

I Carboidrati sono le biomolecole più abbondanti sulla Terra. Sono aldeidi e chetoni poliossidrilici oppure sostanze che liberano questi composti attraverso idrolisi. Possono contenere anche atomi di azoto, fosforo o zolfo.

I monosaccaridi :sono costituiti da una singola unità poliossidrilica aldeidica o chetonica.

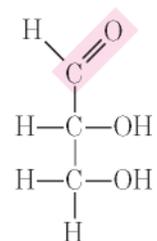
Gli oligosaccaridi :brevi catene di unità monosaccaridiche unite da legami glicosidici.

I disaccaridi :contengono due unità monosaccaridiche.

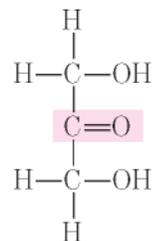
I polisaccaridi :polimeri che contengono 20 o più unità monosaccaridiche.

I glicconiugati :sono polimeri saccaridici legati covalentemente a proteine e a lipidi.

## MONOSACCARIDI IMPORTANTI

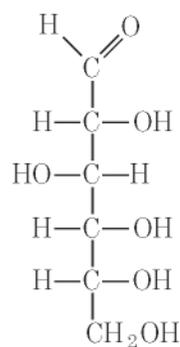


Gliceraldeide,  
un aldotriosio

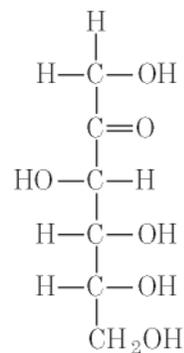


Diidrossiacetone,  
un chetotriosio

(a)

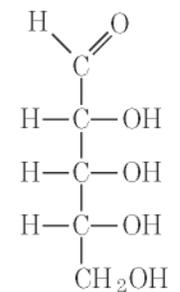


D-Glucosio,  
un aldosesio

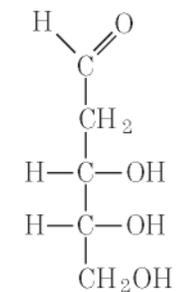


D-Fruttosio,  
un chetosesio

(b)



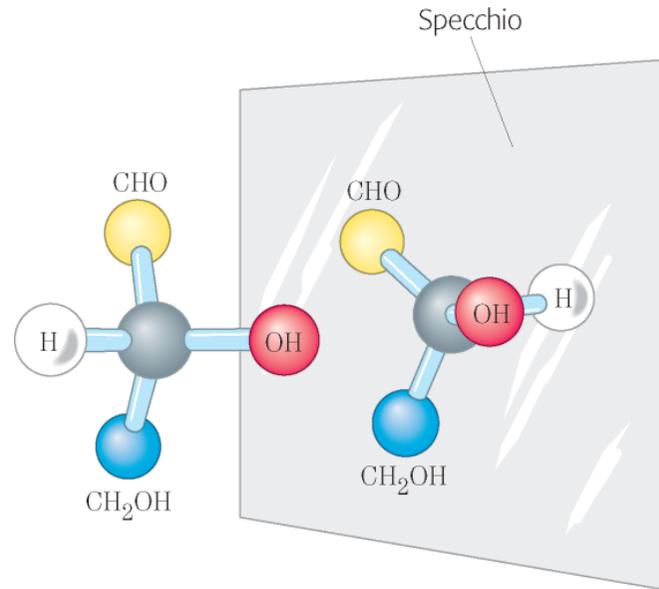
D-Ribosio,  
un aldopentose



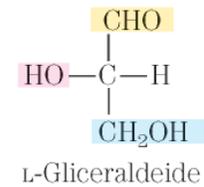
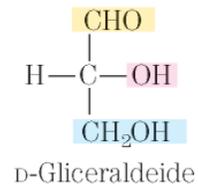
2-Deossi-D-ribosio,  
un aldopentose

(c)

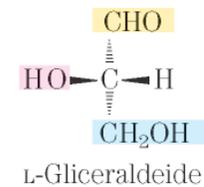
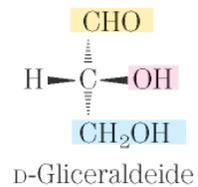
# Tre modi di rappresentare i due stereoisomeri della gliceraldeide



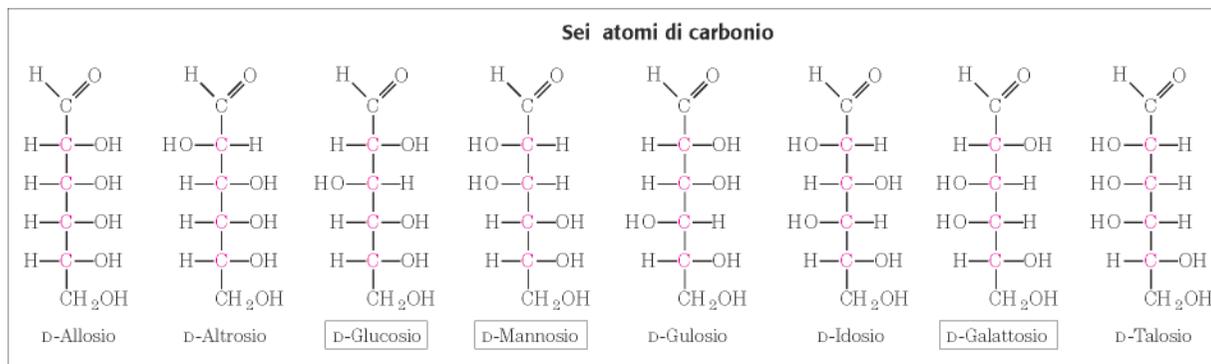
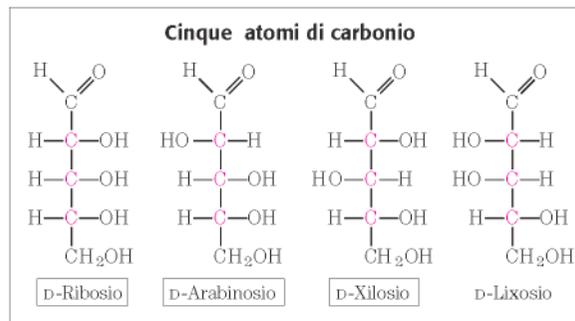
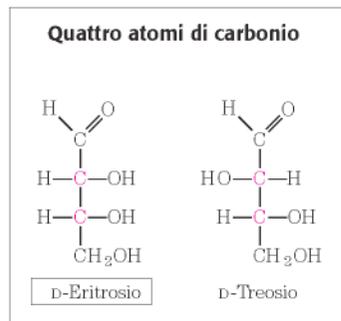
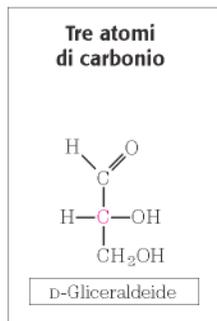
**Modelli a palle-e-bastoncini**



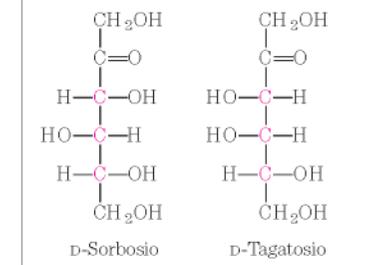
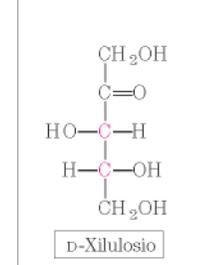
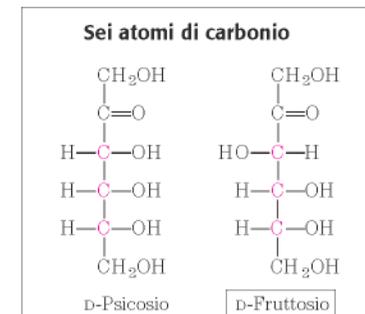
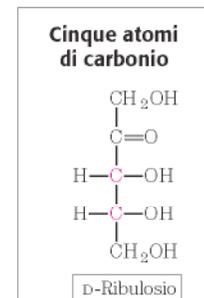
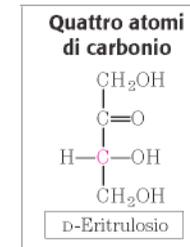
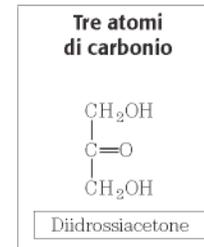
**Formule di proiezione di Fischer**



**Formule in prospettiva**



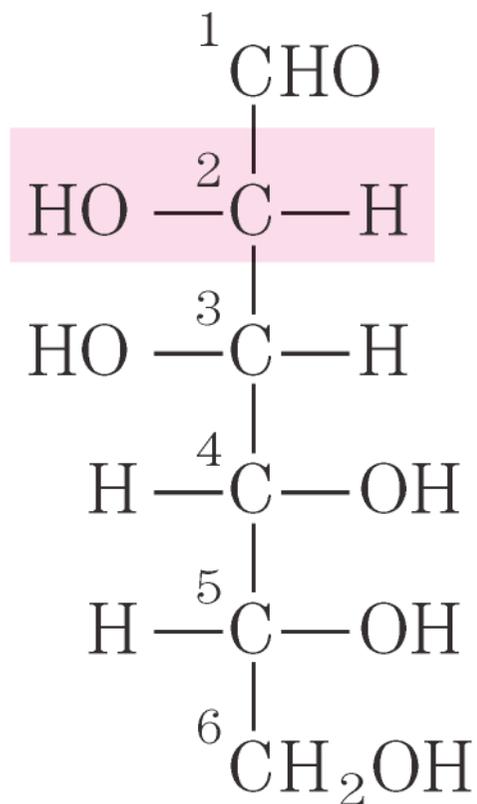
**D-Aldosi (a)**



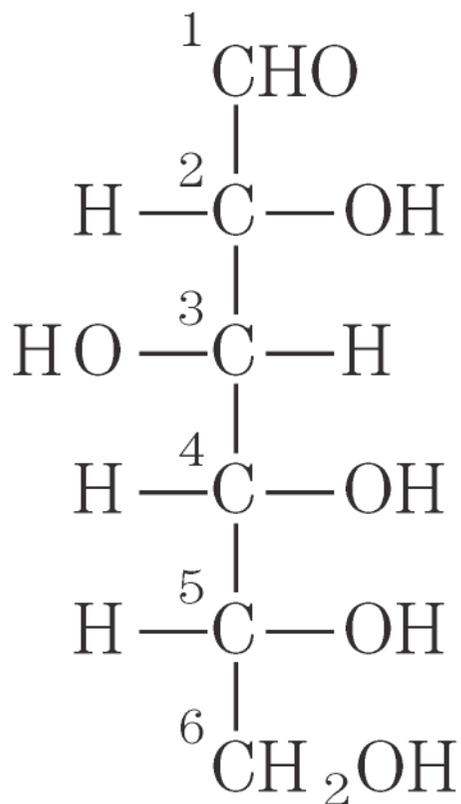
**D-Chetosi (b)**

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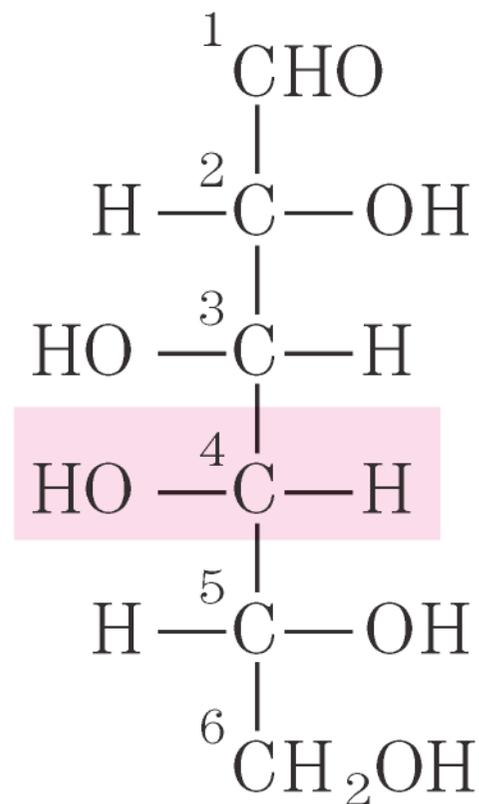
**Epimeri del D-glucosio.** Ogni epimero differisce dal D-glucosio soltanto per la configurazione di un centro chirale



D-Mannosio  
(epimero al C-2)

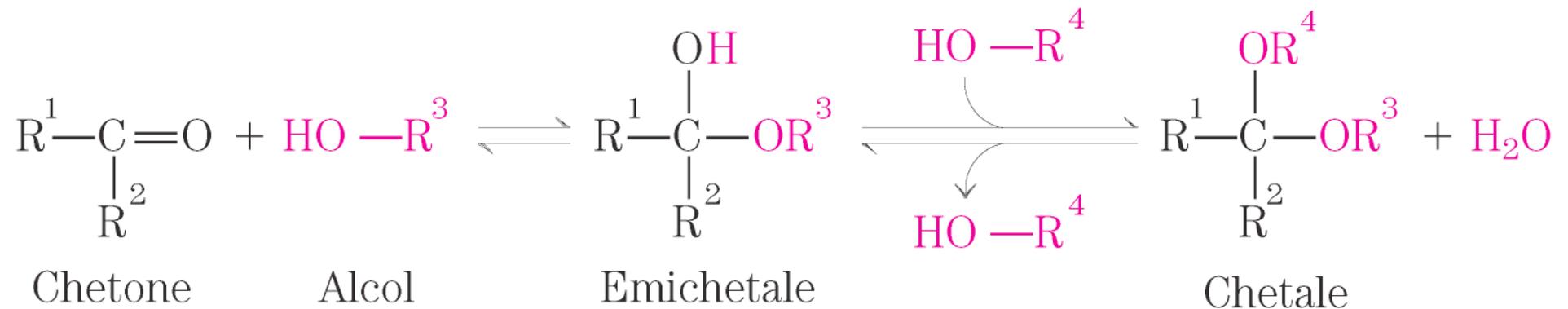
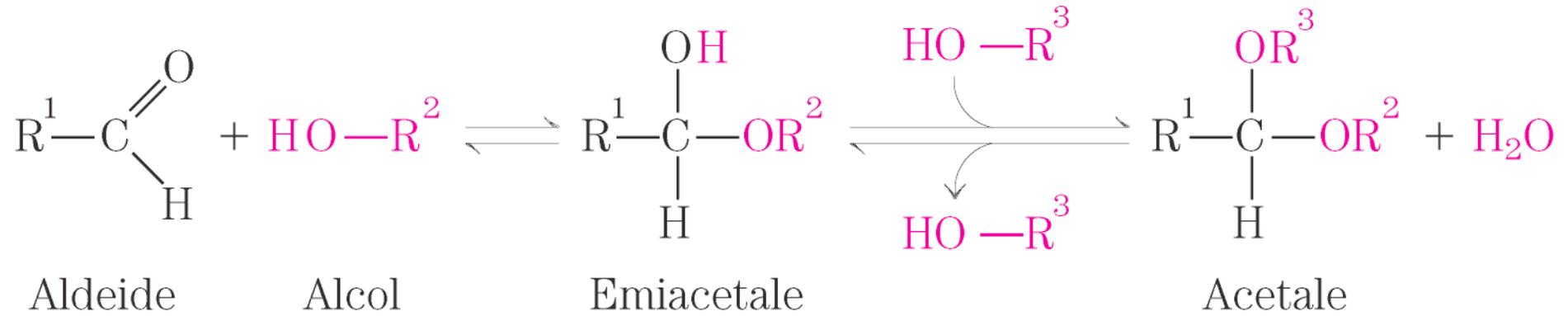


D-Glucosio

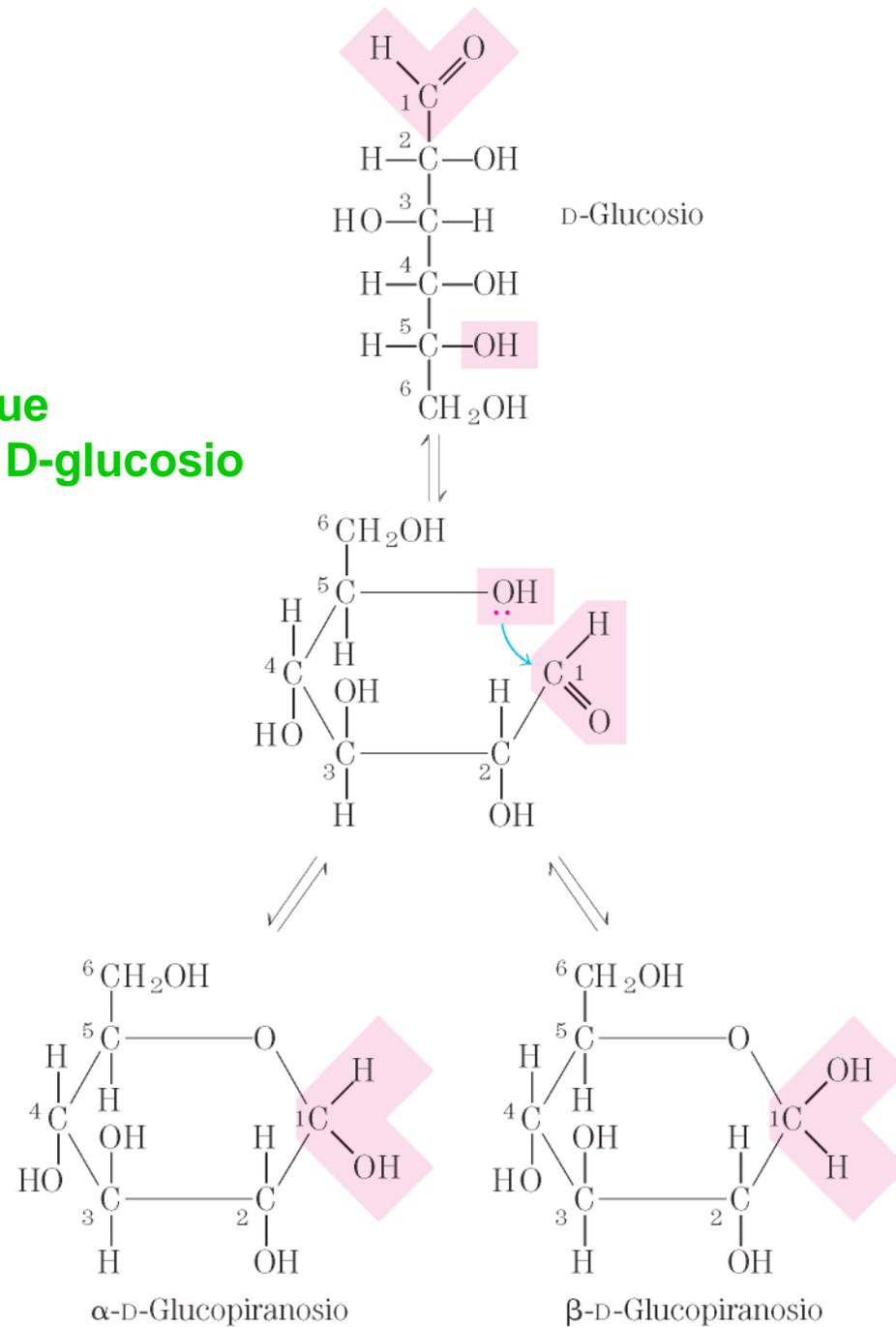


D-Galattosio  
(epimero al C-4)

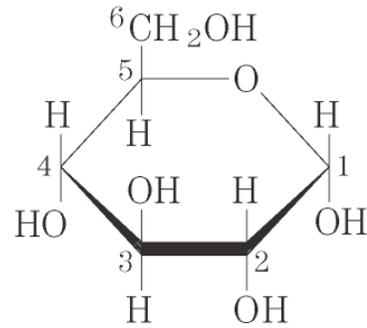
## Formazione di emiacetali e emichetali



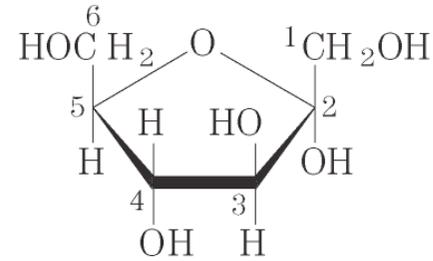
## Formazione dell due forme cicliche del D-glucosio



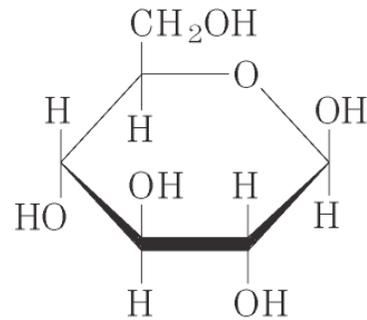
## Piranososi e furanososi: formule in prospettiva di Haworth



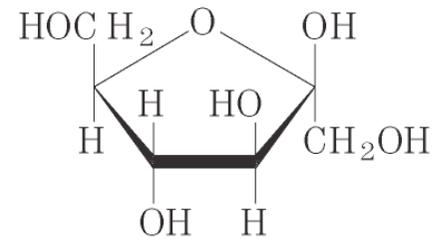
$\alpha$ -D-Glucopiranosio



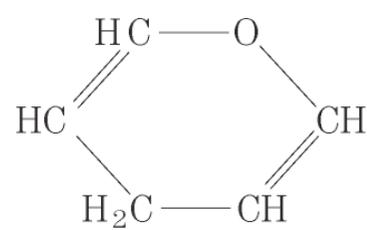
$\alpha$ -D-Fruttofuranosio



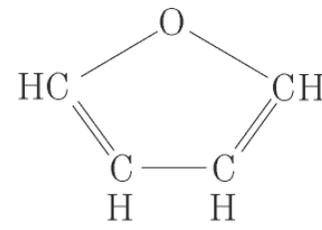
$\beta$ -D-Glucopiranosio



$\beta$ -D-Fruttofuranosio



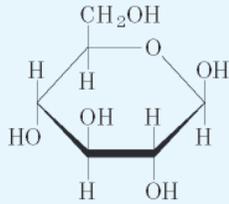
Pirano



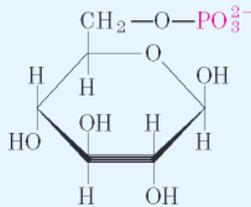
Furano

# Alcuni importanti derivati biologici degli esosi

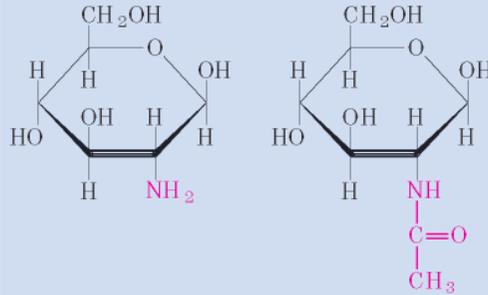
## Famiglia del glucosio



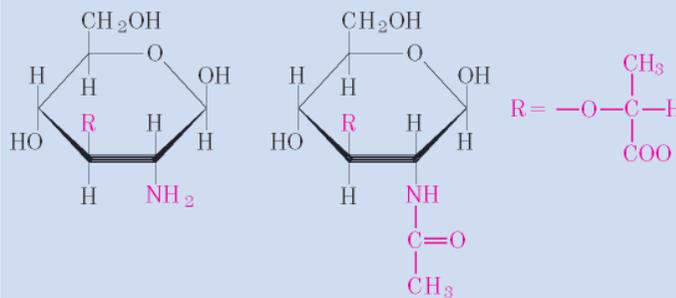
$\beta$ -D-Glucosio



$\beta$ -D-Glucosio 6-fosfato



$\beta$ -D-Glucosammina *N*-Acetil- $\beta$ -D-glucosammina



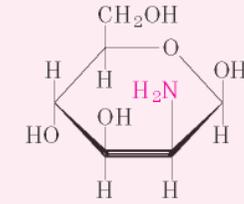
Acido muramico

Acido *N*-acetilmuramico

## Amino-zuccheri

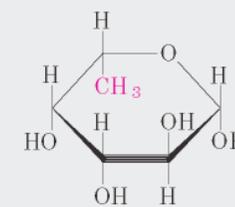


$\beta$ -D-Galattosammina

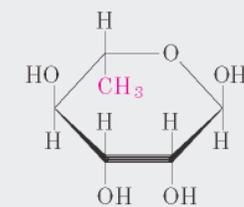


$\beta$ -D-Mannosammina

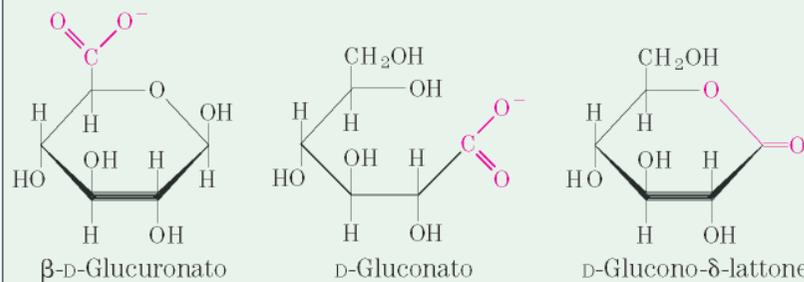
## Deossi-zuccheri



$\alpha$ -L-Fucosio



$\alpha$ -L-Ramnosio

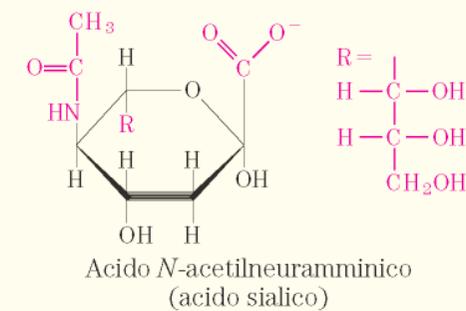


$\beta$ -D-Glucuronato

D-Gluconato

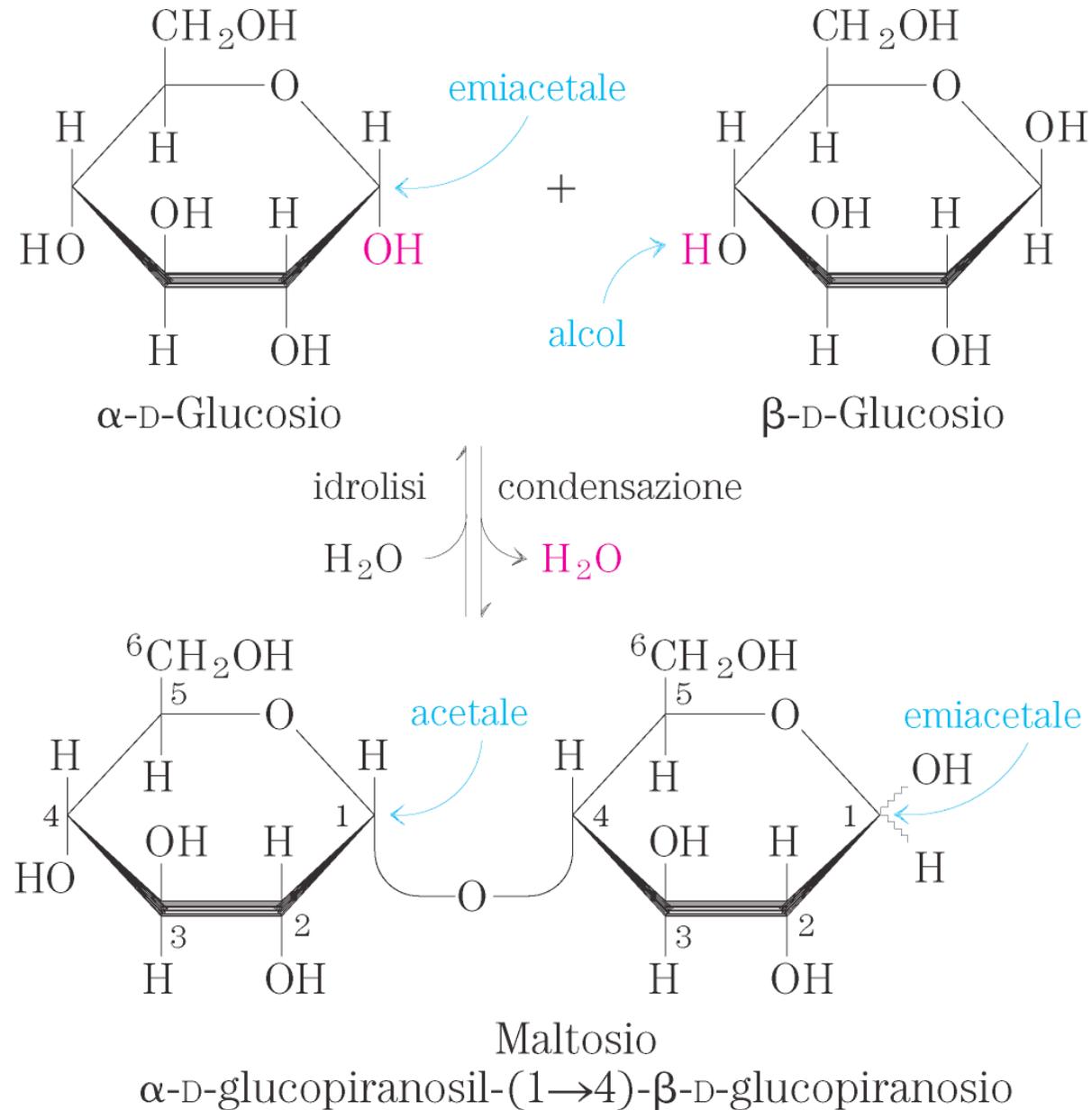
D-Glucono- $\delta$ -lattone

## Zuccheri acidi

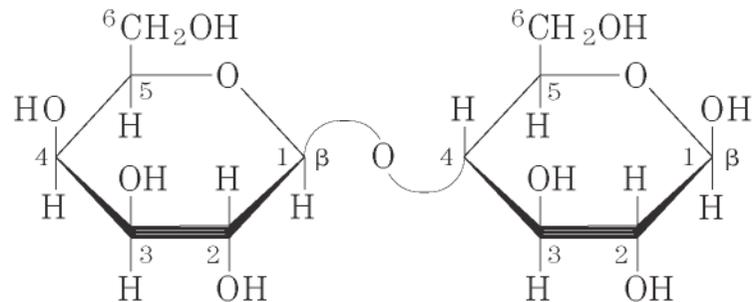


Acido *N*-acetilneuramminico  
(acido sialico)

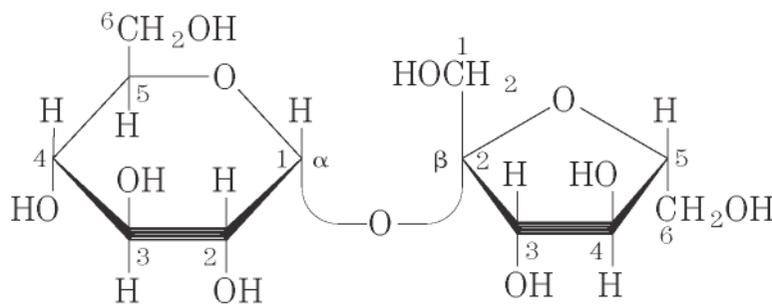
## Formazione di un disaccaride :il maltoso.IL legame O-glicosidico



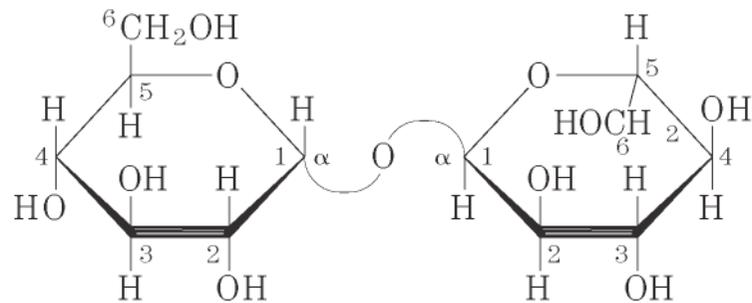
**Alcuni disaccaridi comuni**



Lattosio (forma  $\beta$ )  
 $\beta$ -D-galattopiranosil-(1 $\rightarrow$ 4)- $\beta$ -D-glucopiranosio  
 Gal( $\beta$ 1 $\rightarrow$ 4)Glc



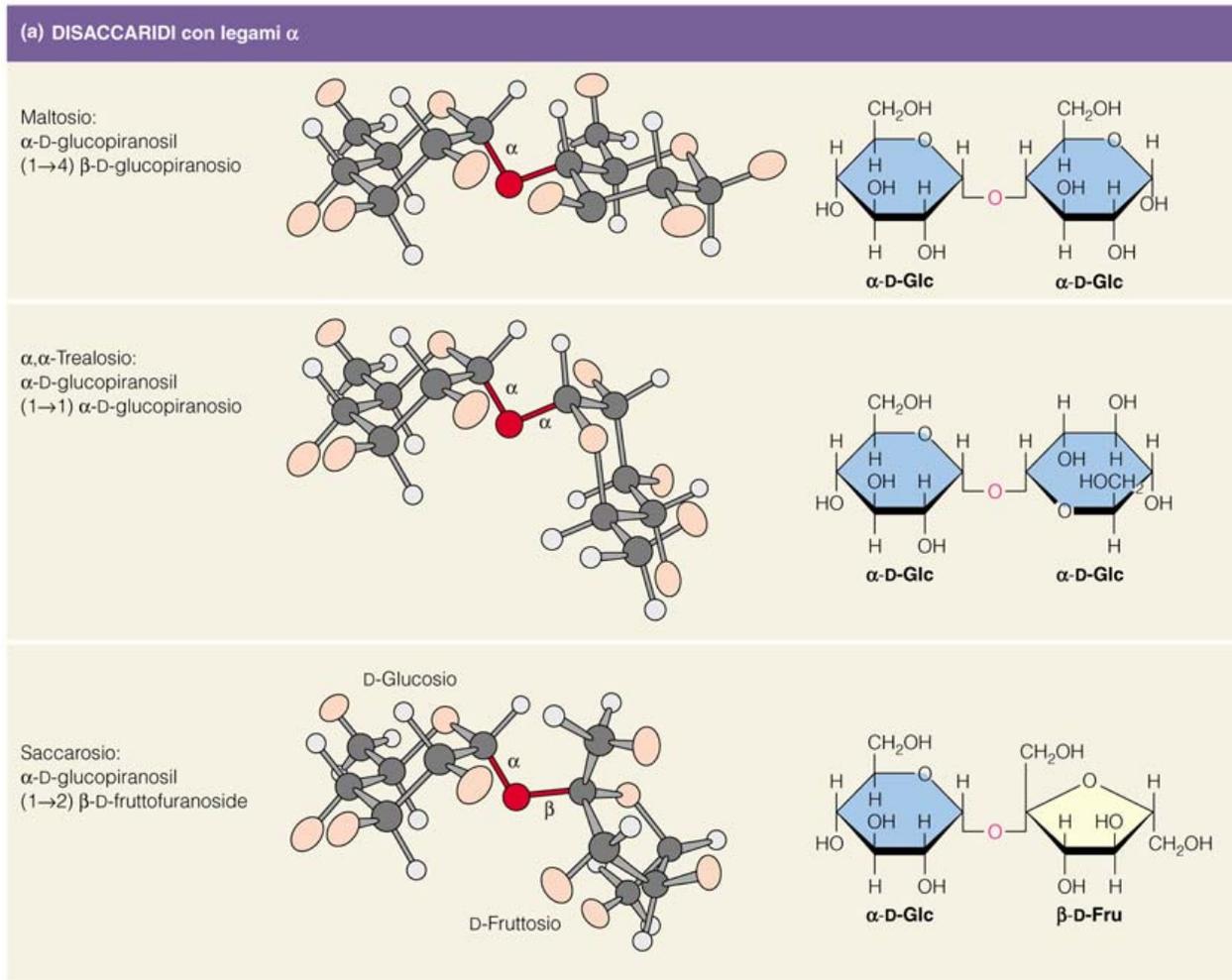
Saccarosio  
 $\alpha$ -D-glucopiranosil- $\beta$ -D-fruttofuranoside  
 Glc( $\alpha$ 1 $\leftrightarrow$ 2 $\beta$ )Fru



Trealosio  
 $\alpha$ -D-glucopiranosil- $\alpha$ -D-glucopiranoside  
 Glc( $\alpha$ 1 $\leftrightarrow$ 1 $\alpha$ )Glc

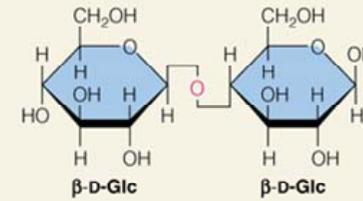
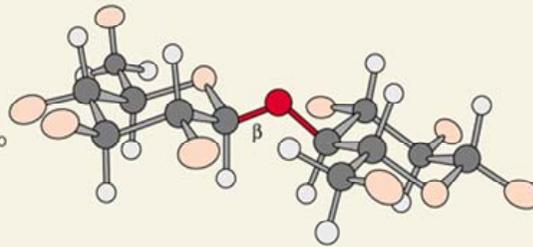
# Strutture di alcuni disaccaridi importanti.

I modelli a palla e bastoncino sono riportati a sinistra, con gli atomi di ossigeno anomeric evidenziati di rosso. A destra sono mostrate le proiezioni di Haworth delle stesse molecole, con i monomeri indicati da diverso colore: blu=glucosio, giallo=fruttosio.

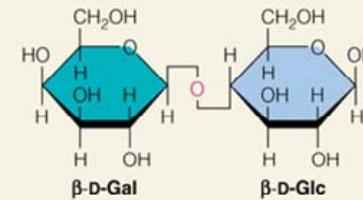
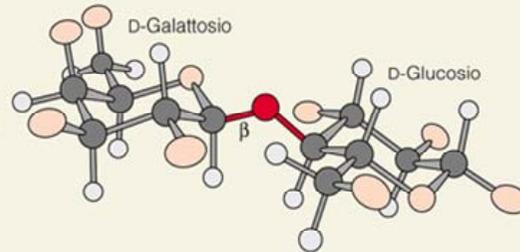


(b) DISACCARIDI con legami  $\beta$

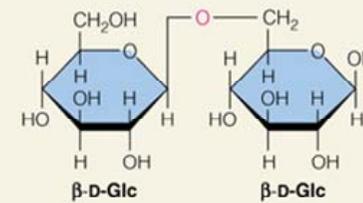
Cellobiosio:  
 $\beta$ -D-glucopiranosil  
(1 $\rightarrow$ 4)  $\beta$ -D-glucopiranosio



Lattosio:  
 $\beta$ -D-galattopiranosil  
(1 $\rightarrow$ 4)  $\beta$ -D-glucopiranosio



Gentobiosio:  
 $\beta$ -D-glucopiranosil  
(1 $\rightarrow$ 6)  $\beta$ -D-glucopiranosio

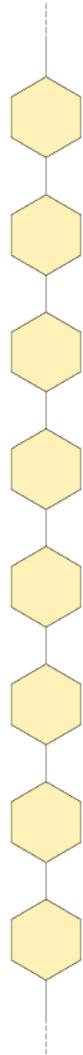


## Strutture di alcuni disaccaridi importanti.

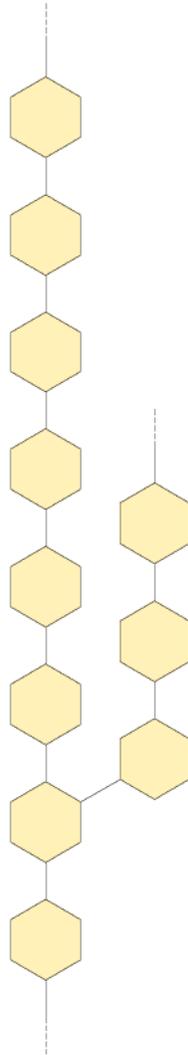
I modelli a palla e bastoncino sono riportati a sinistra, con gli atomi di ossigeno anomeric evidenziati di rosso. A destra sono mostrate le proiezioni di Haworth delle stesse molecole, con i monomeri indicati da diverso colore: blu=glucosio, giallo=fruttosio.

## Omopolisaccaridi

Non ramificato



Ramificato

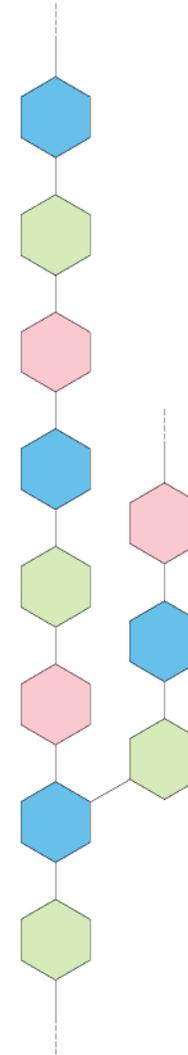


## Eteropolisaccaridi

Due tipi  
di monomero,  
non ramificato



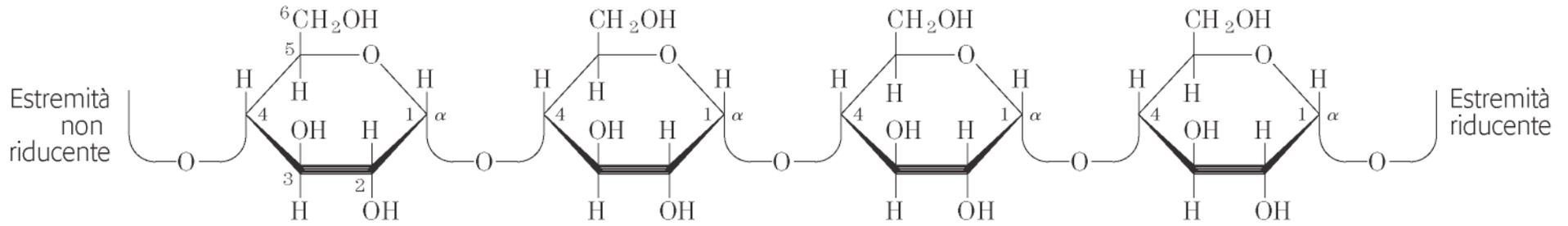
Diversi tipi  
di monomero,  
ramificato



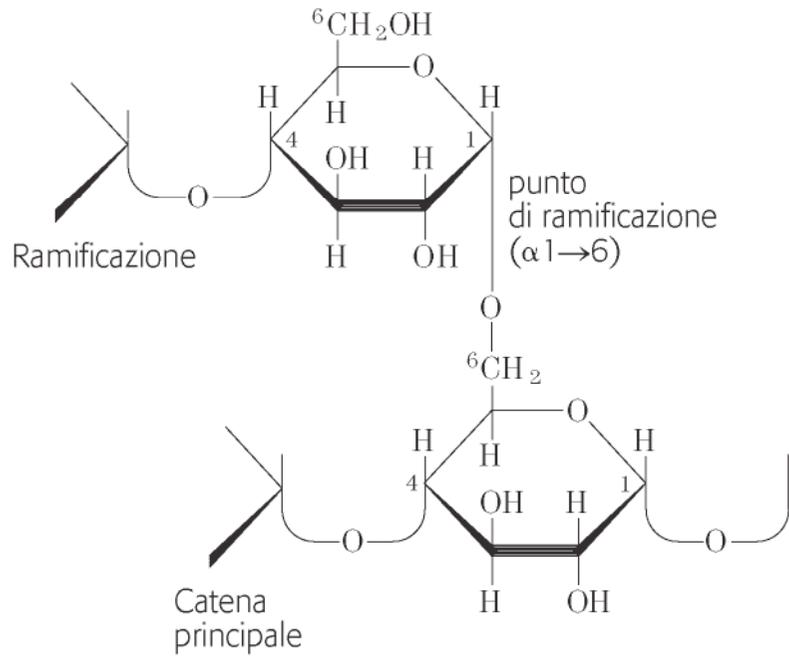
## Struttura e funzione di alcuni polisaccaridi

Polimero	tipo	unità ripetute	dimensione	funzione
AMIDO				riserva di energia delle piante
amilosio	omo	( $\alpha$ 1-4)Glc lineare	50-5000 unità	
amilopectina	omo	( $\alpha$ 1-4)Glc con ramificazioni ( $\alpha$ 1-6) ogni 24-30 residui	fino a $10^6$	
GLICOGENO	omo	( $\alpha$ 1-4)Glc con ramificazioni ( $\alpha$ 1-6) ogni 8-12 residui	fino a 50000	riserva di energia negli animali
CELLULOSA	omo	( $\beta$ 1-4)Glc	fino a 15000	strutturale nelle piante
IALURONATO	etero	GlcA GlcNAC	fino a 100000	strutturale nei vertebrati, matrice extracellulare di pelle e tessuto connettivo, viscosità e lubrificazioni nelle giunture

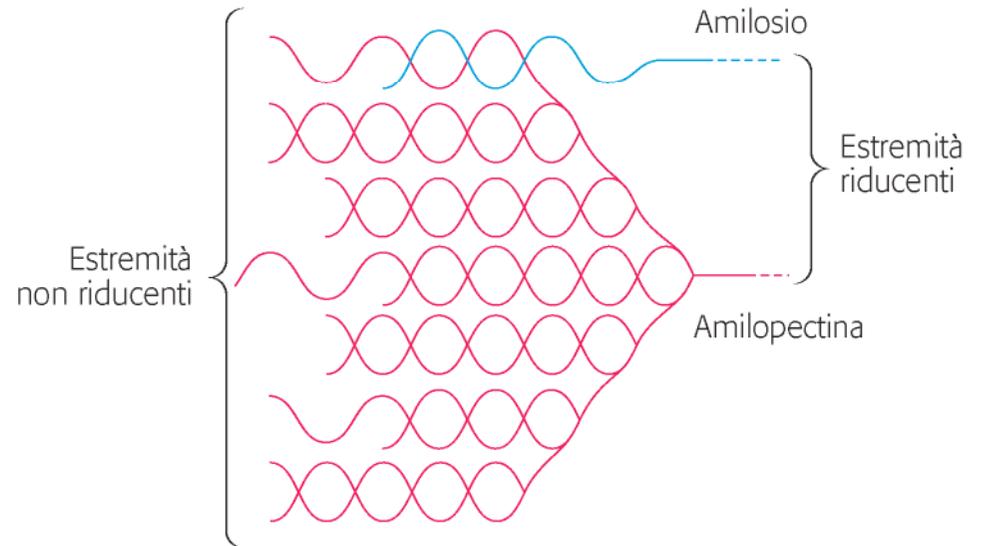
# L'amido : l'amilosio e l'amilopectina



(a) Amilosio

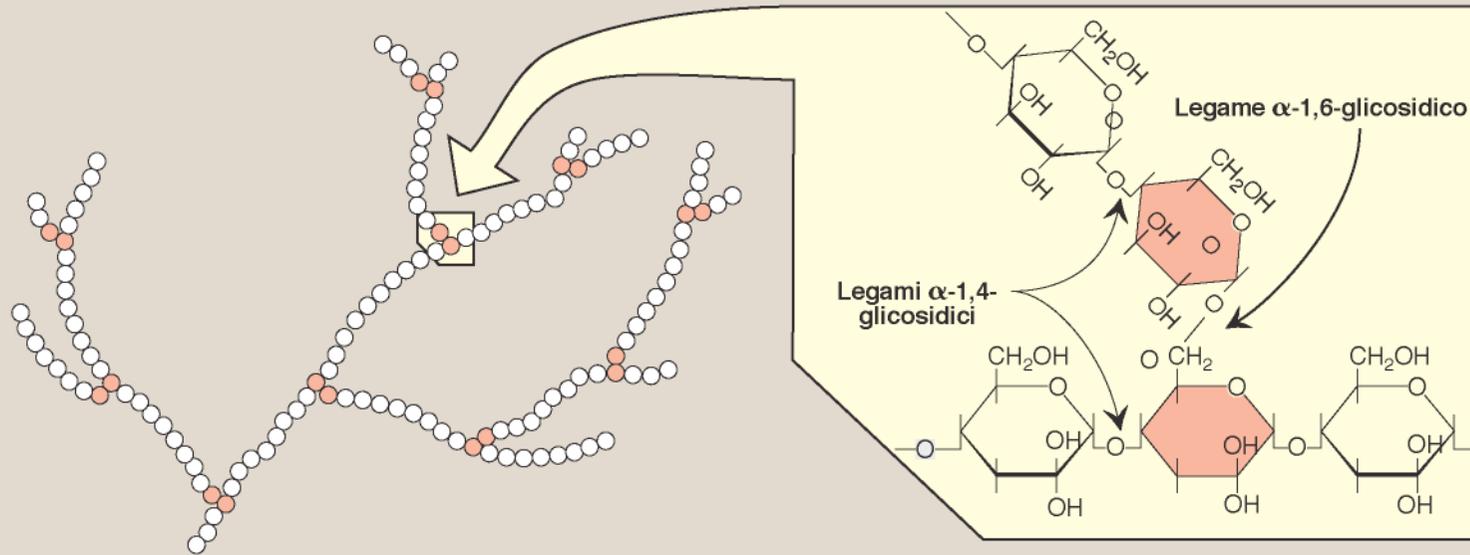


(b) Punto di ramificazione dell'amilopectina

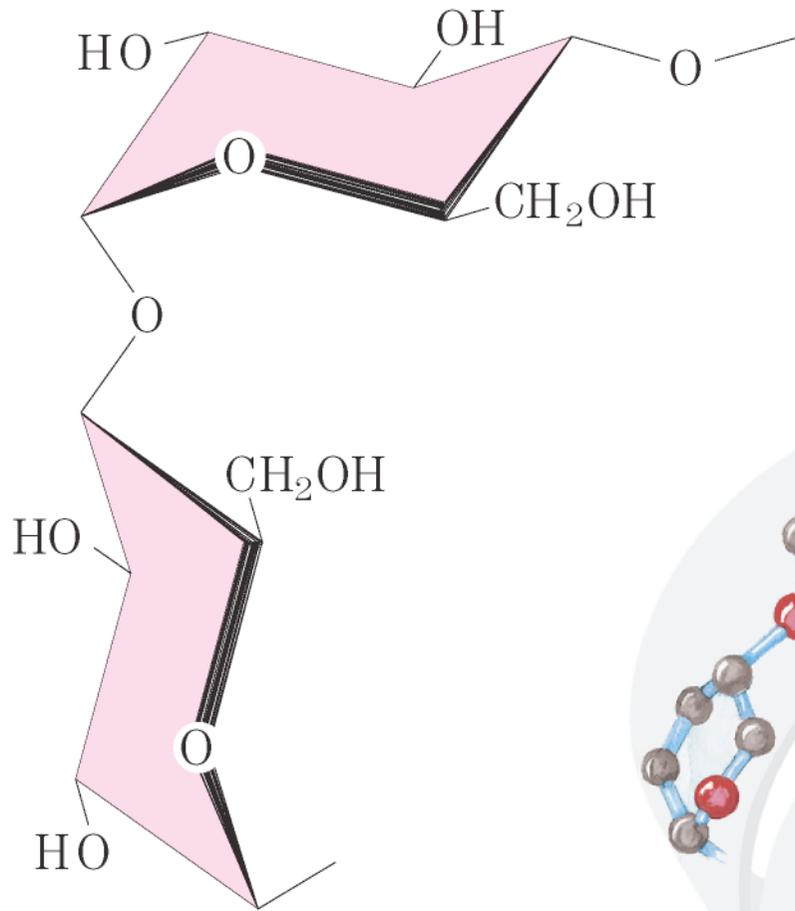


(c)

# Il glicogeno



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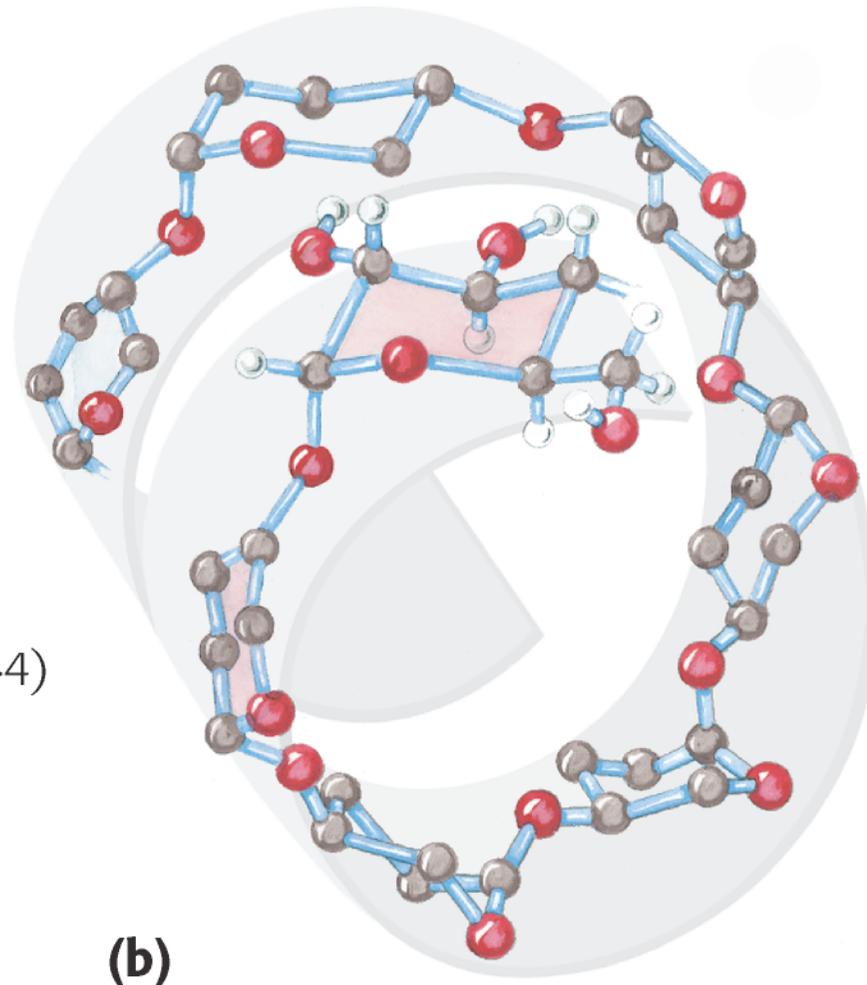


Unità di D-glucosio  
unite con legami ( $\alpha 1 \rightarrow 4$ )

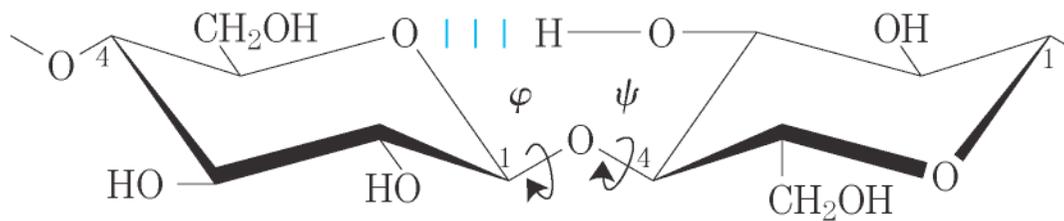
(a)

### La struttura dell'amido(amilosio).

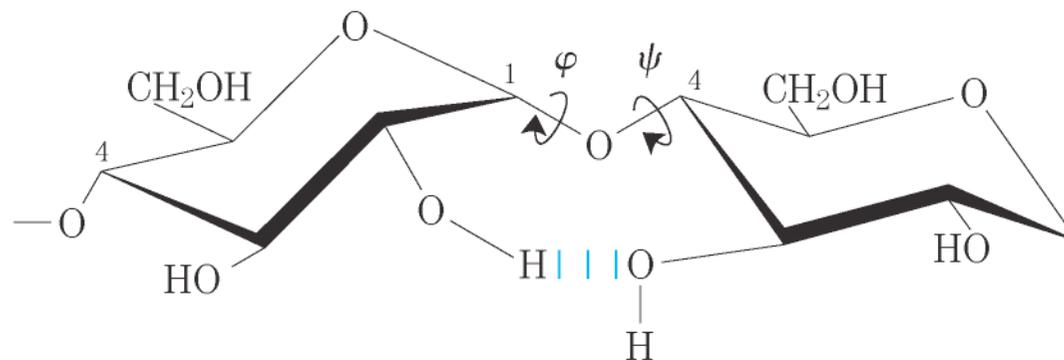
La conformazione dei legami( $\alpha 1-4$ ) dell'amilosio, dell'amilopectina e del glicogeno obbliga il polimero ad assumere una struttura compatta con avvolgimento elicoidale



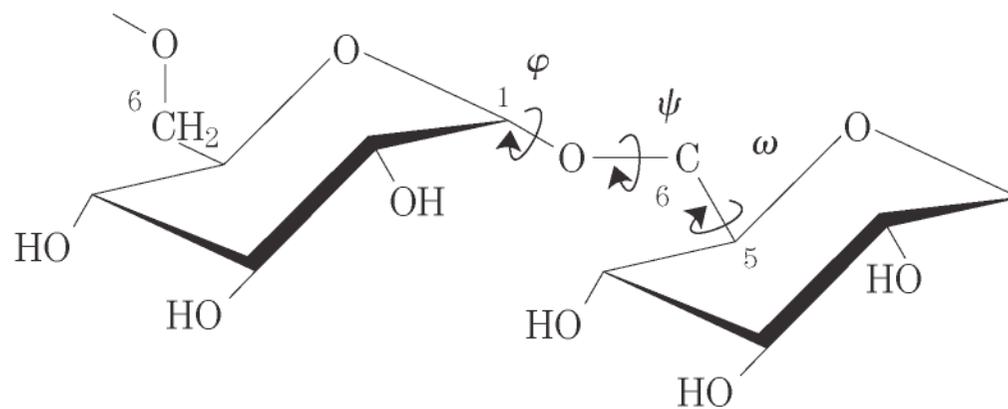
(b)



Cellulosa  
ripetizioni Glc ( $\beta 1 \rightarrow 4$ )

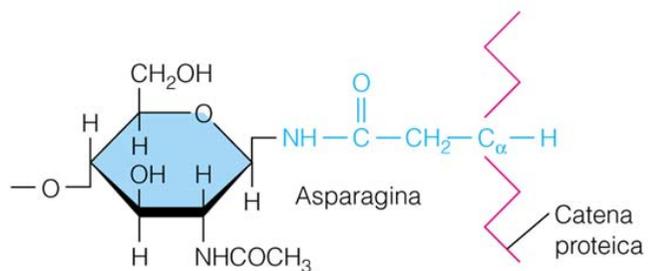


Amylosio  
ripetizioni Glc ( $\alpha 1 \rightarrow 4$ )

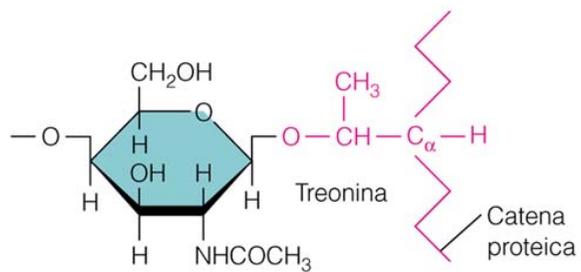


Destrano  
ripetizioni Glc ( $\alpha 1 \rightarrow 6$ ) con ramificazioni ( $\alpha 1 \rightarrow 3$ )

## Legami delle glicoproteine



(a) N-Acetilglucosamina



(b) N-Acetilgalattosamina

## Gli antigeni dei gruppi sanguigni del sistema ABO

