

Sweet & Sour Smorgasboard

First, the Sweet! Build your own sugar.¹

Choose your ingredients:

- aldose or ketose
- pyranose or furanose
- triose or tetrose or pentose or hexose
- open chain or hemiacetal form
- Fischer projection or Haworth projection or chair drawing
- anomeric carbon α or β
- original flavor, or 2-amino or 2-deoxy or 2-N-acetyl
- Note: We could include D or L sugars here, but let's just make them D!

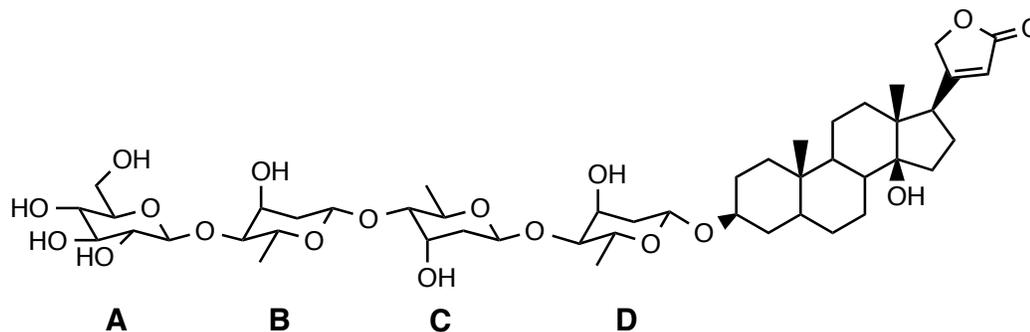
The recipe:

1. Choose an option for each ingredient, then draw the sugar that would result. Not all combinations make a sweet meal. You should, however, be able to state why a particular combination is not possible.
2. Now, choose and draw one of the following relative to your first drawing: enantiomer, diastereomer, epimer, conformation
3. On your own, repeat 1 and 2 until you know these terms and concepts!
4. On your own, consider the ingredient lists above. The lists are not independent. For instance, the stereochemistry of the anomeric carbon doesn't come up unless certain other things are true. Arrange the lists in a flow chart or some kind of hierarchy which shows the relationships among the terms.

¹Of course, not all sugars taste sweet, and not all can be metabolized by humans.

Now, the Sour, or, a Toxin

Digitalis is an important drug in cardiology. It makes the heart muscle beat more forcefully and thus increases the flow of blood. It is typically used in congestive heart failure. Digitalis must be monitored carefully as it has a narrow therapeutic window: too little, no effect. Too much, and the heart beats itself to death (yikes!).² Digitalis is isolated from the foxglove plant, *Digitalis purpurea*. A picture of the plant is shown below, as is the structure of one of the compounds in the plant. This compound is a glycoside, which is a compound that has a non-sugar piece combined with one or more sugars. Most drugs derived from natural sources are decorated with sugars in this manner. In the case of digitalis, the sugars are essential to the biological activity.



1. Are any of these sugars glucose?
2. Mark all anomeric carbons with an arrow.
3. How many different sugars are present?
4. Circle an example of an axial substituent.
5. Describe the linkage from **A** → **B**.
6. Describe the linkage from **B** → **C**.
7. Describe the linkage from **C** → **D**.

²Paracelsus, one of the revered Greek physicians, gave good advice (paraphrased): "The dose makes the poison."