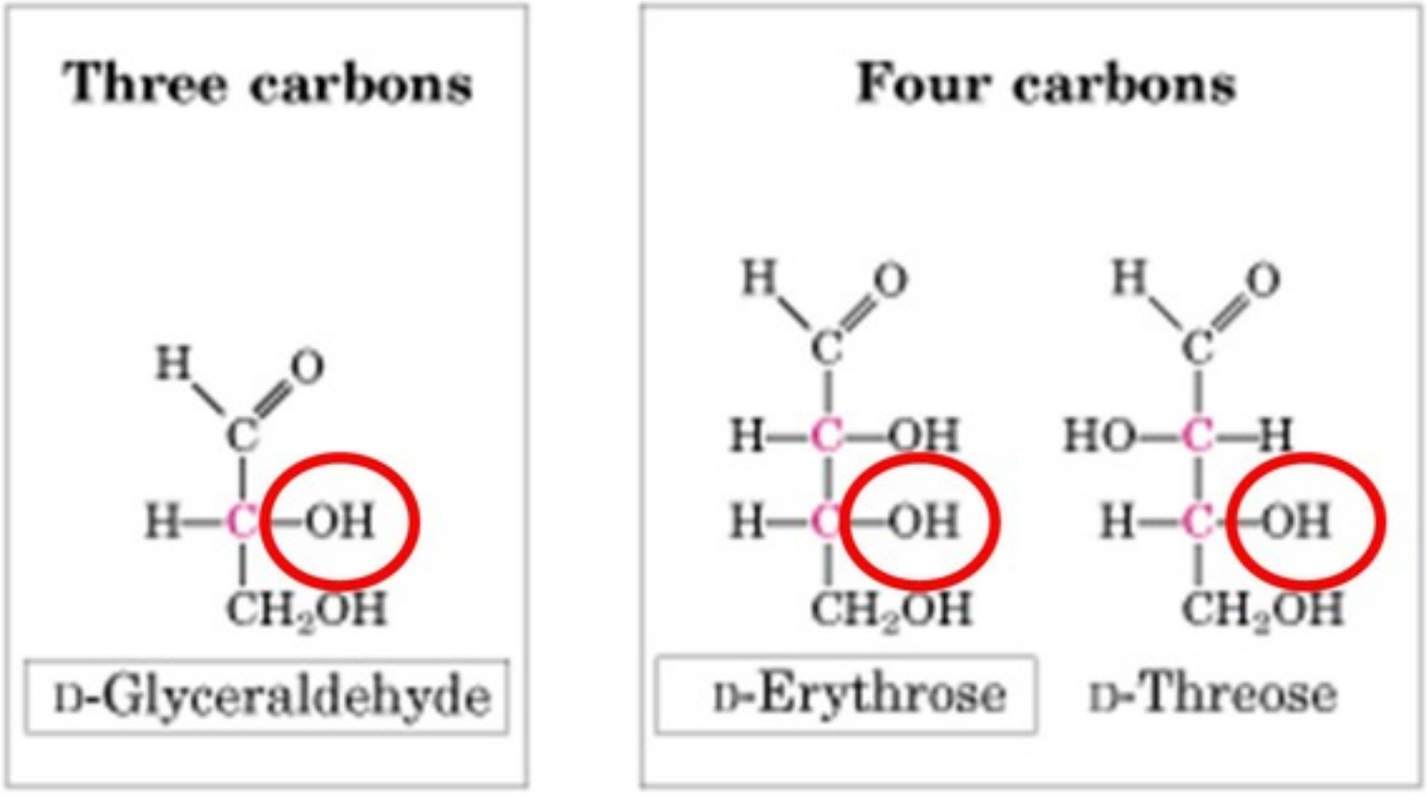
Nomenclatura básica:

- **Trioses, tetroses, pentoses, hexoses e heptoses.**

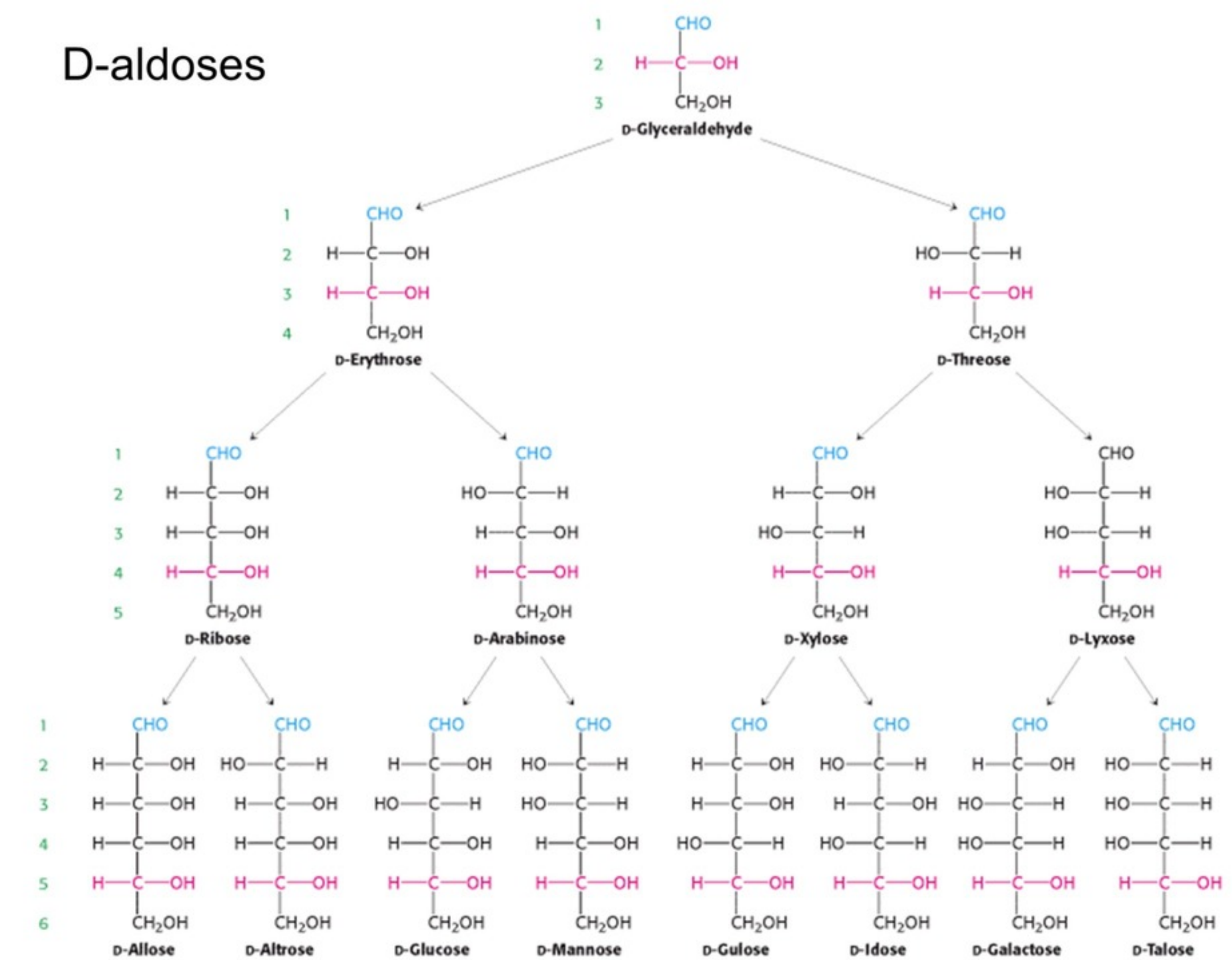


- **Existência de várias carbonos assimétricos, logo de vários isômeros.**

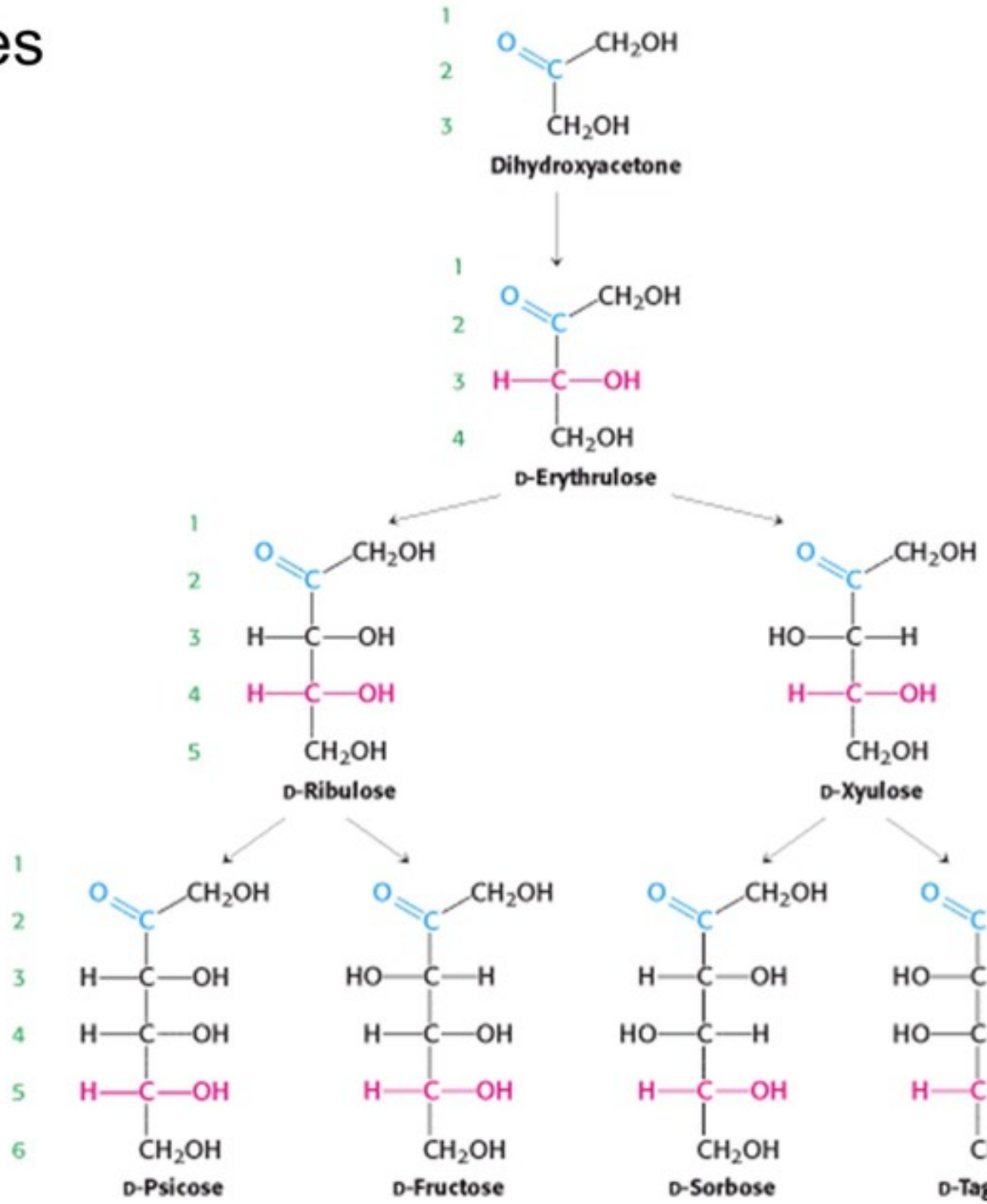
Isomerismo D e L



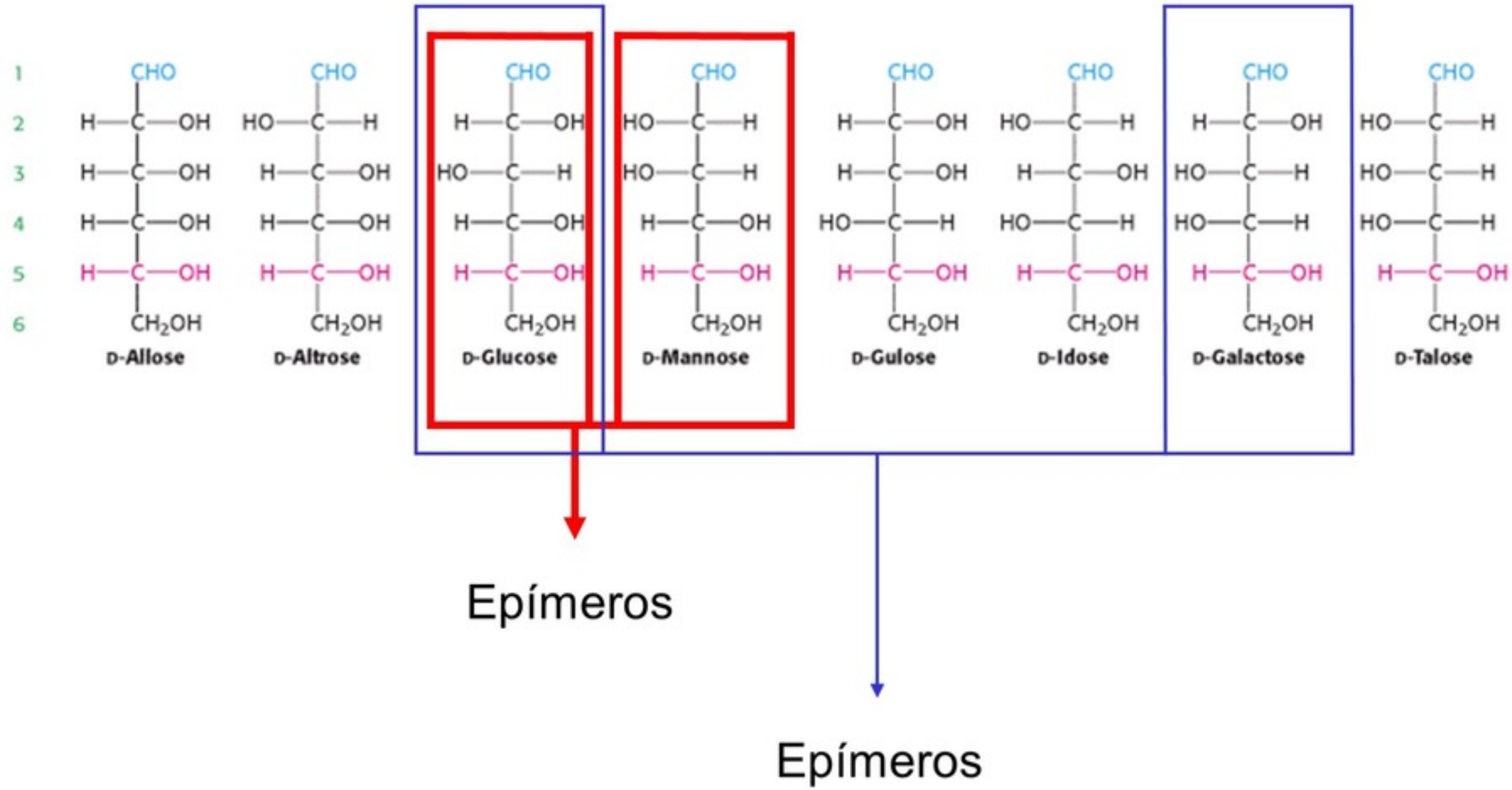
D-aldoses


D-Glyceraldehyde
D-Erythrose
D-Threose
D-Ribose
D-Arabinose
D-Xylose
D-Lyxose
D-Allose
D-Altrose
D-Glucose
D-Mannose
D-Gulose
D-Idose
D-Galactose
D-Talose

D-cetoses


Dihydroxyacetone
D-Erythrulose
D-Ribulose
D-Xylulose
D-Psicose
D-Fructose
D-Sorbose
D-Tagatose

Epimerismo

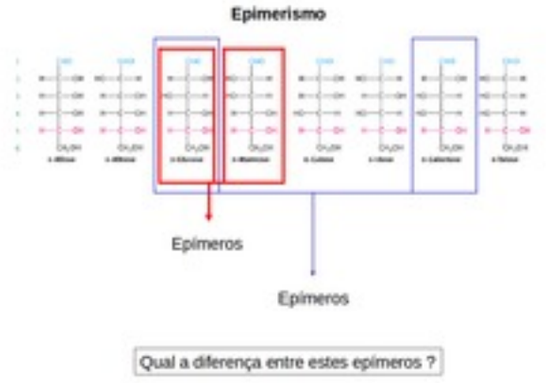


Epímeros

Epímeros

Qual a diferença entre estes epímeros ?

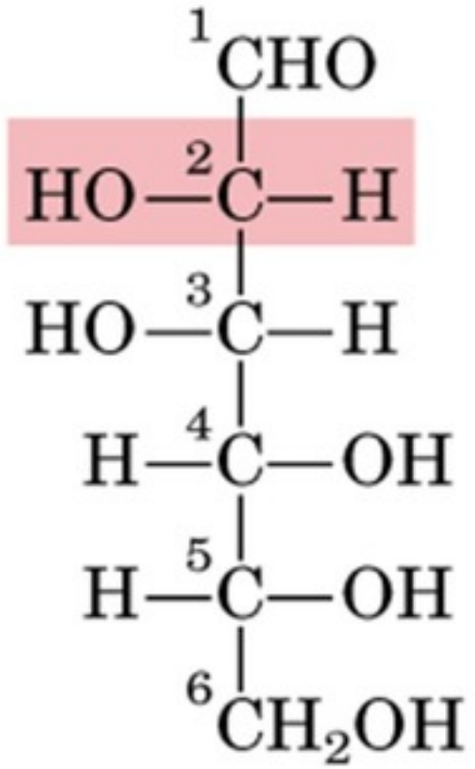
Open Ended Question



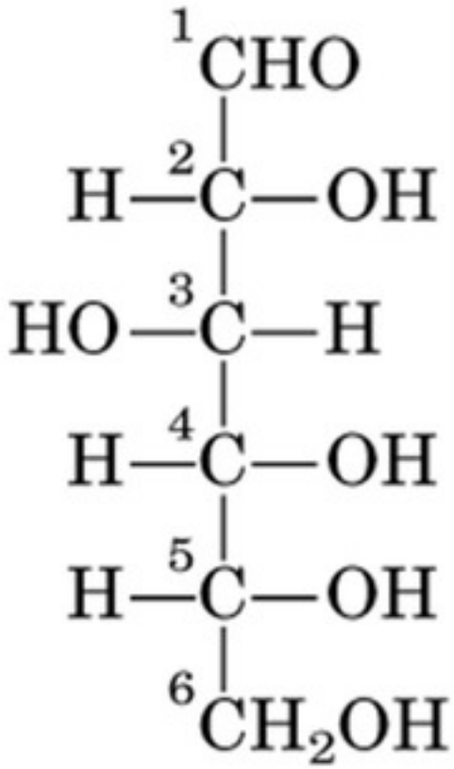
Qual é a diferença entre estes epímeros?

Please enter your answer here.

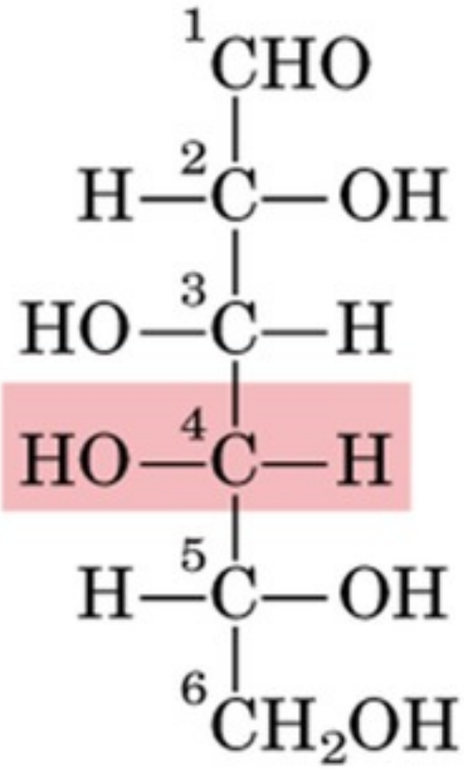
Epimerismo



D-Mannose
(epimer at C-2)

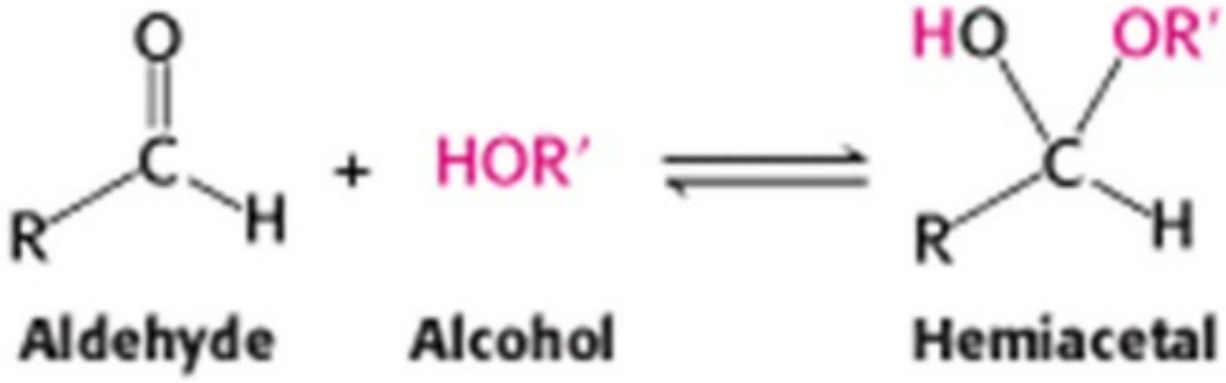


D-Glucose



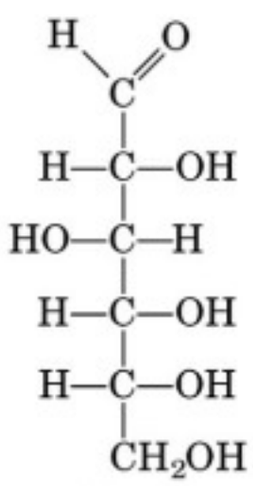
D-Galactose
(epimer at C-4)

Hemiacetal e hemicetal

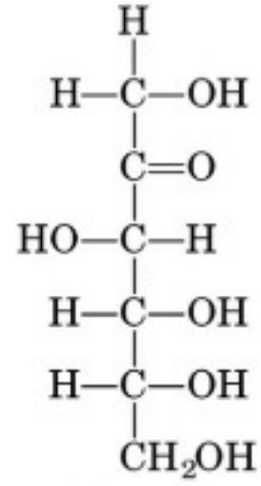


Aldehyde **Alcohol** **Hemiacetal**

Ketone **Alcohol** **Hemiketal**



D-Glucose, an aldohexose

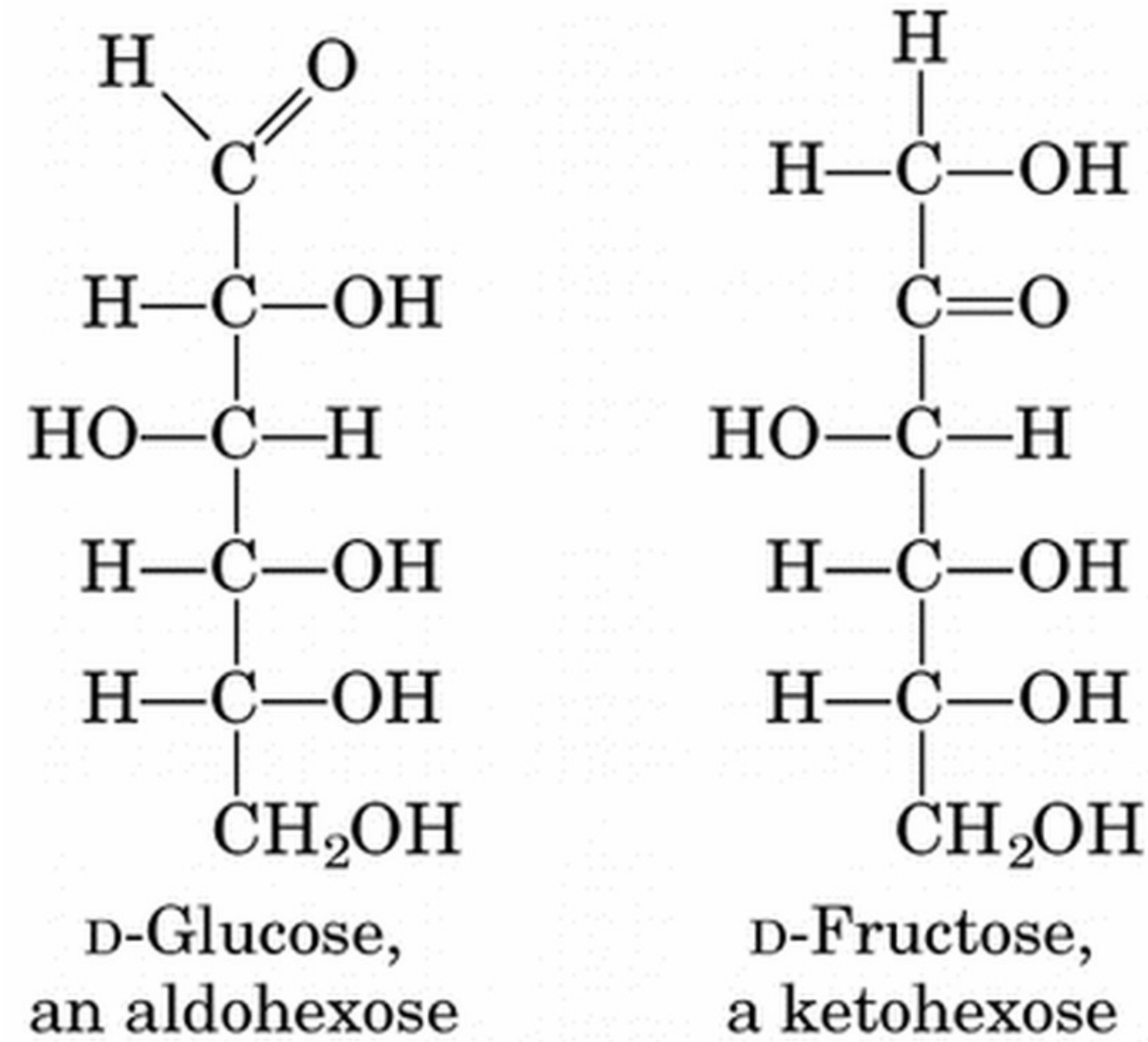


D-Fructose, a ketohexose

Qual grupo álcool poderia reagir ?

Draw It

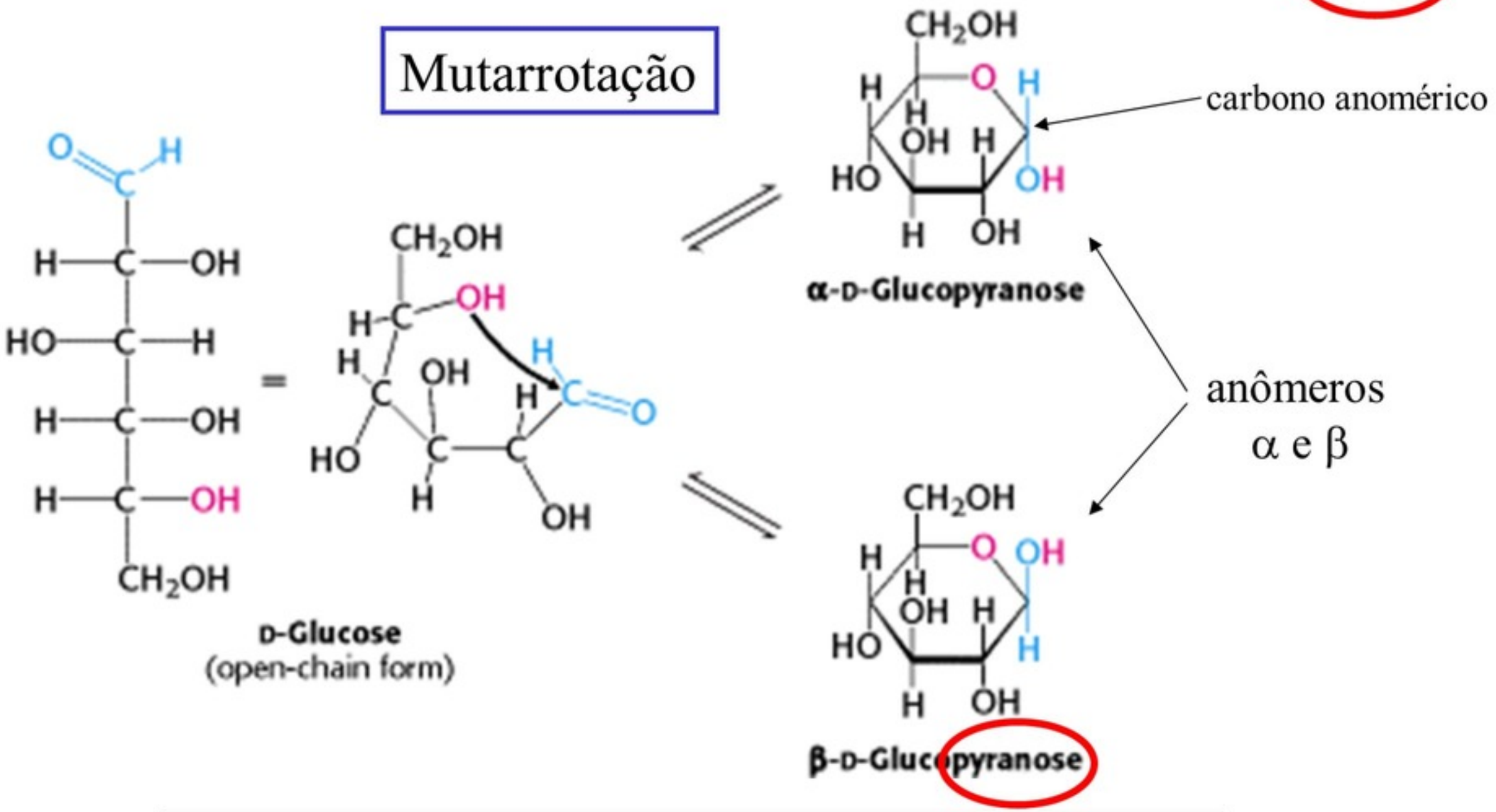
Qual grupo álcool poderia reagir?



Ciclização de aldoses

Em solução, a forma preferencial da glicose não é em cadeia aberta, mas sim ciclizada em anel.

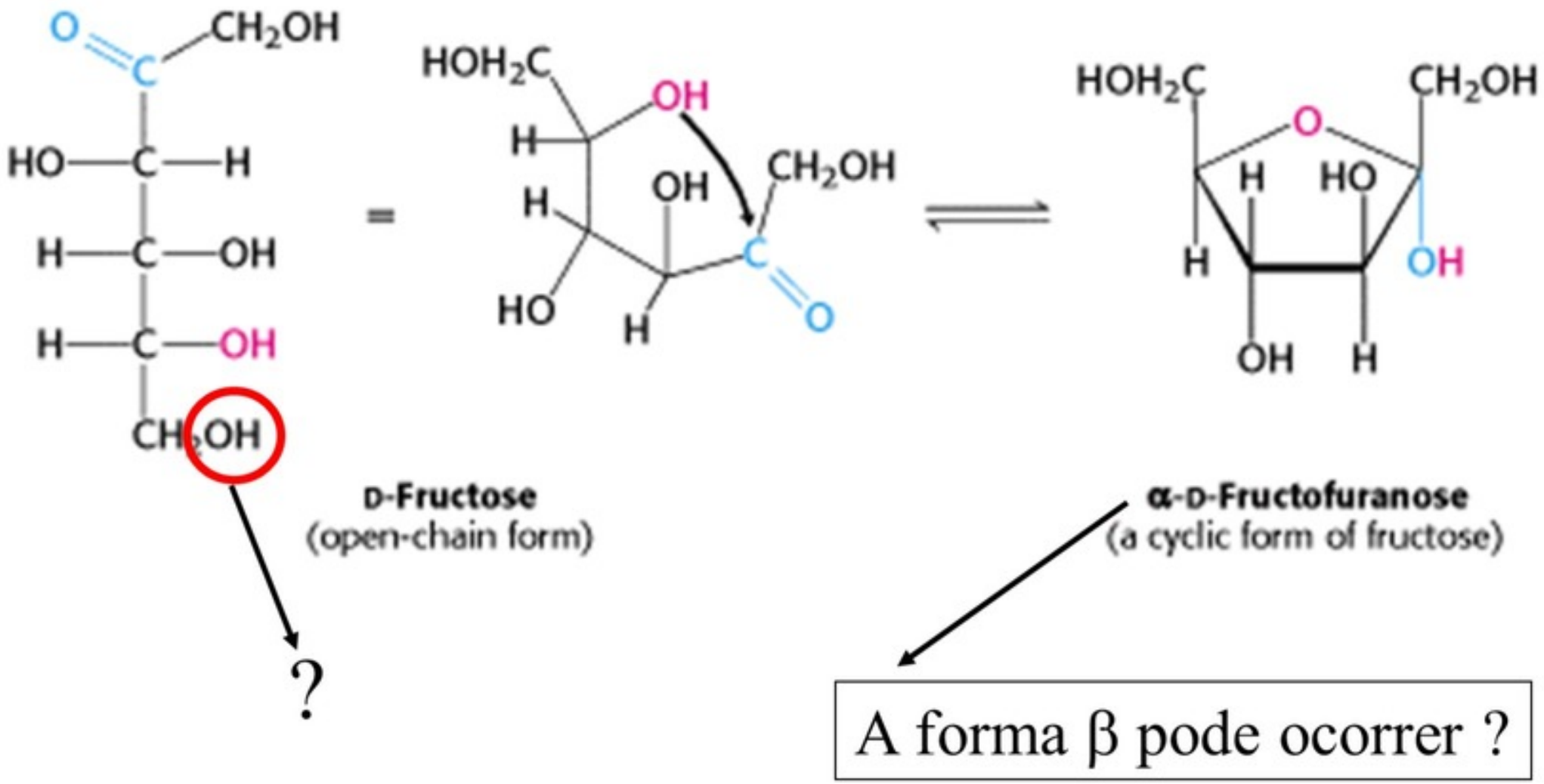
Mutarrotação



A ciclização cria mais um centro assimétrico !

Ciclização de cetoses

Furan

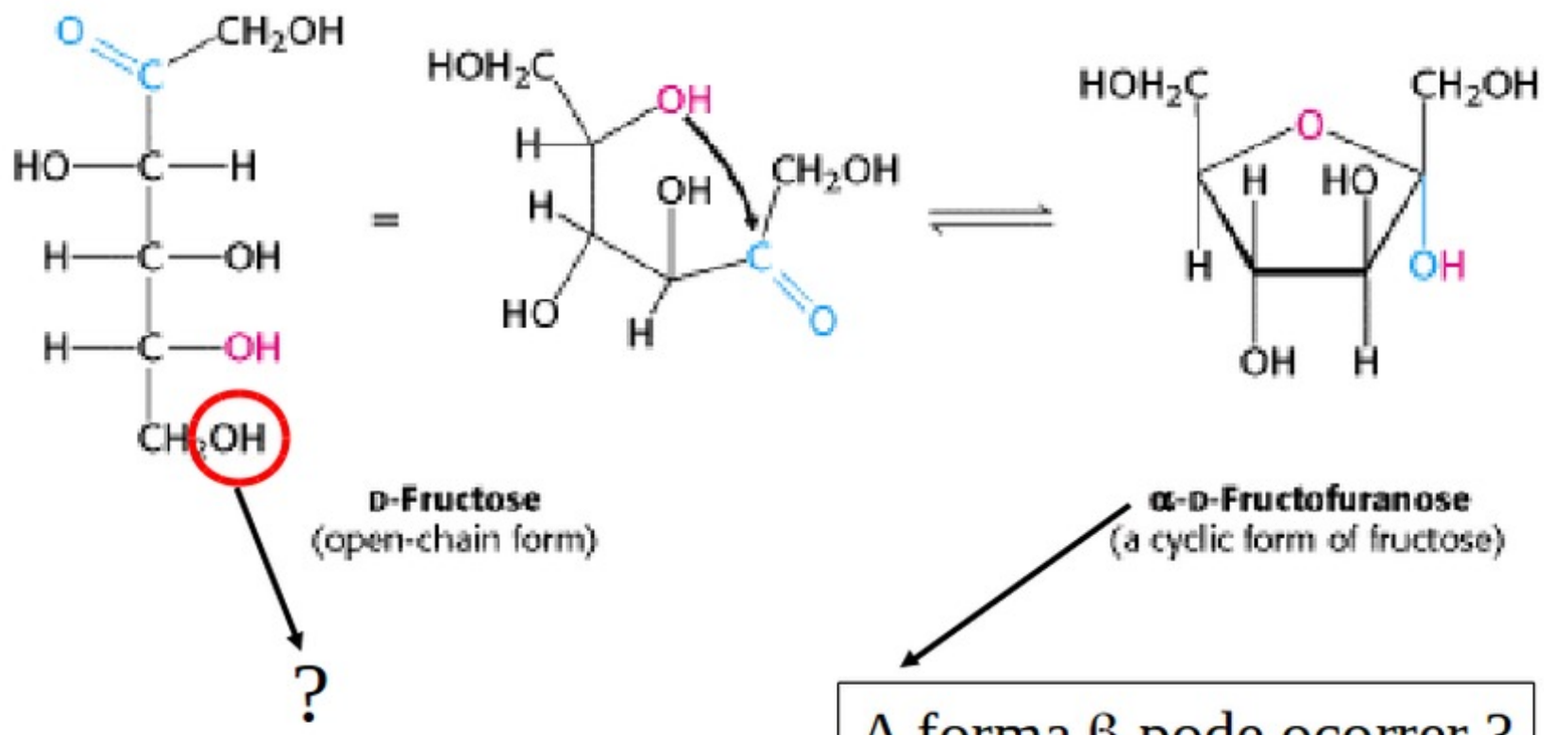


Draw It

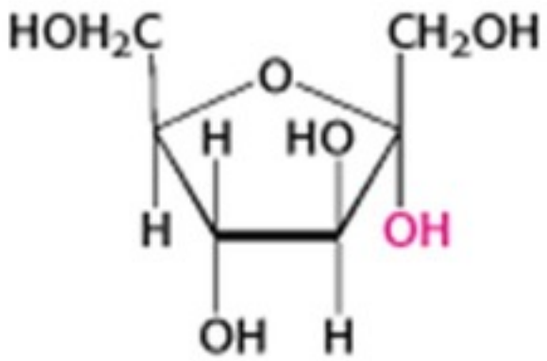
A forma beta pode ocorrer?

Ciclização de cetoses

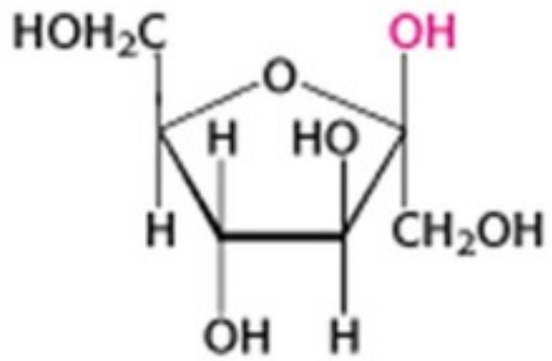
Furan



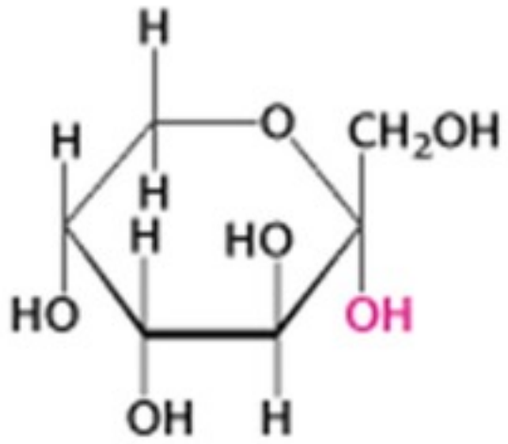
Frutose



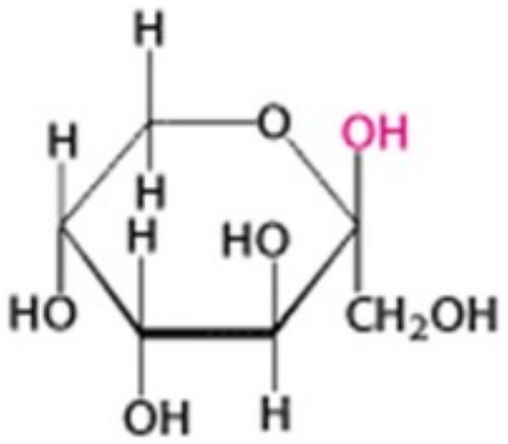
α-D-Fructofuranose



β-D-Fructofuranose

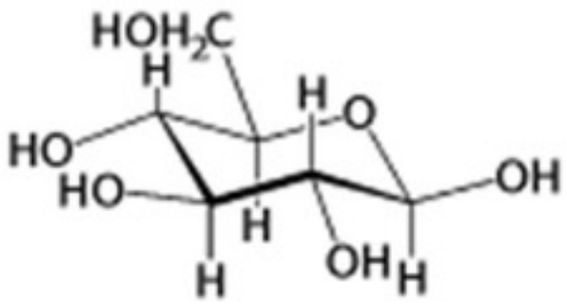


α-D-Fructopyranose

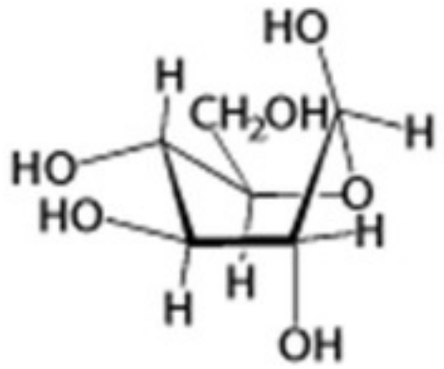


β-D-Fructopyranose

Estruturas em cadeira e barco

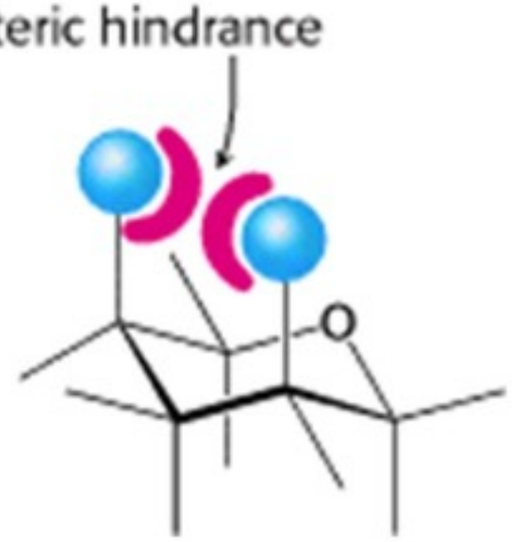


Chair form

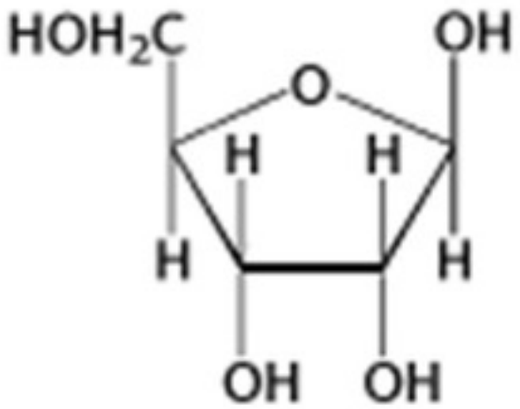


Boat form

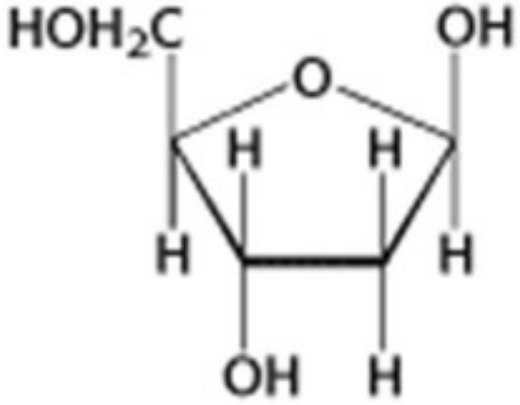
O que vai definir o arranjo estrutural em forma de cadeira ou barco ?



Outros monossacarídios

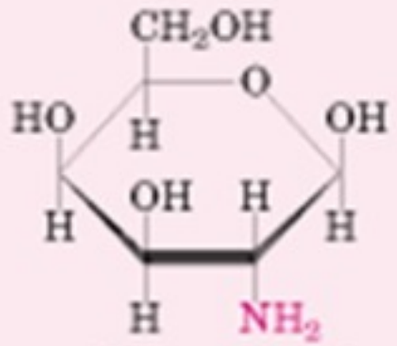


D-Ribose

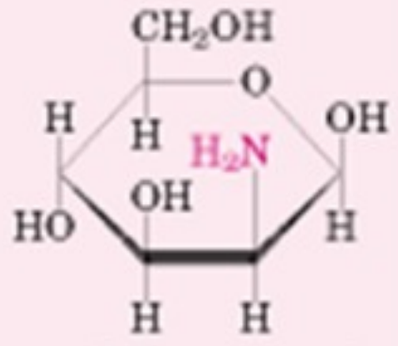


2-Deoxy-D-ribose

Amino sugars

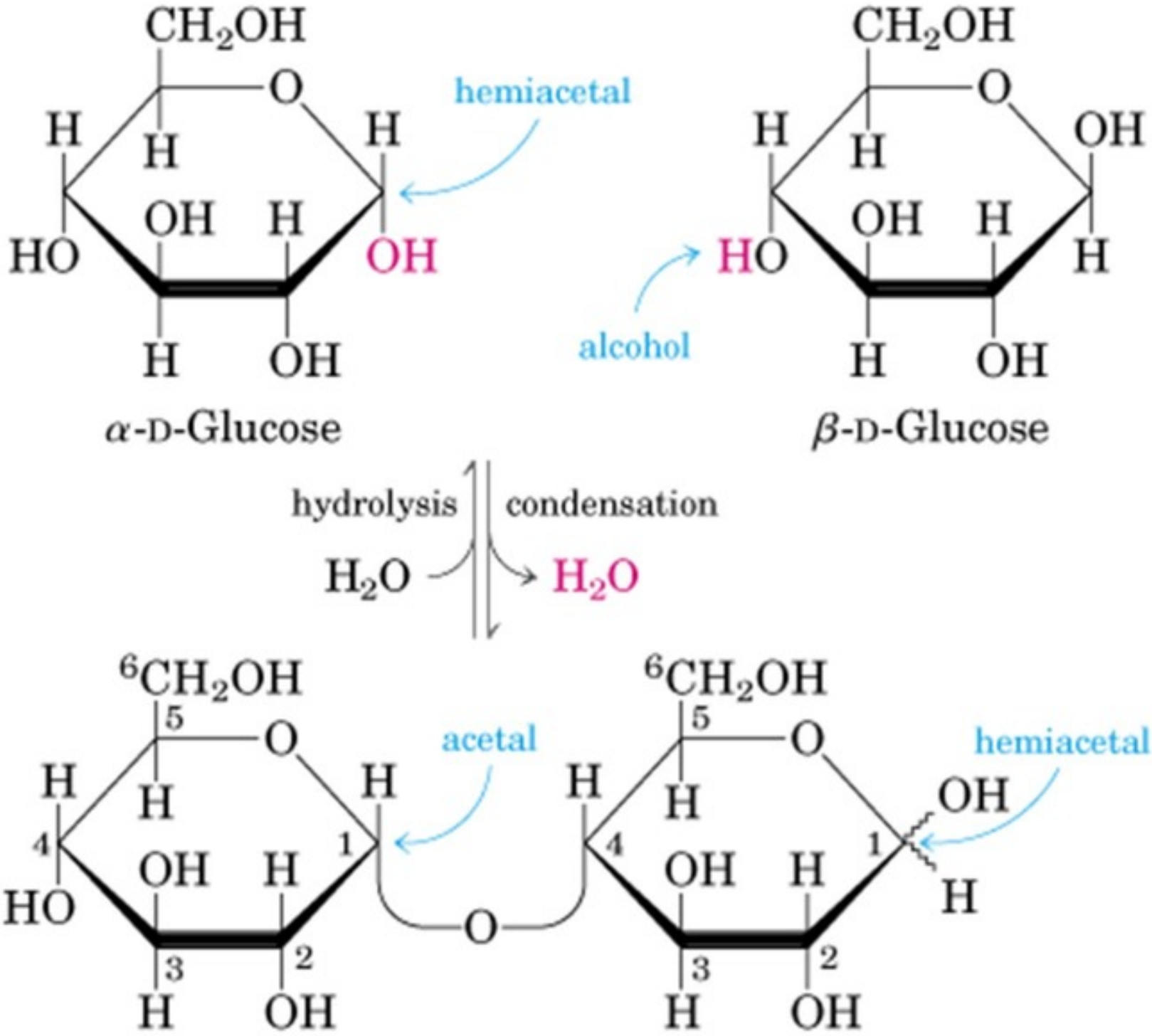


β-D-Galactosamine

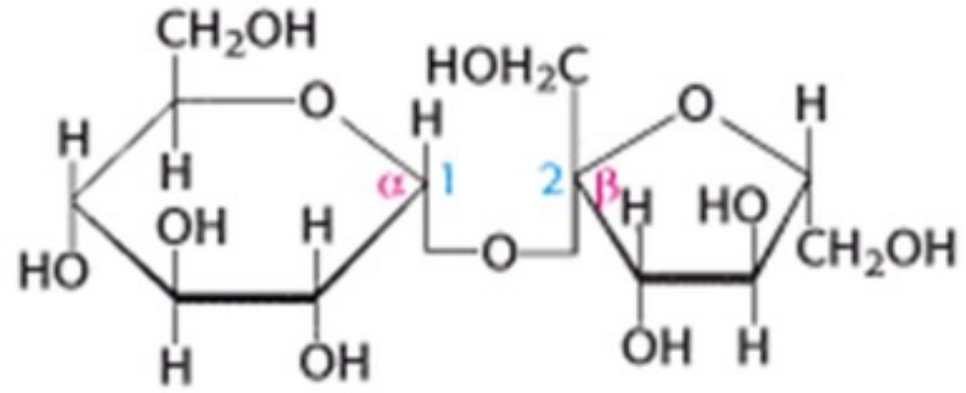


β-D-Mannosamine

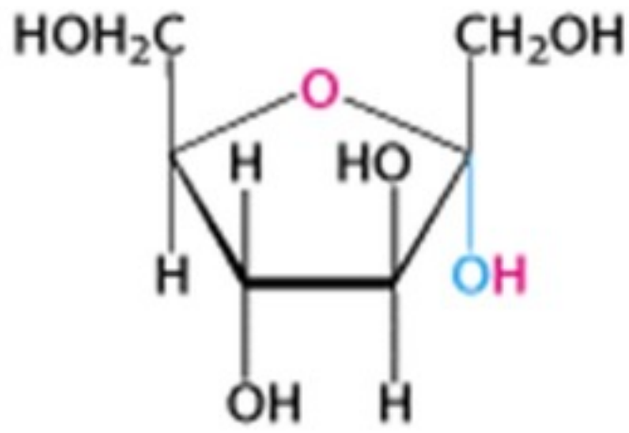
Ligações glicosídicas



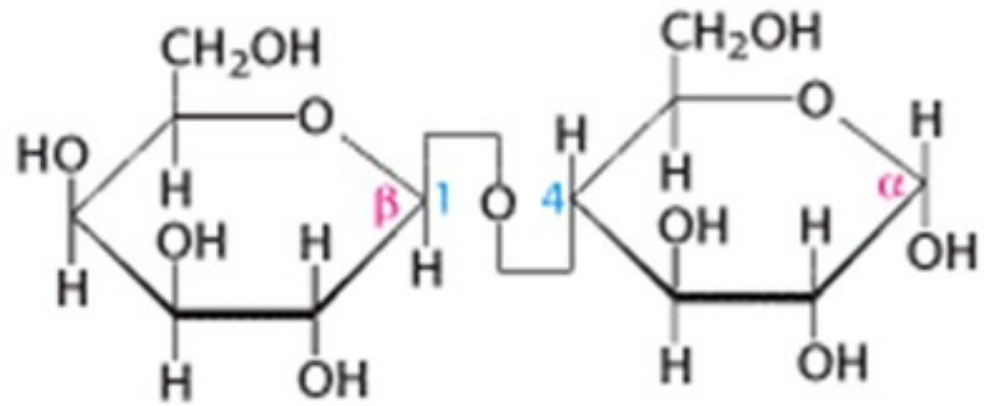
Dissacarídios



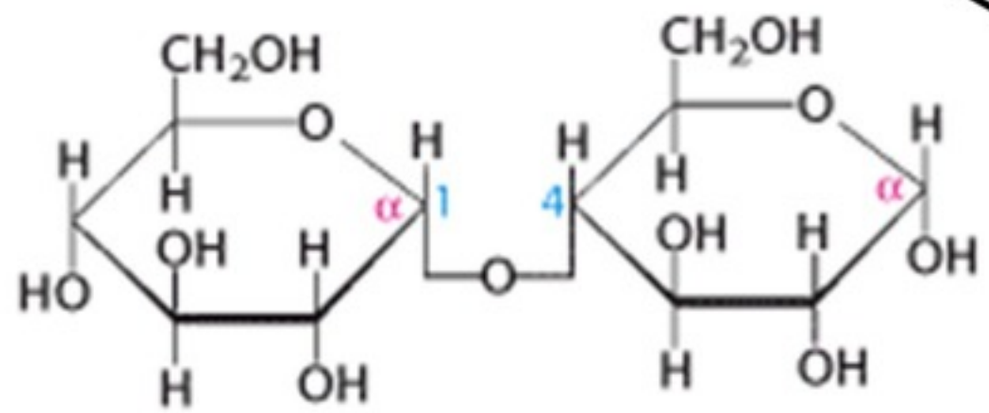
Sucrose
(α-D-Glucopyranosyl-(1→2)-β-D-fructofuranose



α-D-Fructofuranose



Lactose
(β-D-Galactopyranosyl-(1→4)-α-D-glucopyranose

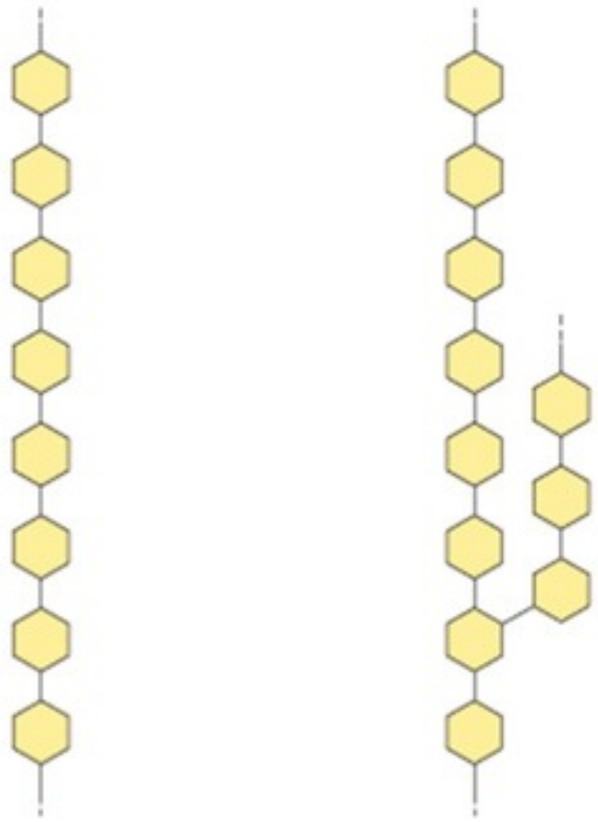


Maltose
(α-D-Glucopyranosyl-(1→4)-α-D-glucopyranose

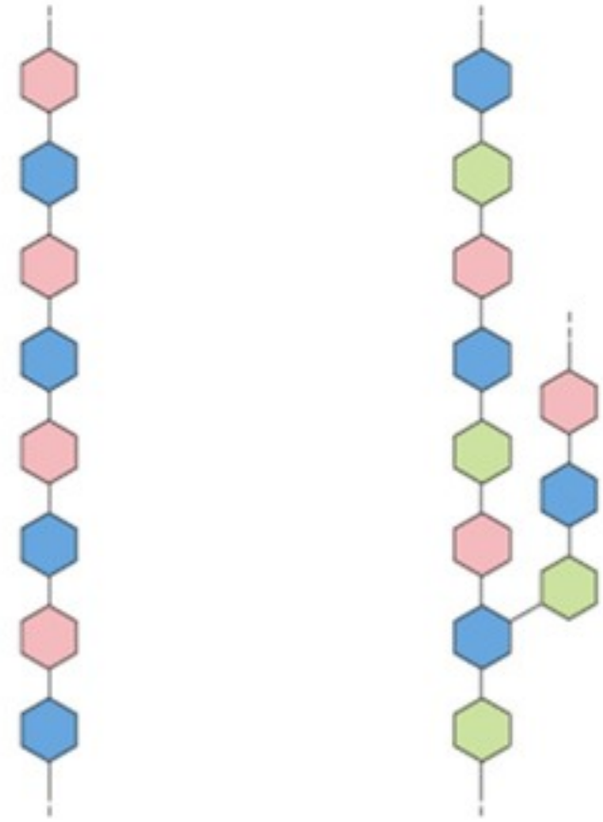
Tipo de ligação !

Polissacarídios

Homopolissacarídios



Heteropolissacarídios



Polissacarídios

Structures and Roles of Some Polysaccharides

Polymer	Type*	Repeating unit†	Size (number of monosaccharide units)	Roles
Starch				Energy storage: in plants
Amylose	Homo-	(α1→4)Glc, linear	50–5,000	
Amylopectin	Homo-	(α1→4)Glc, with (α1→6)Glc branches every 24 to 30 residues	Up to 10^6	
Glycogen	Homo-	(α1→4)Glc, with (α1→6)Glc branches every 8 to 12 residues	Up to 50,000	Energy storage: in bacteria and animal cells
Cellulose	Homo-	(β1→4)Glc	Up to 15,000	Structural: in plants, gives rigidity and strength to cell walls
Chitin	Homo-	(β1→4)GlcNAc	Very large	Structural: in insects, spiders, crustaceans, gives rigidity and strength to exoskeletons
Peptidoglycan	Hetero-; peptides attached	4)Mur2Ac(β1→4) GlcNAc(β1	Very large	Structural: in bacteria, gives rigidity and strength to cell envelope

Compare as ligações entre amilose e celulose !

Draw It

Compare as ligações entre a amilose e a celulose

Polissacarídios

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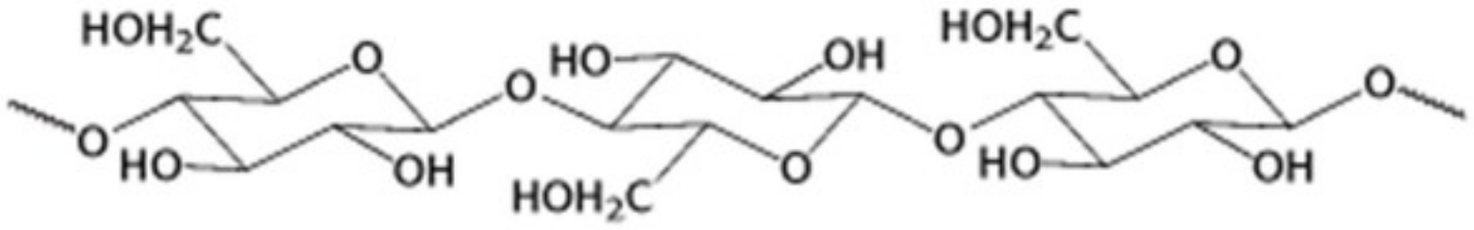
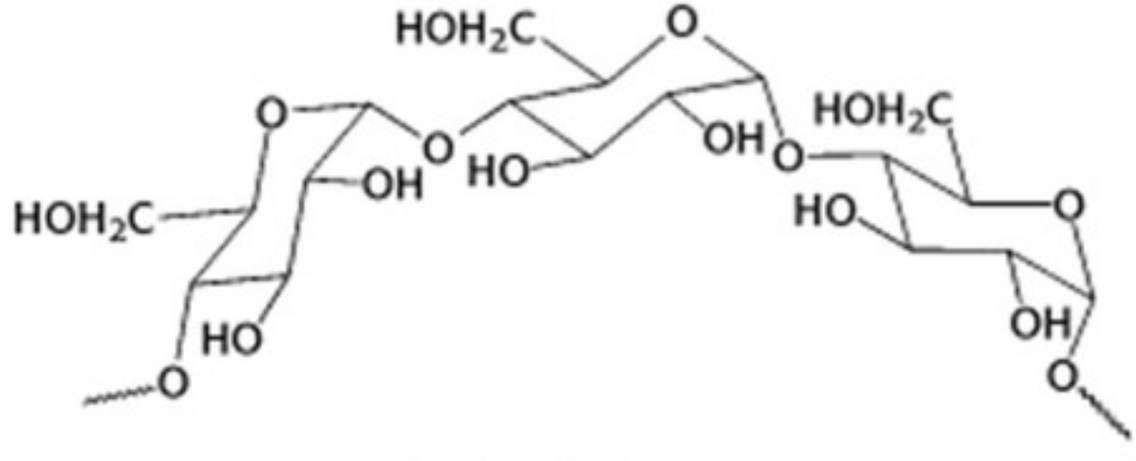
Compare as ligações entre amilose e celulose !

Polissacarídios



Cellulose
(β-1,4 linkages)



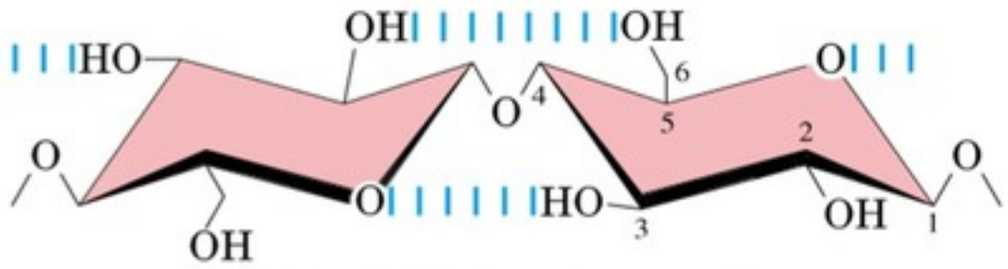
Starch and Glycogen
(α-1,4 linkages)

As ligações glicosídicas determinam a estrutura do polissacarídio:

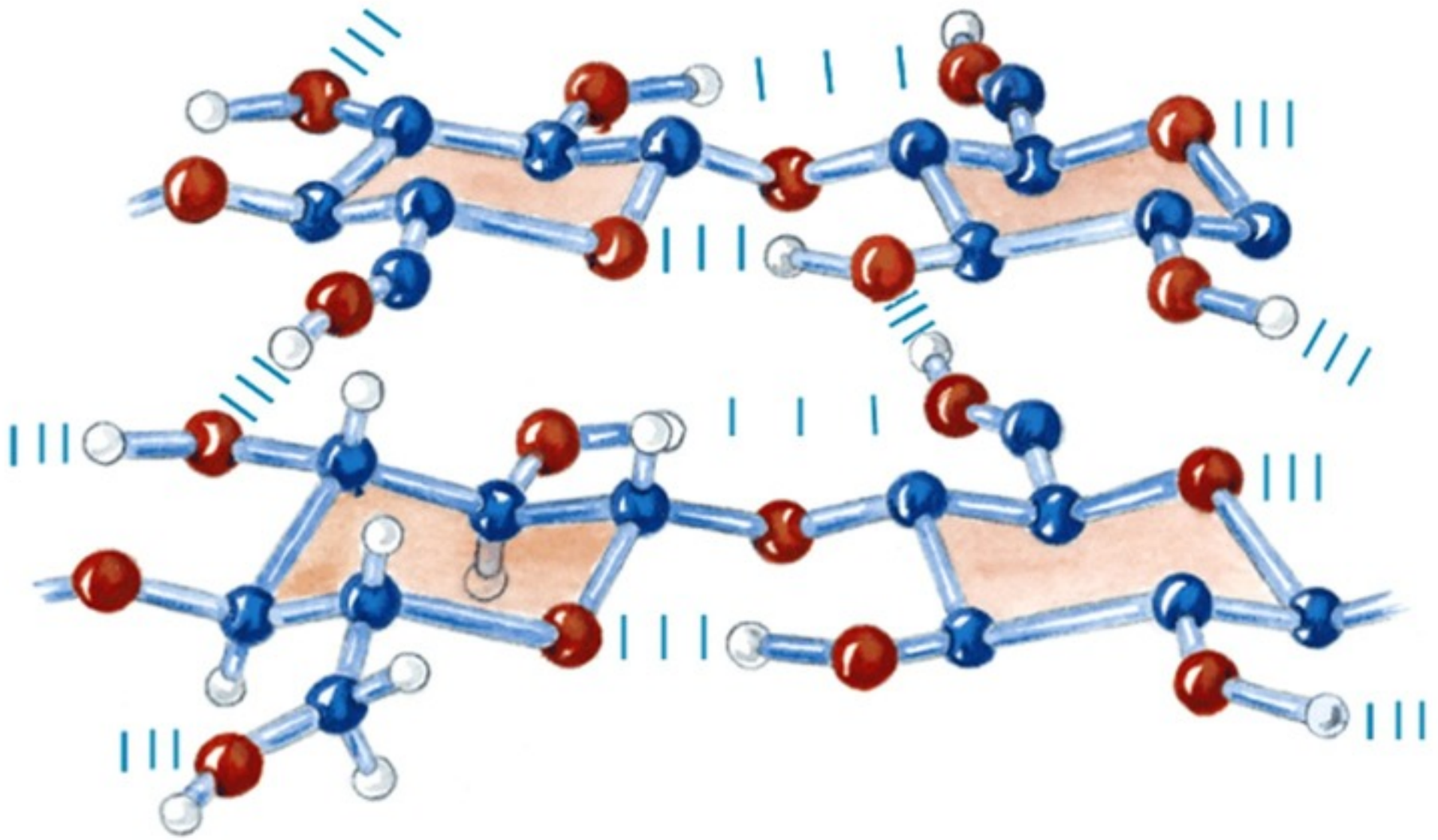
As ligações do tipo β-1,4 favorecem as cadeias esticadas, que por sua vez favorecem as funções estruturais.

As ligações do tipo α-1,4 favorecem estruturas dobradas, que por sua vez favorecem as funções de armazenamento.

Polissacarídios

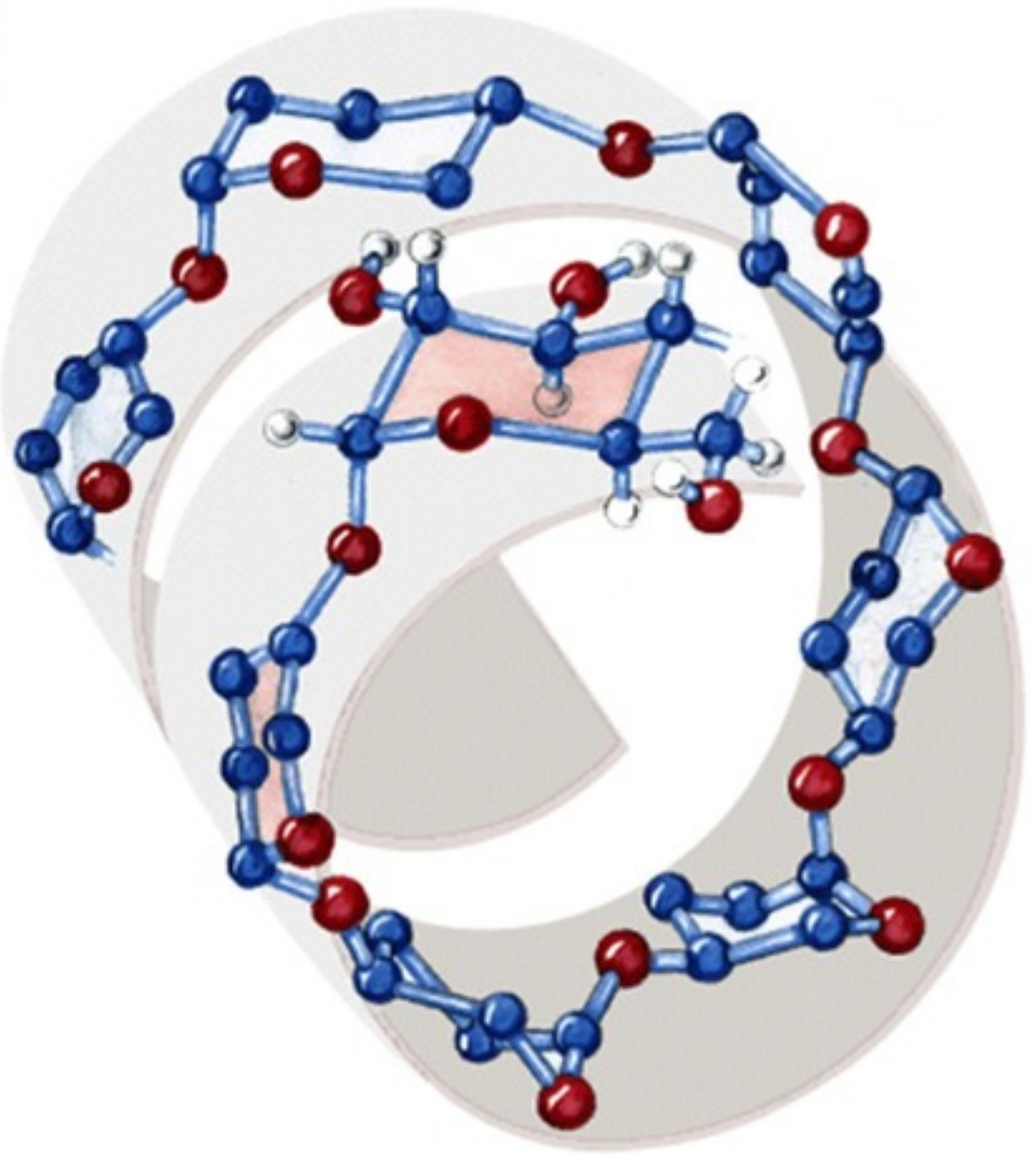


(β1→4)-linked D-glucose units

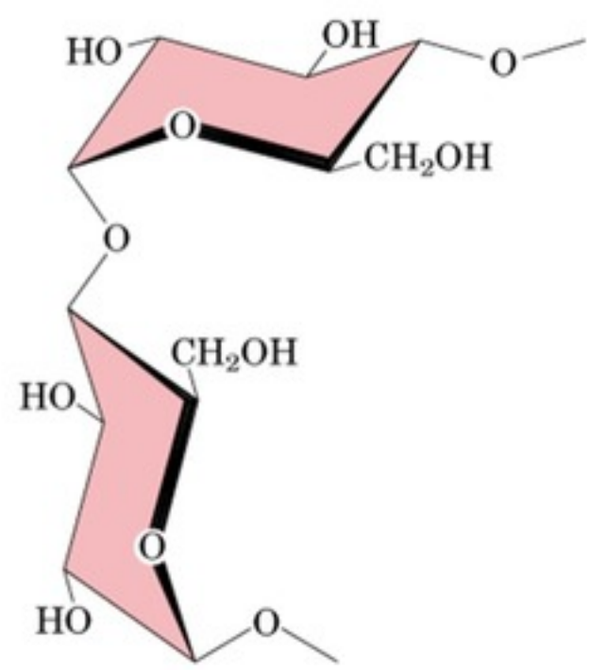


Celulose

Polissacarídios

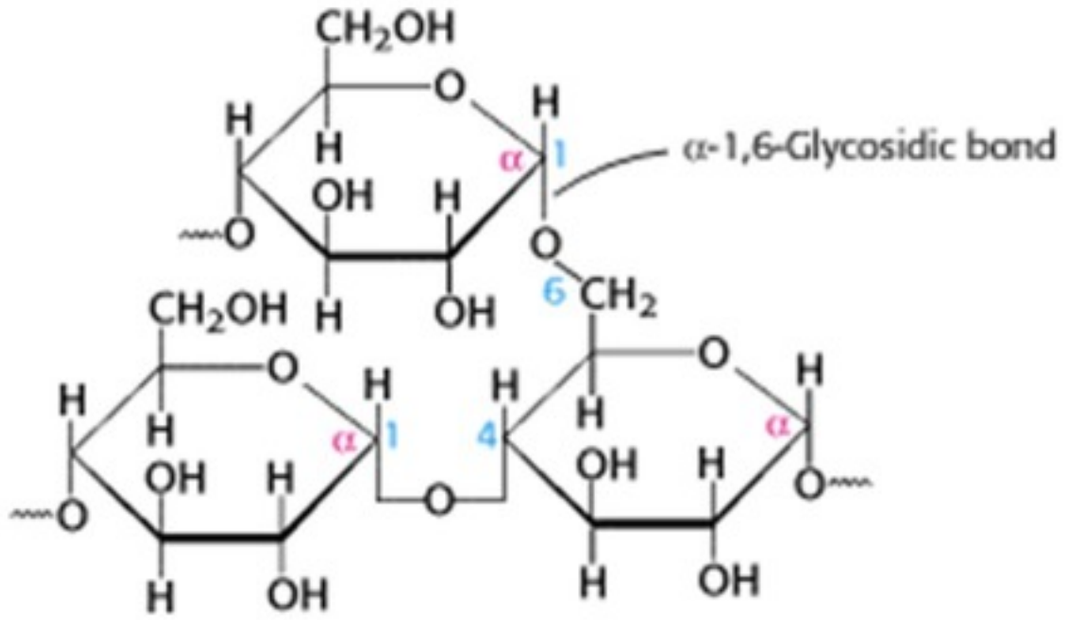


Amilose

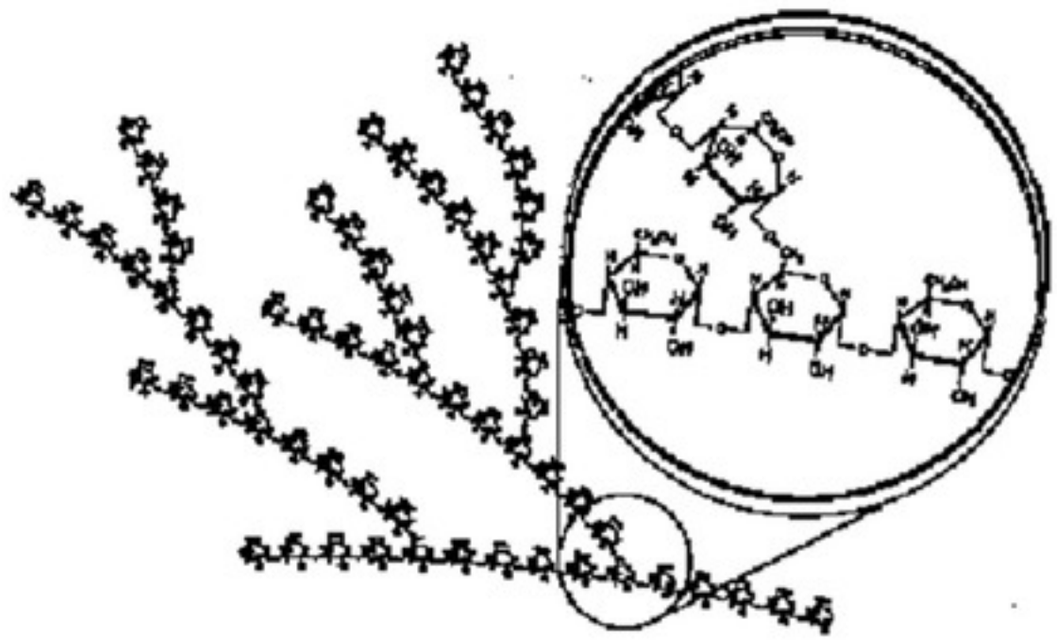


(α1→4)-linked D-glucose units

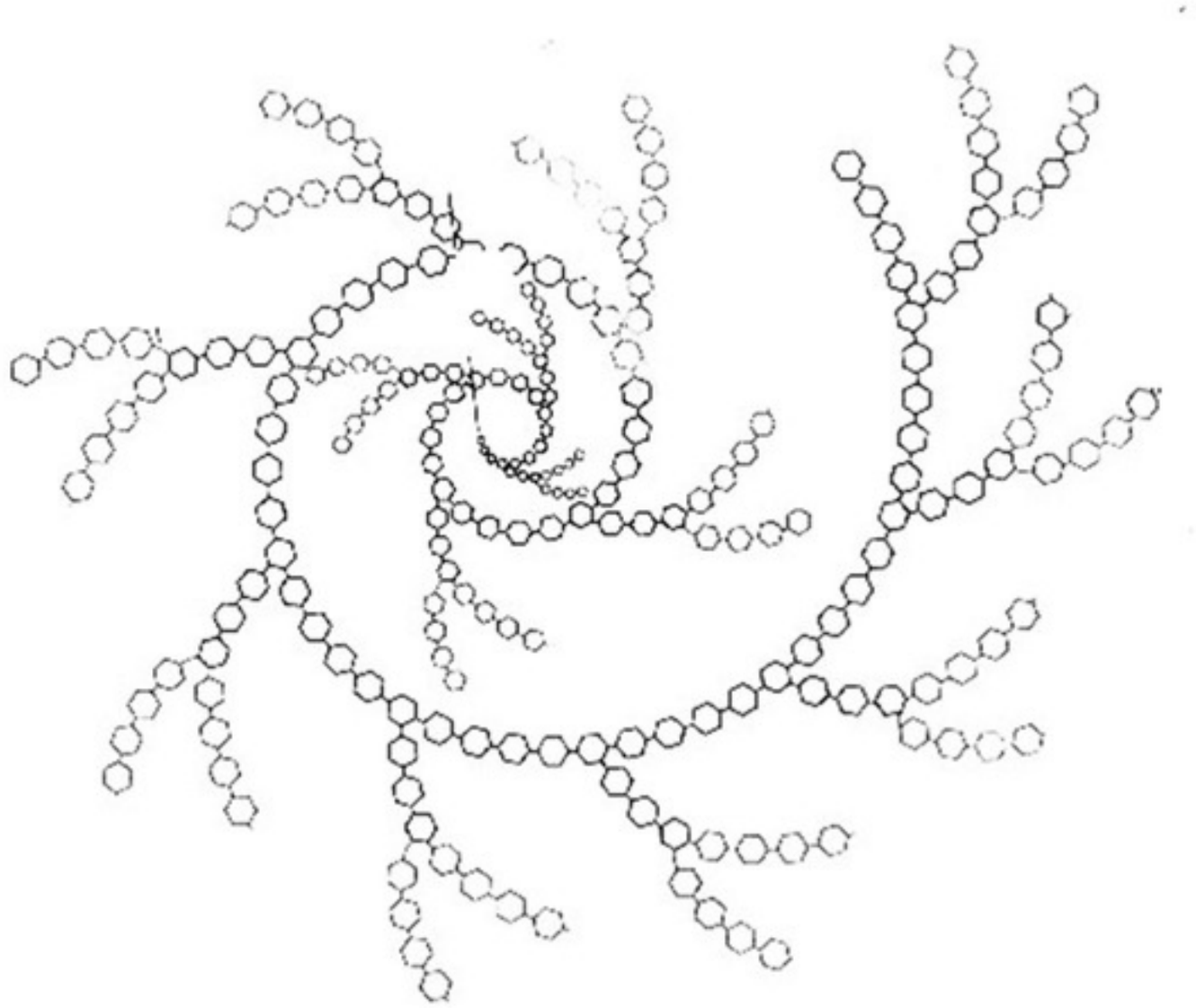
Polissacarídios



Glicogênio, **aproximadamente a cada 10 moléculas de glicose ocorre uma ramificação através de uma ligação glicosídica do tipo α-1,6**



Polissacarídios



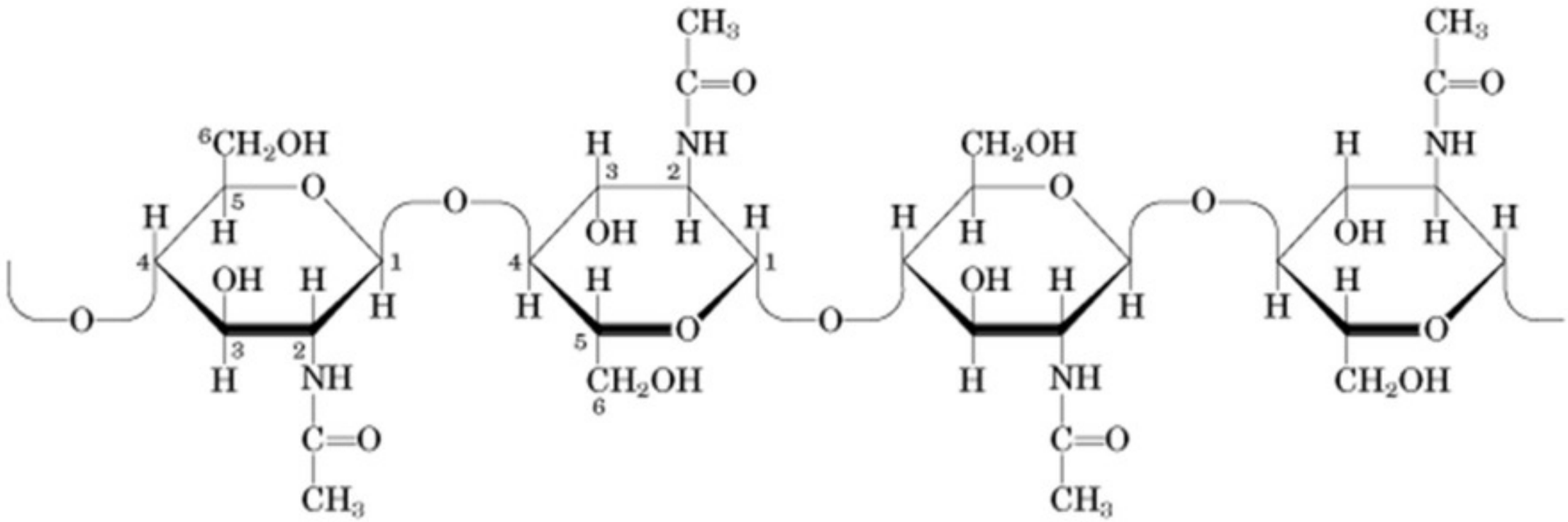
Glicogênio

Open Ended Question

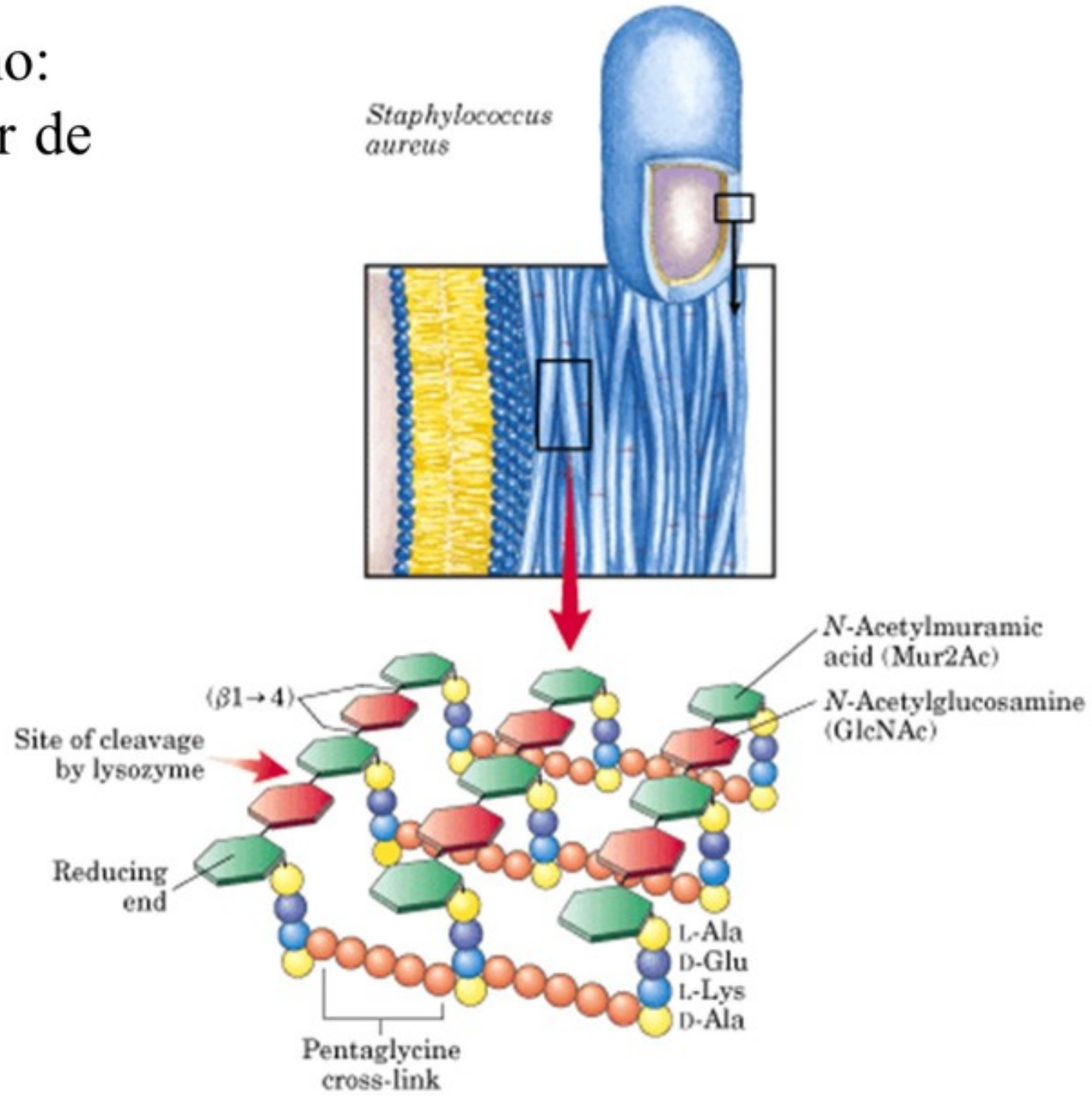
Os seres humanos são capazes de digerir amido, amilose mas não a celulose. Por que?

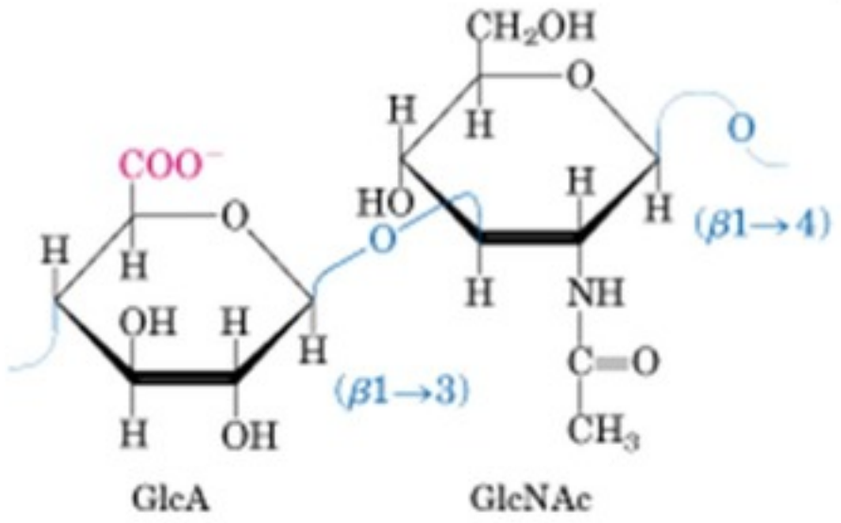
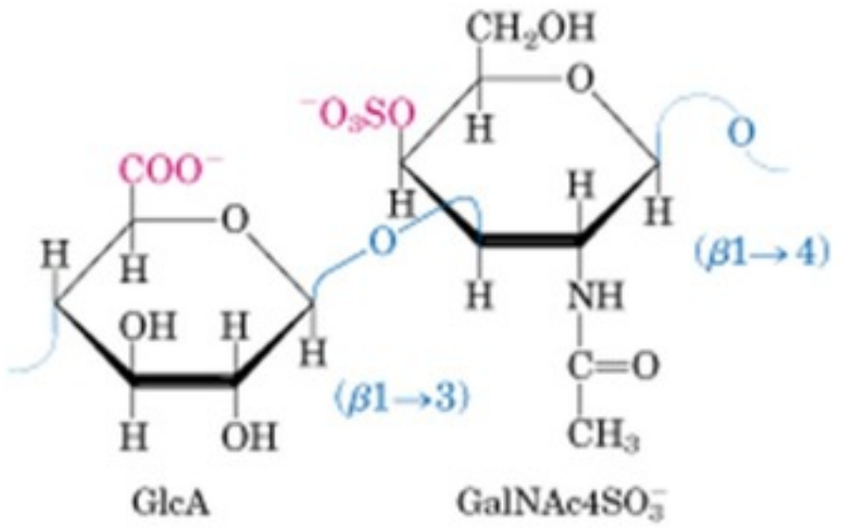
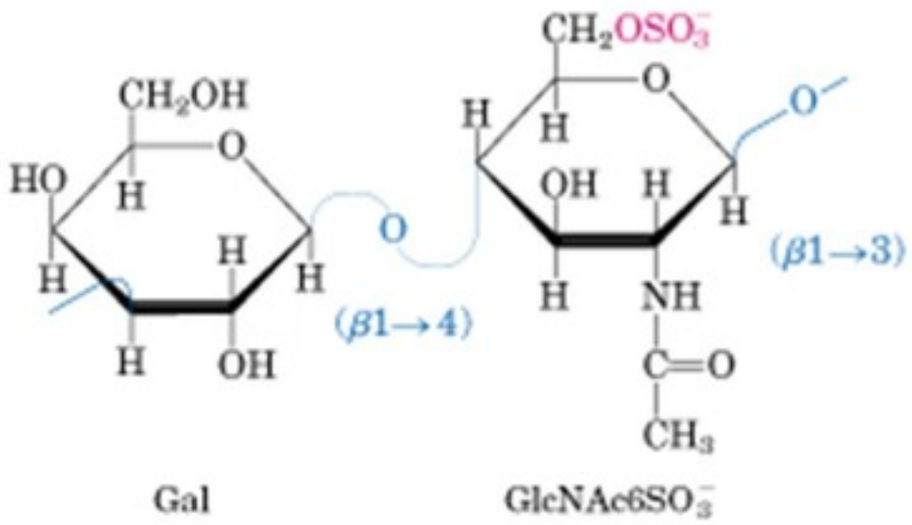
Please enter your answer here.

Quitina: homopolimero de
N-acetyl-D glucosamine, lig (beta 1->4)



Peptidoglicano: Parede celular de bactérias

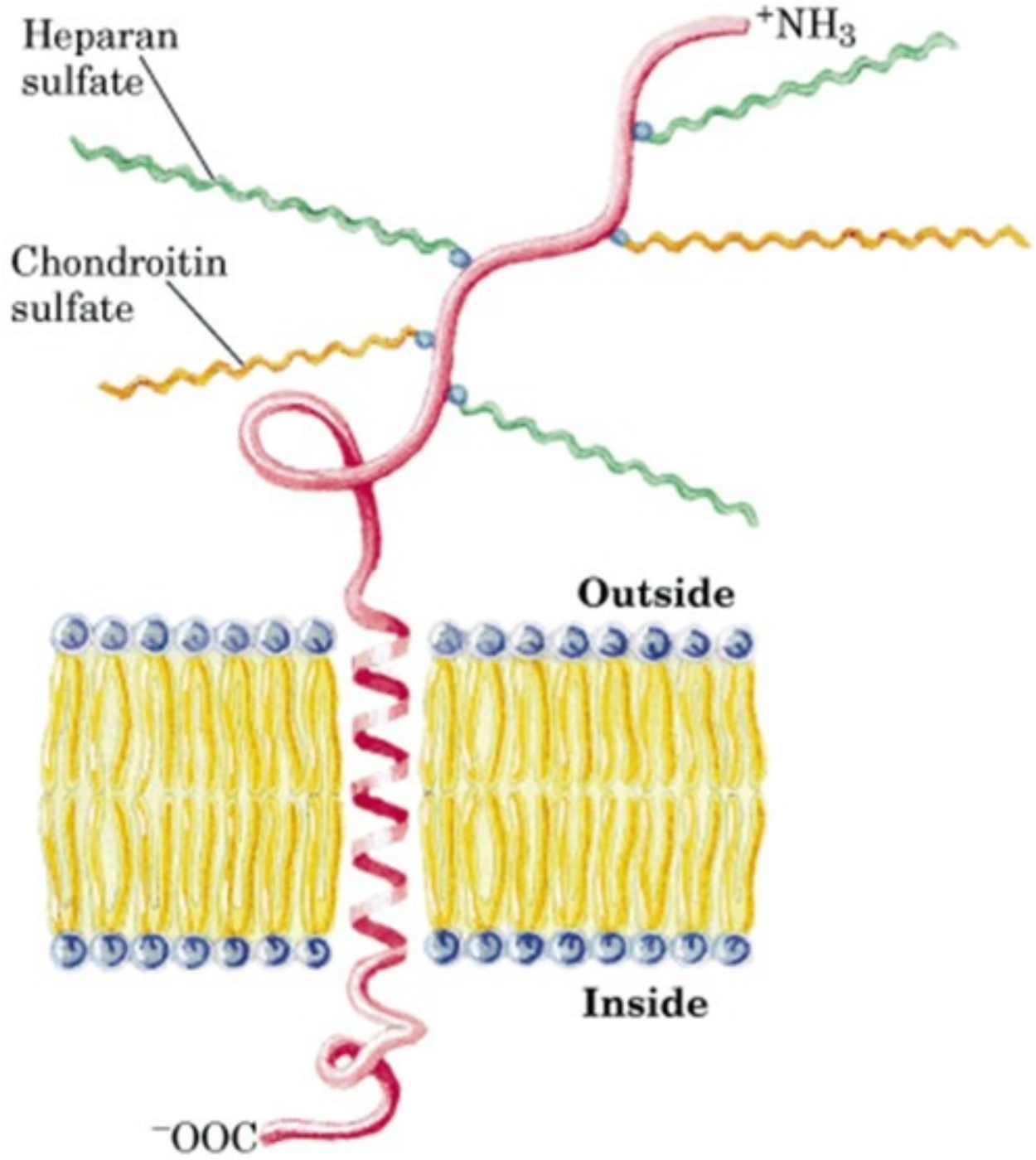


Glycosaminoglycan	Repeating disaccharide	Number of disaccharides per chain
Hyaluronate		~50,000
Chondroitin 4-sulfate		20–60
Keratan sulfate		~25

Matriz extracelular

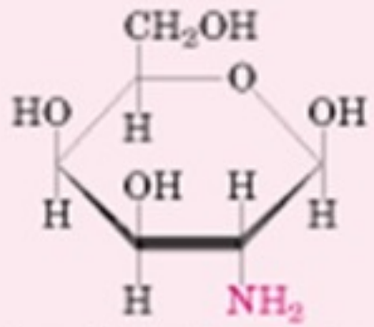
Glicoproteínas

São proteínas que contém carboidratos em diferentes quantidades, ligados como cadeias grandes ou pequenas, ramificadas ou não.

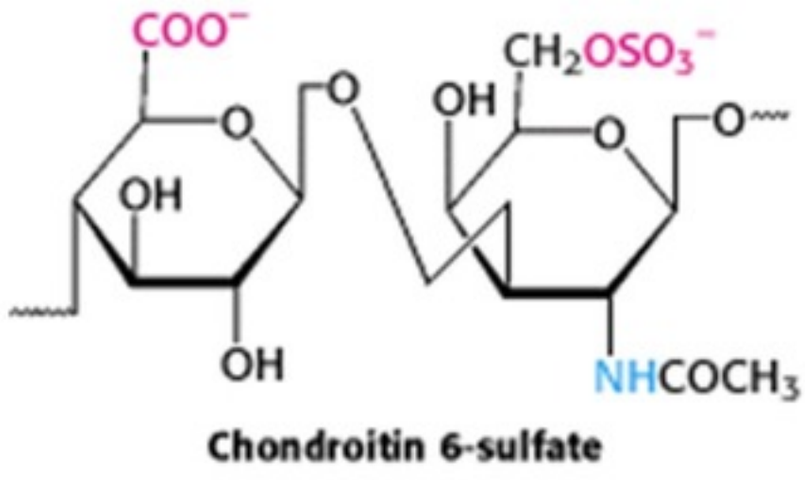


Aminoaçúcares

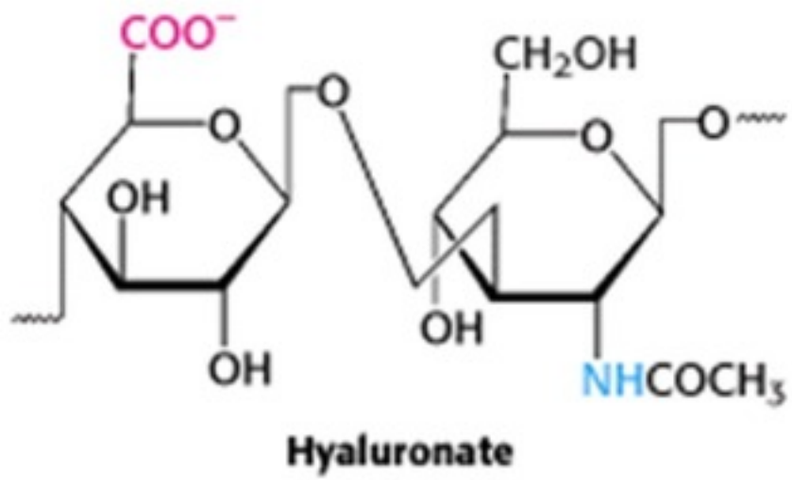
Amino sugars



β-D-Galactosamine



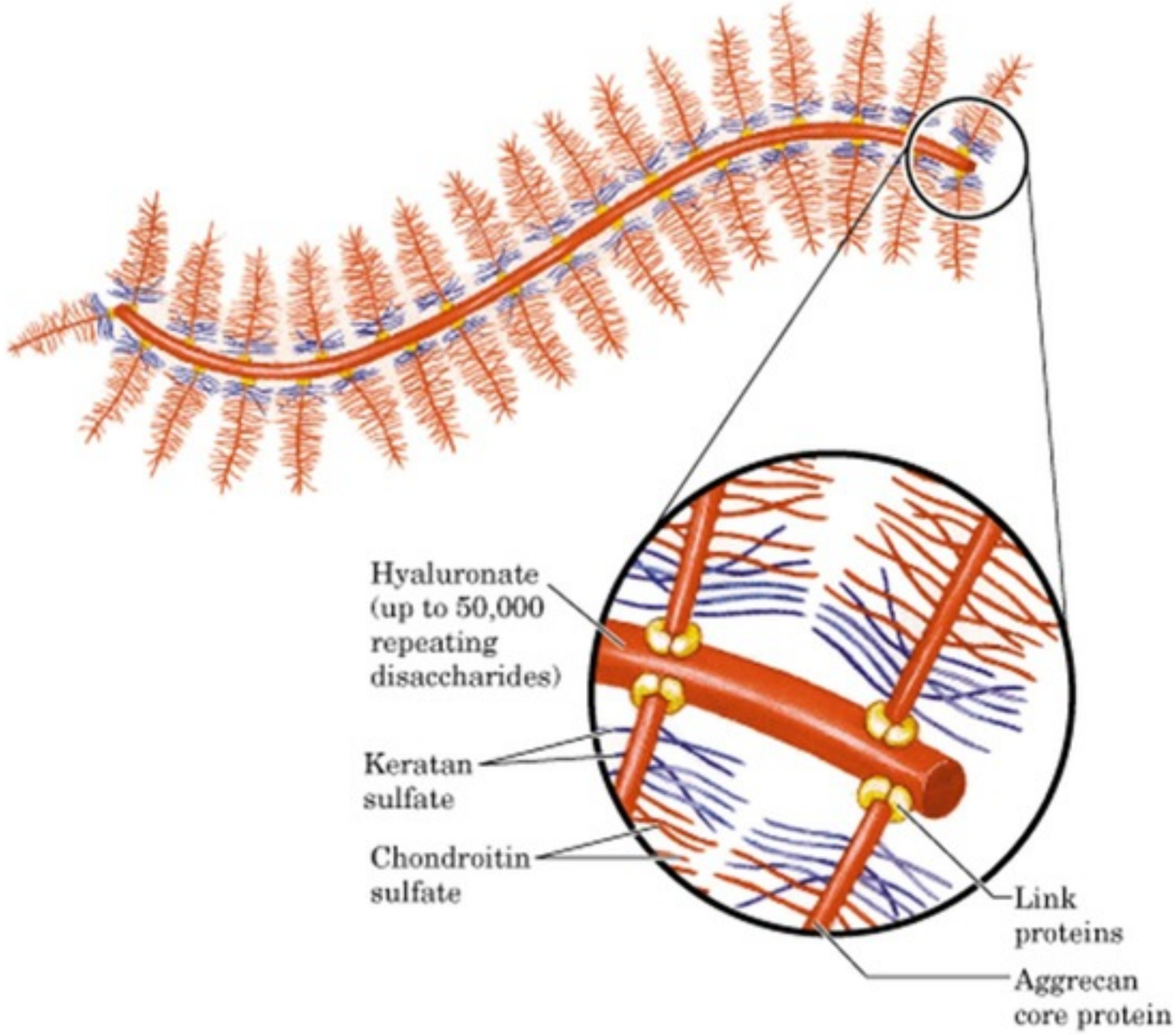
Chondroitin 6-sulfate



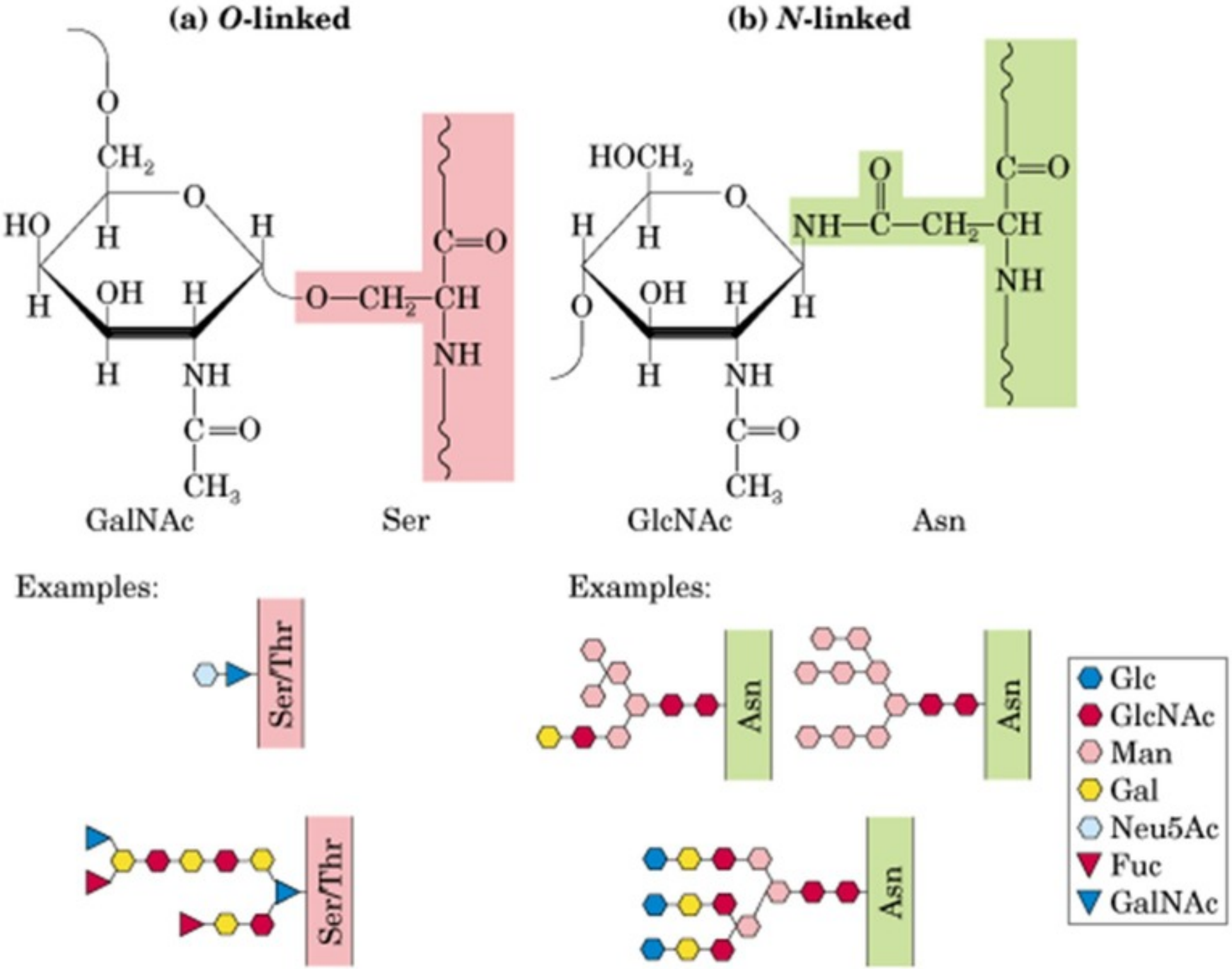
Hyaluronate

Glicosaminoglicanos

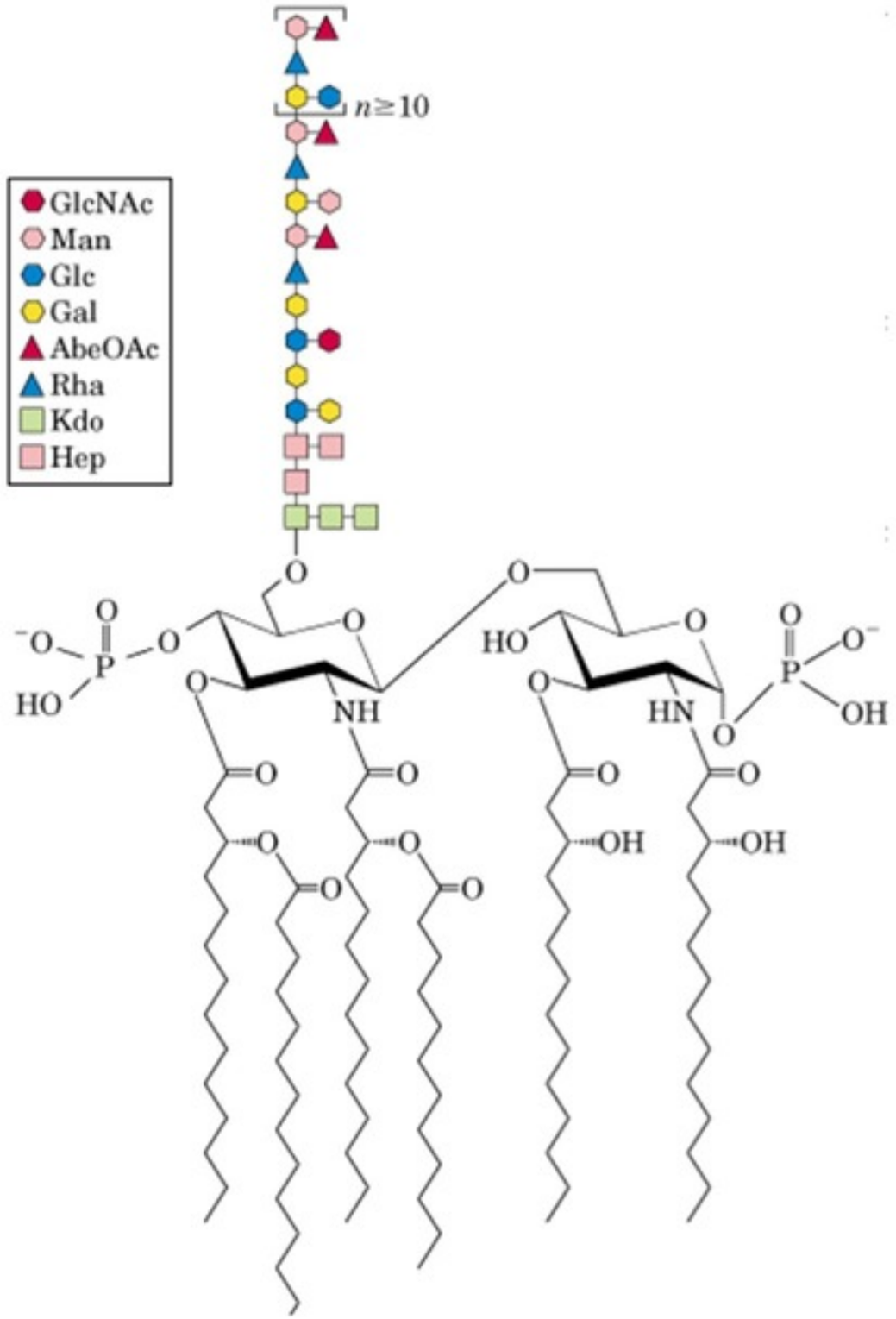
São cadeias de carboidratos complexos, caracterizados pela sua composição de **amino açúcares** e **ácidos urônicos**. Quando essas cadeias são ligadas a uma proteína são chamados de **proteoglicanos**.



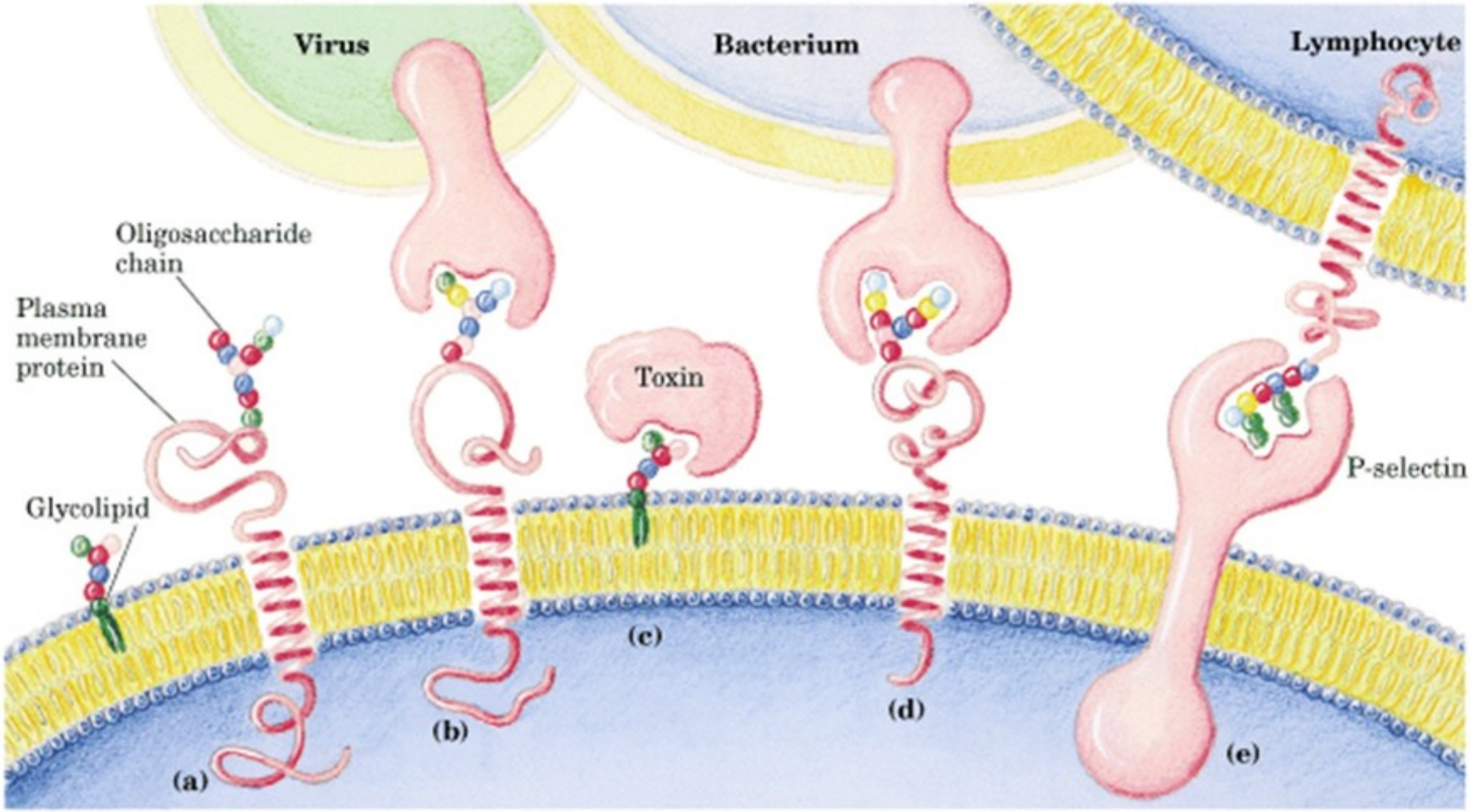
Ligações glicosídicas em glicoproteínas



Glicolipídios



lipopolissacarídeo


Virus
Bacterium
Lymphocyte
Oligosaccharide chain
Plasma membrane protein
Glycolipid
Toxin
P-selectin
(a)
(b)
(c)
(d)
(e)

Poll

A porção de carboidratos de algumas glicoproteínas podem servir de sítios de reconhecimento celular. Para isso, a porção de oligossacarídeo deve ter o potencial de existir em uma grande variedade de formas. Qual das opções abaixo pode produzir uma maior variedade de estruturas?

- oligopeptídeos compostos de 5 diferentes resíduso de aminoácidos
- oligossacarídeos composos de 5 diferentes monossacarídeos