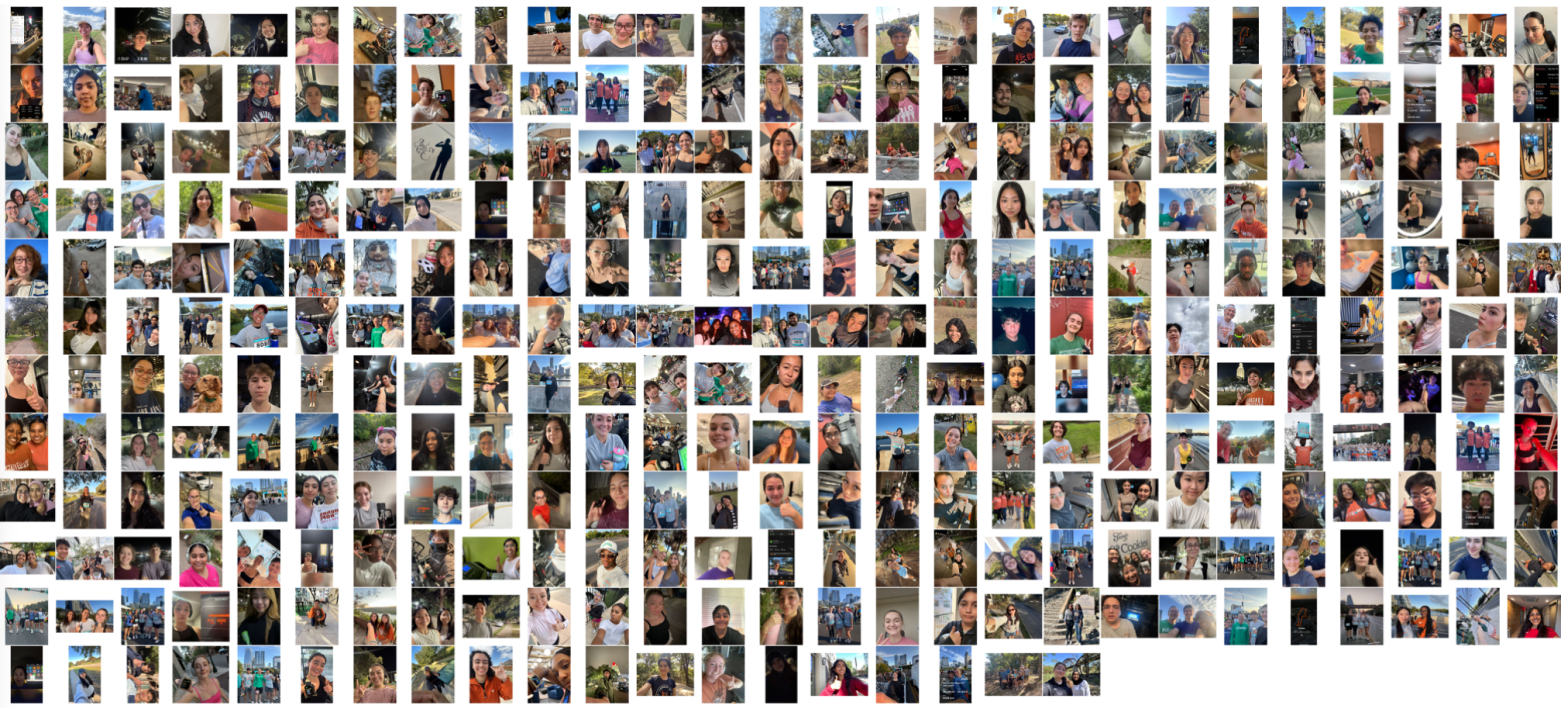
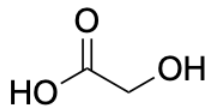
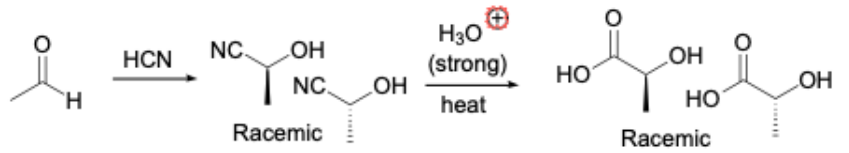


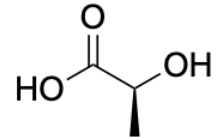
Good start but we need many more of you to send me selfies!



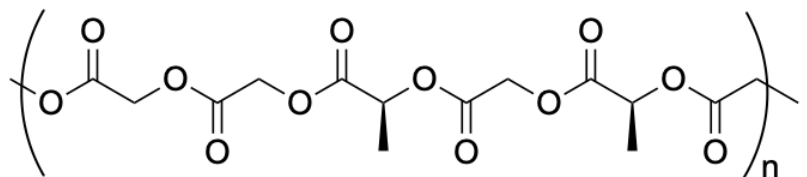
Dissolving Stiches



2-hydroxyacetic acid



(S)-2-hydroxypropanoic acid
L(+)-Lactic acid



Vicryl (Polyglactin 910)

Dissolving Stiches — the esters slowly hydrolyze, weakening the fiber structure.

Carbohydrates

Monosaccharides → 5 or 6 carbons and are aldehydes and ketones

pentose

hexose

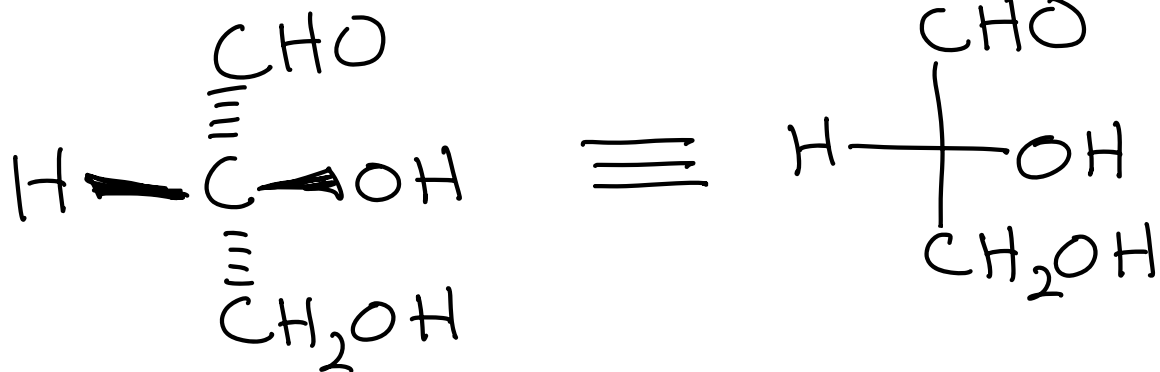
aldose

ketose

Ex.

Glucose is an aldohexose

Stereochemistry



(R)-D-Glyceraldehyde

↗
dextrorotatory
(+)

Called
Fischer
projection

"Like a Teddy Bear
giving you a hug"

Can I have
a hug please?

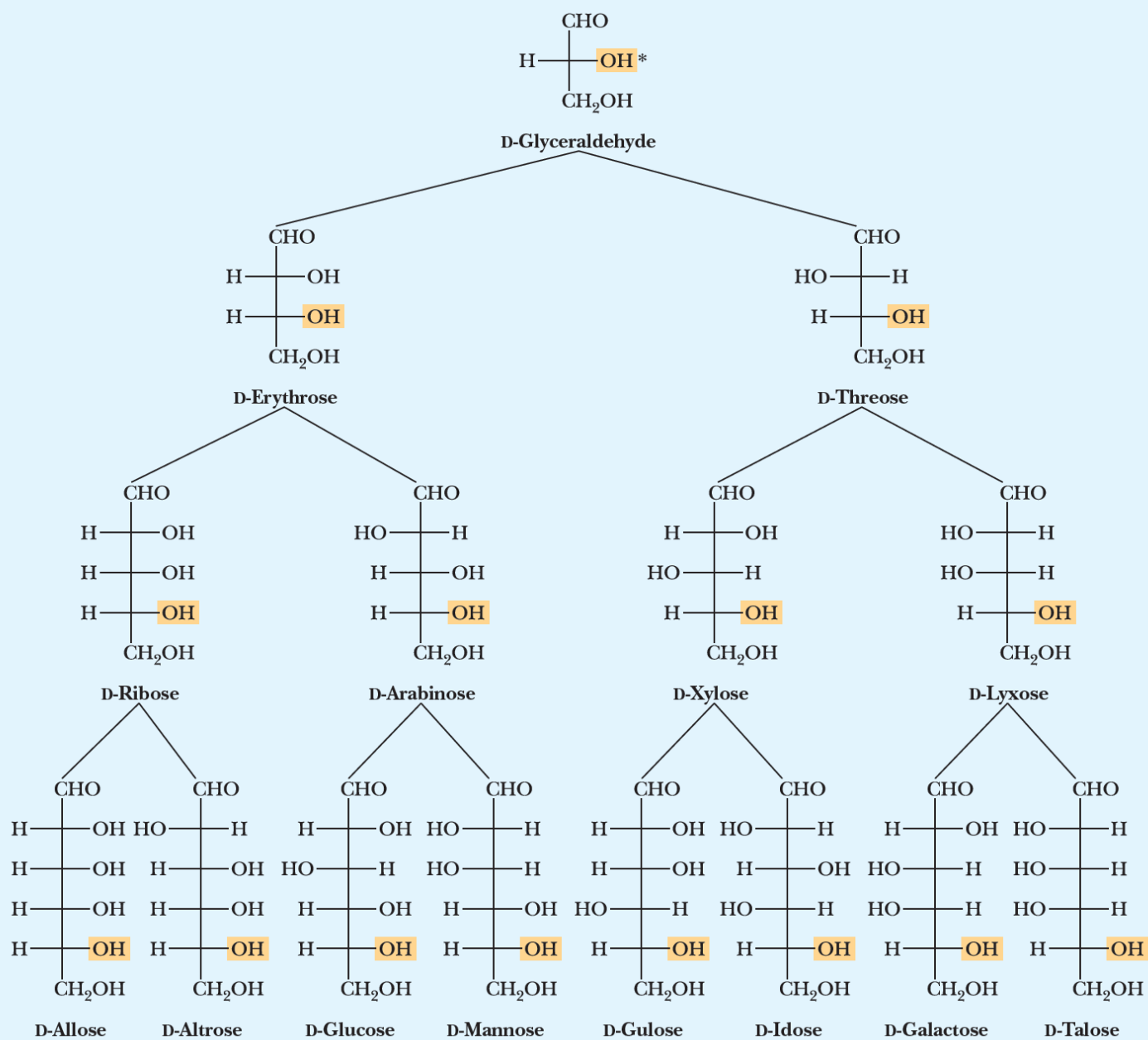


Stereochemistry defines the different carbohydrates

→ Due to the way carbohydrates are synthesized in cells → the common carbohydrates all have the same stereochemistry as D-glyceraldehyde at the carbon farthest from the carbonyl (aldehyde or ketone)

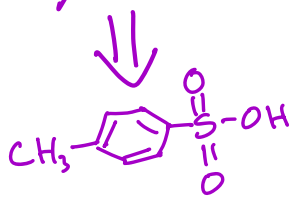
That is why they are called "D" carbohydrates

Table 25.1 Configurational Relationships Among the Isomeric D-Aldotetroses, D-Aldopentoses, and D-Aldohexoses

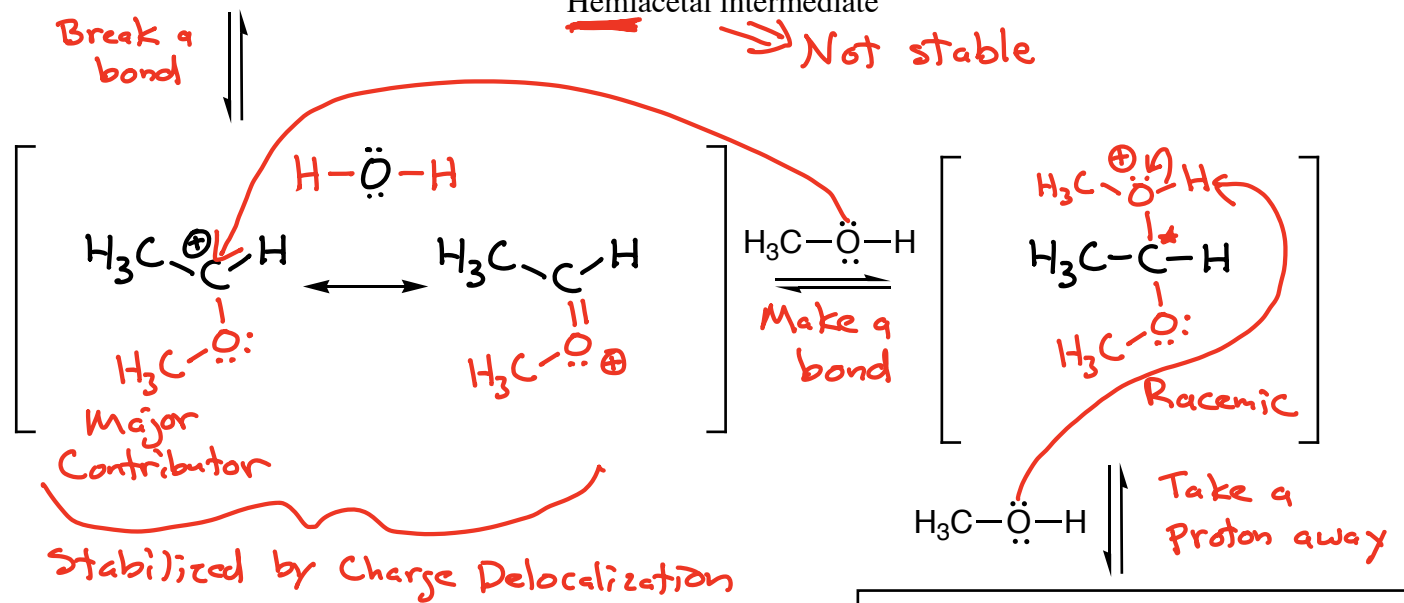
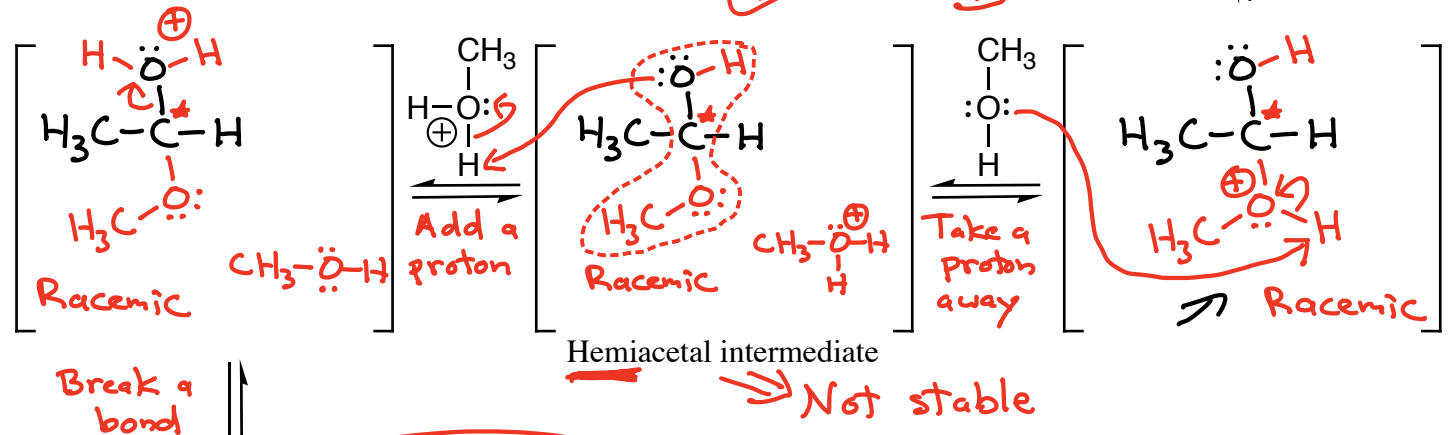
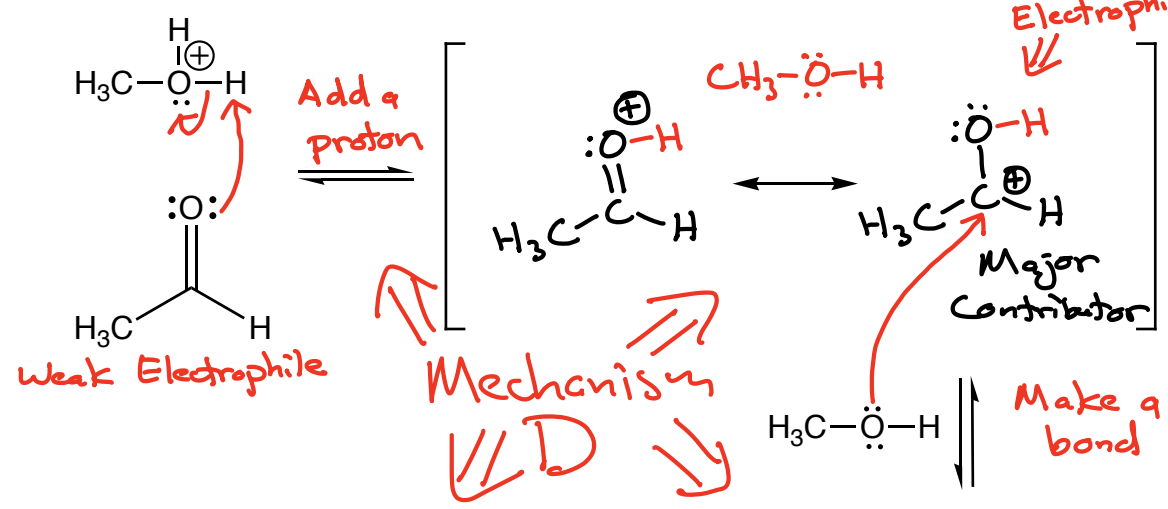




TsOH or H₂SO₄
 Tosylic Acid
 Acid Catalyzed Hemiacetal and Acetal Formation From an Aldehyde or Ketone



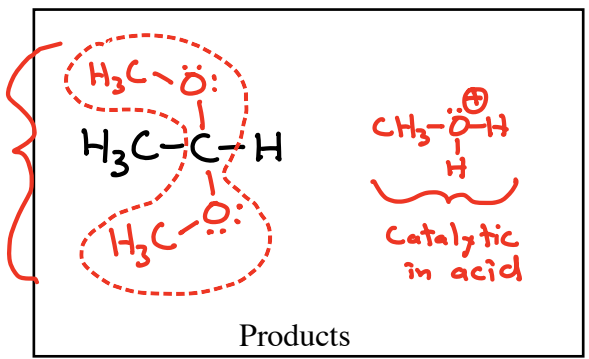
"Hey, does that thing have a hemi in it?" "SWEET!"



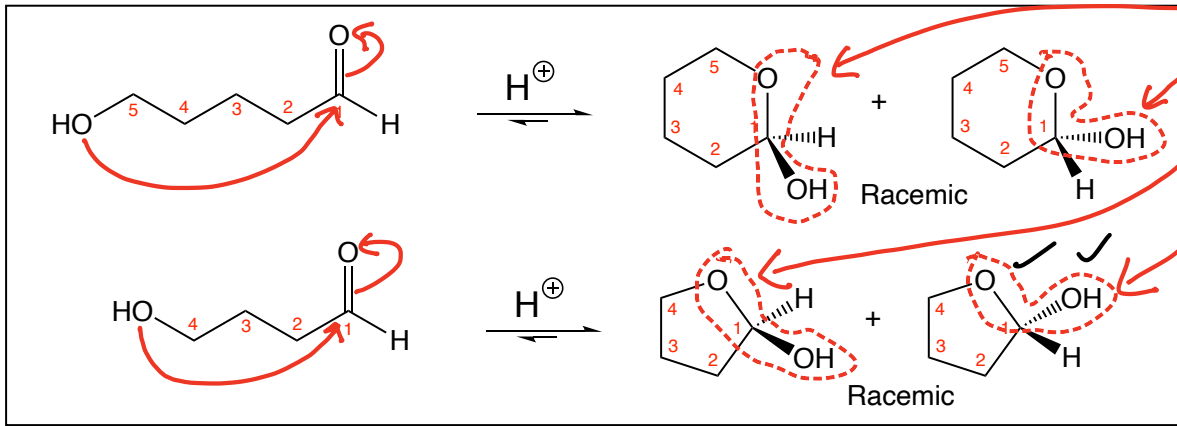
Key Recognition Element (KRE):

Two bonds to O atoms from an sp³ C atom

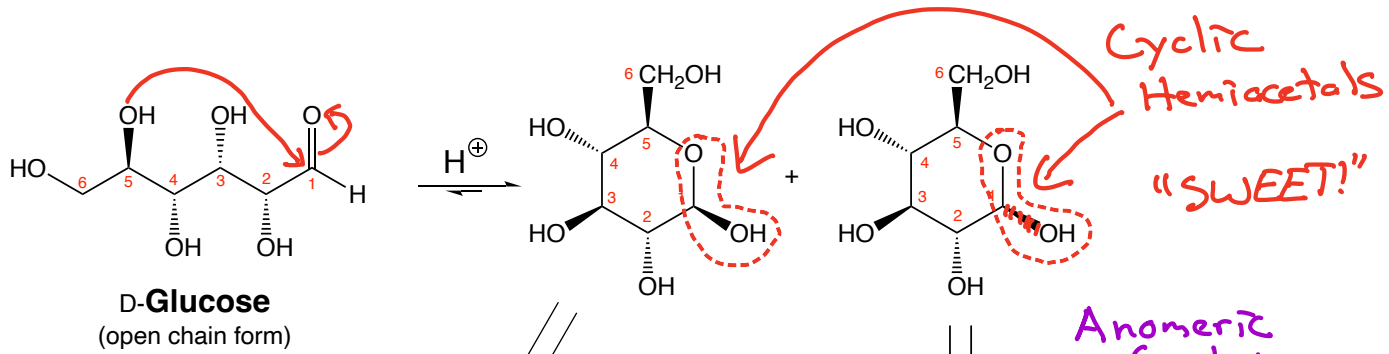
Definition of an acetal



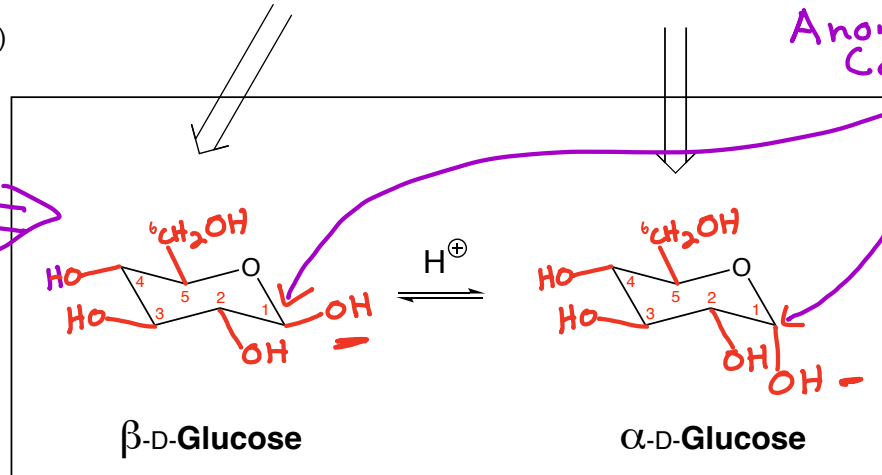
Cyclic Hemiacetals and Carbohydrates



The cyclic form of hemiacetals are stable - "SWEET!"
 → The chelate effect



This interconversion is called "mutarotation"



Biochemists call these two forms "anomers"

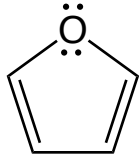
β -D-Glucopyranose
 means "6-membered ring"

More stable → every group is equatorial!

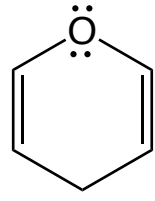
α -D-Glucopyranose
 Less stable → one -OH is axial

For Glucose:
 "α is axial!"

5-membered ring

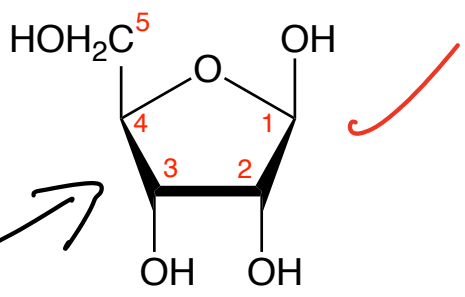


Furan

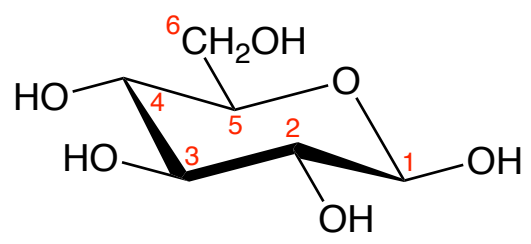


Pyran

6-membered ring

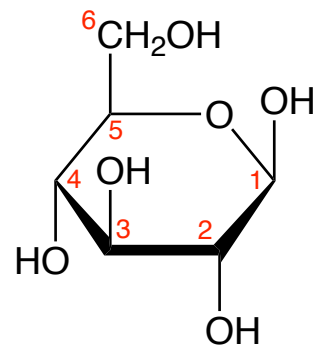


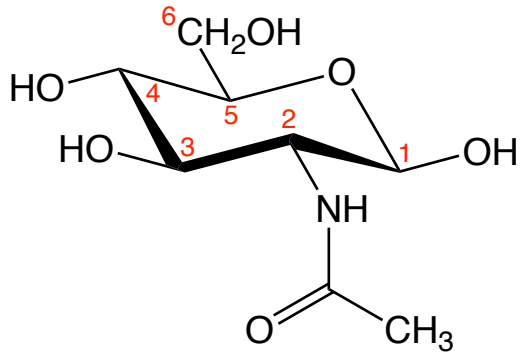
A furanose
 β -D-Ribose
or β -D-Ribofuranose



A pyranose
 β -D-Glucose
or β -D-Glucopyranose

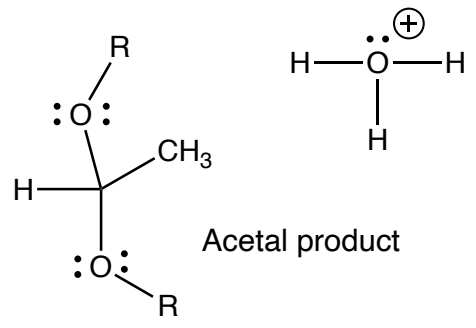
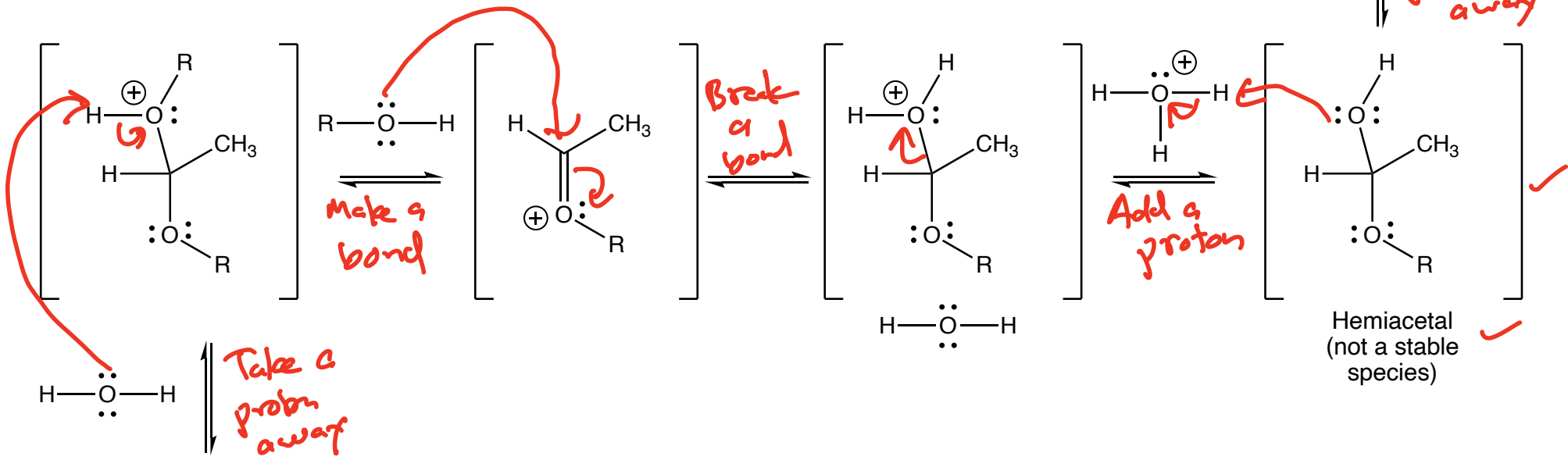
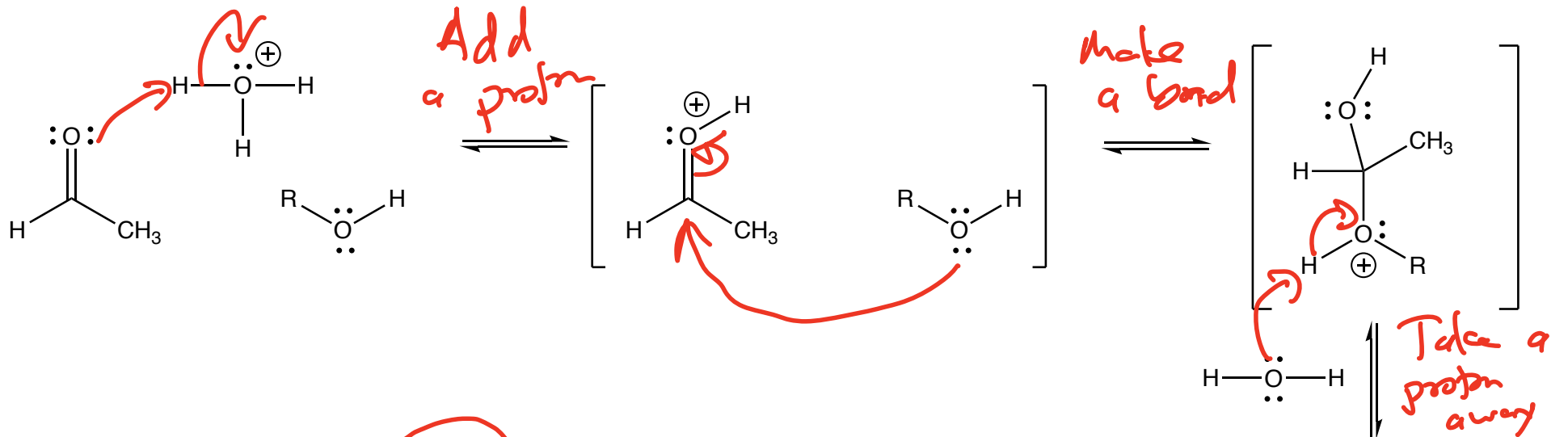
This is called a Haworth projection

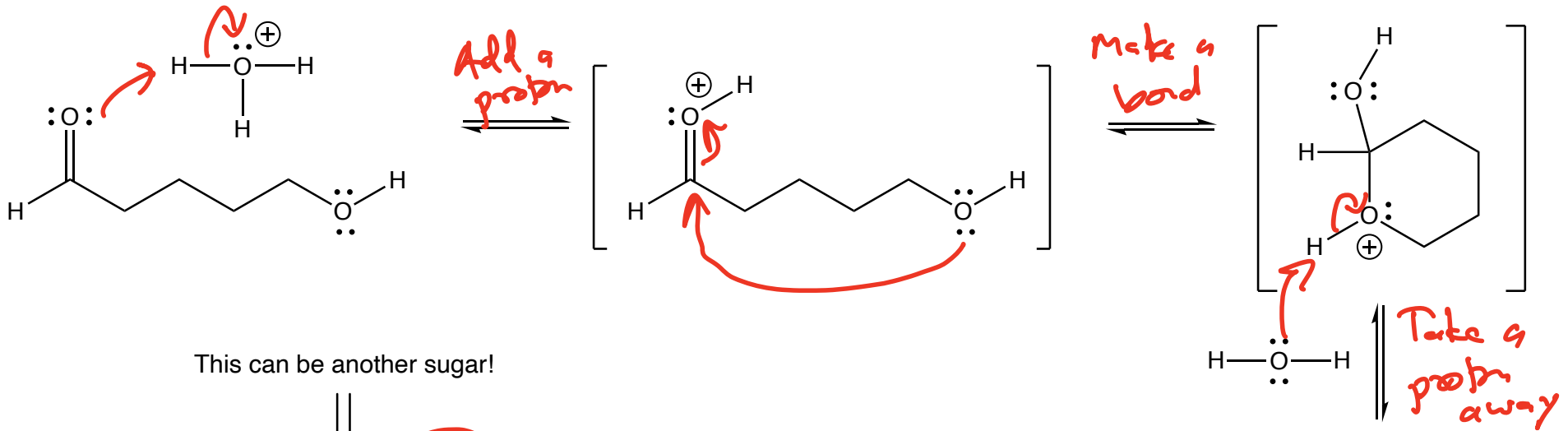




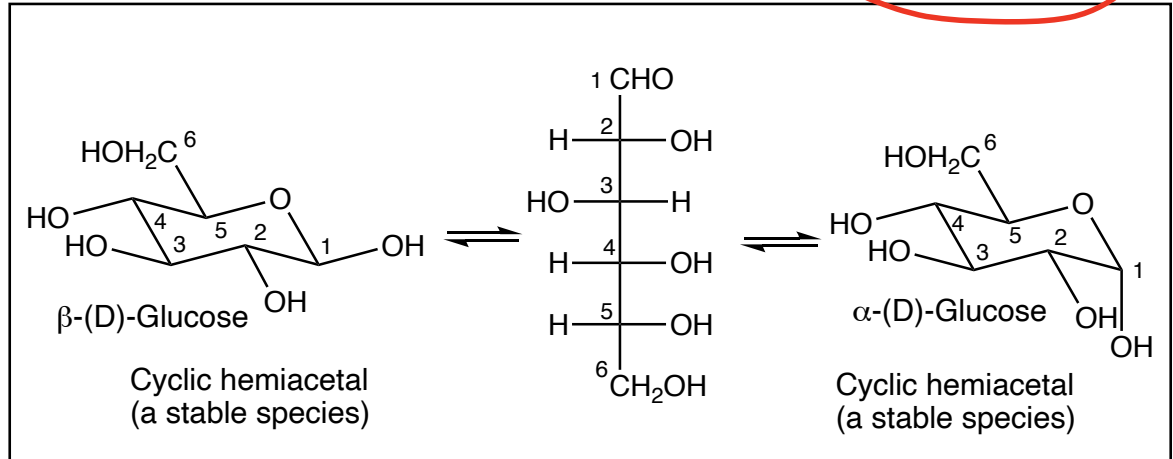
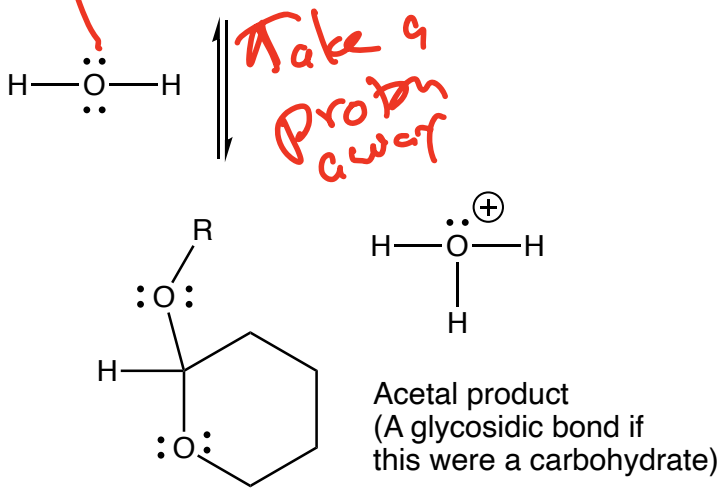
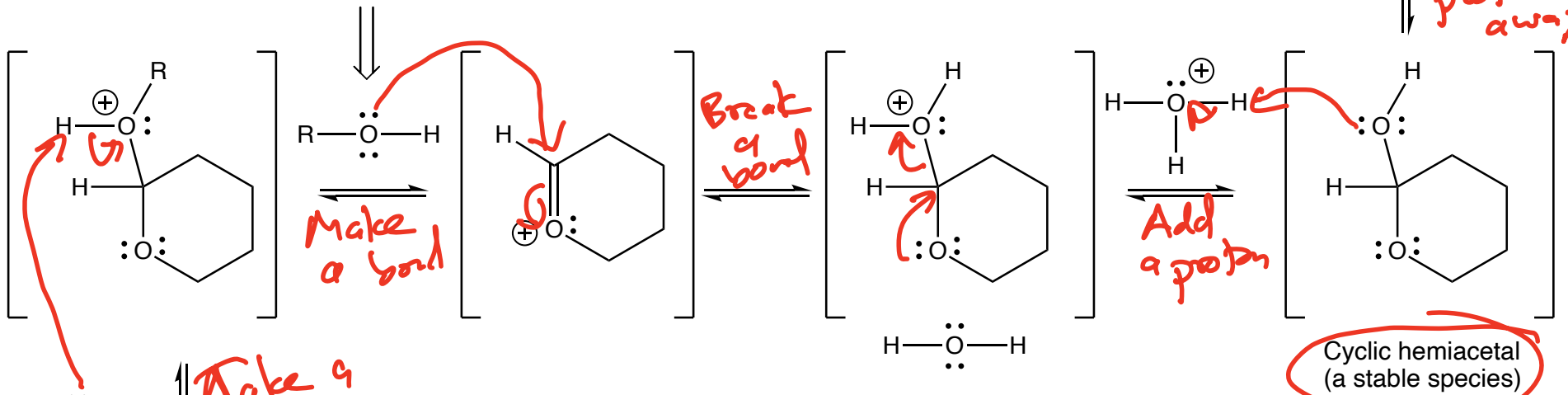
N-Acetyl-D-Glucosamine
(GlcNAC)

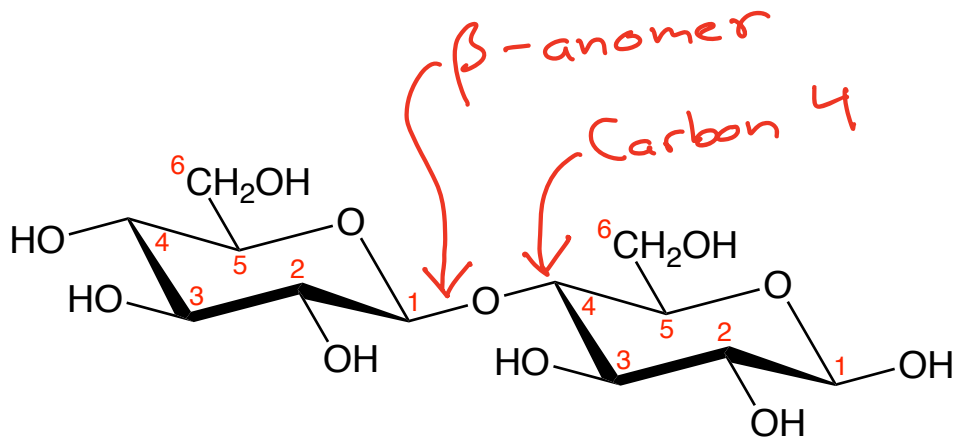




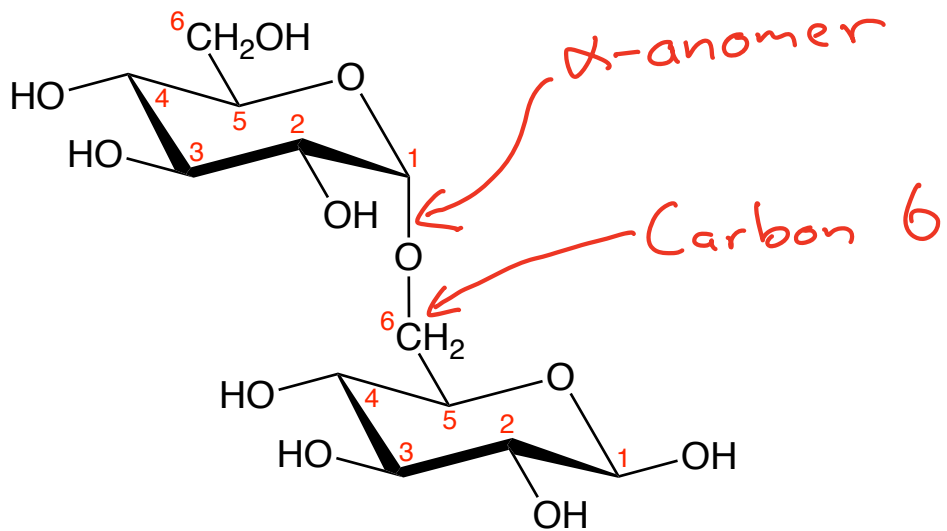


This can be another sugar!



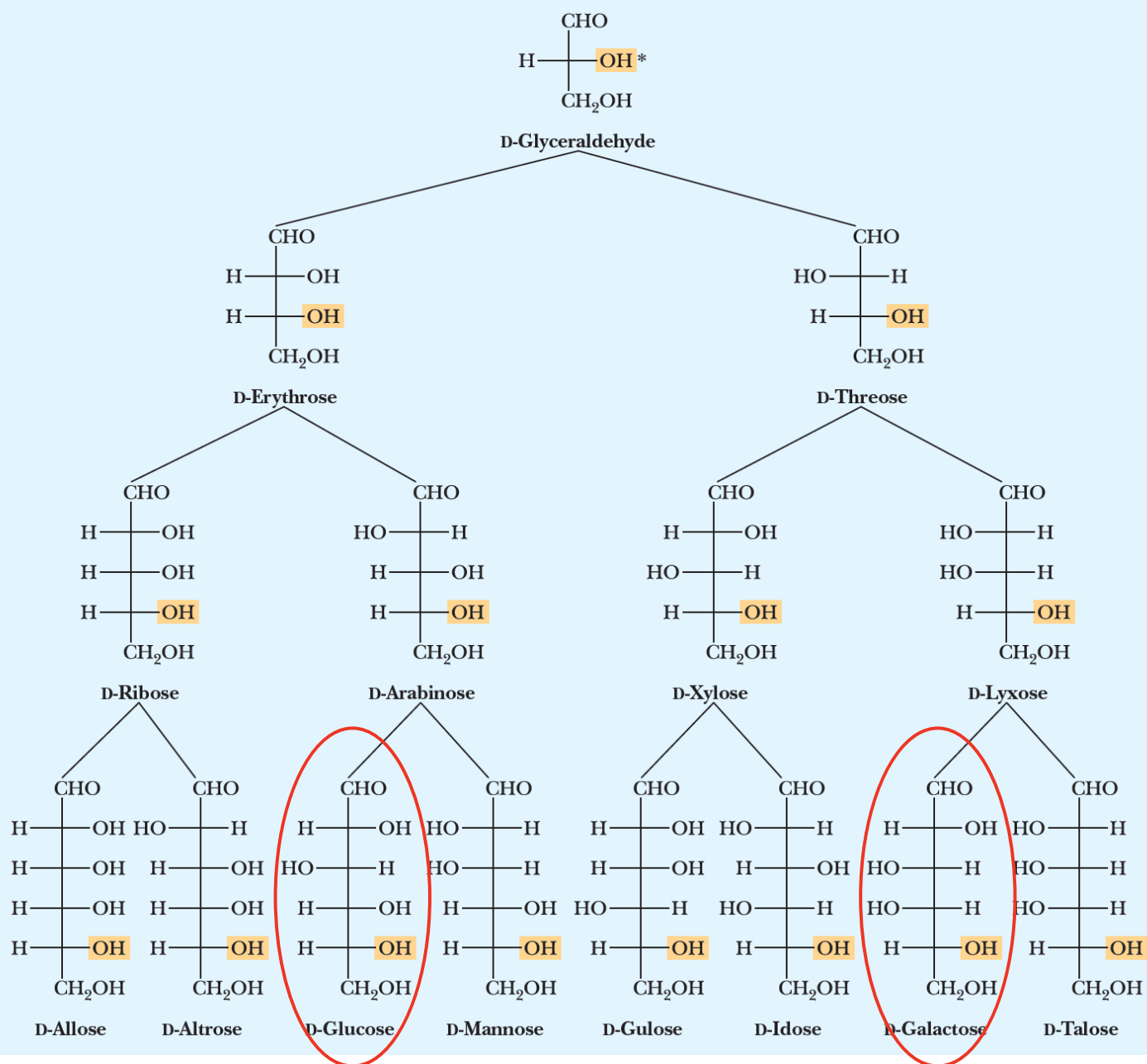


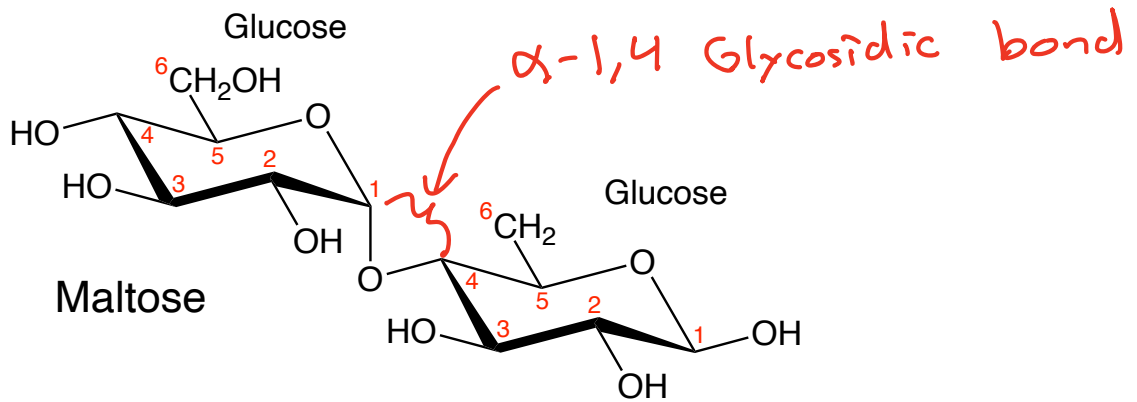
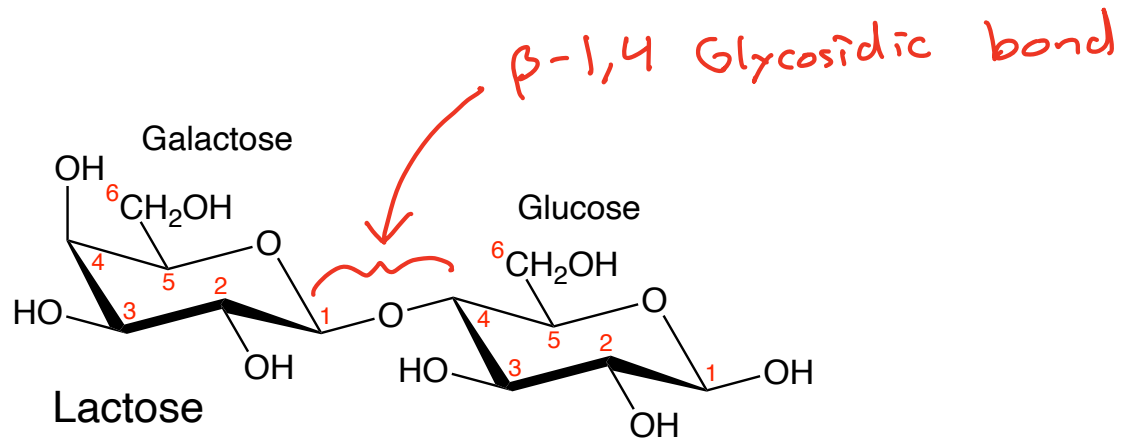
This is a β -1,4-Glycosidic Bond



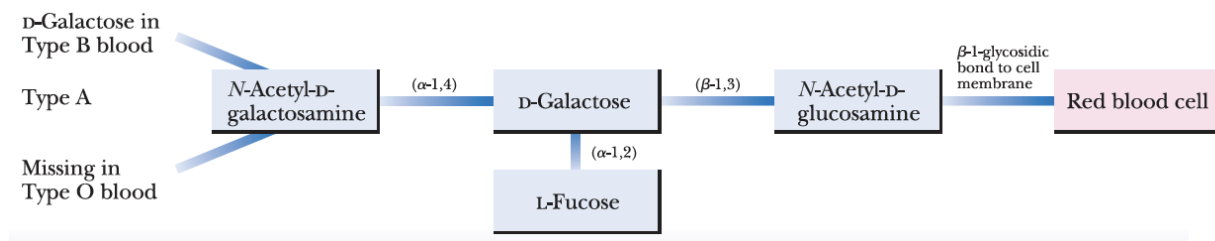
This is an α -1,6-Glycosidic Bond

Table 25.1 Configurational Relationships Among the Isomeric D-Aldotetroses, D-Aldopentoses, and D-Aldohexoses



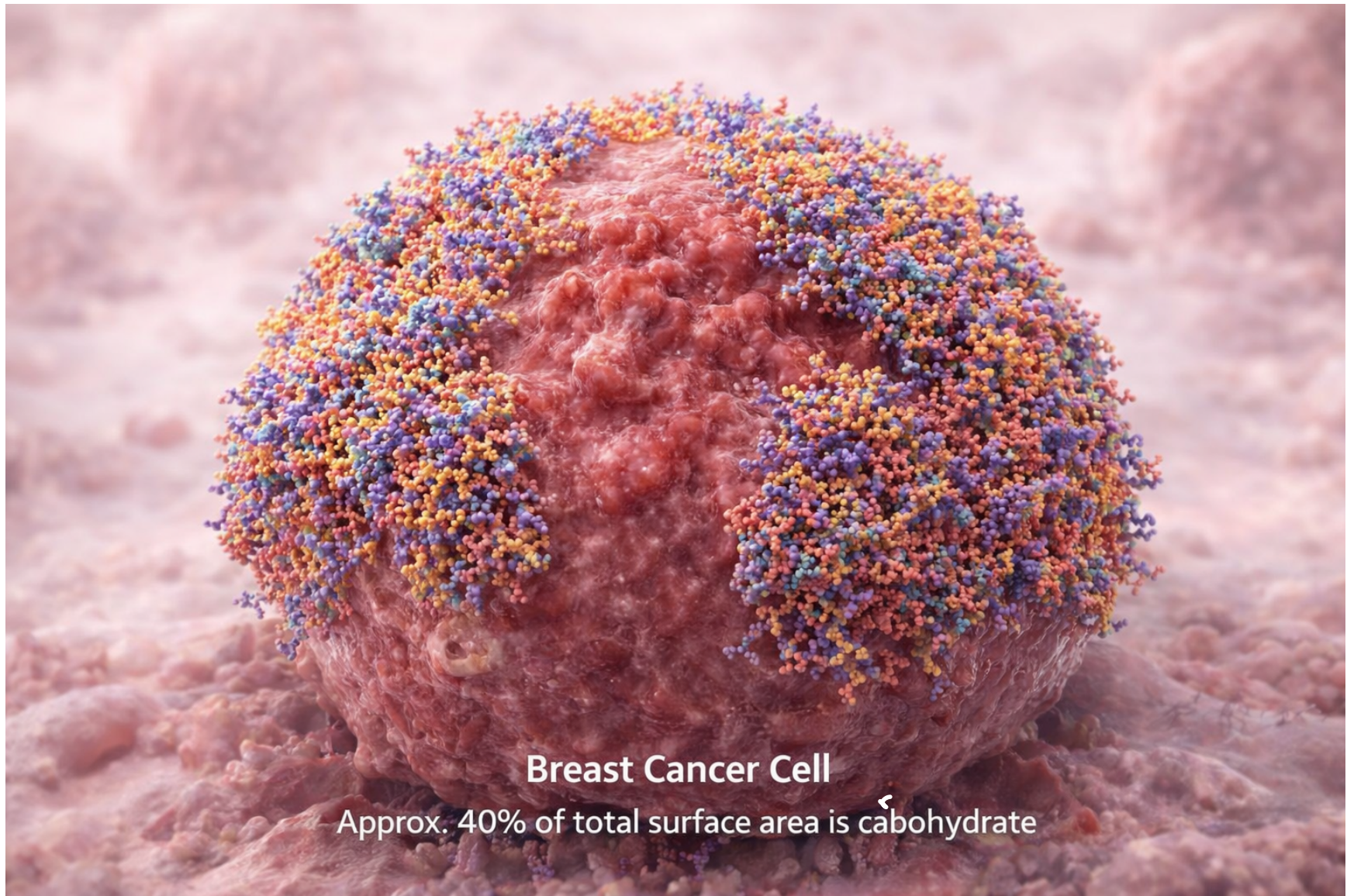


We can link more carbohydrates together, always at Carbon 1, with α or β linkages at carbons 2, 3, 4 or 6



We have a lot to learn about carbohydrates and their role in biology and human health. Carbohydrates cover cells \rightarrow We don't know why!!!

Generated by AI → Mostly accurate but don't believe the details



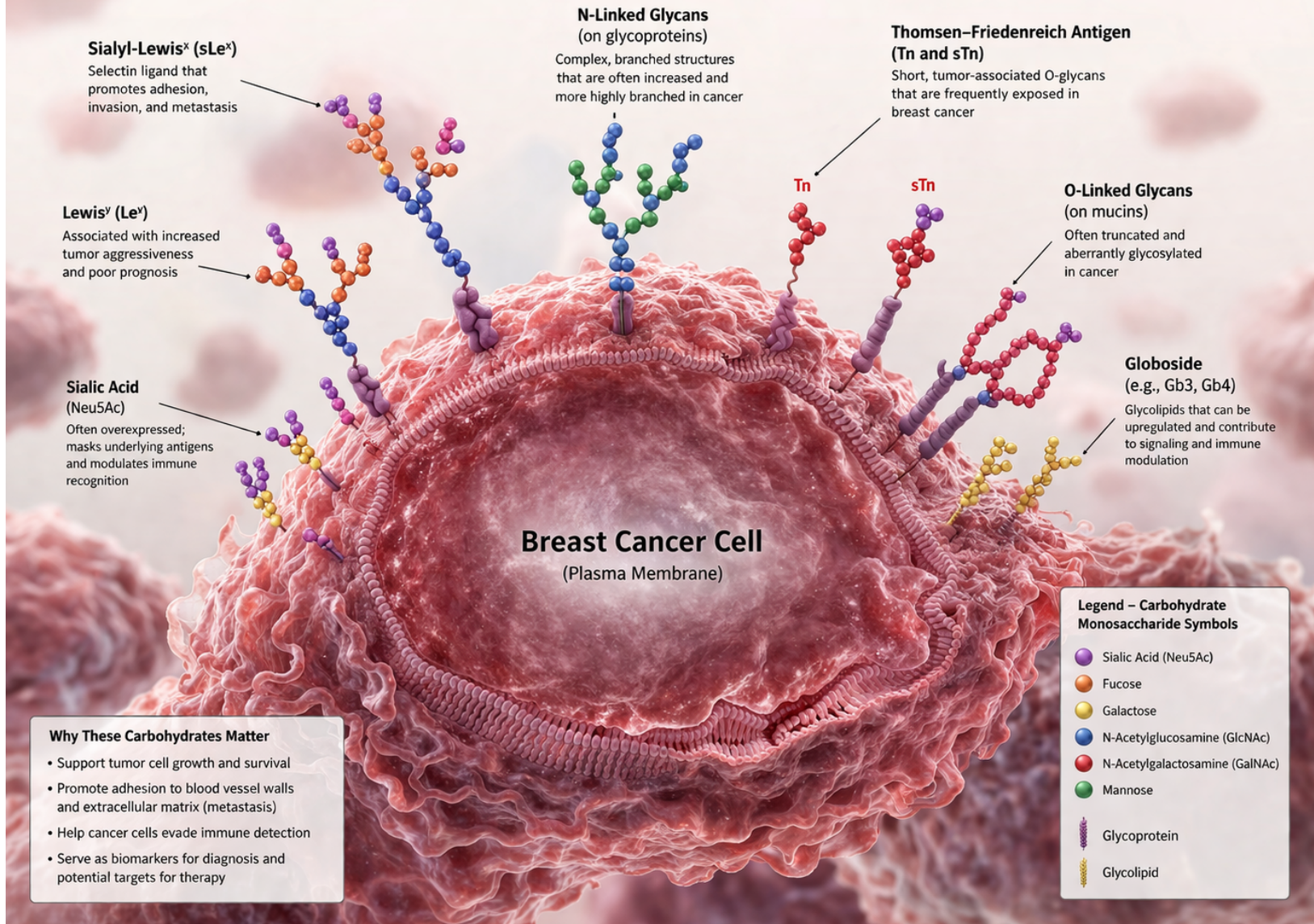
Breast Cancer Cell

Approx. 40% of total surface area is carbohydrate

Generated by AI → Accurately indicates the different carbohydrates on cancer cells

Key Carbohydrates on the Surface of a Breast Cancer Cell

Aberrant glycosylation is a hallmark of cancer. The carbohydrates (glycans) on the cell surface are often overexpressed or have altered structures, contributing to tumor growth, immune evasion, metastasis, and signaling.



The entire collection of
carbohydrates on a
cell surface

REVIEW

Don't sugarcoat it: How glycocalyx composition influences cancer progression

Alexander Buffone Jr.^{1,2} and Valerie M. Weaver^{2,3}

Mechanical interactions between tumors and the extracellular matrix (ECM) of the surrounding tissues have profound effects on a wide variety of cellular functions. An underappreciated mediator of tumor–ECM interactions is the glycocalyx, the sugar-decorated proteins and lipids that act as a buffer between the tumor and the ECM, which in turn mediates all cell-tissue mechanics. Importantly, tumors have an increase in the density of the glycocalyx, which in turn increases the tension of the cell membrane, alters tissue mechanics, and drives a more cancerous phenotype. In this review, we describe the basic components of the glycocalyx and the glycan moieties implicated in cancer. Next, we examine the important role the glycocalyx plays in driving tension-mediated cancer cell signaling through a self-enforcing feedback loop that expands the glycocalyx and furthers cancer progression. Finally, we discuss current tools used to edit the composition of the glycocalyx and the future challenges in leveraging these tools into a novel tractable approach to treat cancer.

Introduction

The mechanical interactions between a cell and the ECM tissue that encompasses it control nearly all aspects of cellular fate (Daley et al., 2008). The glycocalyx, the thick mixture of protein, lipids, and their post-translational sugar structures, surrounds all living cells and acts as a buffer between the cell and the ECM, especially in terms of mechanics (Butler and Bhatnagar, 2019). In cancer, the size of the tumor cell glycocalyx as a whole is significantly increased (Pavelka and Roth, 2010), and this in turn alters all aspects of tumor progression including transmembrane receptor function, cellular tension, integrin-mediated signaling, cell–cell and cell–ECM interactions, and immune recognition (Uchimido et al., 2019). On the other hand, the composition of the glycan structures decorating the protein and lipid backbones during cancer is context dependent, as the glycan trees are either elongated or truncated based on the specific cancer (Munkley and Elliott, 2016). Regardless, the composition of these sugar structures in the glycocalyx plays an important role in regulating both the overall phenotype and mechanics of the tumor (Martinez-Seara Monne et al., 2013). This review will discuss both the protein and lipid backbones that comprise the glycocalyx and also the critical glycan structures attached to these backbones, which are altered during cancer progression. Furthermore, we will detail how mechanics modulates the structure and function of the cancer glycocalyx and how this

drives a “feedback loop” which drives malignancy. Finally, we will discuss current strategies to “prune” the glycocalyx in a specific manner to modulate cancer progression.

Key protein and lipid backbones of the glycocalyx in vivo

The composition and structure of the glycocalyx, a heterogeneous mixture of proteins and lipids that extend away from the cell membrane to which they are anchored, affect nearly all interactions between the cell and the extracellular environment. The height of the glycocalyx varies widely between cells and tissues but in general ranges from tens of nanometers to several micrometers thick (Möckl et al., 2019). The proteins and lipids of the glycocalyx have bulky post-translational sugar structures decorating their surface that extend the height and bulkiness of the glycocalyx and give it a strong negative charge (Reitsma et al., 2007). Cell surface chemokine receptors and integrins that are encompassed by the glycocalyx are much shorter (~10 nm; Ye et al., 2010) and must navigate this negative charge and the repulsion between the ECM and glycocalyx, in order for cellular adhesion, migration, signaling, and most any cell-surface interactions to occur (Hammer and Tirrell, 1996).

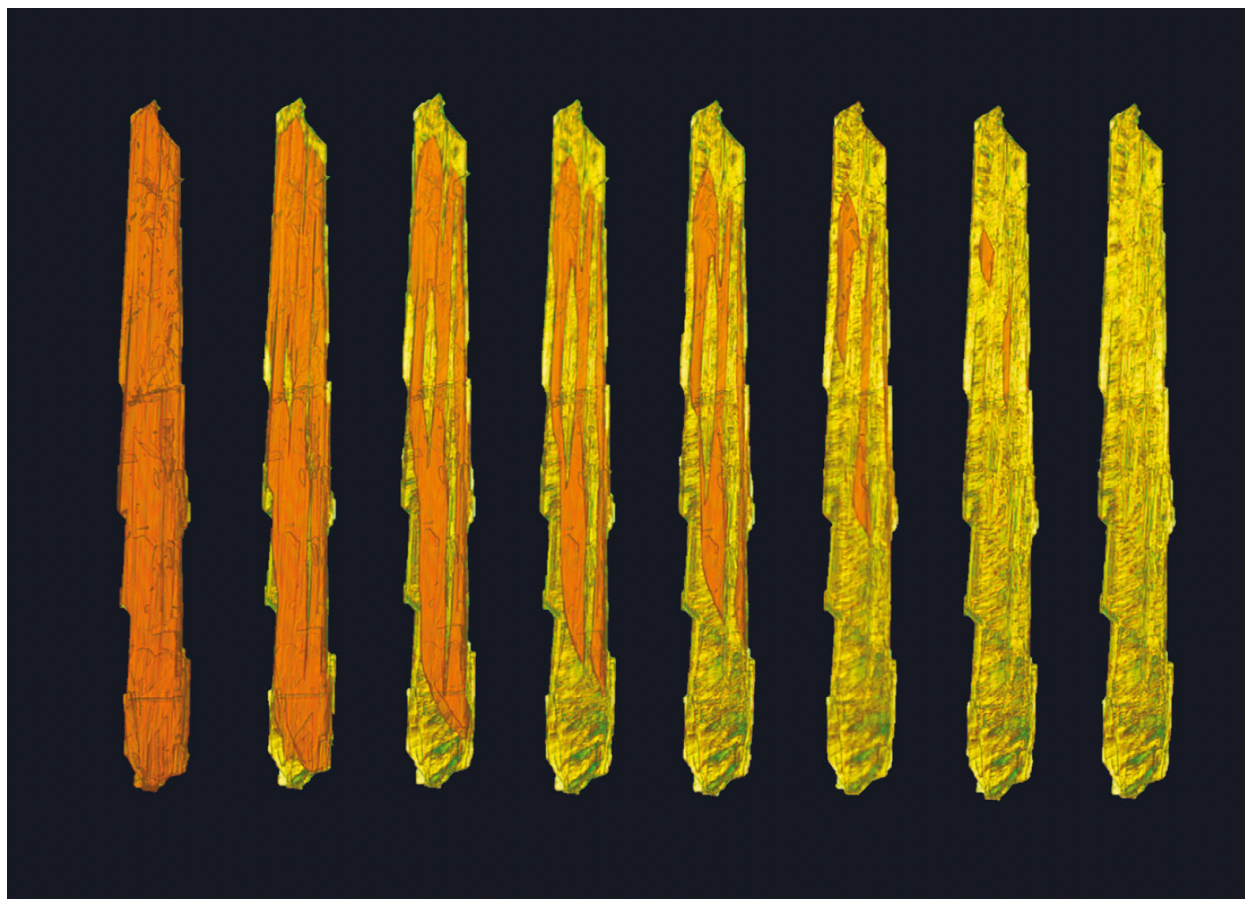
The protein and lipid backbones of the cellular glycocalyx comprise four main classes with unique glycosylation patterns (Fig. 1): mucins, which are glycoproteins with bulky

¹Department of Bioengineering, University of Pennsylvania, Philadelphia, PA; ²Center for Bioengineering and Tissue Regeneration, Department of Surgery, University of California, San Francisco, San Francisco, CA; ³Departments of Radiation Oncology and Bioengineering and Therapeutic Sciences, Eli and Edythe Broad Center of Regeneration Medicine and Stem Cell Research, and Helen Diller Comprehensive Cancer Center, University of California, San Francisco, San Francisco, CA.

Correspondence to Valerie M. Weaver: Valerie.Weaver@ucsf.edu.

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Pop Quiz Timeout!



Journal of
Materials Chemistry C



PAPER



Cite this: *J. Mater. Chem. C*, 2015,
3, 12156

Solution- and solid-state photophysical and stimuli-responsive behavior in conjugated monoalkoxynaphthalene-naphthalimide donor-acceptor dyads†

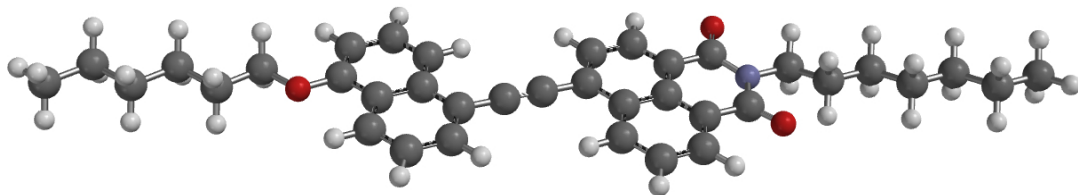
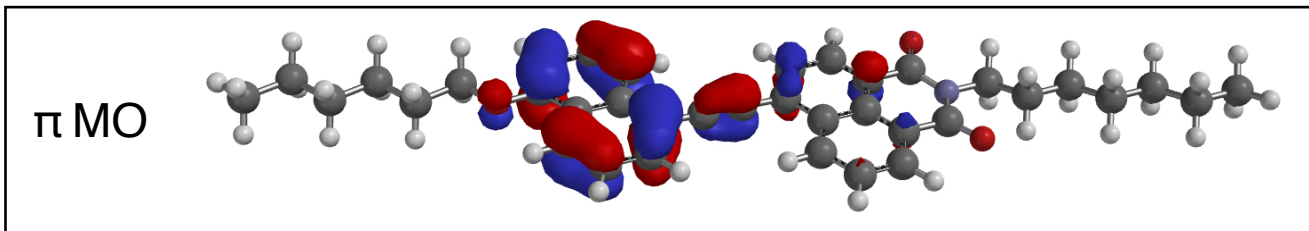
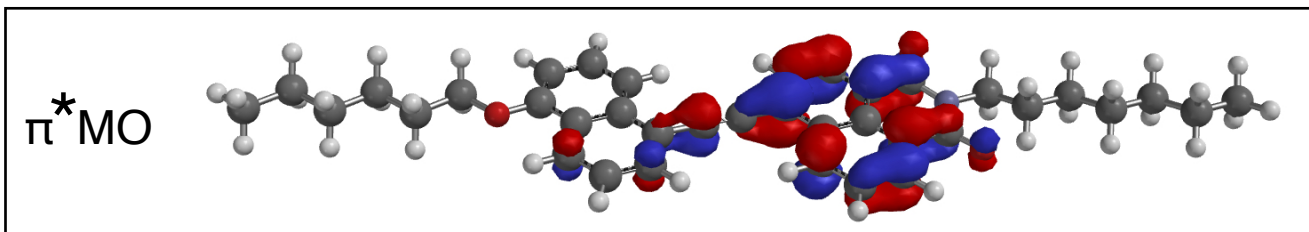
Cameron Peebles, Christopher D. Wight and Brent L. Iverson*

The stimuli-responsive properties of a series of aromatic conjugated monoalkoxynaphthalene-naphthalimide donor-acceptor dyads were studied. Two of the dyads, dyads **1** and **4**, showed a difference in solid-state color between relatively faster (yellow) and slower (yellow-orange or orange) evaporation from solution, while the other dyads, dyad **2** and **3**, only showed one color (yellow-green) for both evaporation rates. Importantly, highly solvatochromic dyad **4** displayed thermochemical (orange to yellow), mechanochemical (orange to yellow) and vapochemical (yellow to orange) stimuli-responsive behavior in the solid-state with repeatable cycles of color changing. Structural and spectroscopic studies indicated that the stimuli-responsive behavior of dyad **4** is the result of a 180° molecular rotation wherein the thermodynamically more stable head-to-head stacked orange crystalline solid interconverts with a head-to-tail stacked soft-crystalline yellow mesophase. The thermochemical transition of **4** from a presumably more stable crystalline state (orange) to a metastable soft crystalline mesophase state (yellow) that persists at room temperature unless exposed to solvent vapor is particularly noteworthy.

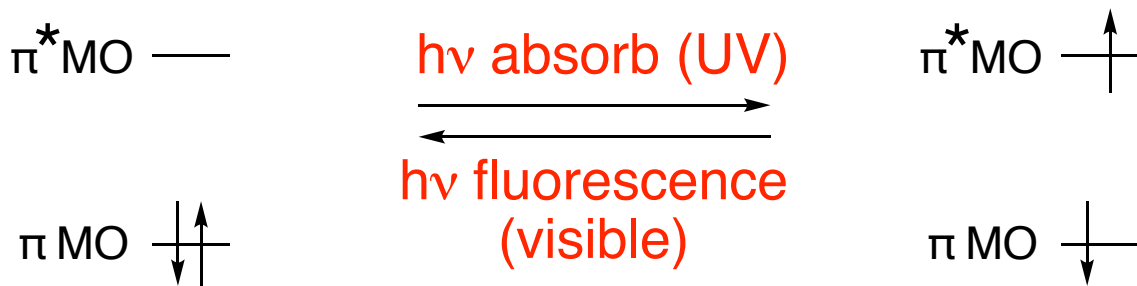
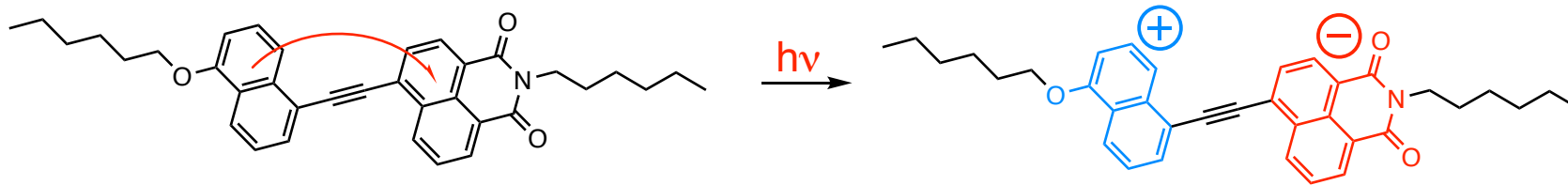
Received 3rd August 2015,
Accepted 30th September 2015

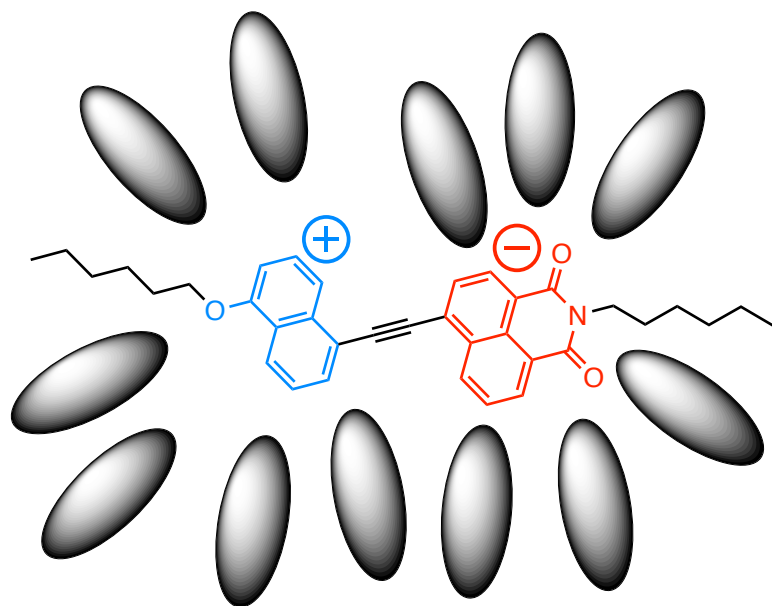
DOI: 10.1039/c5tc02397a

www.rsc.org/MaterialsC



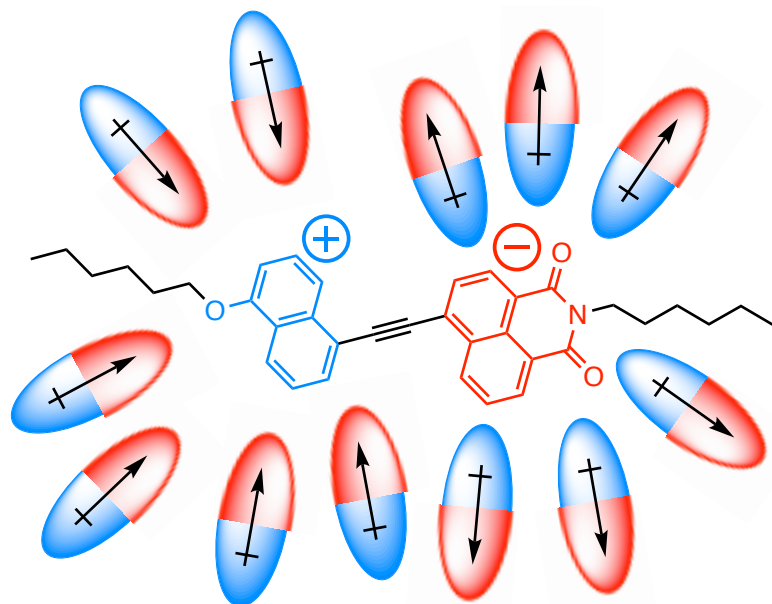
Blue Light = higher energy
Orange light = lower energy





Non-polar Solvent Molecule

No stabilization of the
charged excited state



Polar Solvent Molecule

Stabilization of the
charged excited state



← Less Polar Solvents
More Polar Solvents →

NAME (Print): _____

Chemistry 320N
Pop Quiz
April 15, 2026

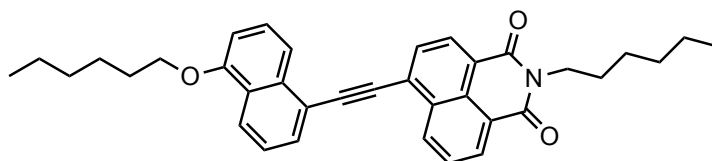
EID _____

SIGNATURE: _____

Please print the
first three letters
of your last name
in the three boxes

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This pop quiz is worth 1 full percentage or T-score point added to your 3rd midterm grade if you get the answer correct.

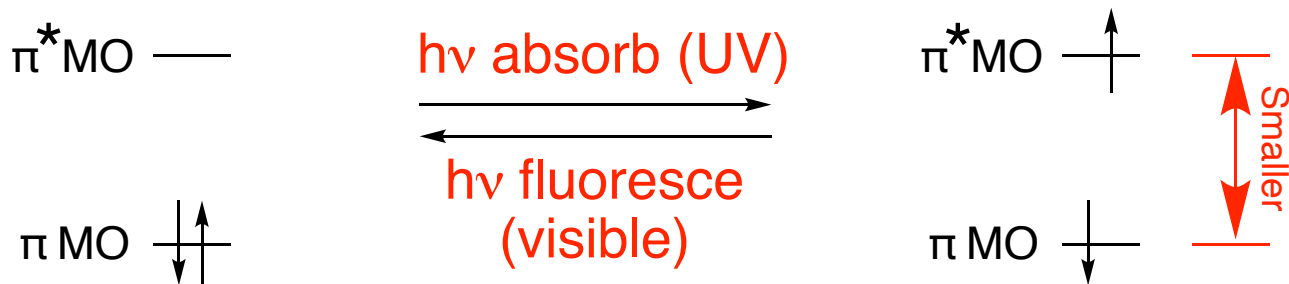


For the molecule we are discussing that absorbs light by creating a charge separated state as I described in class, there is a very strong solvent dependence to the wavelength of light emitted as fluorescence. The solvents in the various flasks all have the same concentration of the molecule in them. We are looking at fluorescence under UV light. The solvents range from highly polar to very nonpolar.

- The flask with the orange fluorescence is the most polar solvent, and the flask with the blue fluorescence is the most nonpolar solvent.
- The flask with the orange fluorescence is the most nonpolar solvent, and the flask with the blue fluorescence is the most polar solvent.

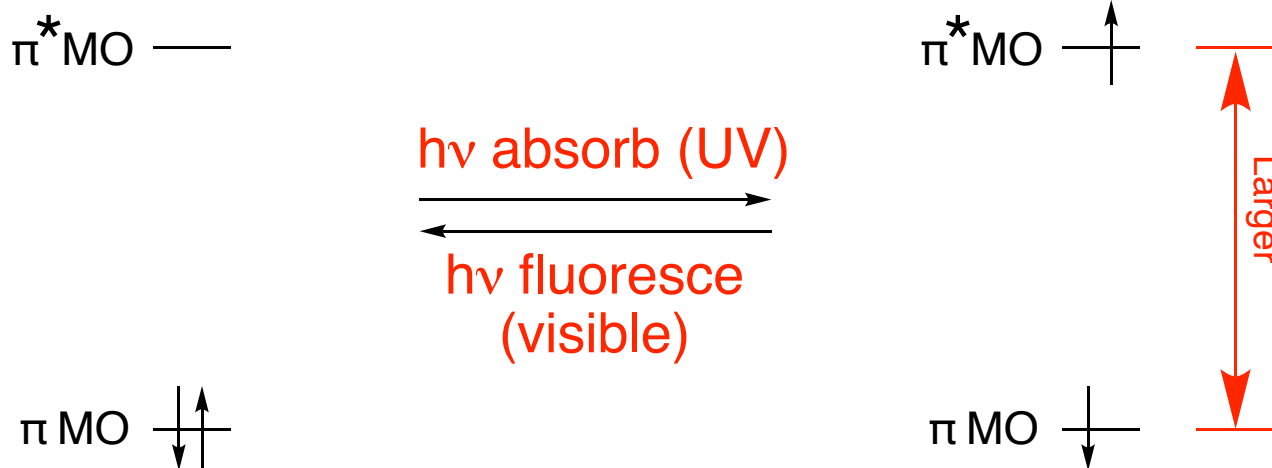
This will not be graded but will be passed on as feedback to the appropriate offices. On a scale of 1 - 10, 10 being best, how would you rate the quality of academic advising you are getting at UT Austin. Put your number in the box please.

--



Polar Solvent - the charged excited state is well solvated because the solvent molecules have a relatively large molecular dipole that interacts favorably with the charges. There is a smaller energy difference between the ground state and excited state, corresponding to orange light

Pop Quiz Answer



Non-polar Solvent - the charged excited state is disfavored because it is not well-solvated. There is no molecular dipole in the solvent to interact favorably with the charges. This makes the charged excited state higher in energy. There is a larger energy difference between the ground state and excited state, corresponding to blue light

Pop Quiz Answer



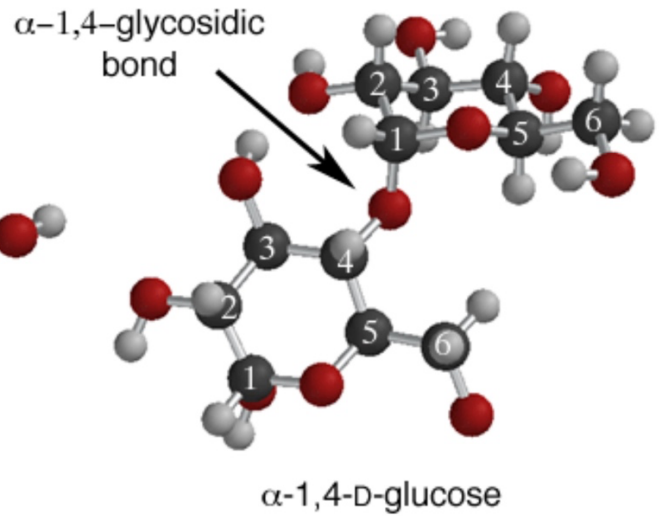
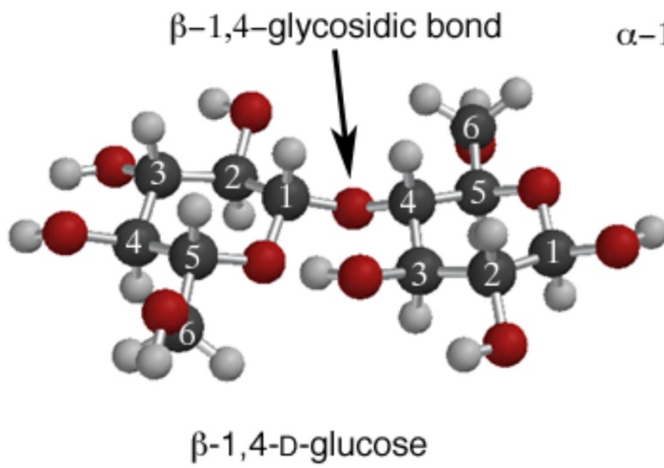
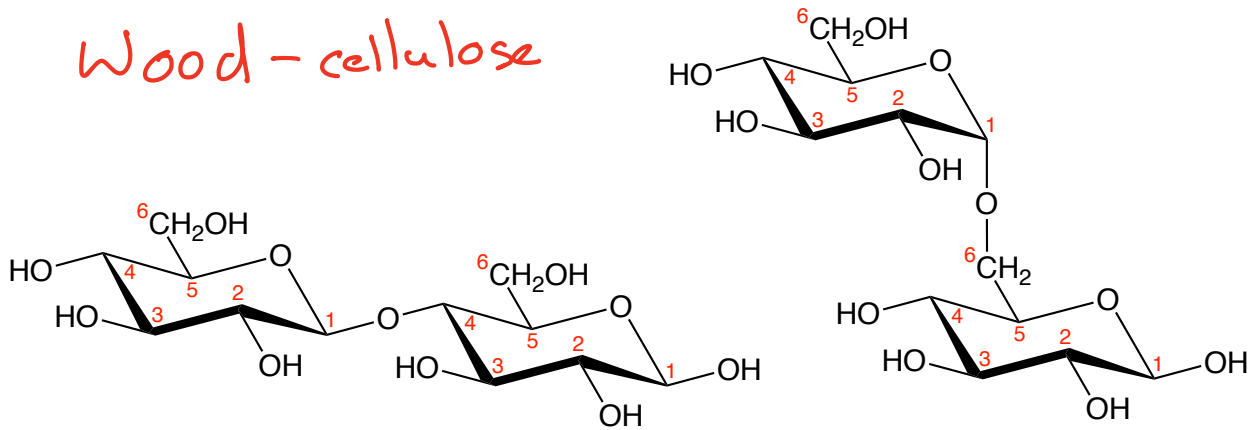
VS.



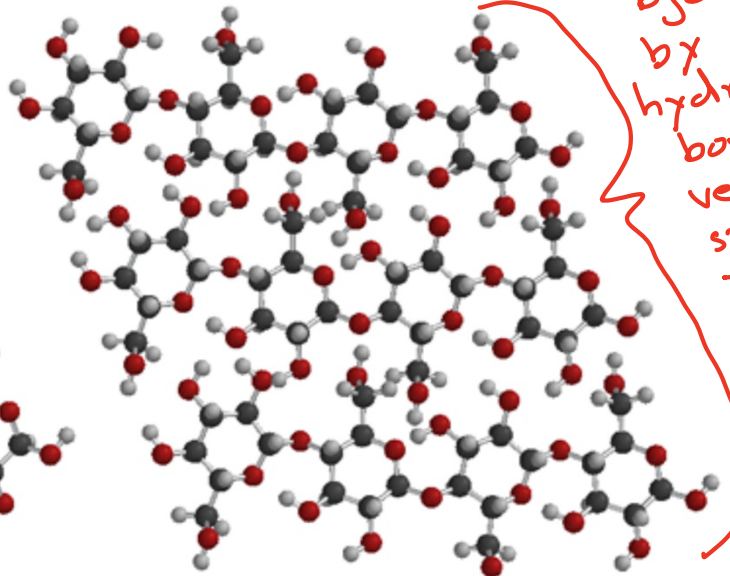
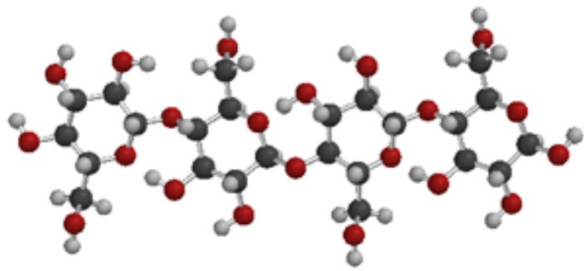
What is the difference —
They are both polymers
of D-Glucose

Potato - starch

Wood - cellulose

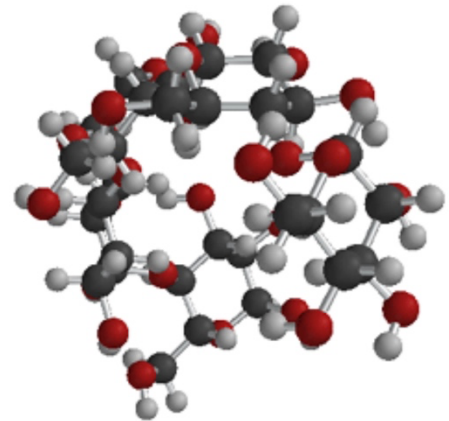
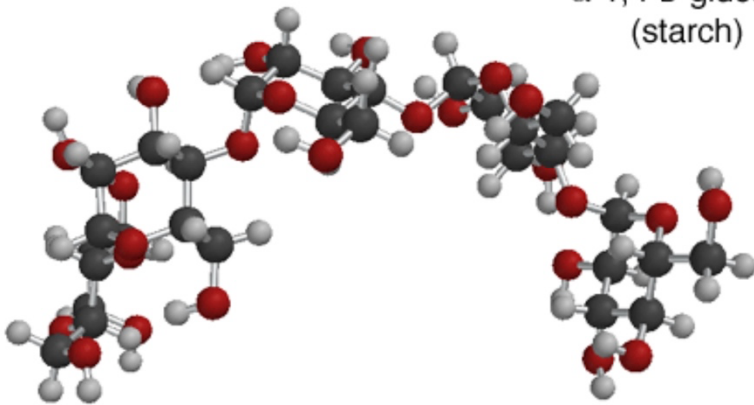


β -1,4-D-glucose
(cellulose)



All held together by hydrogen bonds - very strong 3d structure

α -1,4-D-glucose
(starch)



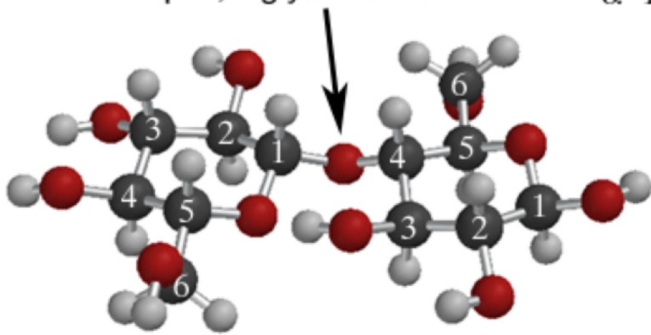
Cannot assemble into a stable 3d structure



vs.

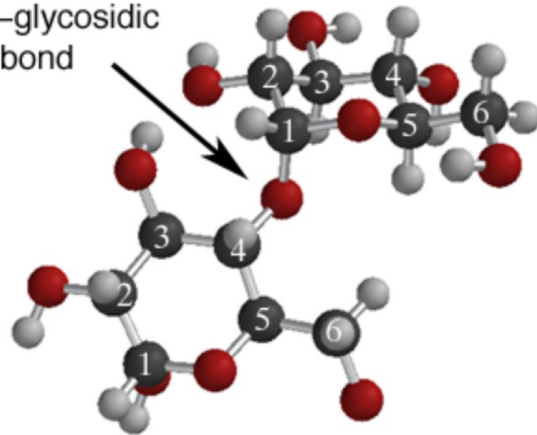


β -1,4-glycosidic bond



β -1,4-D-glucose

α -1,4-glycosidic bond



α -1,4-D-glucose