Chem 431A-L21-F'07 (week 7) admin: Chapt 5 deadline in next week, Monday. NO CLASS Monday, Nov12. Veterans Day	Last lecture: 1) MWC and KNF models of Hb. 2) Bohr effect. CO_2 transport. 2.3-BPG 3) antibody structure

Today: group quiz
1) Brief intro to antibody structure 2) muscle structure
3) Intro to Carbohydrates 4) Quiz

Other examples of protein-ligand interaction: Hb is useful model but also different from other ligand protein binding. It uses prosthetic group (heme) and it has a small molecule ligand, O_2. Its best example of *complementary* binding is that of *2,3 BPG* <u>Antibodies</u> (immunoglobulins) The immune system provides another example of *complementary* interactions between proteins and ligands. *Immunoglobulins* or *antibodies* bind to bacteria, viruses, foreign cells, or even large foreign molecules thus destroying them in some way.	Target molecules or cells of the antibodies are ***antigens***. Any particular molecular structure within antigen that antibody binds to is the ***antigenic determinant* or *epitope***. Small molecules ≤ 5000 daltons usually not antigens but if bound to larger molecules they can be, called ***haptens***. **Immunoglobulin G** (IgG) (one of 5 Ig's in verteb) -has 4 polypeptide chains: 2 ***heavy chains*** and 2 ***light chains***. Linkage is by noncovalent intxns and disulfide bonds. MW150,000, 3 domains: one Fc & two Fab fragments. Fc=easily **c**rystallized fragment Fab=antigen binding fragment (identical, sites of variability for different antibodies) Fab binds by induced fit. K_d as low as 10^{-10}! tight-fit

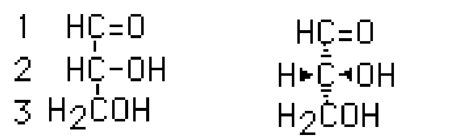
Other examples: actin, myosin & molecular motors Basis for mechanical motion of cells and organisms. Muscle tissue: contain ***myosin*** and ***actin***. (≈ 540 kdaltons) **Myosin**= has 6 subunits: 2 heavy, 4 light chains. c-termini: 2 supercoiled α-helices n-termini: 2 domains with 2 light chains each myosin aggregates = *thick filaments*	**Actin** = found in most eukaryotic Cells Globular actin, *G-actin* are monomers that form long polymers: *F-actin* . Actin is associated with the *thin filament* which contains 3 proteins: F-actin, *tropomyosin* and *troponin* Look at the force generation of a cycle

OK (1) Overall intro: carbohydrates ("CHO") are fuel molecules, with the general formula. They are polar, non ionic. Of the form $(C{*}H_2O)_n$ where n≥3. most abundant types of molecules in the biosphere because of the presence of cellulose in plants: trees. Wood. Among the most vital of the energy releasing molecs are CHO's. central pathways have developed in the org. which date back before oxygen utilization to the use of these molecules. For what? To produce ATP for the body. For plants, glucose is the main product of photosynthesis. It accounts for most of the bulk of the plants.	(2) the structure of sugars: C's with either aldehyde, (-CHO) or or ketone, R-(C=O)-R ending is "-ose"; aldoses have aldehyde groups –HC=O ketoses have ketone groups R–(C=O)-R basic structure of sugars is the monosaccharide. Polysacch are made up of polymers of monosaccharides.

Monosaccharides: (monomeric sugars)

Consider a triose: D-glyceraldehyde n=3.

smallest sugars have at least 3 carbons: note that we count the c's from top (aldehyde side), and that C_2 is asymmetric ("chiral center"). Thus can have 2 possible enantiomers.(mirror images)



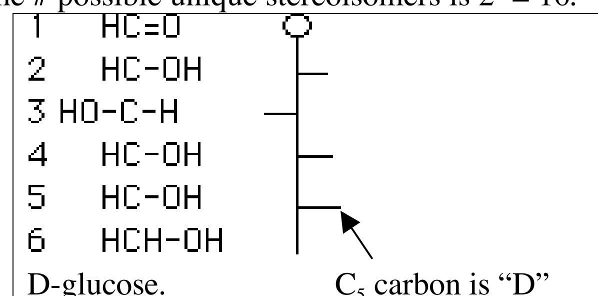
D-glyceraldehyde

The above representation of molec is for D glyceraldehyde. It is an aldotriose. Note what L-glyceraldehyde would look like. (The vertical bonds are curling toward the board on either end and the horizontal bonds reach out to us out of the board.)

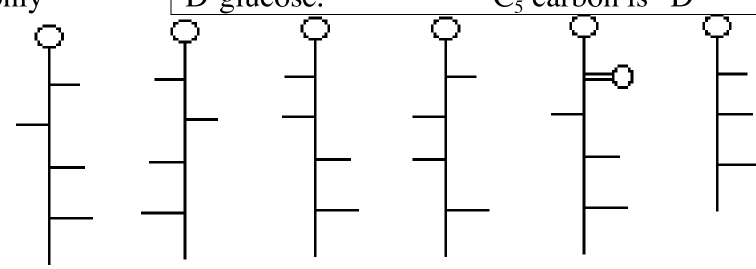
There are only 2 possible aldotrioses because there is only 1 chiral center.
These 2 are D-glyceraldehyde & L- glyceraldehyde.
Note that these 2 are mirror images of one another.
Look at glucose (glucose (which has formula C6H12O6 , an aldohexose), the most fundamental monosacch.) Glucose is an aldohexose (6 carbons).

For aldhexoses, there are there are 4 chiral centers and the # possible unique stereoisomers is $2^4 = 16$.

Glucose is a D-sugar because its struc looks like: It's a D sugar because the farthest chiral carbon (C5) has same configuration around the chiral carbon as D-glyceraldehyde. In nature, D-sugars are the norm. L-sugars are rare and for special cases only.



Sugars that differ by configuration around only 1 chiral carbon are called epimers. Thus glucose and mannose are epimers of each other. Note that mannose has HOCH at C2 position while glucose has HCOH at C2 position. Know the structures of D-glyceraldehyde, D-ribose, D-glucose, D-fructose & dihydroxyacetone. etc (see right)as well as their ring structures.



D-Glc L-Glc D-Man D-Gal D-Fru D-ribo

Note that D-fructose and dihydroxyacetone (DHA) are ketohexoses! The ketone group is in the C2 position. (they have one less chiral center than equiv. aldose). So for ketohexoses, there are only 2^3 possible stereoisomers. Or 8 possibilities. If limit ourselves only to the D's, we have 4 possibilities.

Chemical reactions of sugars: Alcohols (-OH) react with carbonyl groups (C=O) of aldehydes and ketones to form hemiacetals and hemiketals, respectively:
Eg: R-OH + R'CHO ---> R-O-C(H,OH)-R' (hemiacetal)
R-OH + R'-(C=O)-R" -> R-O-C(R',OH)-R" (hemiketal)