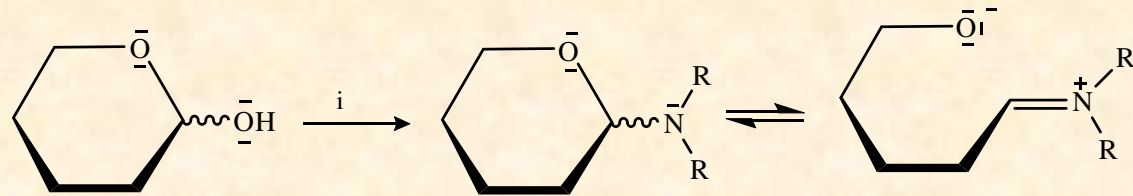


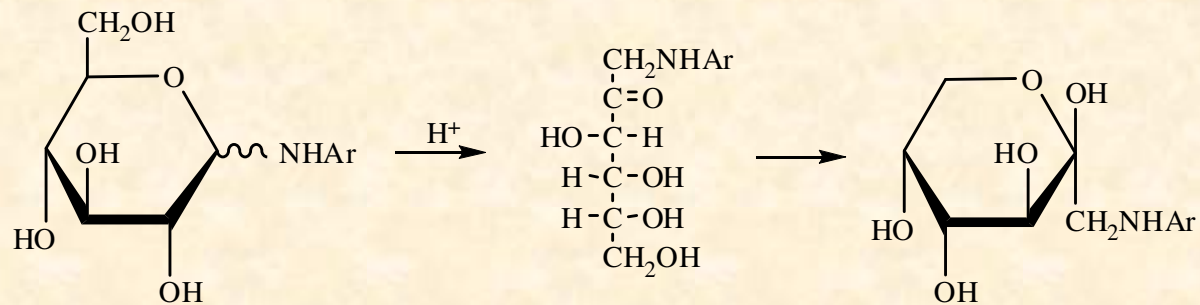
# SACHARIDES 5



# Glycosylamines



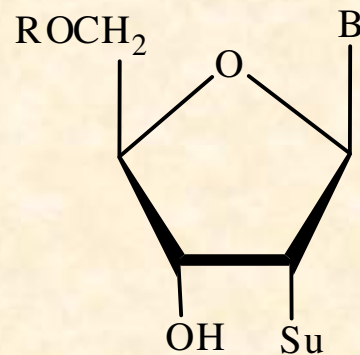
i.  $\text{NH}_3$ ,  $\text{NH}_2\text{R}$  nebo  $\text{NHR}_2$



Amadoriho přesmyk

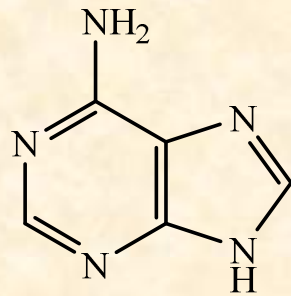
1-arylamino-1-deoxy- $\beta$ -**D**-fruktopyranosa

# Glycosylamine – nucleoside and nucleotides

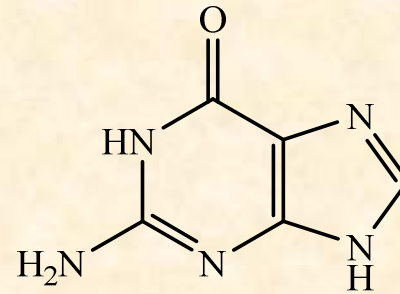


$R = H$  (nucleosides),  $R = PO_3H_2$  (nucleotides)  
 $Su = OH$ ; sugar = D-ribose,  $B =$  adenin, guanin, cytosin, uracil  
 $Su = H$ ; cukr 2-deoxy-D-ribose,  $B =$  adenin guanin, thymidin, uracil)

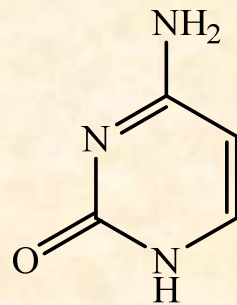
# Nucleobases



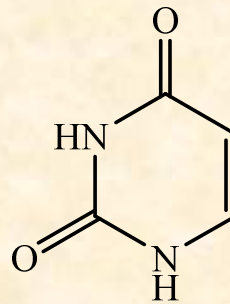
adenine



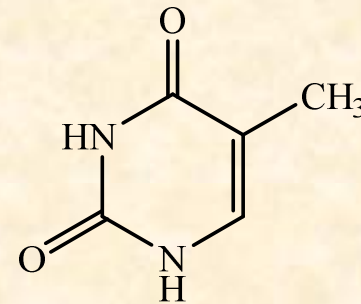
guanine



cytosine

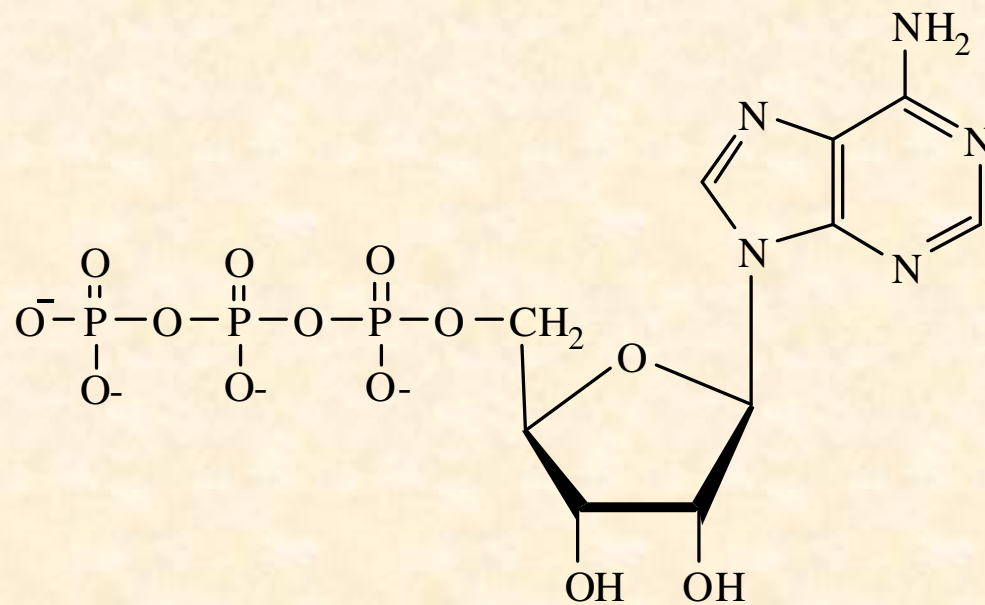


uracil

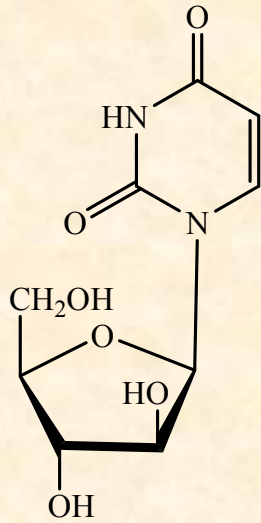


thymine

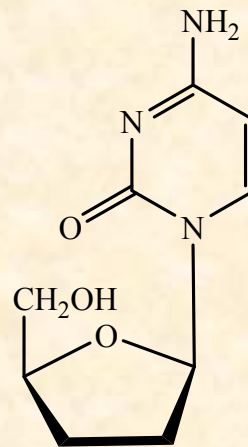
# Adenosine triphosphate



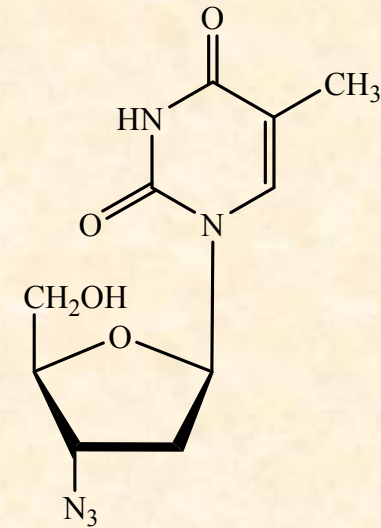
# Glycosylamines



1-( $\beta$ -D-arabinofuranosyl)-  
cytosine (Ara-C)

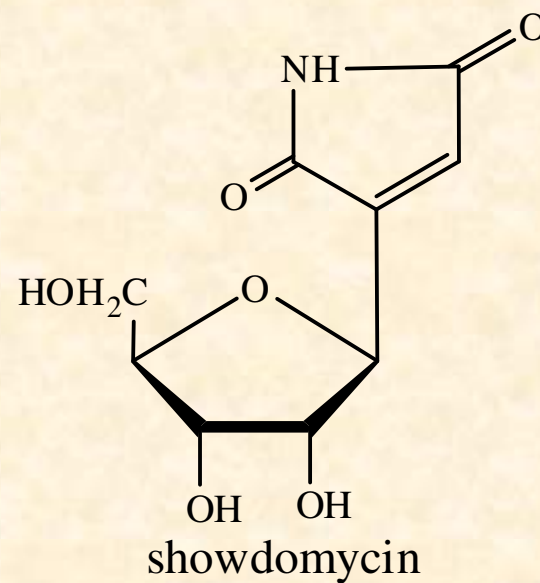
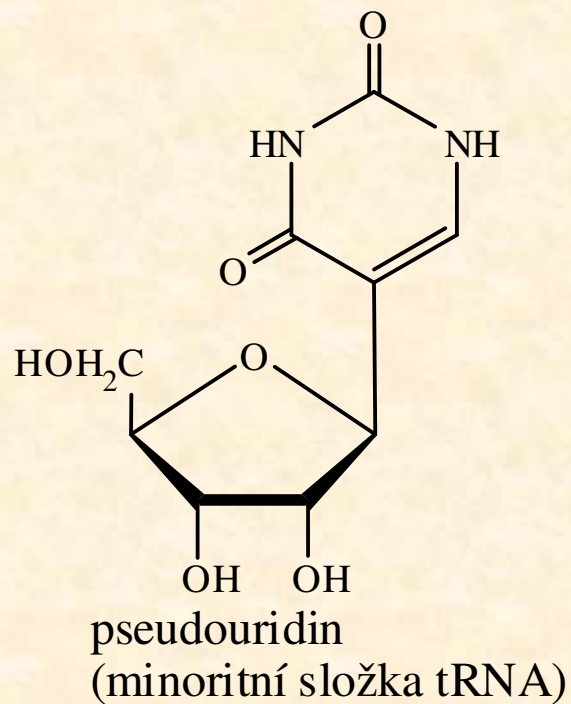


2',3'-dideoxycytidine  
(Zalcitabin)

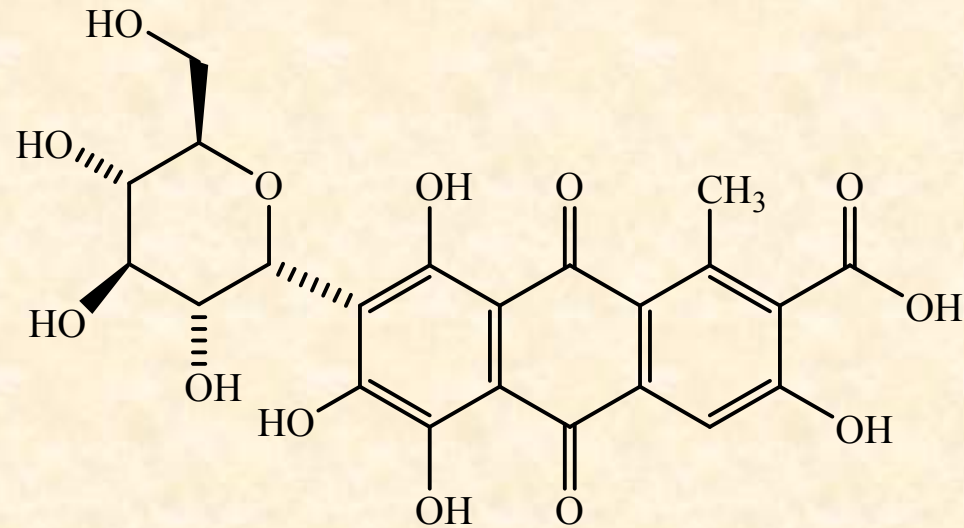


3'-azido-3'-deoxythymidine (AZT)  
1-(3-azido-2,3-dideoxy- $\beta$ -D-  
erythro-pentofuranosyl)thymine

# C-Glycosylderivatives (C-glycosides)



# C-Glykosylderiváty (C-glykosidy)



karmínová kyselina

E 120

from worm *Dactylopius coccus* (Cochineal)

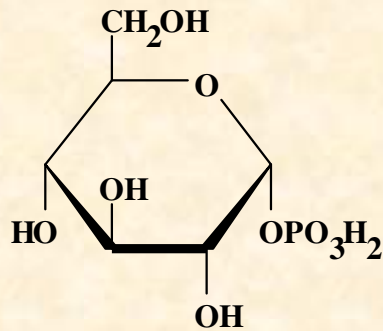


# Reaction of hydroxyl groups

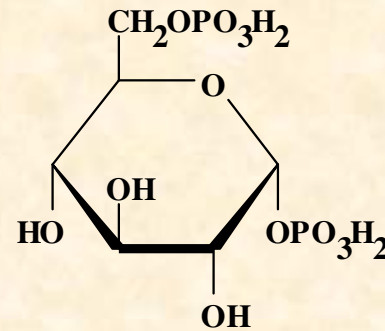
## Esters

- Benzoates – more stable than acetates (prep. Benzoyl chloride in pyridine)
- Trifluoroacetates – very reactive, labile
- *Tert*-butoxy carbonates and carbobenzoxy carbonates, easily removable
- Cyclic carbonates (for 1,2-diols)
- *p*-Toluensulfonic esters (tosylates),
- Methansulfonic esters (mesylates)
- Trifluormethansulfonates (triflates).
- Boronates, sulfates and hydrogensulfates, nitrates
- Fosfates

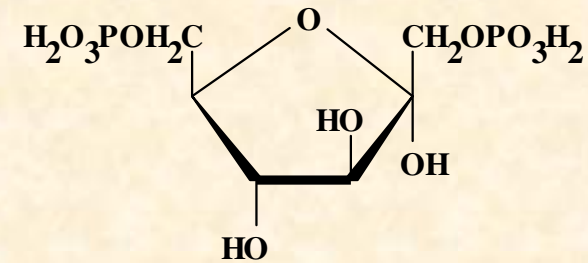
# Reaction of hydroxyl groups Phosphates



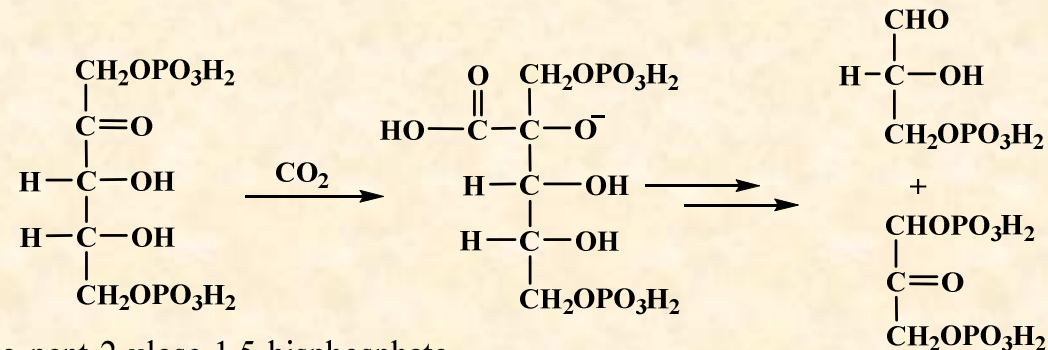
D-glucose-1-phosphate



D-glucose-1,6-bisphosphate

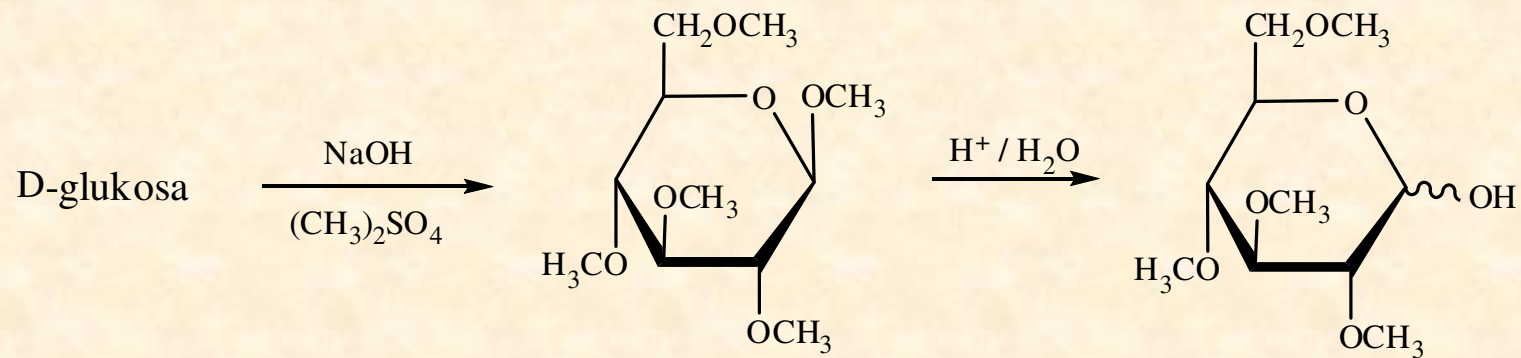


D-fructose-1,6-bisphosphate



D-erythro-pent-2-ulose-1,5-bisphosphate  
(D-ribulose-1,5-bisphosphate)

# Ethers

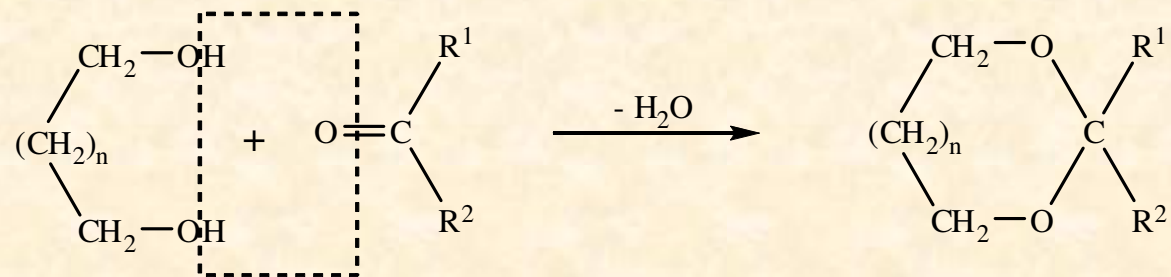


Triphenylmethyl ethers (trityl ethers),

Trimethylsilyl ethers, *tert*-butyldimethylsilyl- a *tert*-butyldiphenylsilyl ethers

Allyl ethers, benzyl ethers

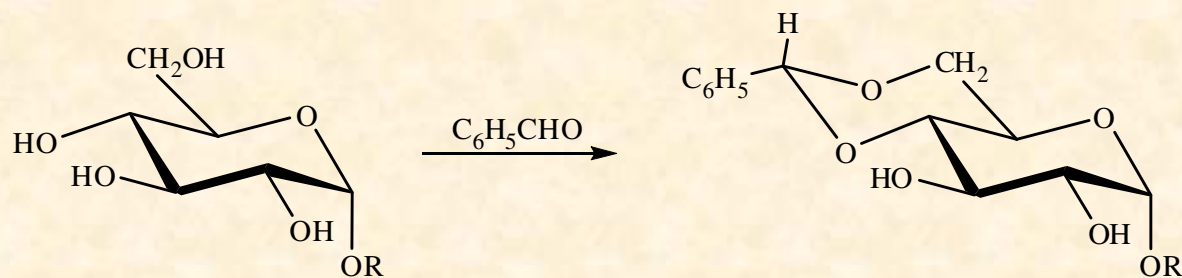
# Acetals a ketals



1,3-dioxolane type of acetals (with acetone)

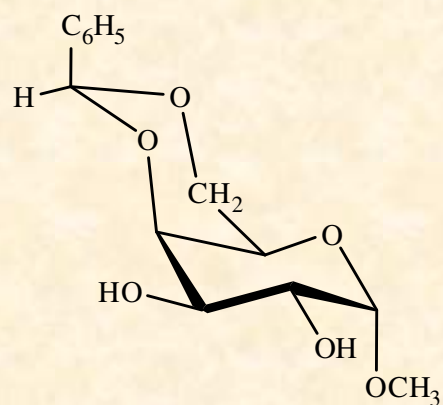
1,3-dioxolane type of acetals (with benzaldehyde)

# Benzylidene acetals



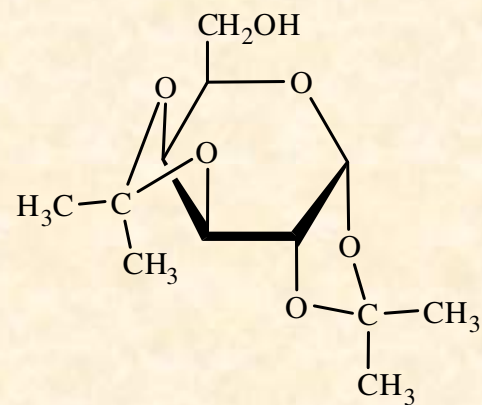
R = H, alkyl, aryl

alkyl-(*R*)-4,6-O-benzylidene- $\beta$ -D-glucopyranoside

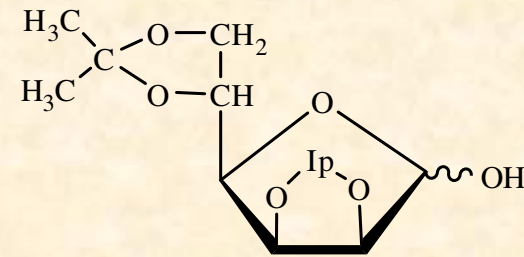


methyl-(*S*)-4,6-O-benzylidene- $\beta$ -D-galactopyranoside

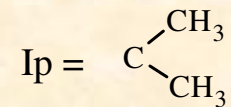
# Isopropylidene acetals



1,2:3,4-di-*O*-isopropyliden-  
β-D-galaktopyranosa

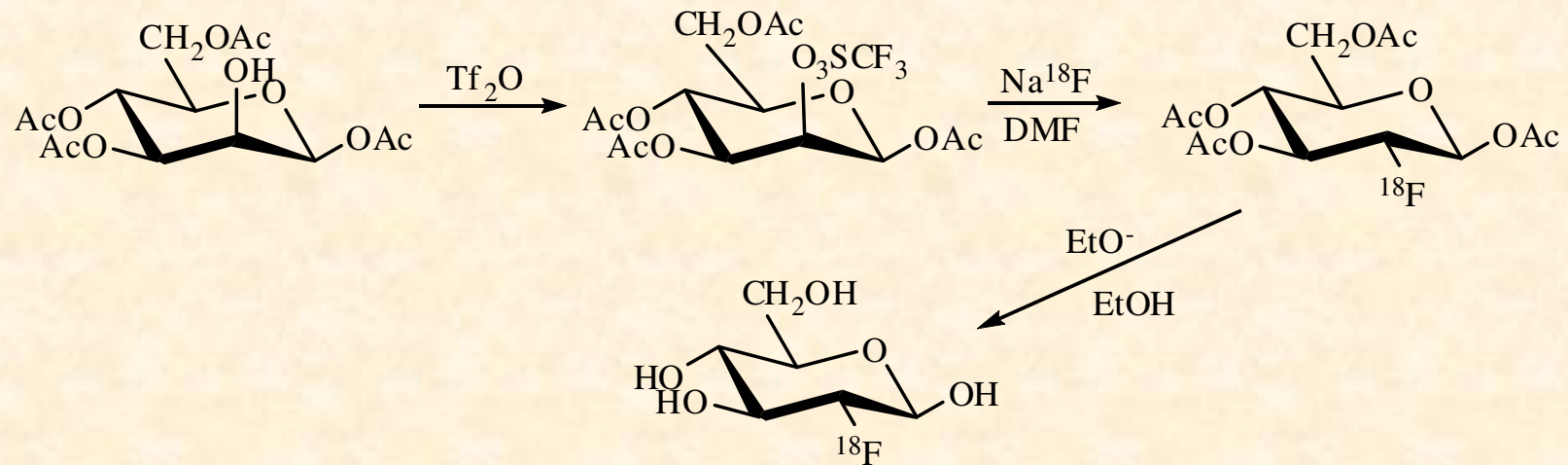


2,3:5,6-di-*O*-isopropyliden-  
D-mannofuranosa



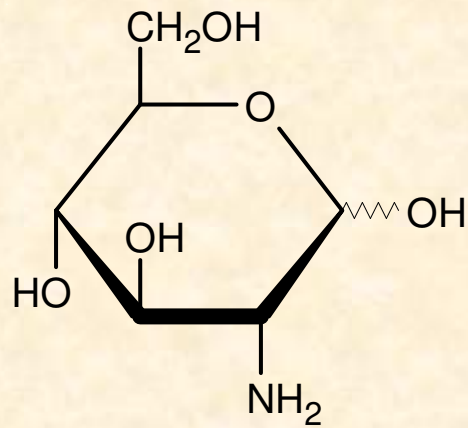
# Halogeno derivatives

$^{18}\text{F}$ -2-deoxy-2-fluor-D-glukosa  
(FDG)

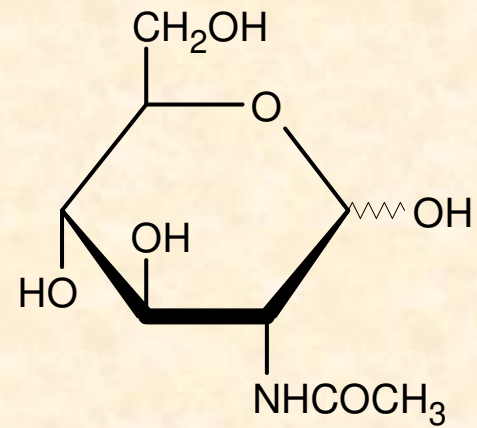


2-deoxy-2-[ $^{18}\text{F}$ ]fluor-D-glukopyranosa

# Amino derivatives



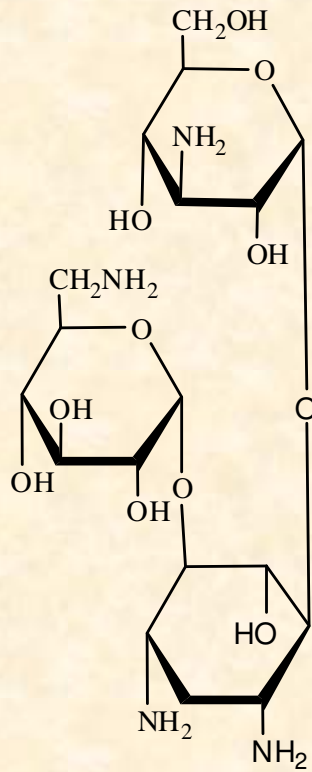
D-glucosamine



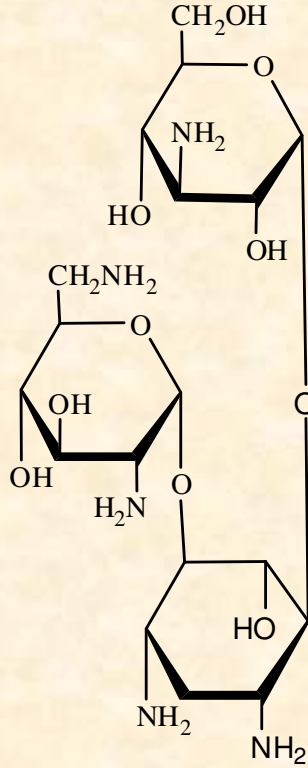
*N*-acetyl-D-glucosamine



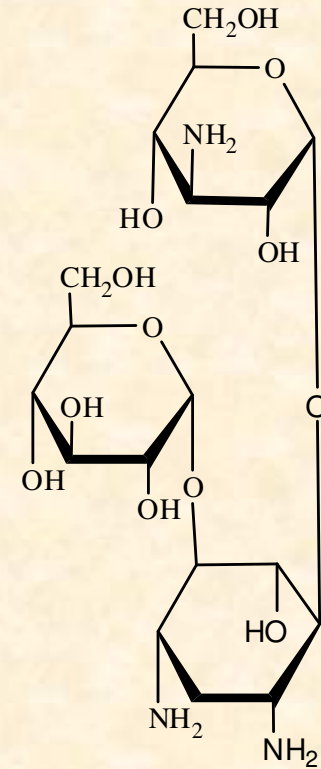
# Kanamycin



kanamycin A

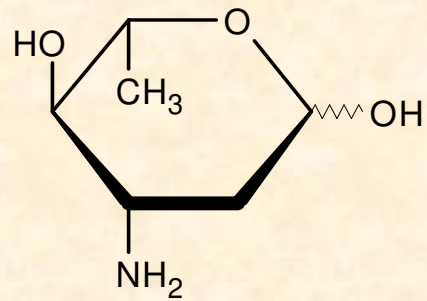


kanamycin B

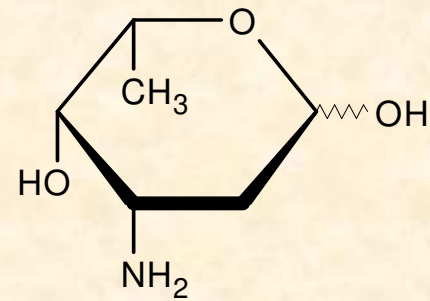


kanamycin C

# Amino sugars

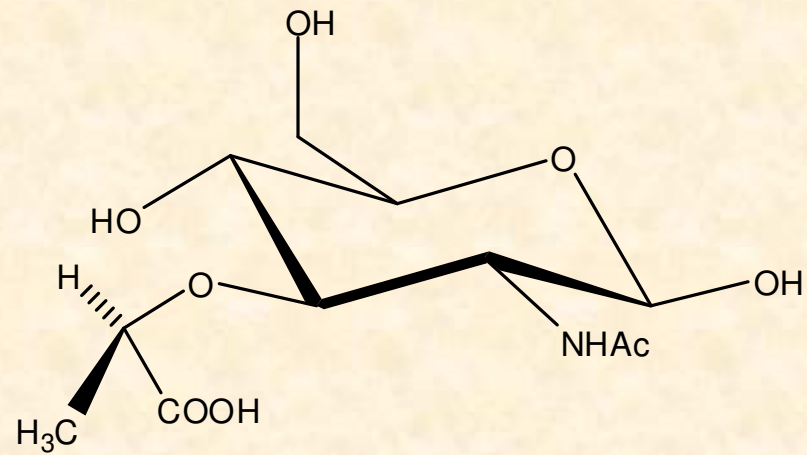
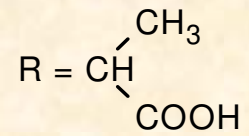
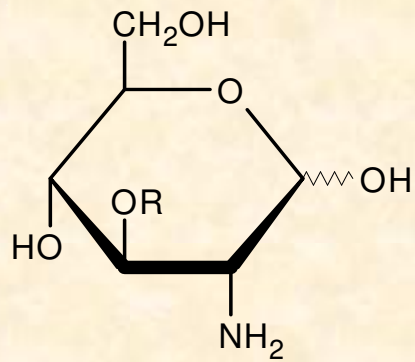


Acosamine

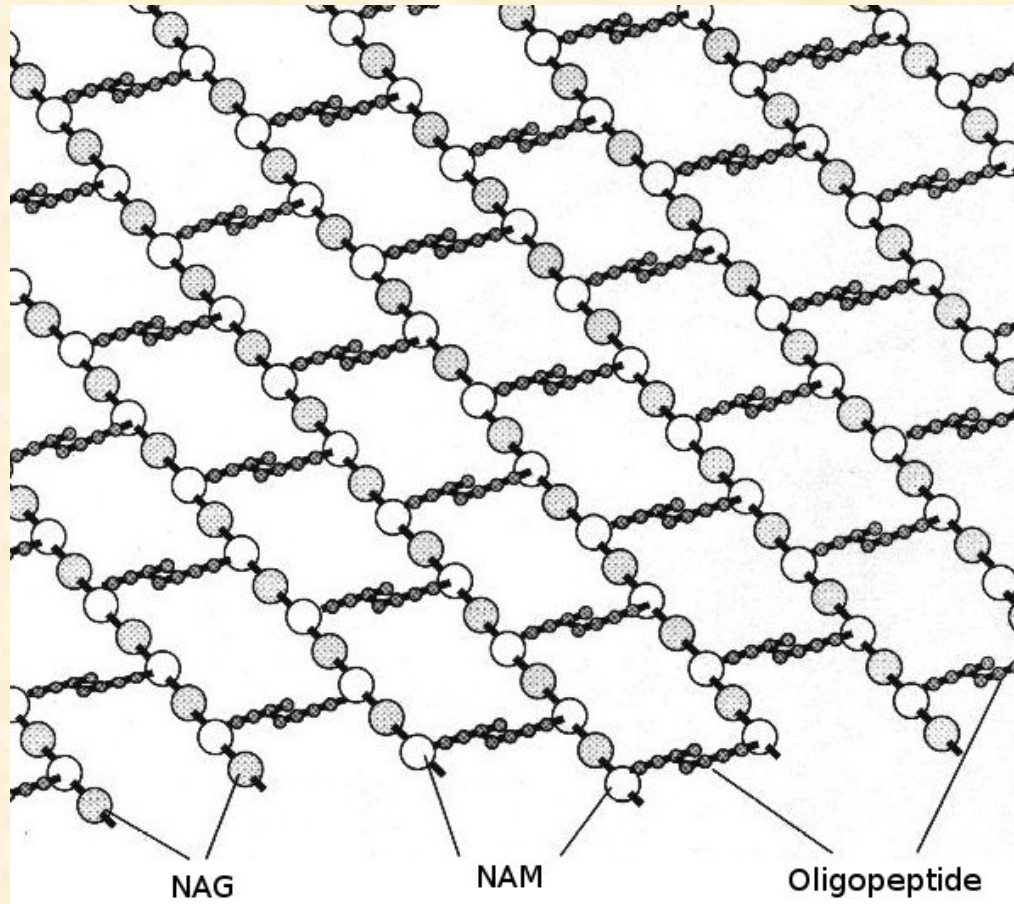


Daunosamine

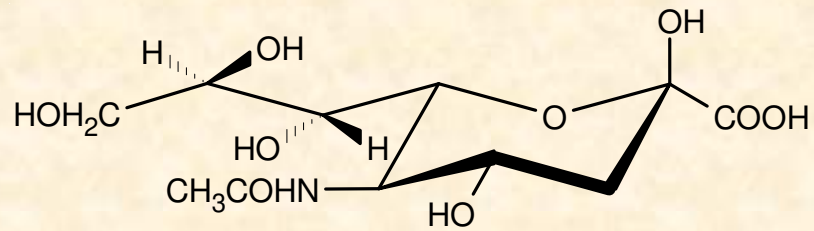
# Muramic acid



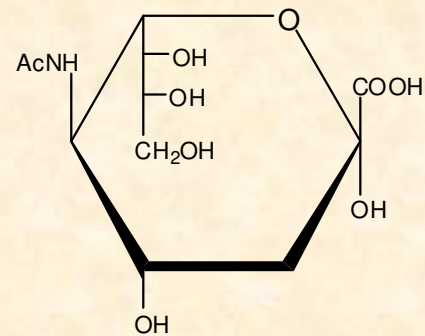
# Peptidoglykan



# NANA

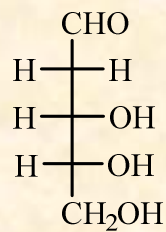


*N*-acetylneuraminic acid

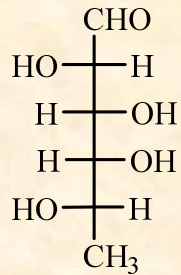


5-acetamido-3,5-dideoxy-D-glycero- $\alpha$ -D-galakto-non-2-ulopyranosová kyselina ( $\alpha$ -Neu5Ac)

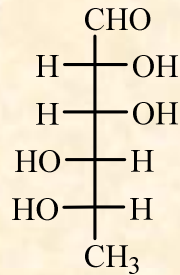
# Deoxy sugars



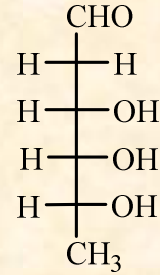
(2-deoxyribose)  
2-deoxy-D-*erythro*-pentose



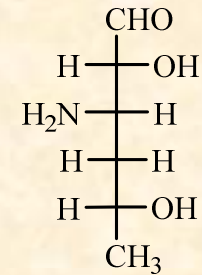
(L-fucose)  
6-deoxy-L-galactose



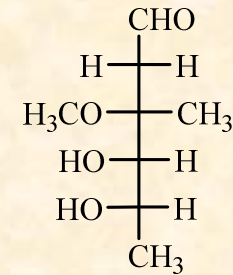
(L-rhamnose)  
6-deoxy-L-mannose



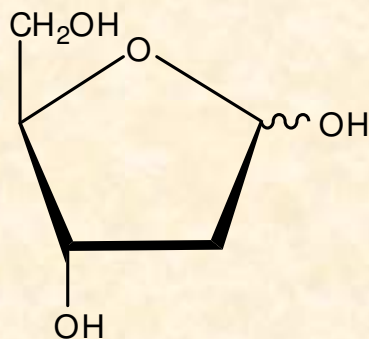
(digitose)  
2,6-dideoxy-D-*ribo*-pentose



(desosamine)  
3,4,6-trideoxy-3-(dimethylamino)-D-*xylo*-pentose

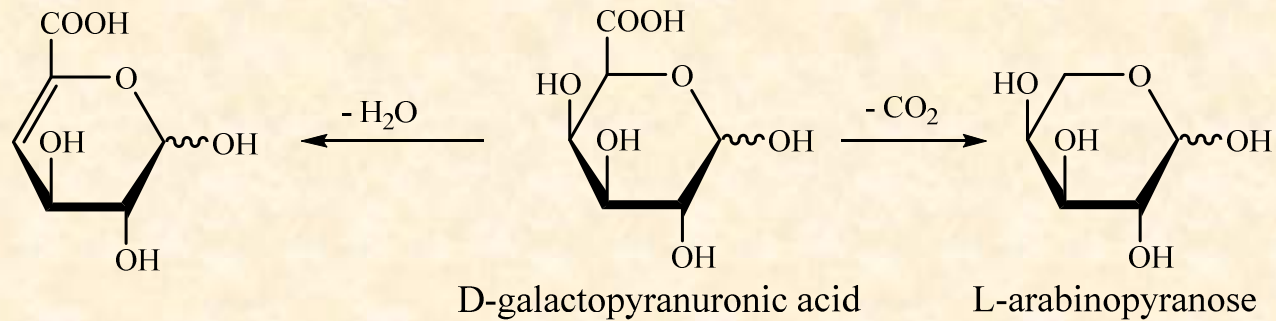
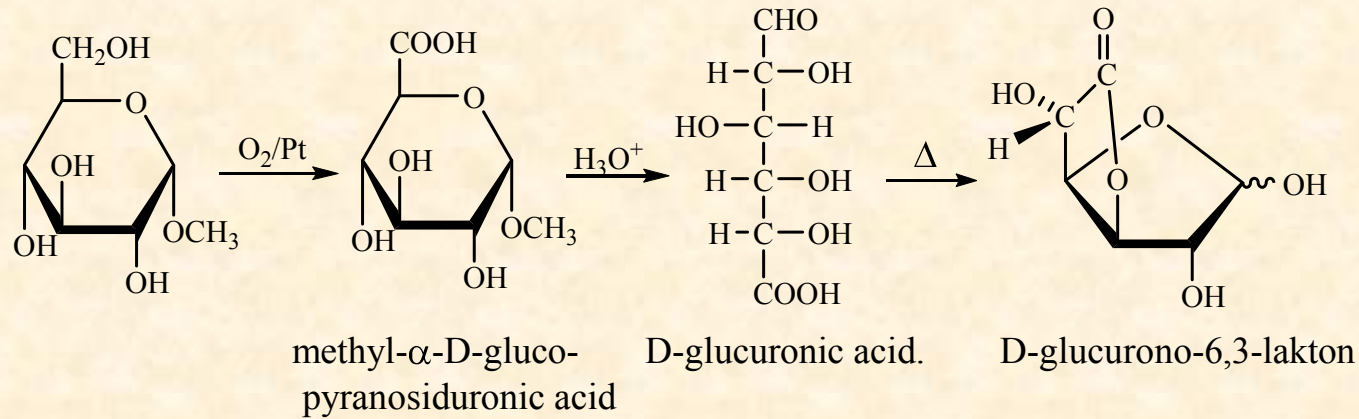


(cladinose)  
2,6-dideoxy-3-C-methyl-3-O-methyl-L-*ribo*-hexose

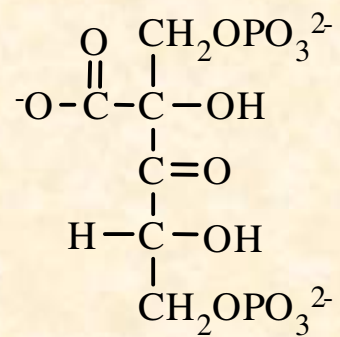


2-deoxy-D-*erythro*-pentofuranosa  
(2-deoxyribose)

# Uronic acids



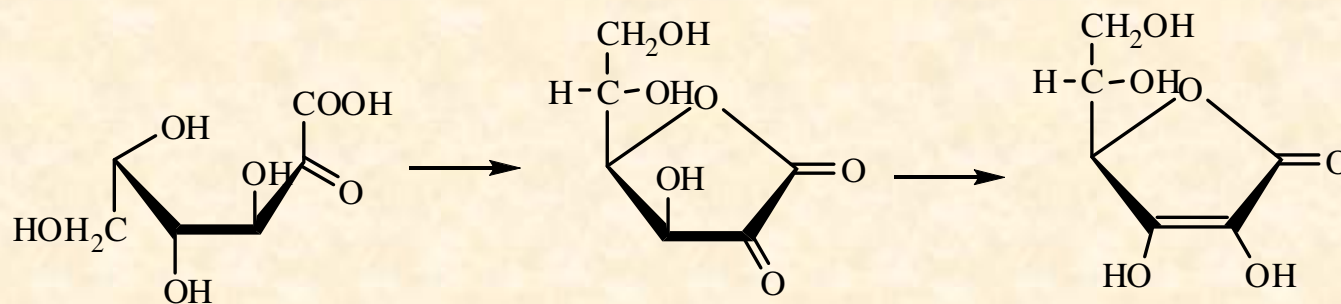
# Branched-chain sugars



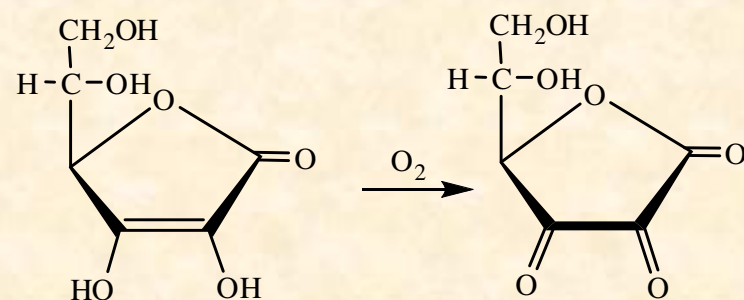
2-C-karboxylato-D-erythro-pent-3-ulosza-1,5-bis(fosfát)



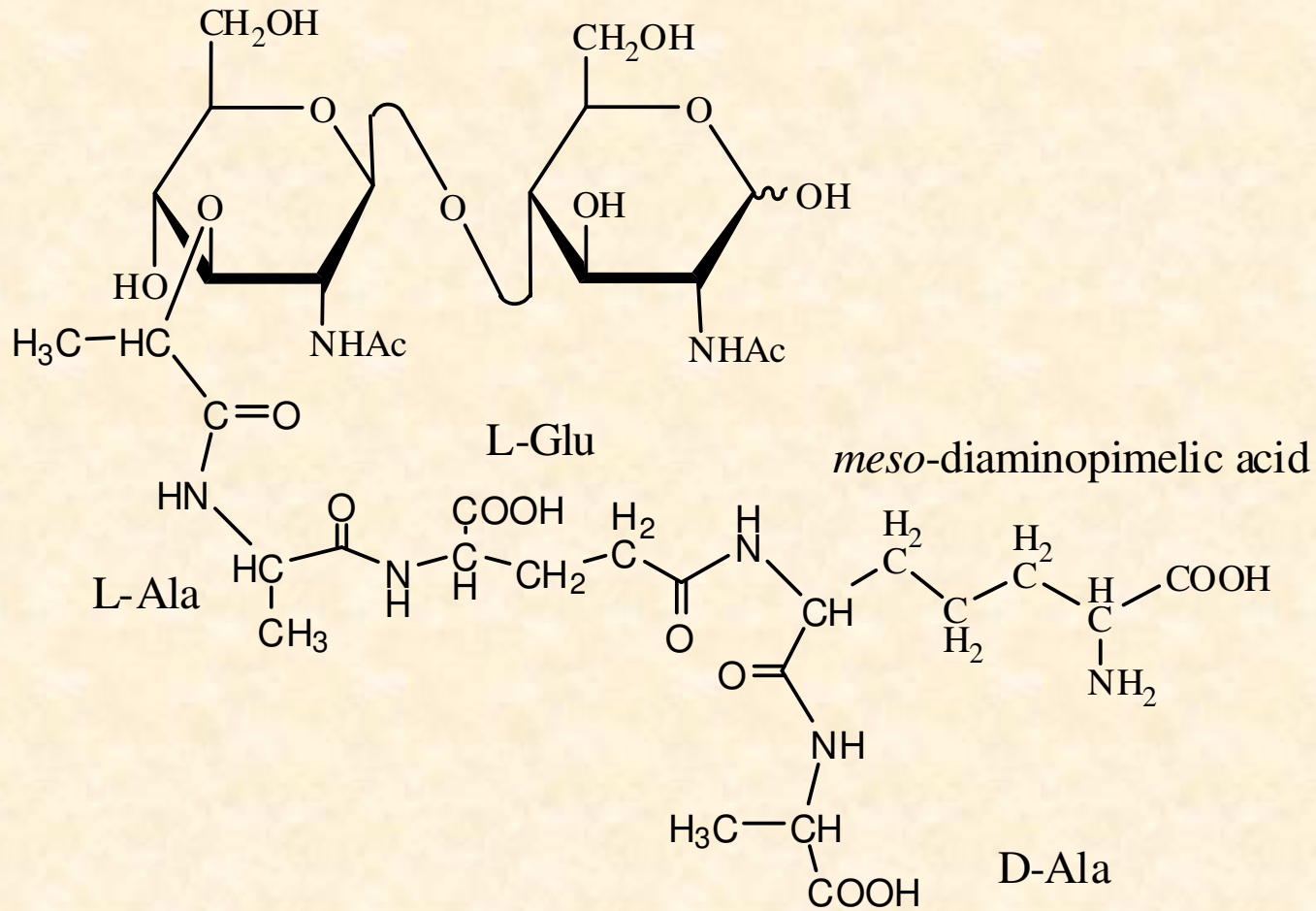
# Ascorbic acid



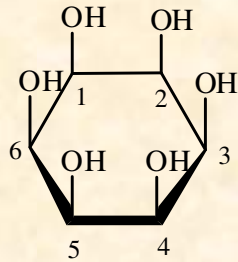
L-askorbová kyselina  
L-threo-hex-2-enono-1,4-lakton



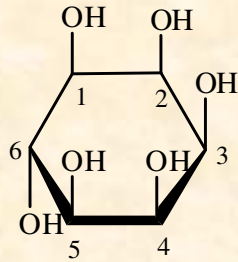
# Sacharidy 11



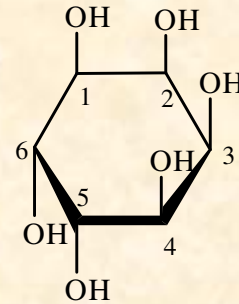
# Cyklitols



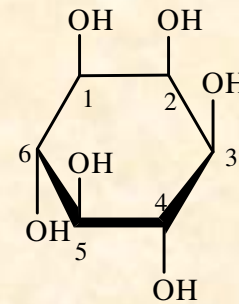
*cis*-inositol  
(1,2,3,4,5,6/0-)



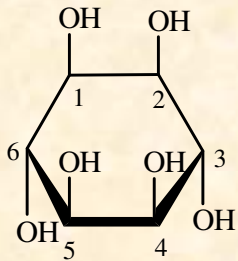
*epi*-inositol  
(1,2,3,4,5/6-)



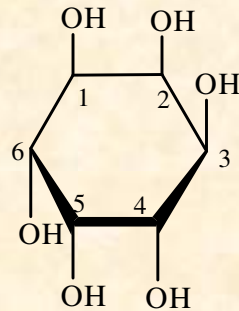
*allo*-inositol  
(1,2,3,4/5,6-)



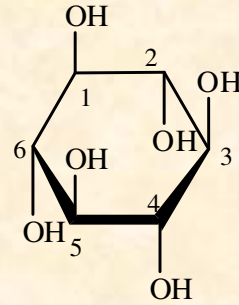
*myo*-inositol  
(1,2,3,5/4,6-)



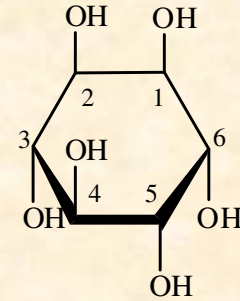
*muco*-inositol  
(1,2,4,5/3,6-)



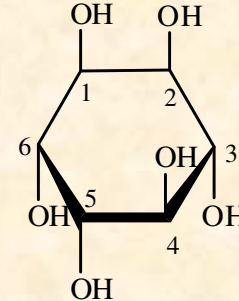
*neo*-inositol  
(1,2,3/4,5,6-)



*scyllo*-inositol  
(1,3,5/2,4,6-)

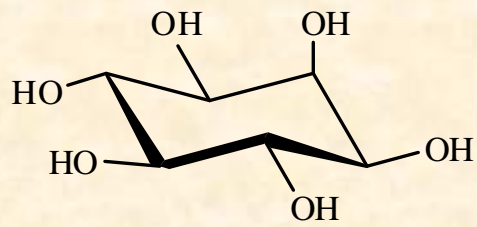


1-D-*chiro*-inositol  
(1,2,4/3,5,6-)

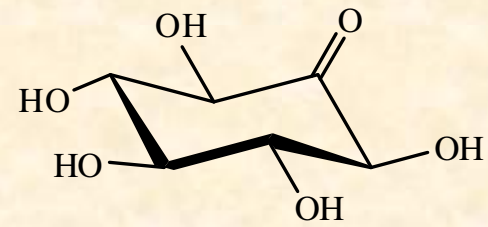


1-L-*chiro*-inositol  
(1,2,4/3,5,6-)

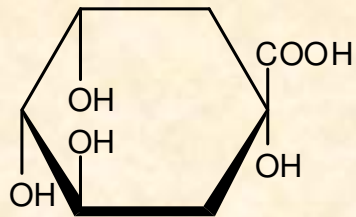
# Cyklitols



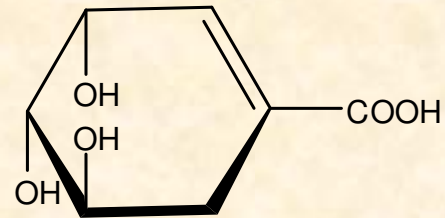
*myo*-inositol



*2-myo*-inosose



(-)-l-quinic acid

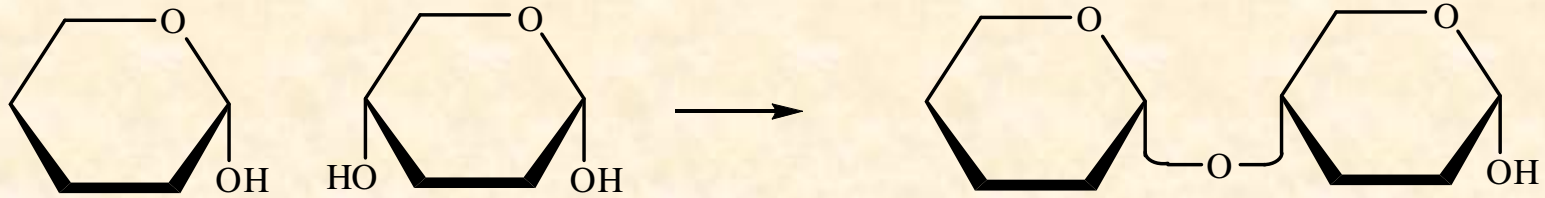


(-)-shikimic acid

# The most important sugars

- L-arabinose
- D-xylose
- D-ribose
- 2-deoxy-D-*erythro*-pentose (2-deoxyribose)
- D-glukose
- D-mannose
- D-galaktose
- 2-amino-2-deoxy-D-glucose (D-glukosamine)
- D-fructose

# Disaccharides and trisaccharides

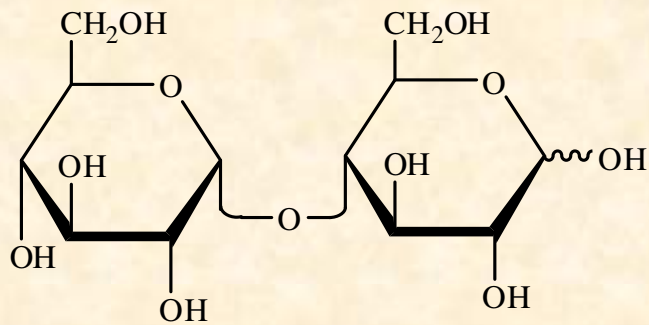


Reducing disaccharide

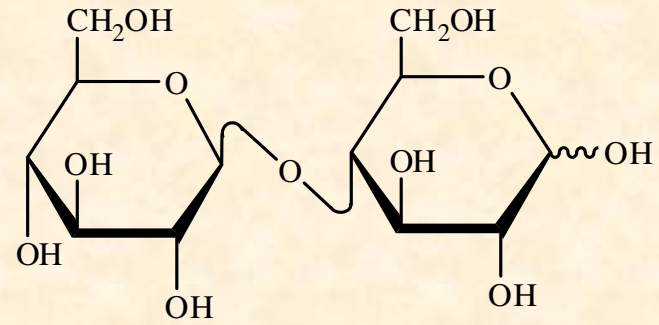


Non-reducing disaccharide

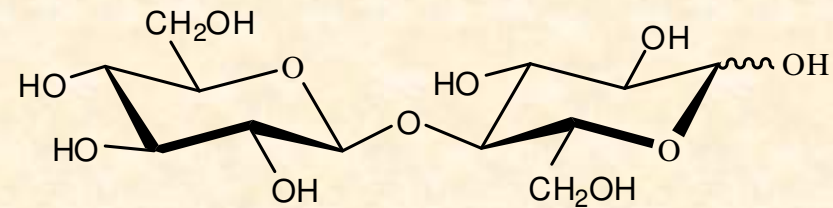
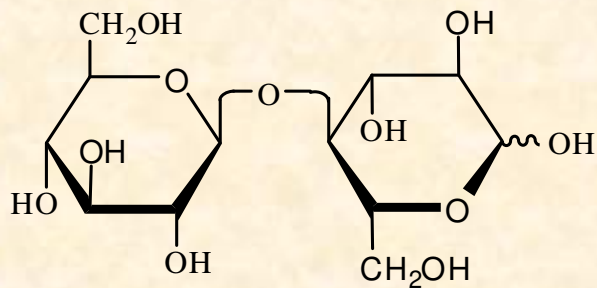
# Disaccharides



maltose

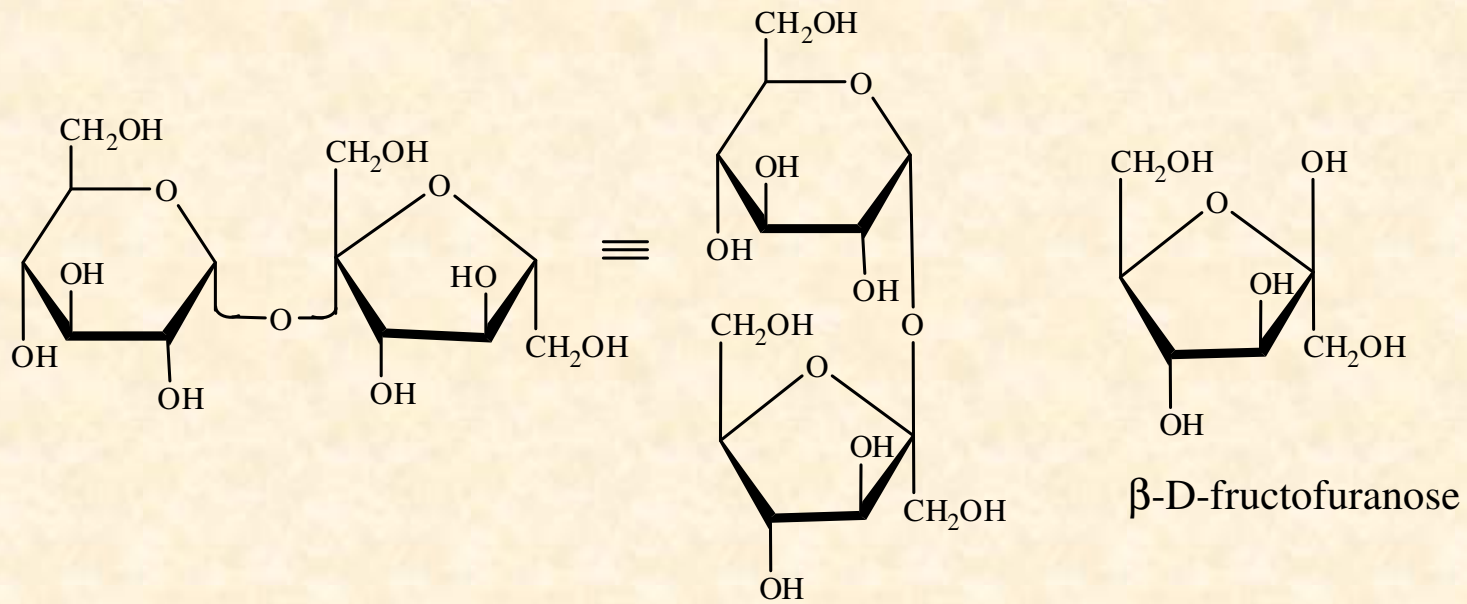


cellobiose



Different ways of oligosaccharide depicting

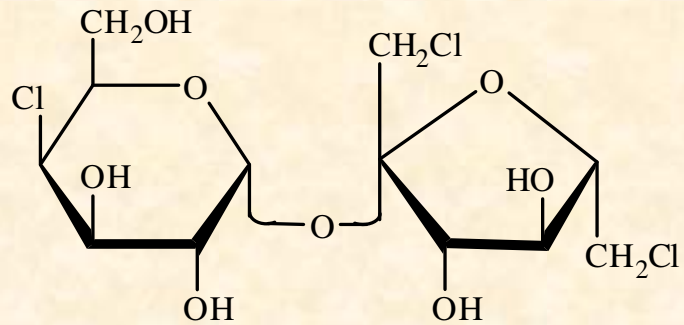
# Sucrose



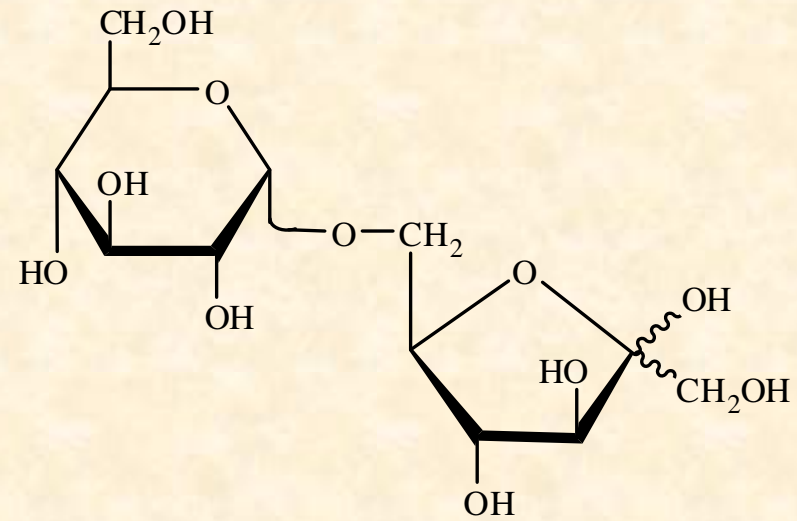
sucrose,  $\beta$ -D-fructofuranosyl- $\alpha$ -D-glucopyranoside



# Sucralose and isomaltulose

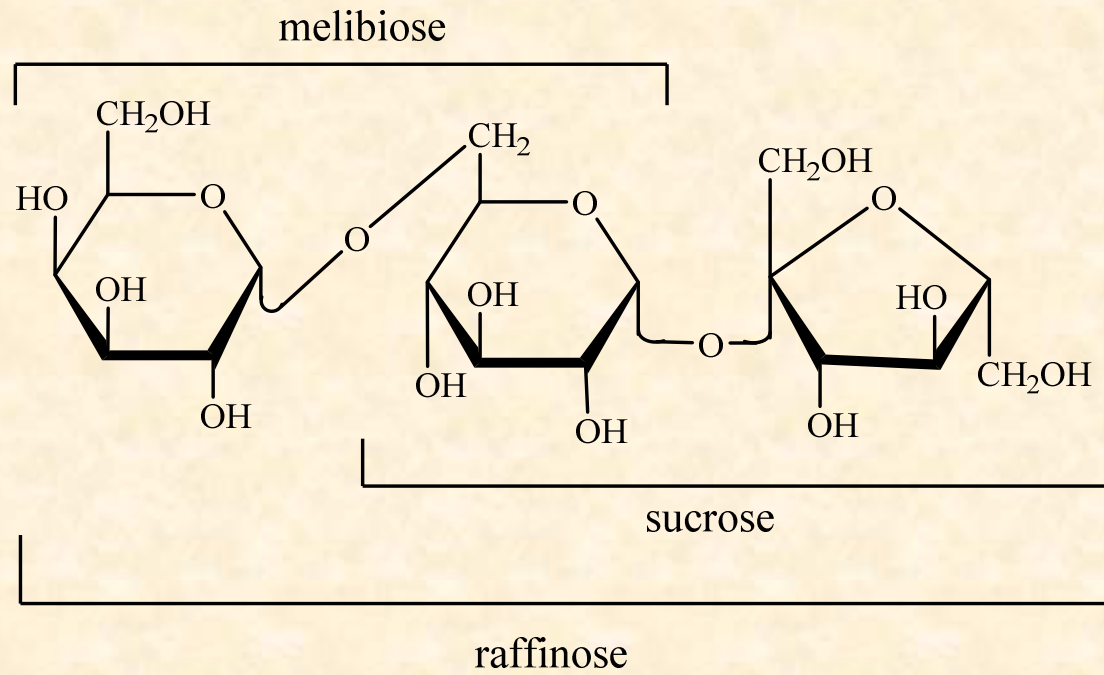


Sucralose

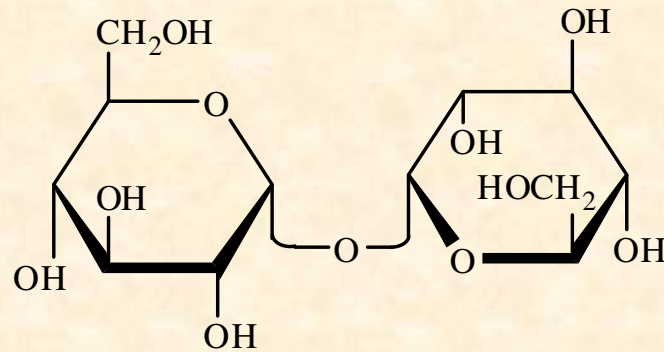


Isomaltulose

# Raffinose

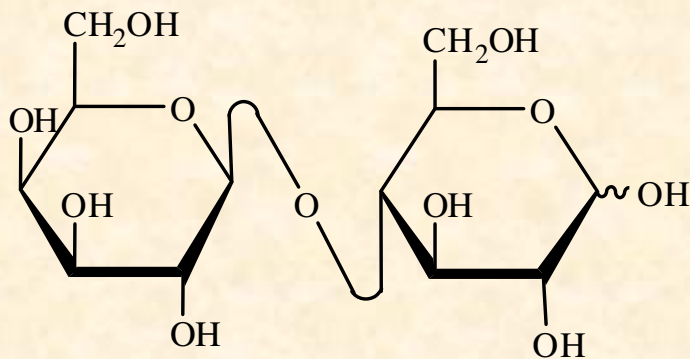


# Natural disaccharides



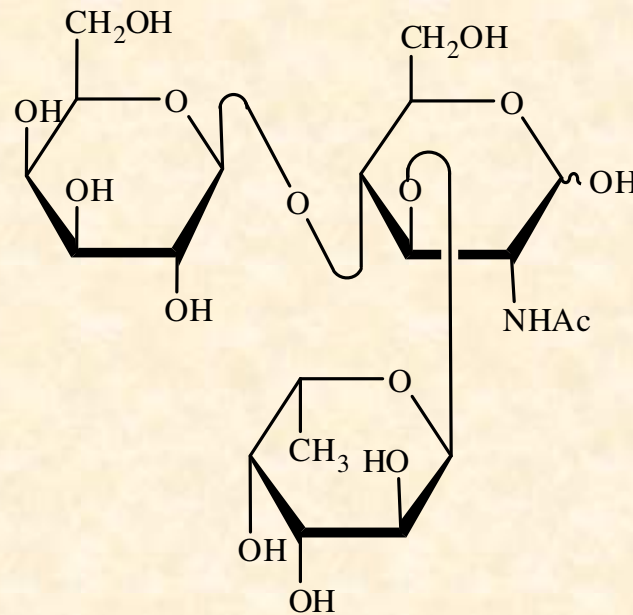
trehalose ( $\alpha$ -D-glucopyranosyl- $\alpha$ -D-glucopyranoside)

maltose ( $\alpha$ -D-glucopyranosyl-(1 $\rightarrow$ 4)-D-glucopyranosc)



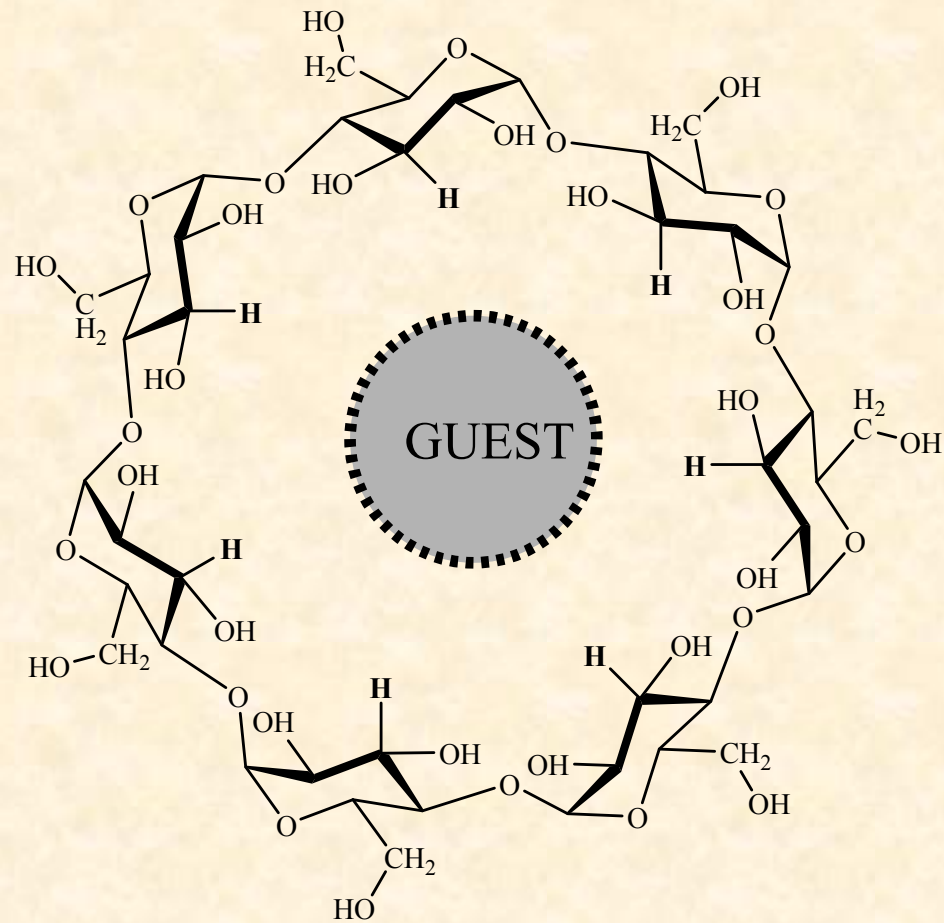
Lactose ( $\beta$ -D-galactopyranosyl-(1 $\rightarrow$ 4)-D-glucopyranose)

# Oligosaccharides of breast milk

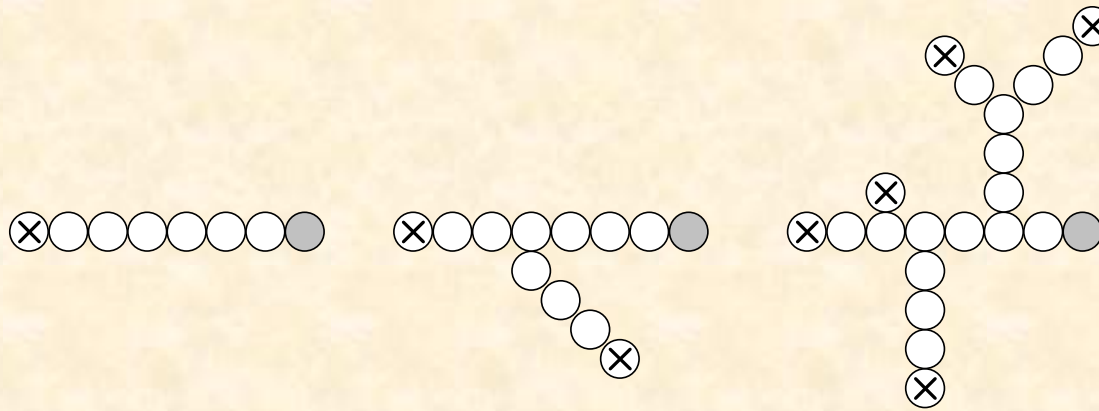


$\beta$ -D-Galp(1 $\rightarrow$ 4)-[ $\alpha$ -L-Fucp(1 $\rightarrow$ 3)]-Glc pNAc (antigen SSEA-1)

# Cykloamyloses (cyklodextrins)



# POLYSACCHARIDES

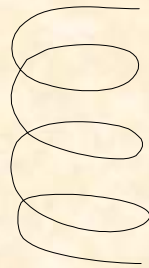


- ⊗ počáteční neredukující jednotka
- koncová redukující jednotka

# Polysaccharides – secondary structure



(a)



(b)



(c)

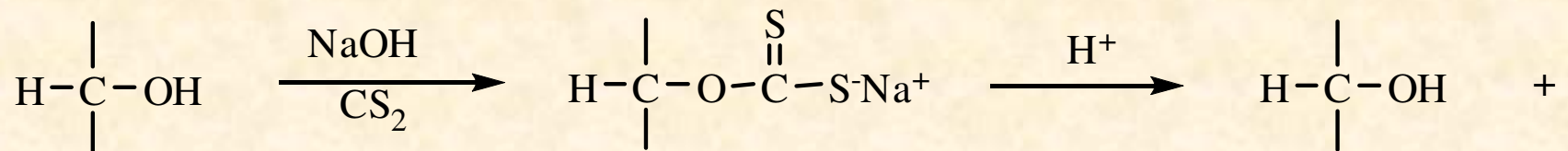


d)

strait belt (a), helix (b), zig-zag arranged belt (c), distorted belt (d).

# Homopolysaccharides

- Starch: *amylose* and branched *amylopectin*
- Amylose – linear (1→4)- $\alpha$ -D-glucan, degree of polymerization cca 2000 (rel. mol. weight around  $10^5$ ).
- Amylopectin - branched  $\alpha$ -D-(1→4)-D-glucan, branching  $\alpha$ -D-(1→6), degree of polymerization  $10^6$ , length of side chains 20-25
- D-glucose units.
- Glycogen – branched D-glucan, rel. mol. weight  $10^8$  (1→4)- $\alpha$ -D-glucan, highly branched,
- Celulose - (1→4)- $\beta$ -D-glucan rel. mol. Weight above  $10^6$ .
- Viscose silk:



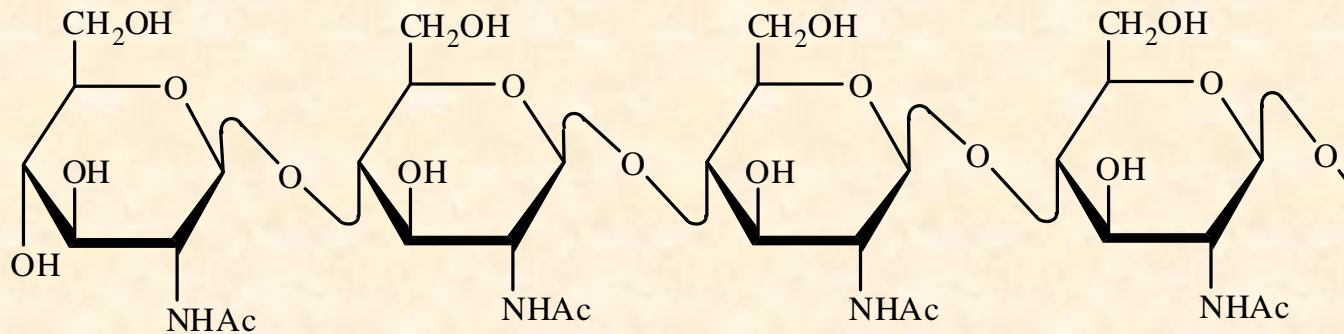


# Homopolysaccharides

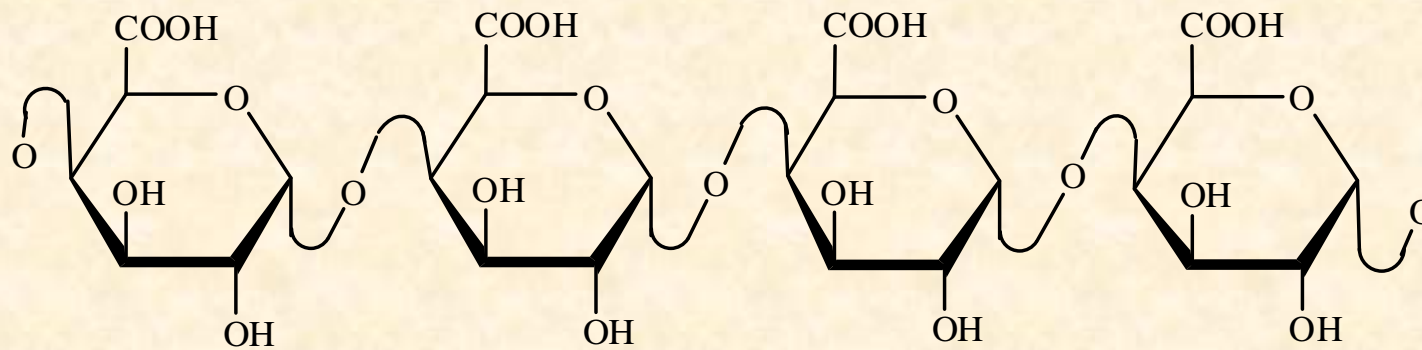
**Dextrans** – branched  $\alpha$ -(1 $\rightarrow$ 6) D-glucans. From sucrose by action of bacterie genus *Leuconostoc*.

**Inulin** - D-fructan. vazby  $\beta$ -(2 $\rightarrow$ 1). Reserve polysaccharide of some plan, e.g. Genus *Dahlia* (chicory, tompinambur, artichoke)

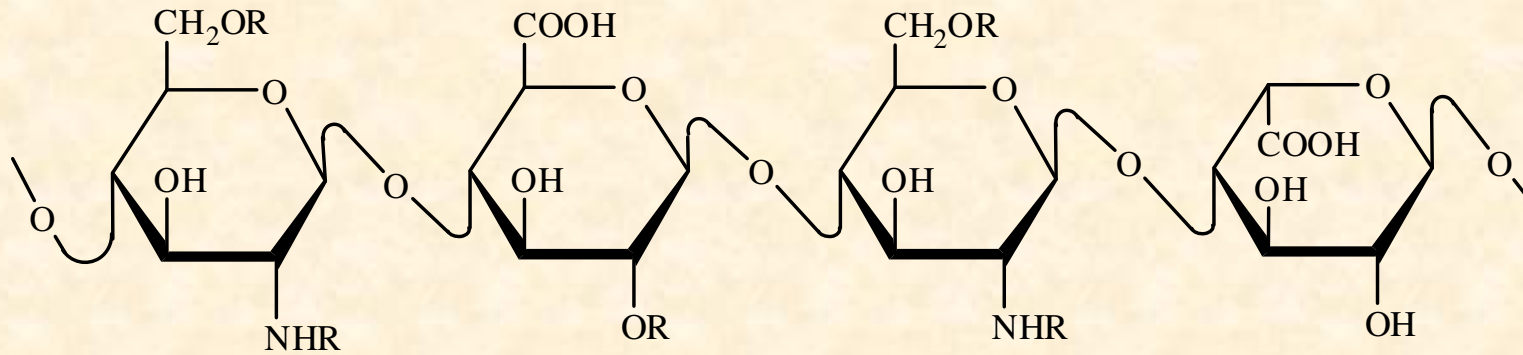
**Chitin** – The most widespread nitrogen-containing polysaccharide in the nature.



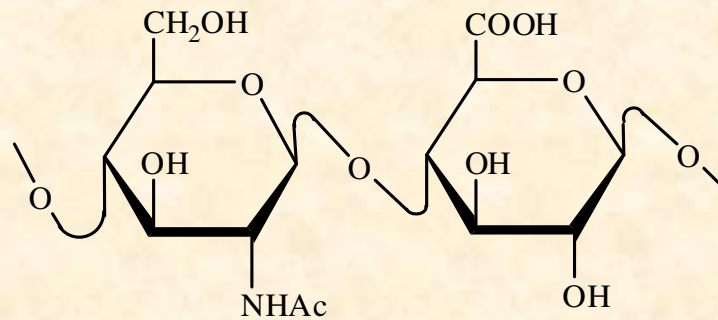
# Pektiny



# Heparin and hyaluronic acid



$R = \text{CH}_3\text{CO}, \text{SO}_3\text{H}$  nebo  $\text{H}$



**KONEC**