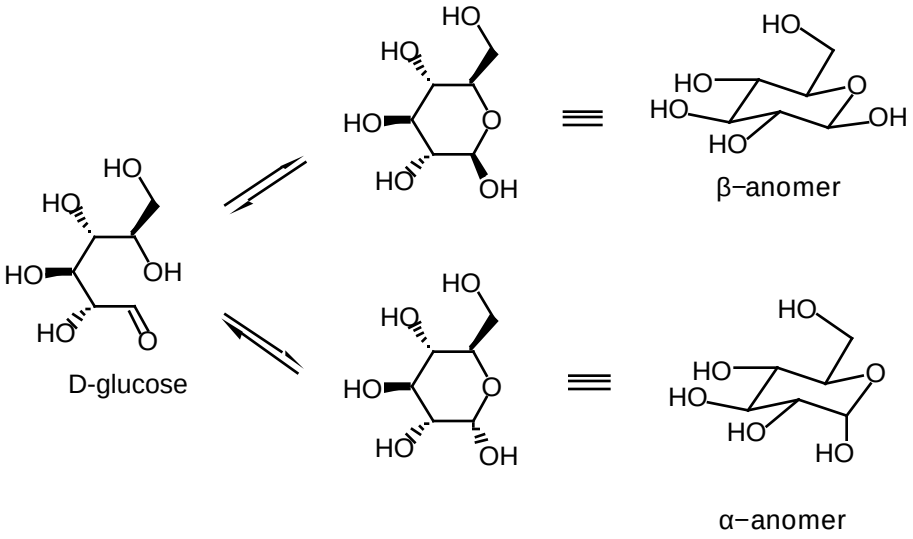
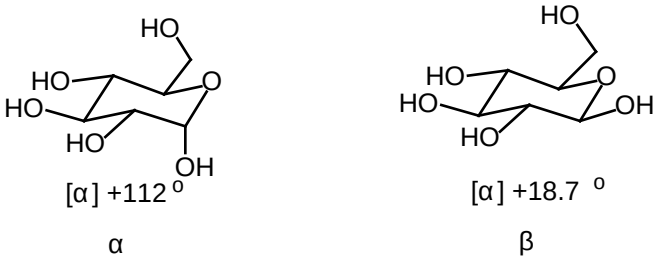
Chemistry 304B, Spring 1999 **Lecture 32**

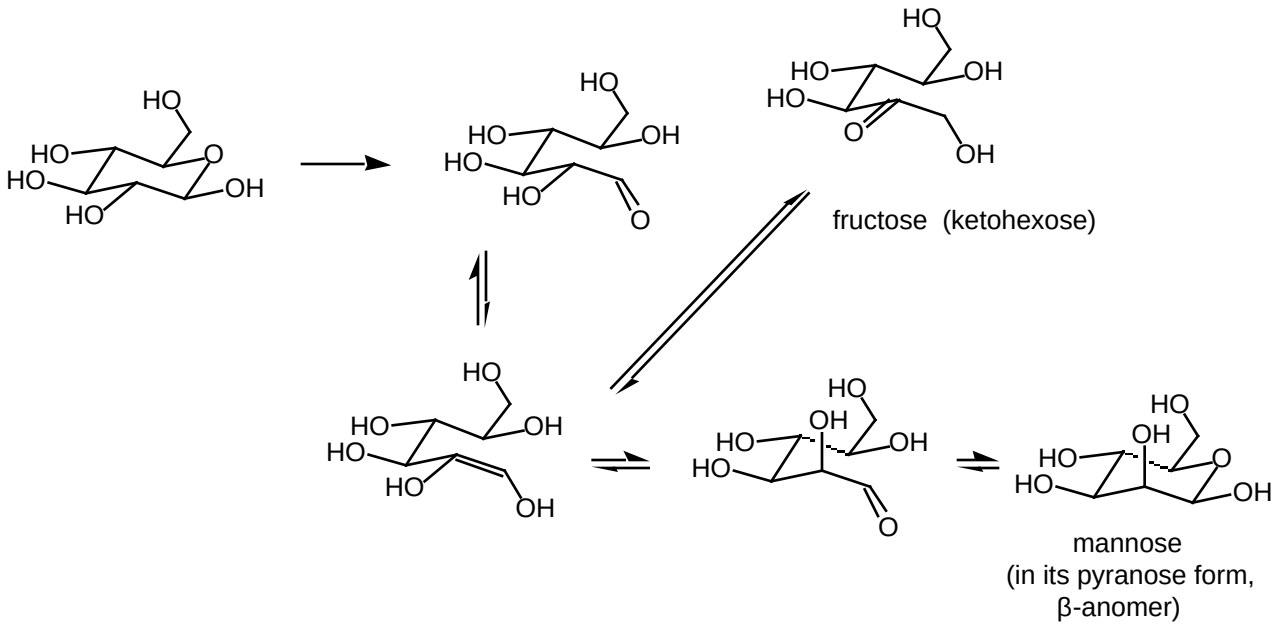
Review sessions: Monday evening, 8 pm Wednesday evening, 8 pm Exam: Thursday: 7:30 pm



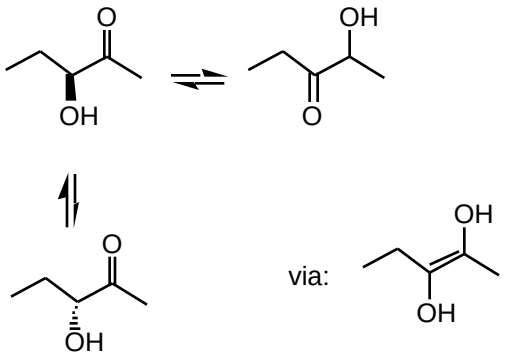


Solution of either anomer in water slowly changes to [α] +52.7 o

"mutarotation"



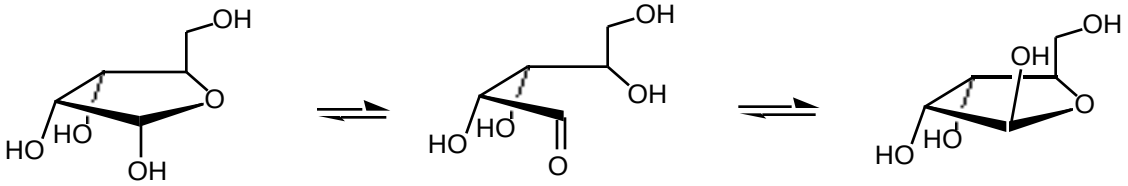
General:



There are 16 [cyclic] aldohexoses: can you draw them?

Do it when you are having trouble falling asleep; it is pretty tedious.

Five carbon sugars: $(CH_2O)_5$

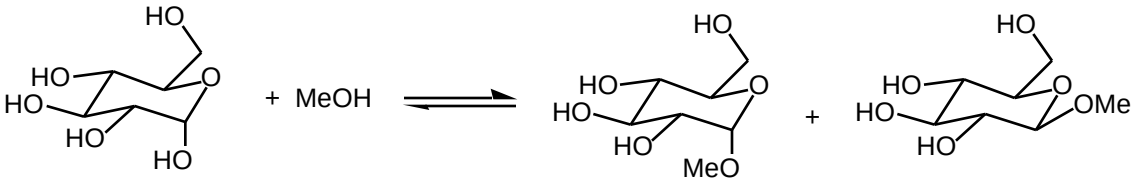


ribose
(furanose form,
α-anomer)

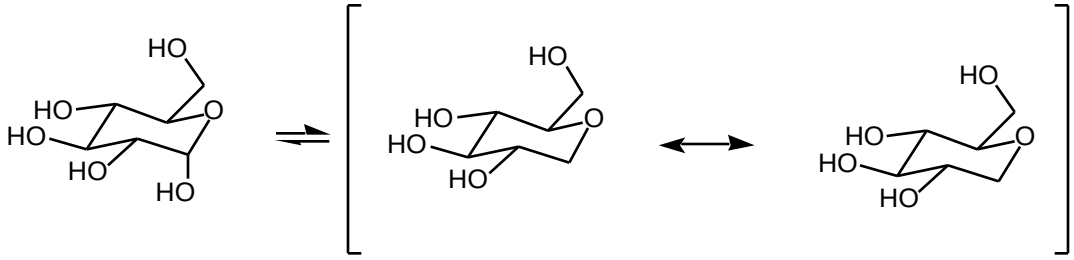
β-anomer

8 [cyclic] stereoisomers in this series (aldehyde form)

Most important reaction of sugars: Glycoside bond formation

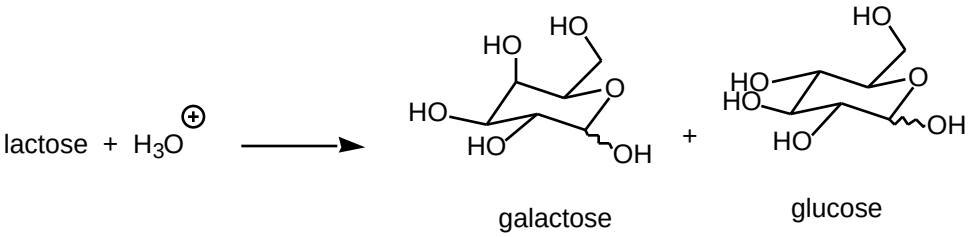


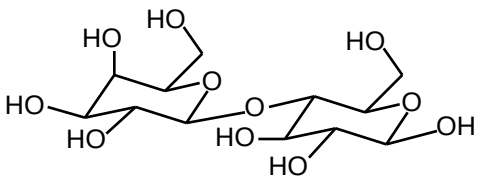
both anomers of the methyl glycoside
glucopyranoside



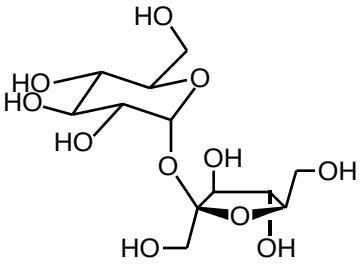
Many common sugars are disaccharides (two sugar units): $C_{12}H_{22}O_{12}$

sucrose, lactose, maltose





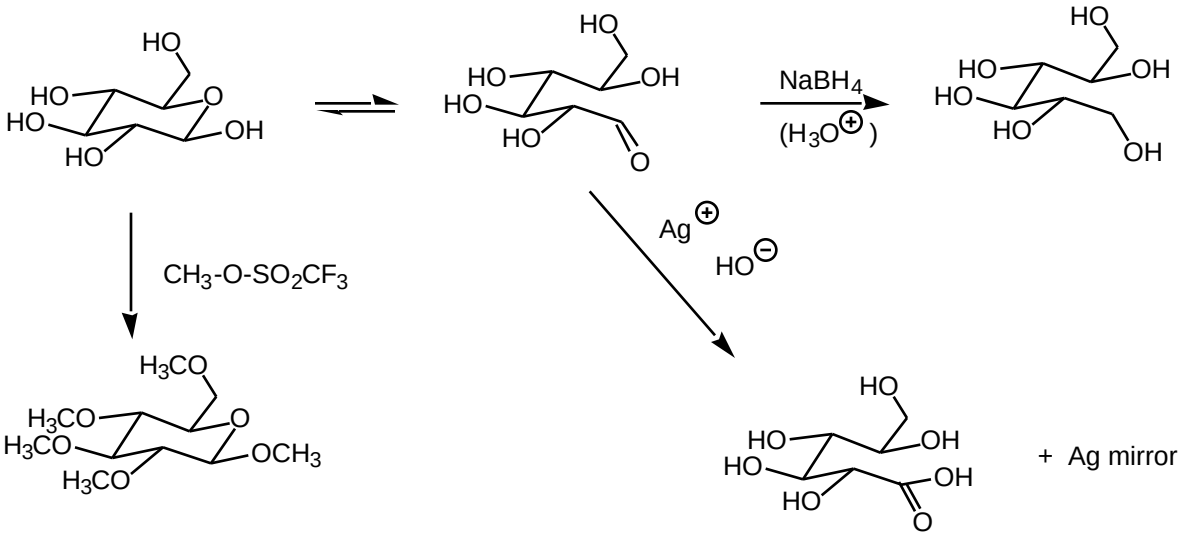
β-linked glycoside bond to the 4-OH group of glucose



Sucrose: an acetal, not a hemiacetal.

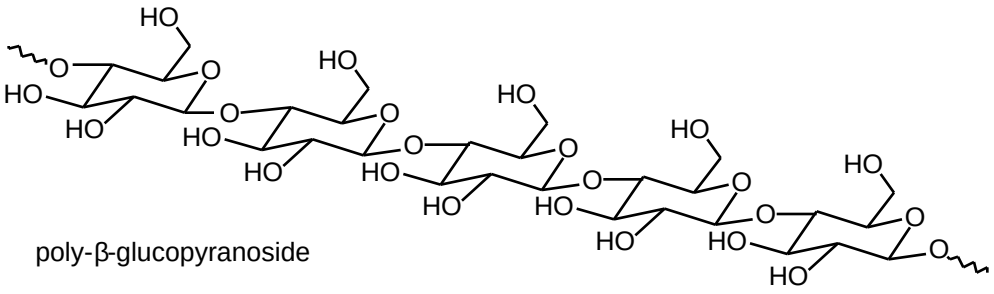
Called a "nonreducing sugar"

Reaction of sugars with an anomeric -OH group (hemiacetal): equilibration to the aldehyde is rapid



Polysaccharides: cellulose, starch, glycogen are common All based on glucose

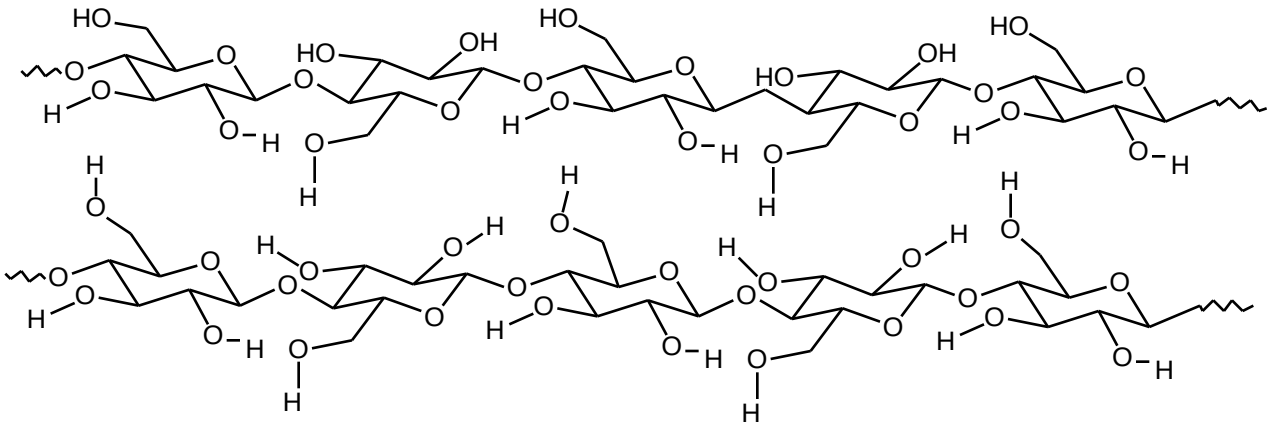
Cellulose: ca 3000 units (MW 500,000) cotton, filter paper = 100% cellulose. Wood, straw = 50%



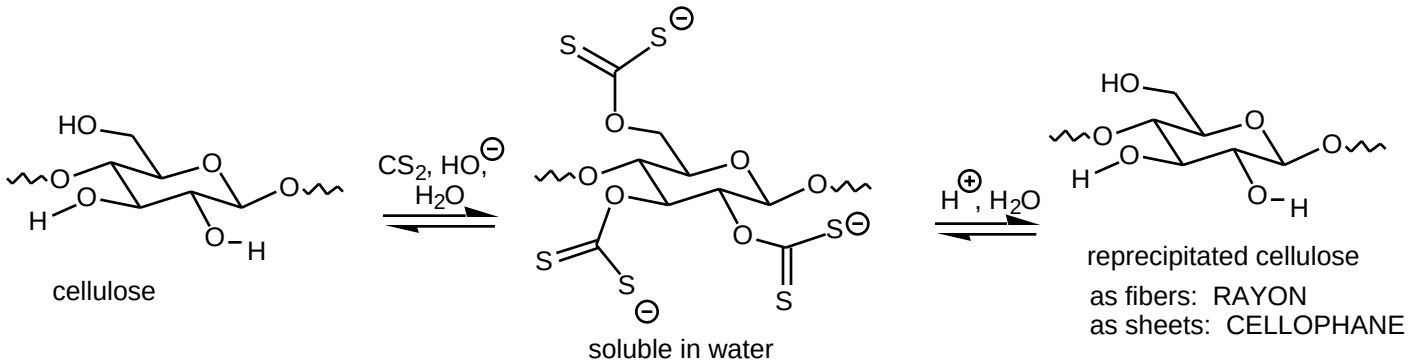
poly-β-glucopyranoside

Structure of cellulose

H-bonding network:



Properties depend on how treated:



cellulose

soluble in water

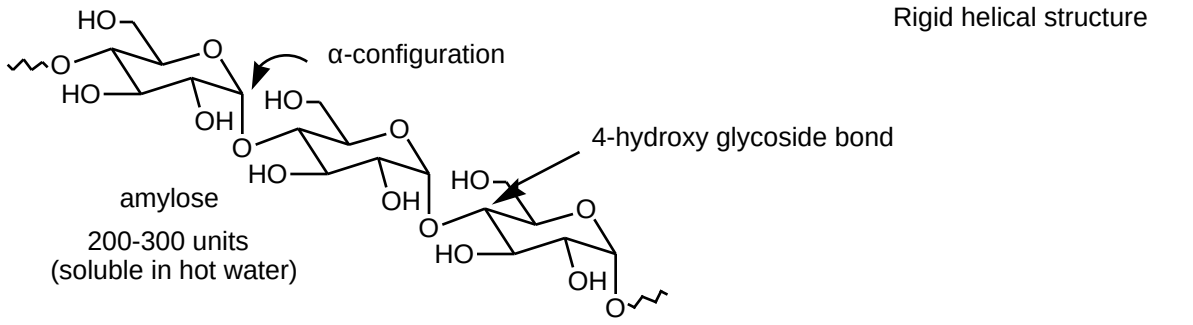
reprecipitated cellulose

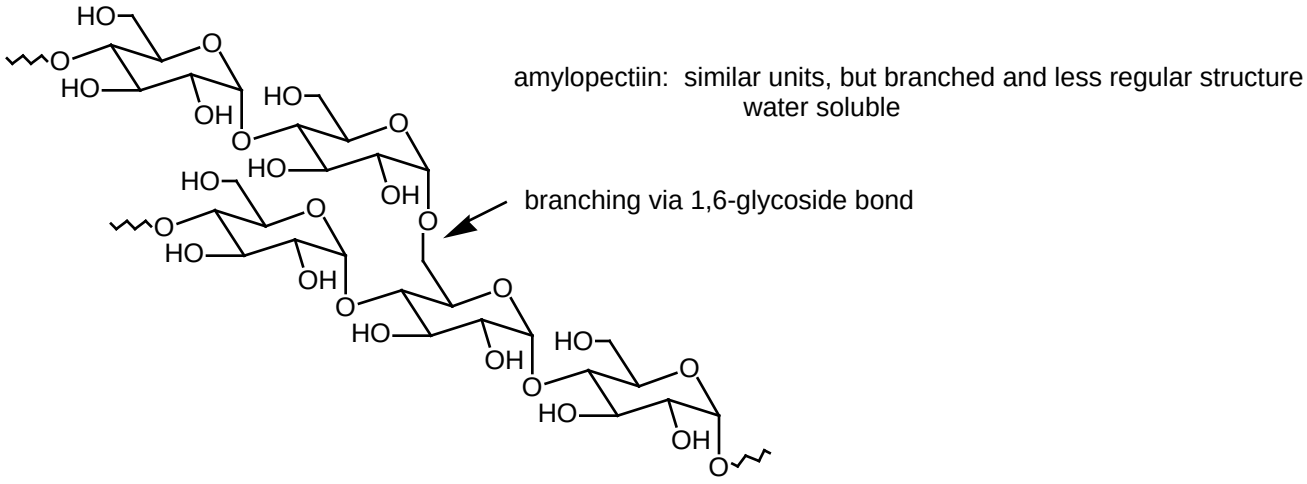
as fibers: RAYON

as sheets: CELLOPHANE

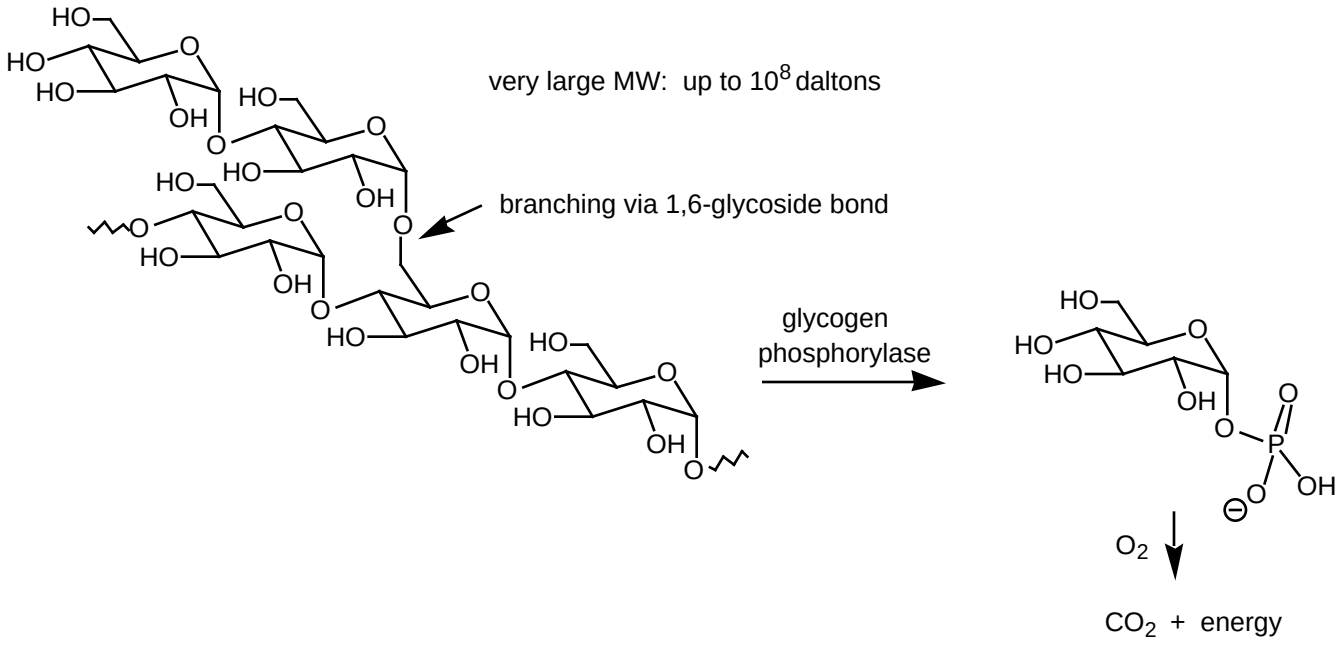
Starch:

Two components:

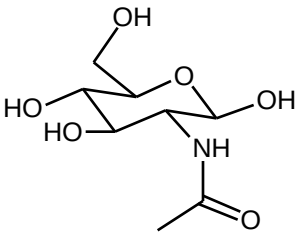




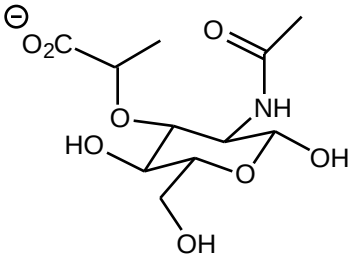
Glycogen: energy storage in humans, for fast release.



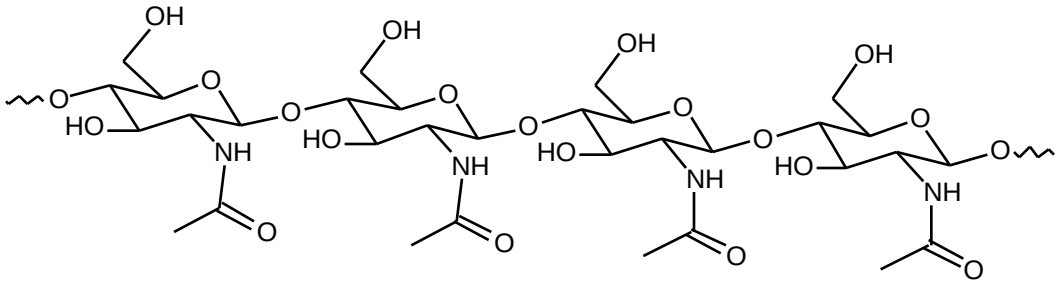
Nitrogen functionalized sugars: Amino sugars, modified as the amide



N-acetylglucosamine
NAG

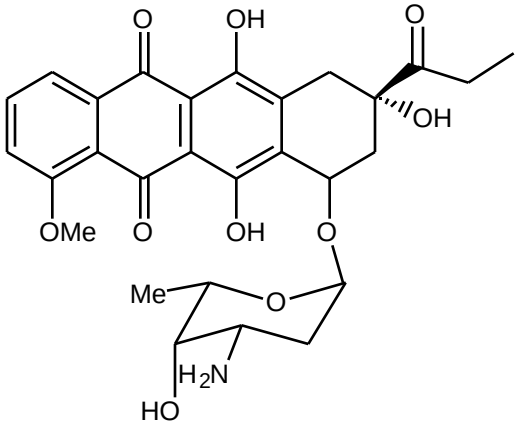


N-acetylmuramic acid
NAM

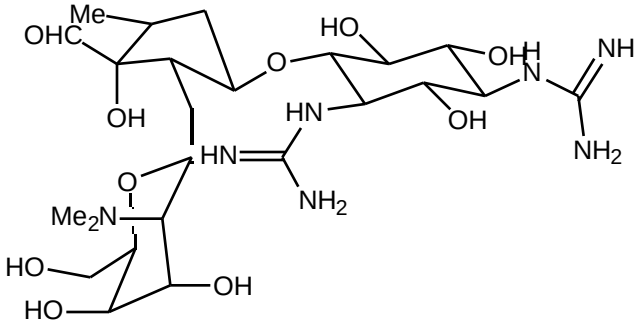


poly-NAG = chitin structural material, with $CaCO_3$, of crab and lobster shells

natural products

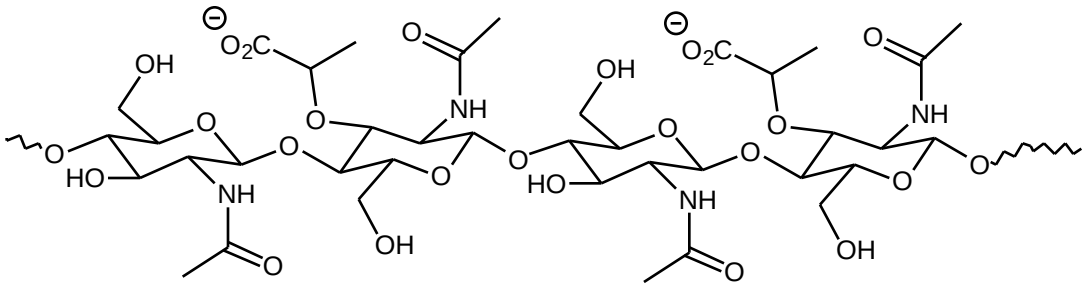


Daunomycin: anticancer agent



streptomycin

Bacterial cell walls: very different from animals--polysaccharide cross-linked with polypeptide

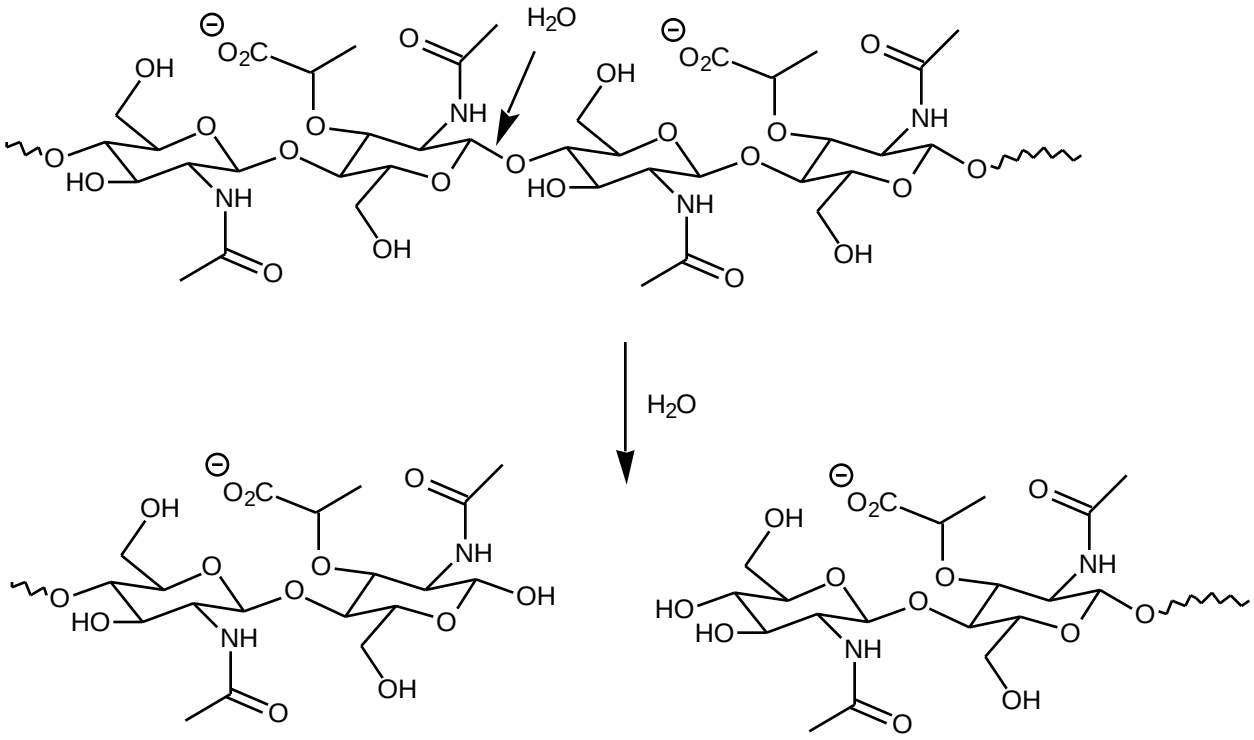


NAG NAM NAG NAM

An enzyme cleaves the bacterial cell wall: hen eggwhite **lysozyme** (1909)

129 AA **4 disulfide bonds** [handout on structure and mechanism]

Binds to a 6-unit section of the polysaccharide of the cell wall and hydrolyzes the acetal linkage



Essential reaction: