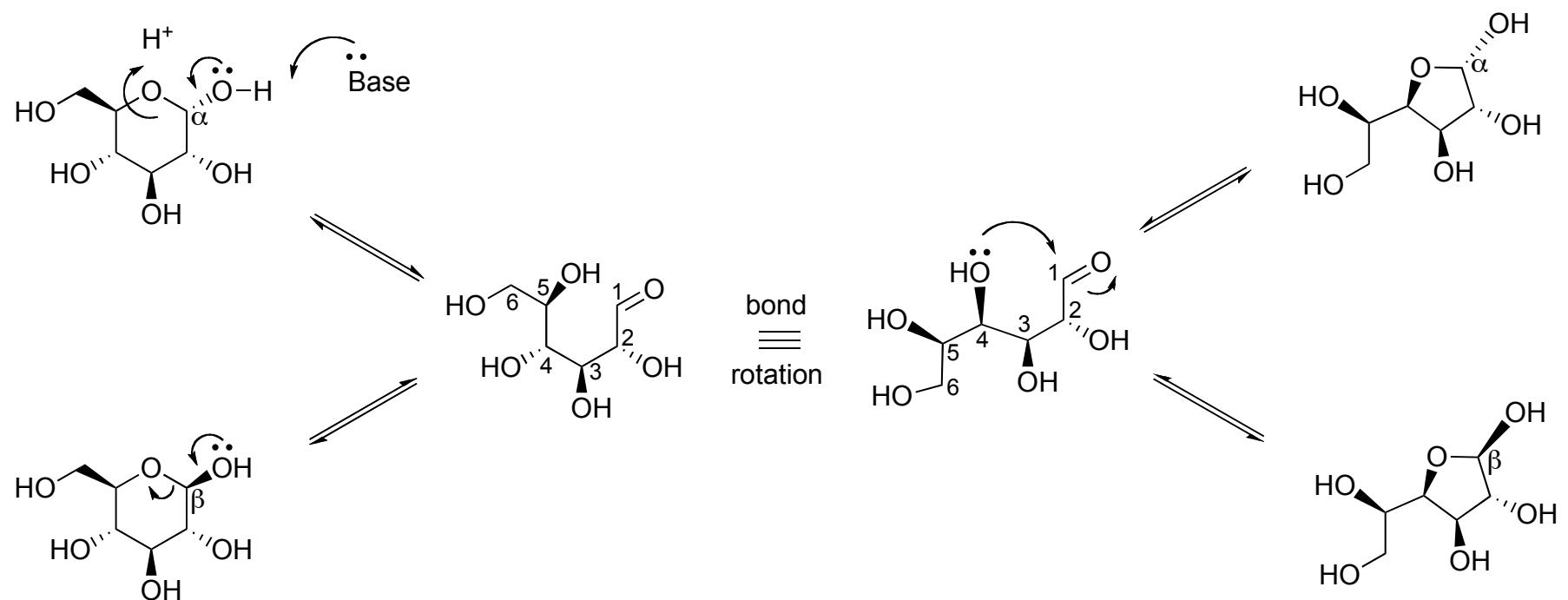


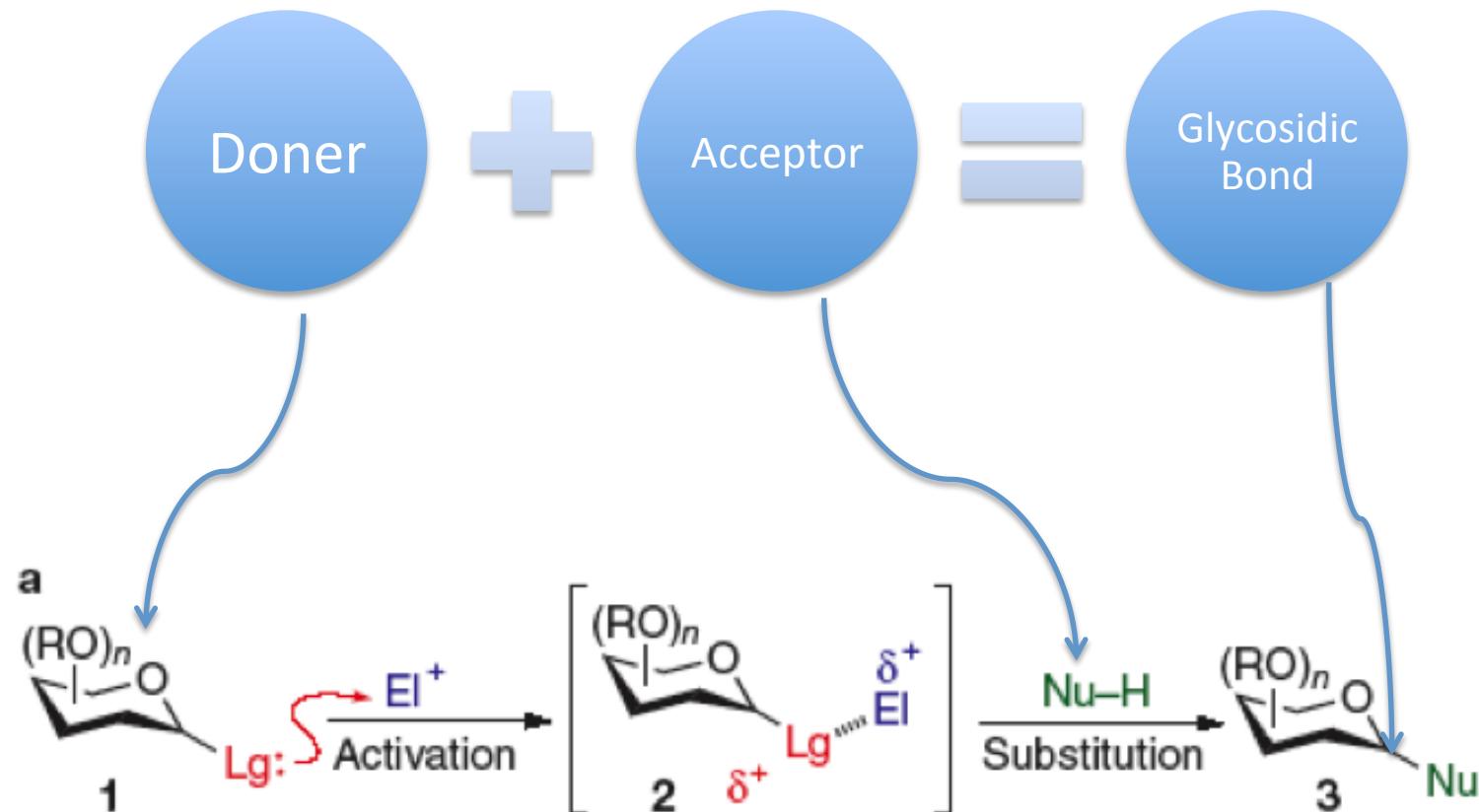
RXN of the anomeric center II

Brief review of mutarotation and furanose/pyranose inter-conversion



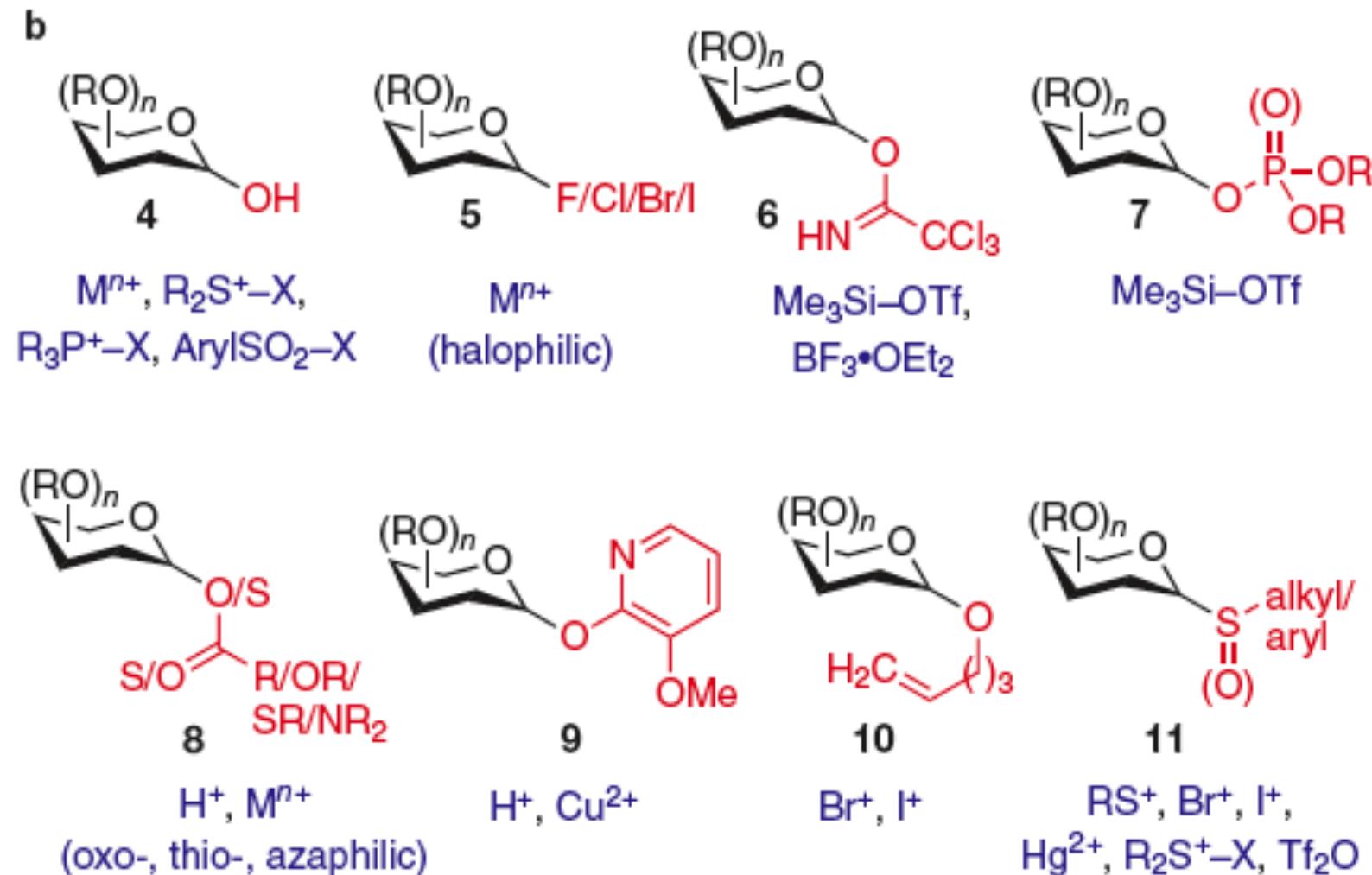
1. Nucleophilic substitution at anomeric centre

Glycosylation

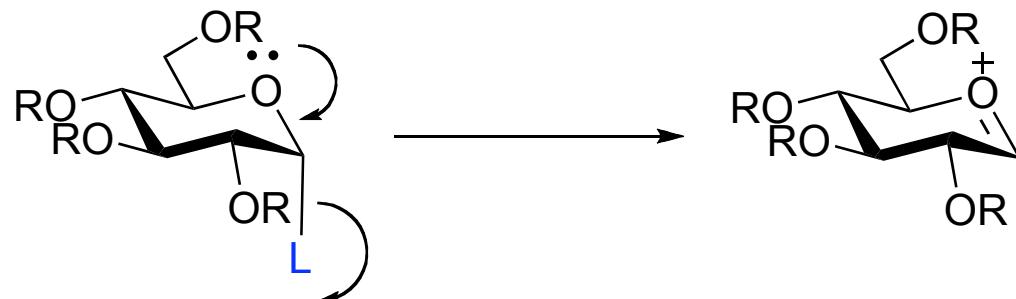


Good leaving group

b

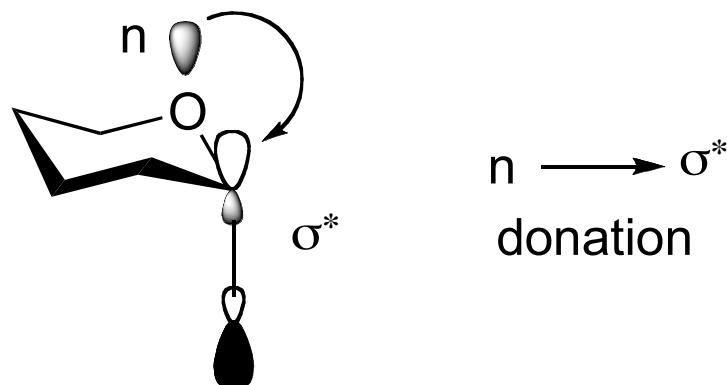


Stereochemistry consideration/ S_N1 or S_N2



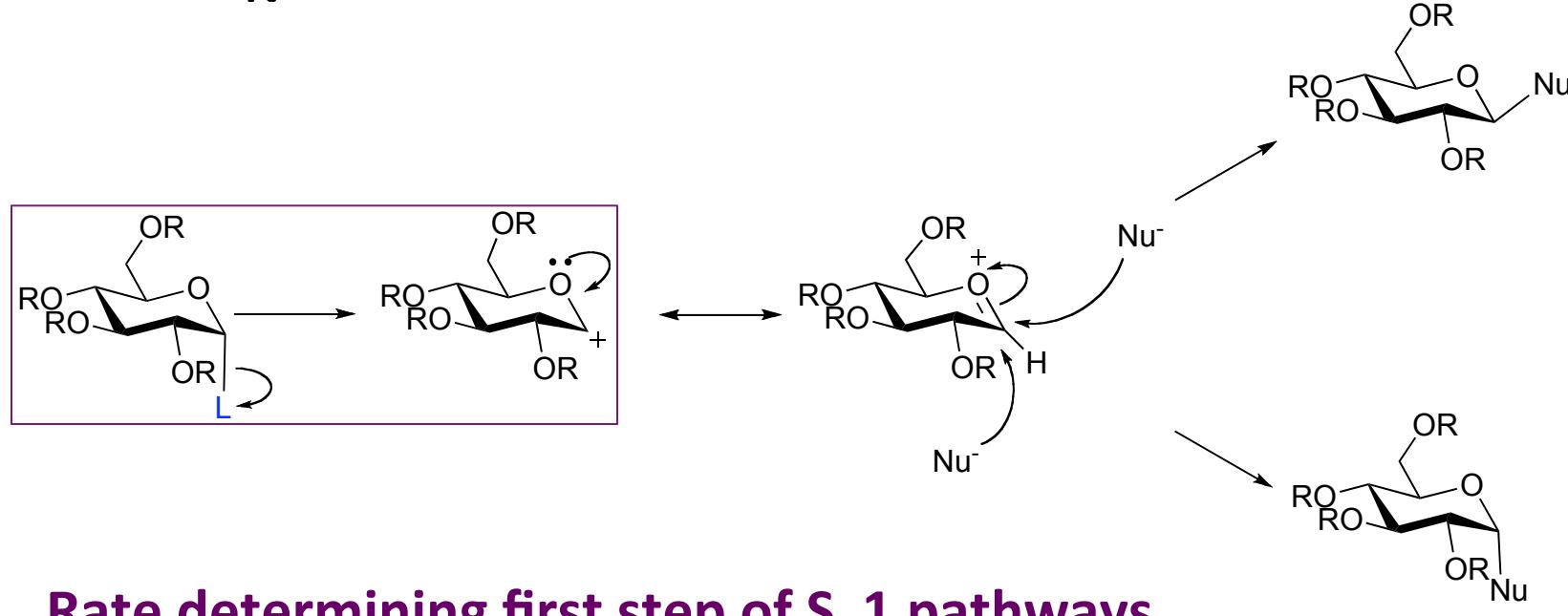
Ring oxygen facilitates S_N1 type pathways

Aid the departure of leaving group and
stabilise the carbonium ion intermediate



Anomeric effect

S_N1 Pathway

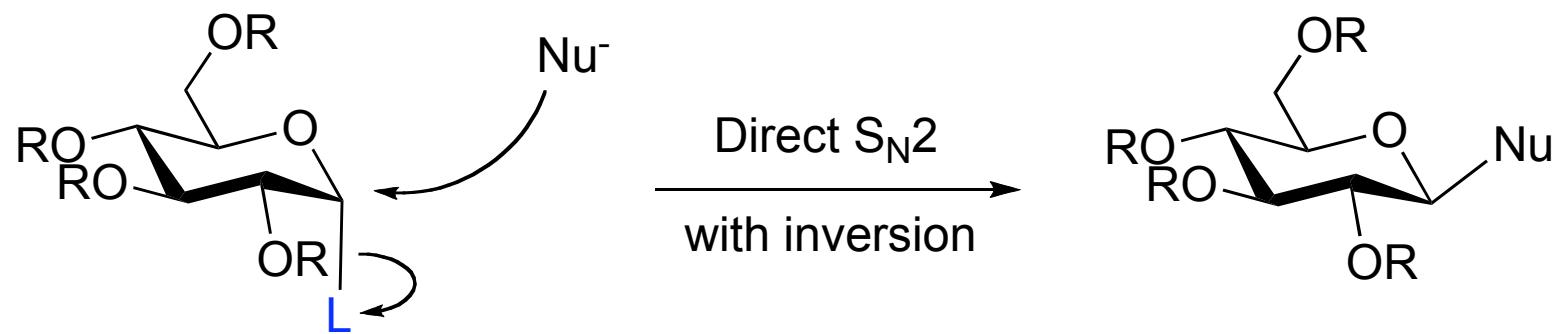


Rate determining first step of S_N1 pathways

There are many factors, such as the nature of the solvent, or of the protecting group R on neighbouring C-2 hydroxyl, that can play an important role in determining the relative amount of these two pdts.

An extra complication, S_N2 type processes can occur competitively with clean inversion of the configuration at anomeric center

S_N2 Pathway

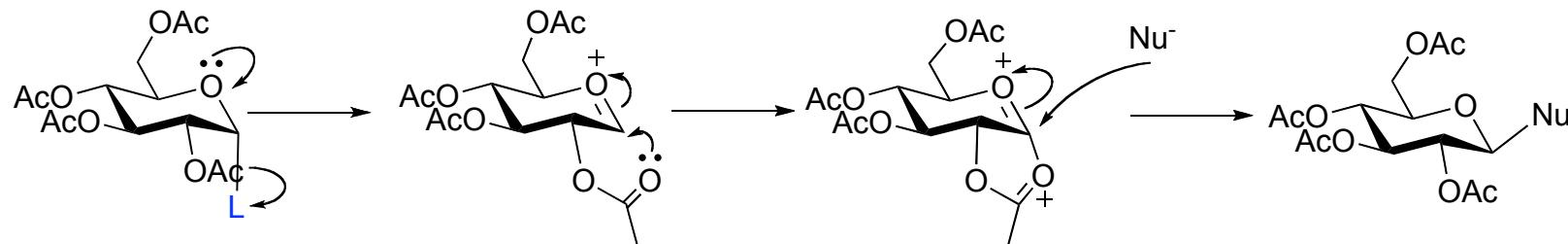


In the hypothetical example, clean S_N2 displacement of the α -anomeric leaving group would lead exclusively to the β pdt.

Neighboring group participation

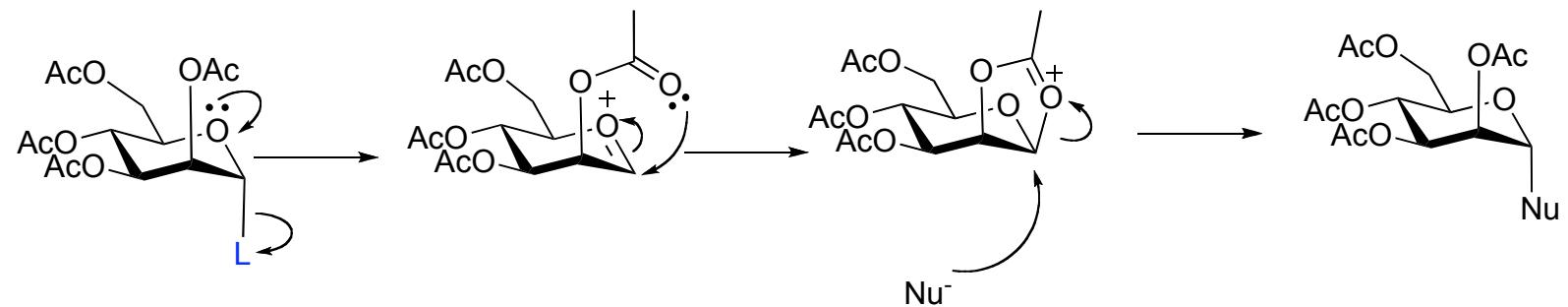
One of the strategies for controlling the stereochemical outcome of nucleophilic substitution rxn

Acetate or benzoate on the 2-hydroxyl group



Participation of the carbonyl oxygen of the acetate at 2 position may stabilise the intermediate glycosyl cation

The formed cyclic oxonium ion can then be opened in an S_N2 fashion by the external added nucleophile.

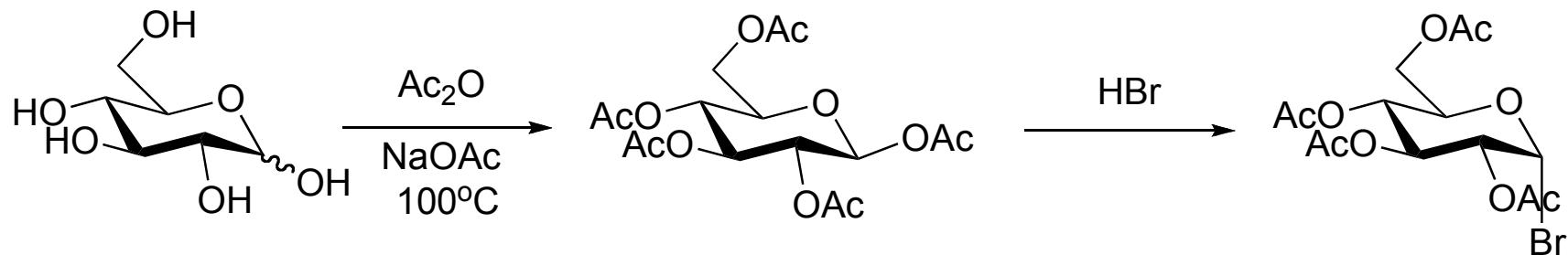


Which type glycosidic bond is easy to form?

2. ANOMERIC ACETATES

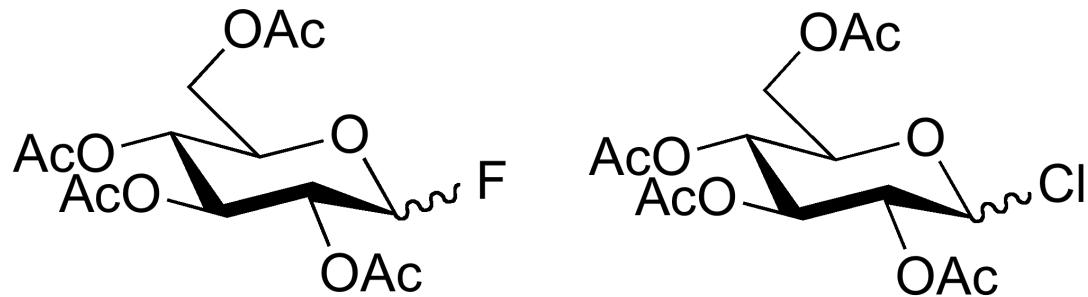
Sugars can be easily acetylated leading to α - or β -anomeric acetates depending on the rxn conditions.

Anomeric acetates are useful precursors for the introduction of other substituents at the anomeric position, since acetates can act as a leaving group under acidic conditions.



Bromides formed exclusively as the α - anomers which are thermodynamically favoured by the anomeric effect.

Although neighbouring group participation might lead to the less stable β -pdts.



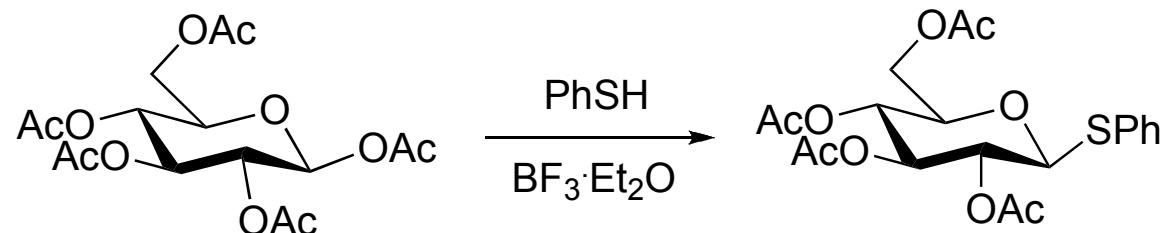
Form analogously, although the increasing strength of the halogen-carbon bond means what equilibration becomes a slower process allowing the observation of the kinetic β -pdts.

Displacement of anomeric acetates with other nucleophiles

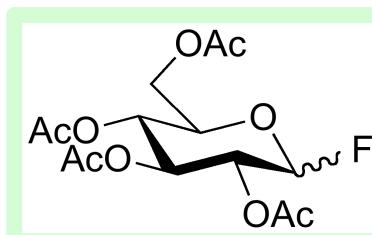
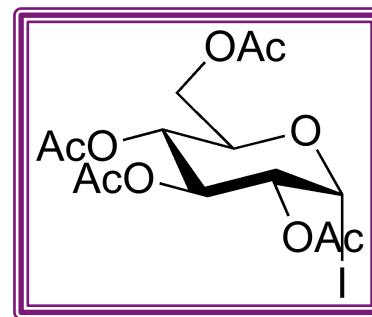
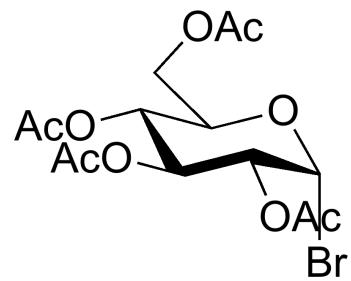
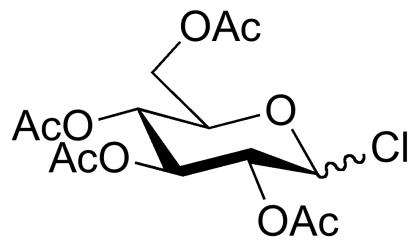
Under Lewis acid conditions.

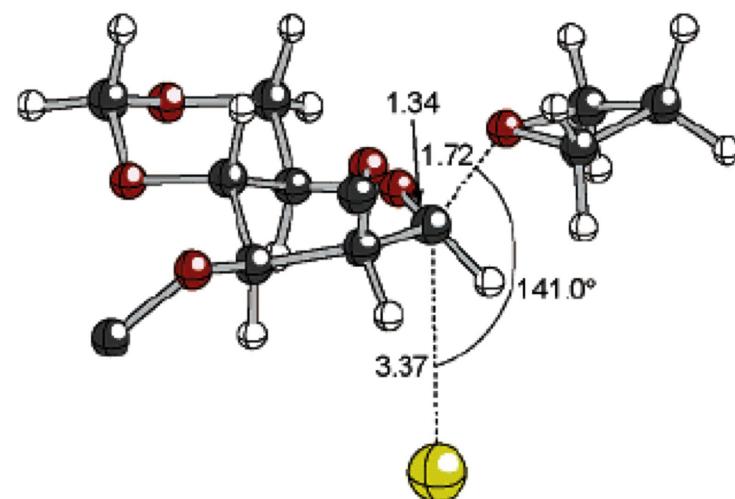
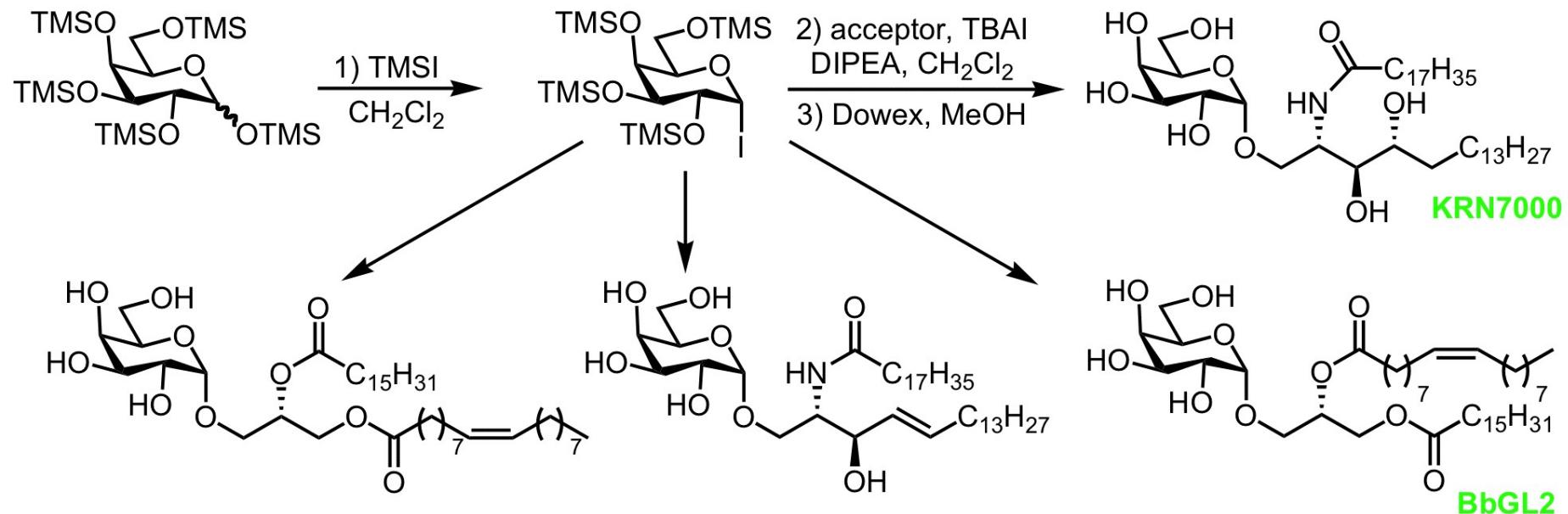
The selenoglycosides may be formed in a similar manner.

Stable anomeric substituents can be selectively activated into good leaving groups.

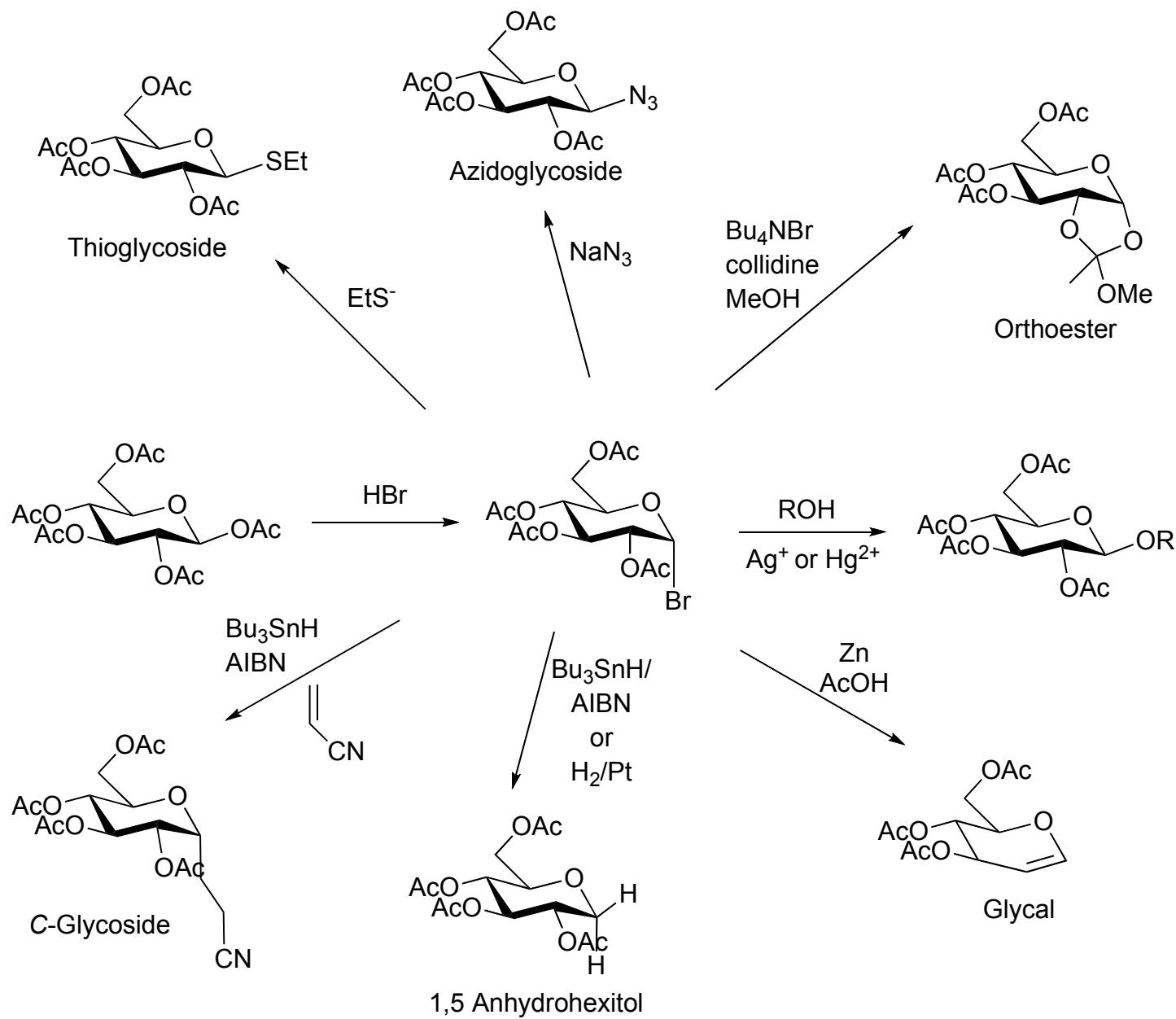


3. ANOMERIC HALIDES

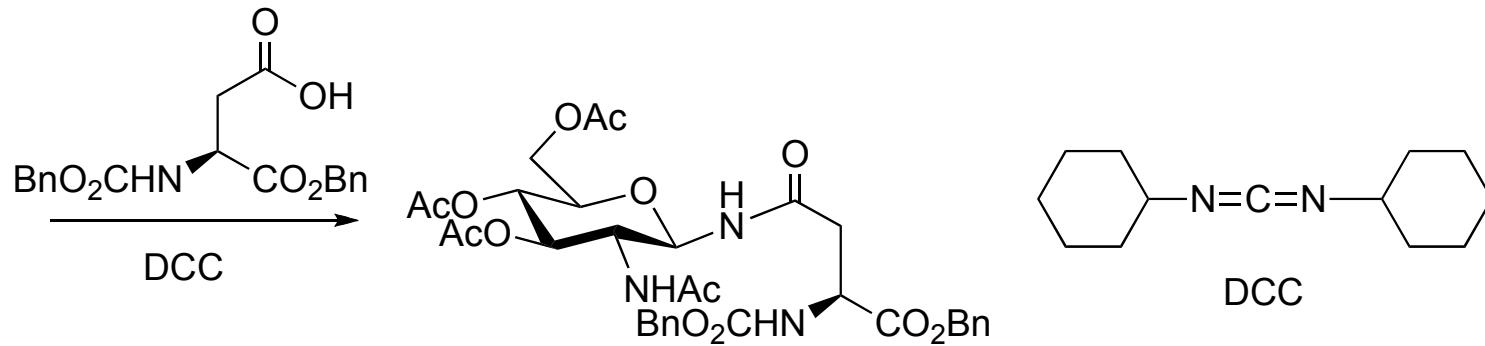
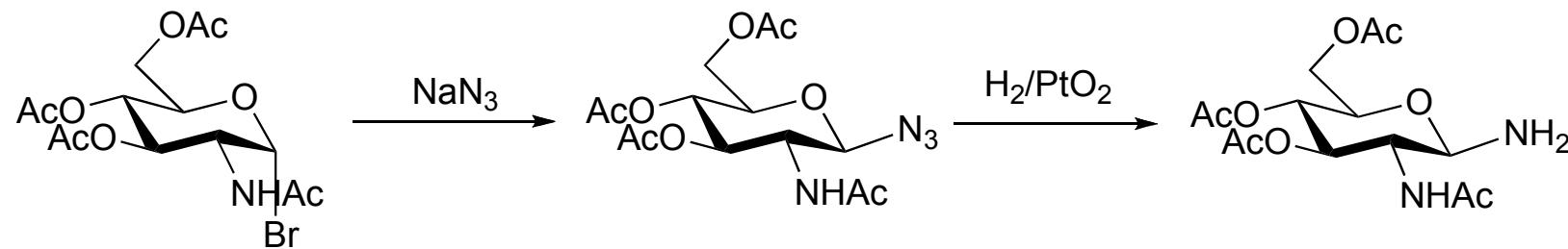
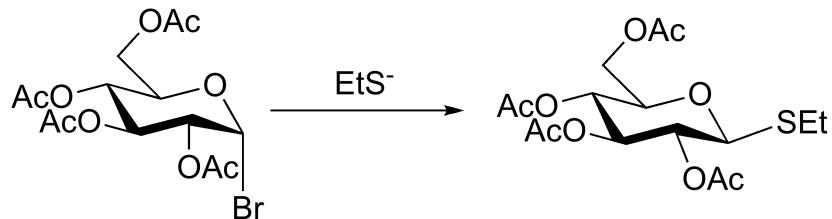




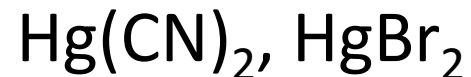
http://chemgroups.ucdavis.edu/%7Egervay-hague/posters/Glycosyl_Iodides_A_Pow.html



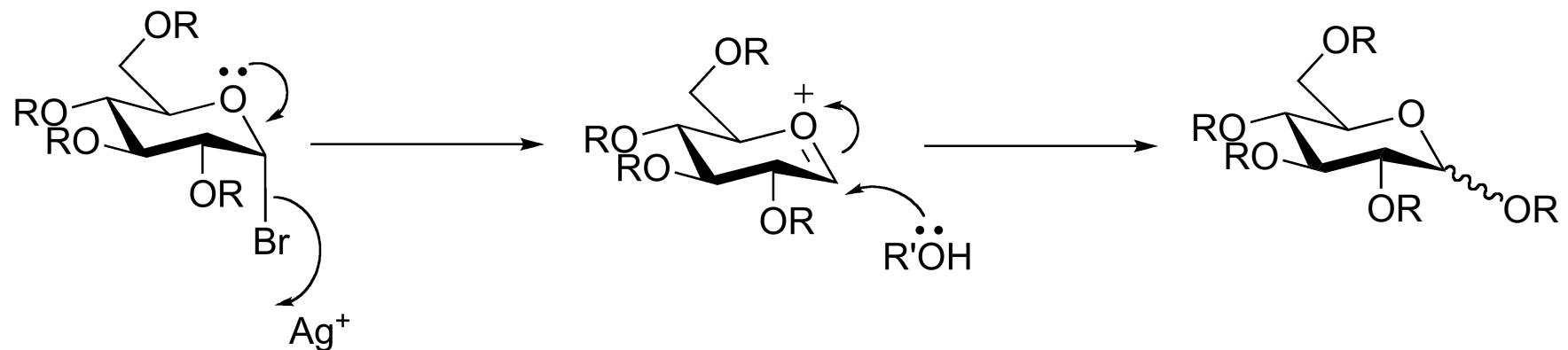
3.1 Nucleophilic substitution rxns



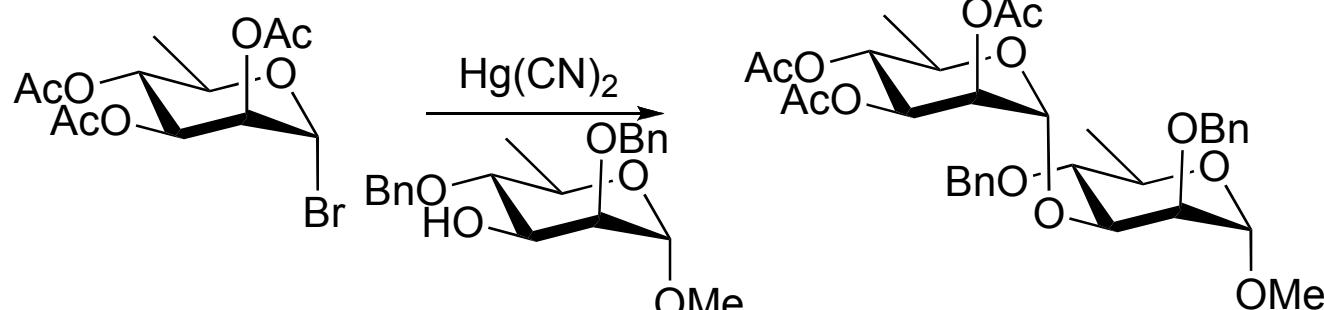
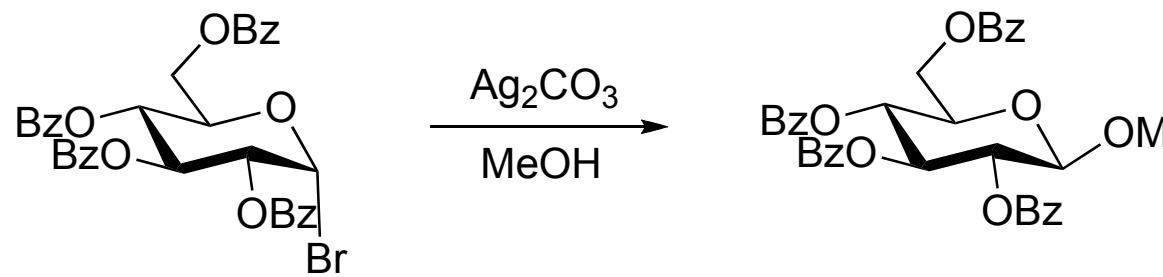
with poorer nucleophiles, such as alcohols



These activators can be regarded as halophiles which aid the departure of the anomeric bromide.



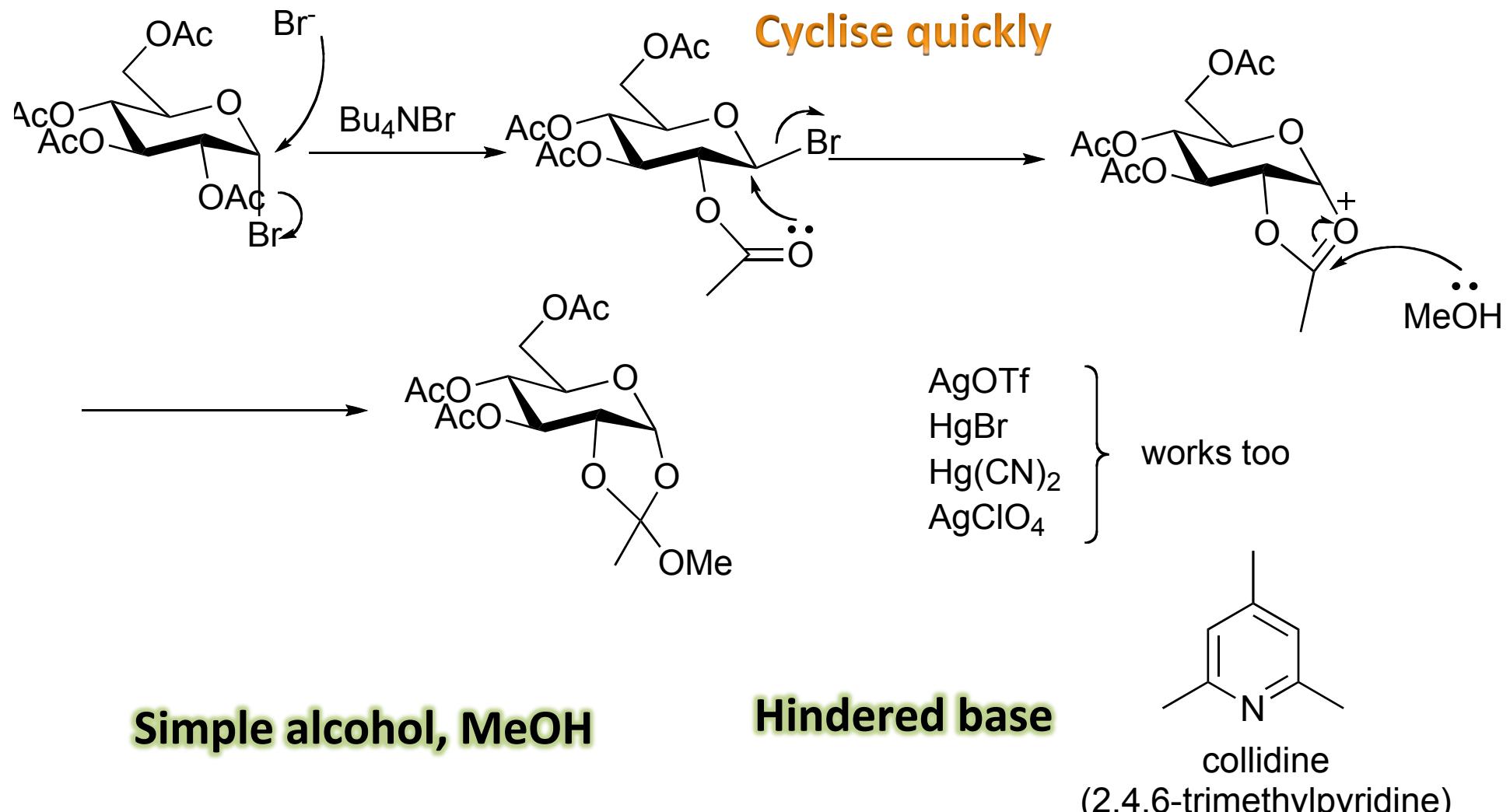
Koenigs-knorr synthesis



anhydrous conditions, e.g. dry DCM

dates back in 1901. named after the two pioneering carbohydrate chemists who first performed these investigations

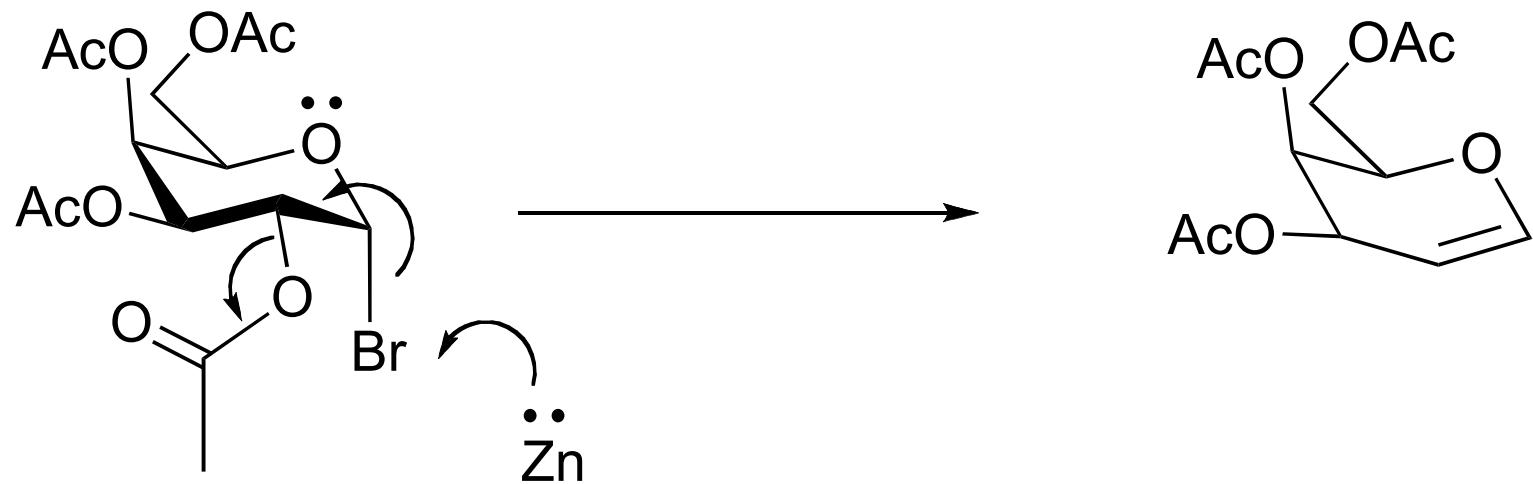
expecting rxns with neighbouring group participation, to 1,2-trans



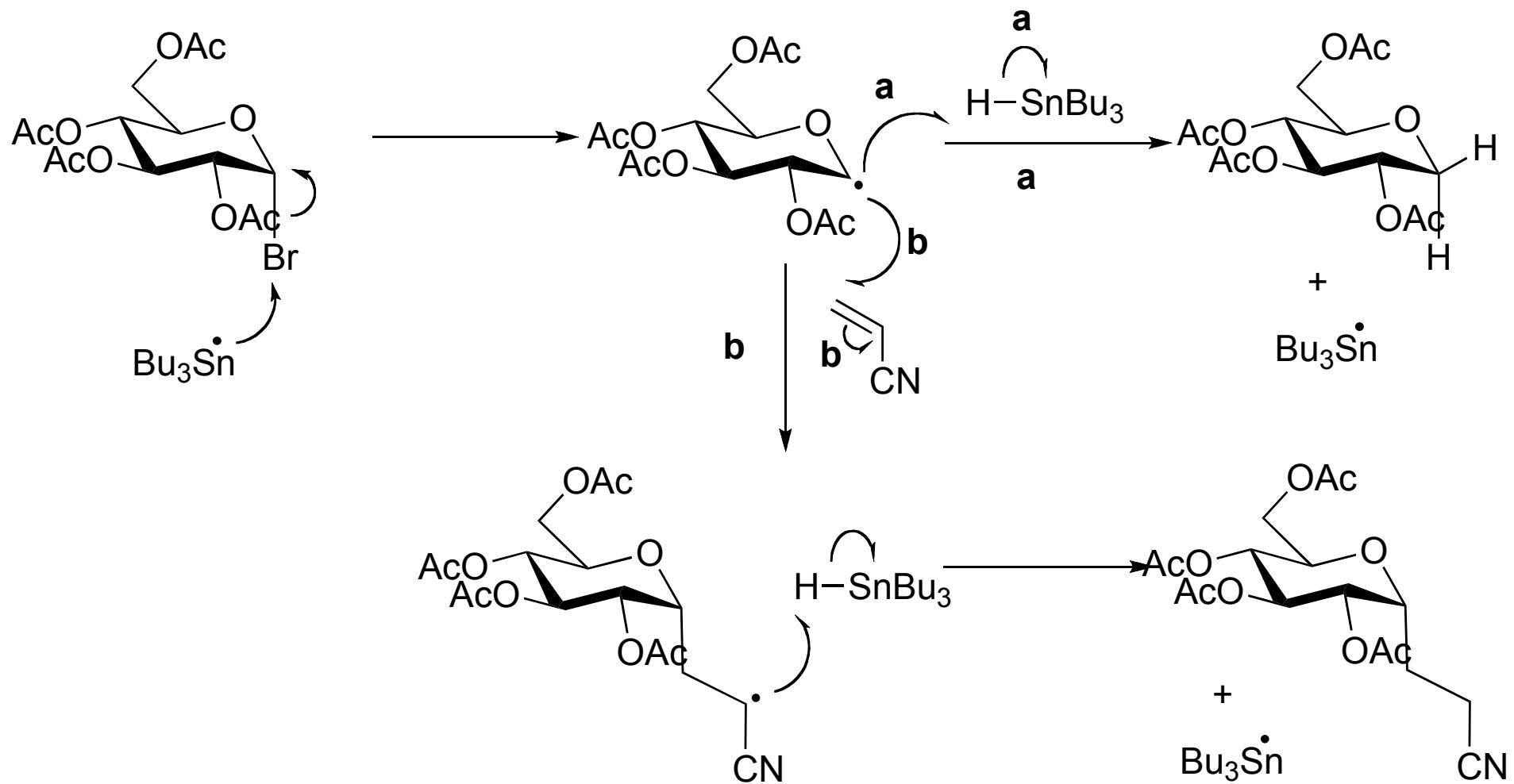
Bu₄NBr, nucleophilic catalyst, allow conversion of the initial α-bromide to the more labile β-bromide by an S_N2

3.2 Reductive elimination rxns, synthesis of glycals

Zinc in acetic acid, useful intermediate for disaccharide synthesis



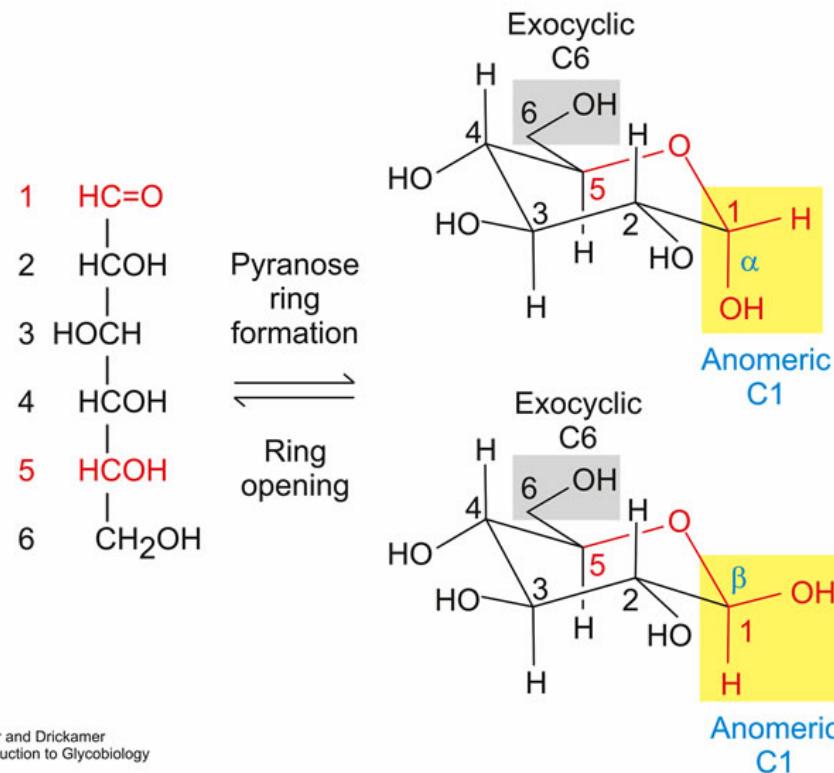
3.3 Free radical rxns



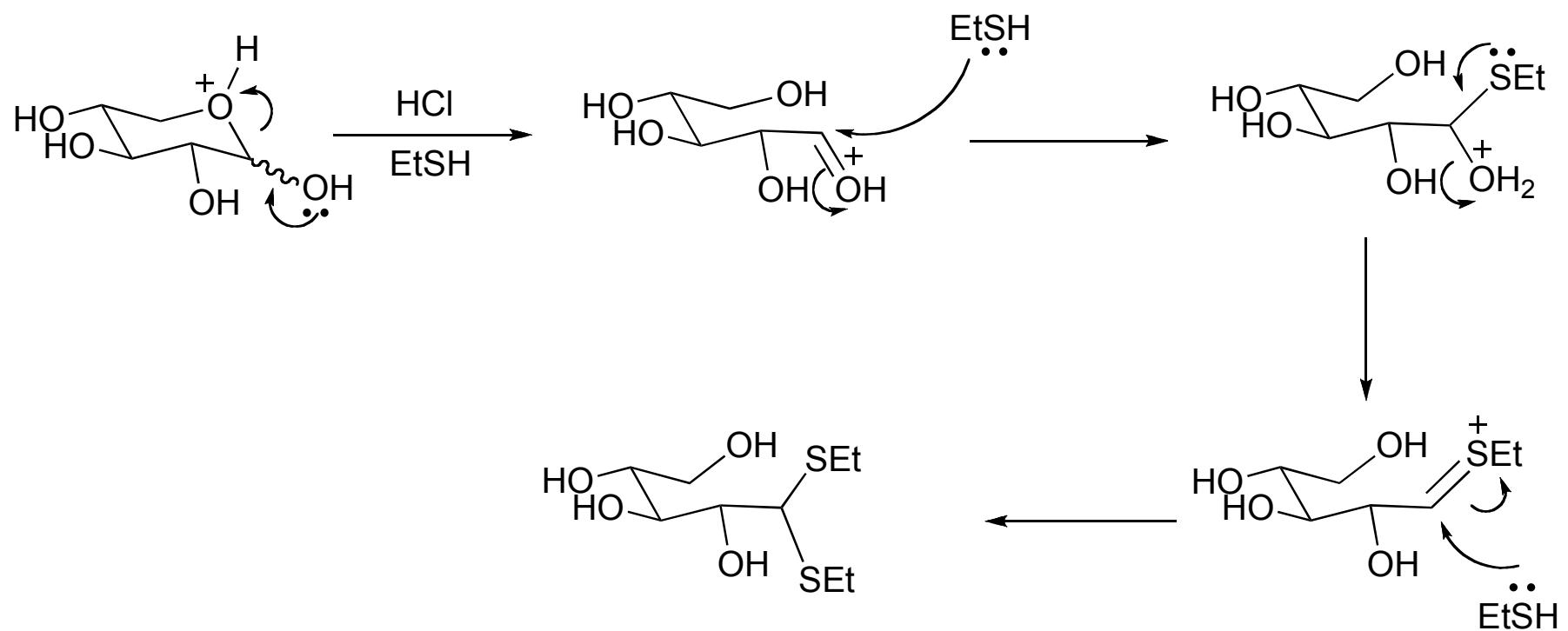
4. Nucleophilic Addition To The Anomeric Centre

Capture of the open chain aldehyde

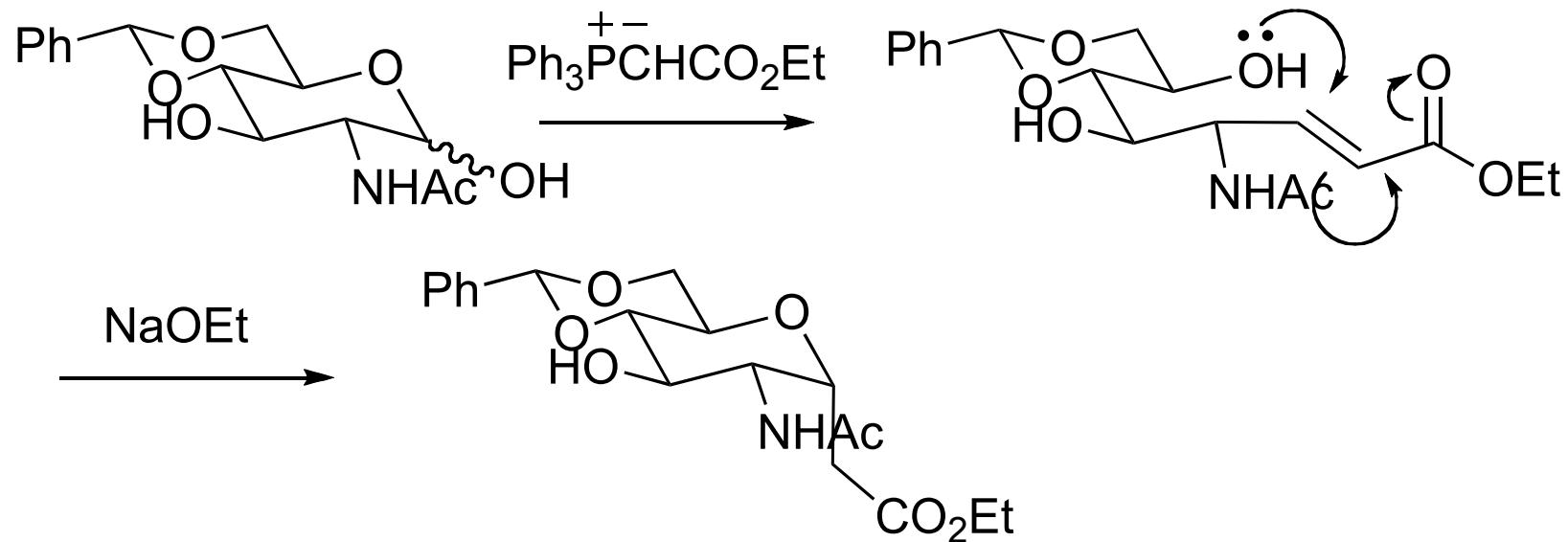
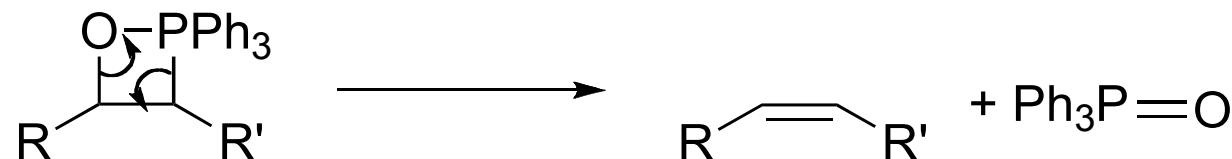
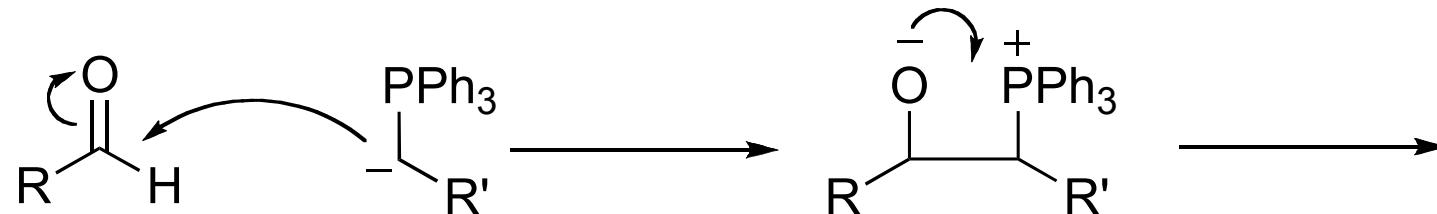
Figure 1.4 Two ways to form a pyranose (6-member) ring from glucose



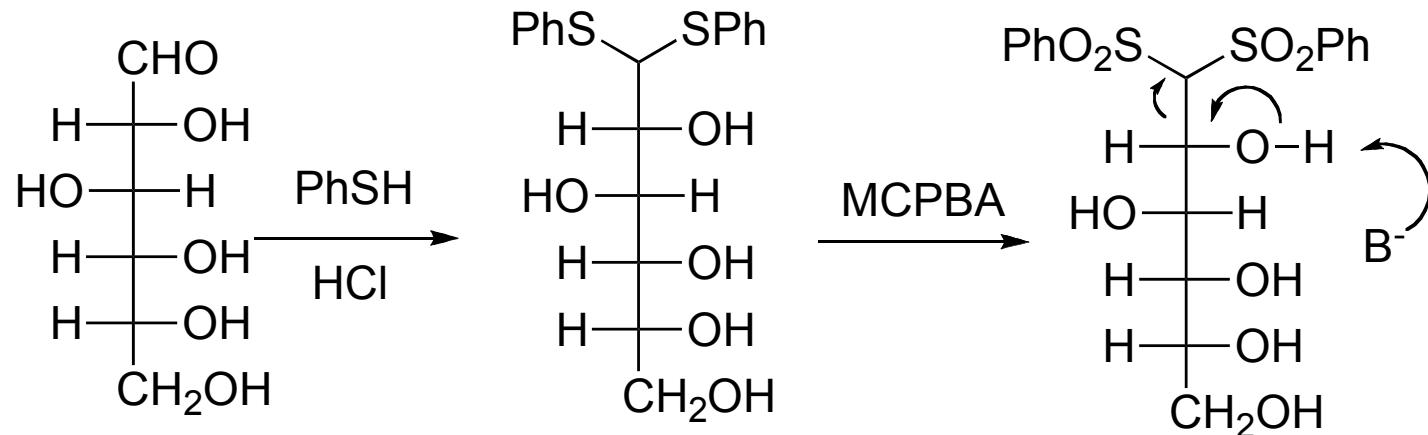
4.1 Dithioacetal formation



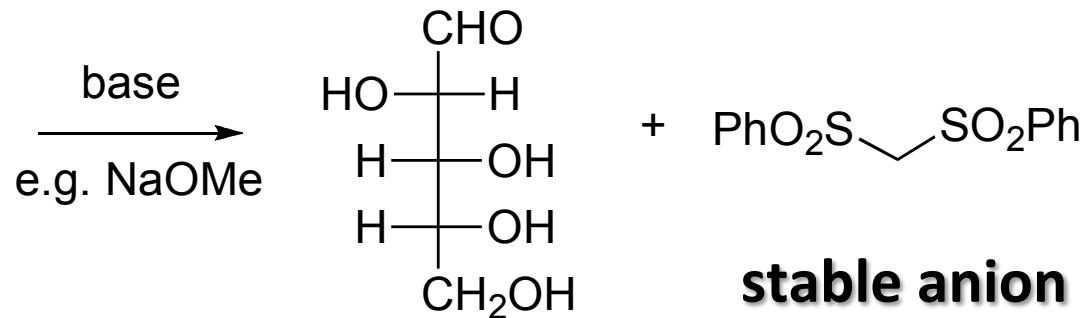
4.2 Wittig/Horner-Emmons rxn



5. Chain Degradation of Sugars

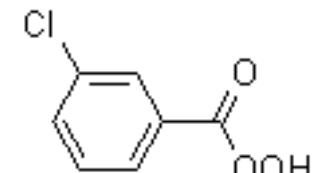


D-Glucose



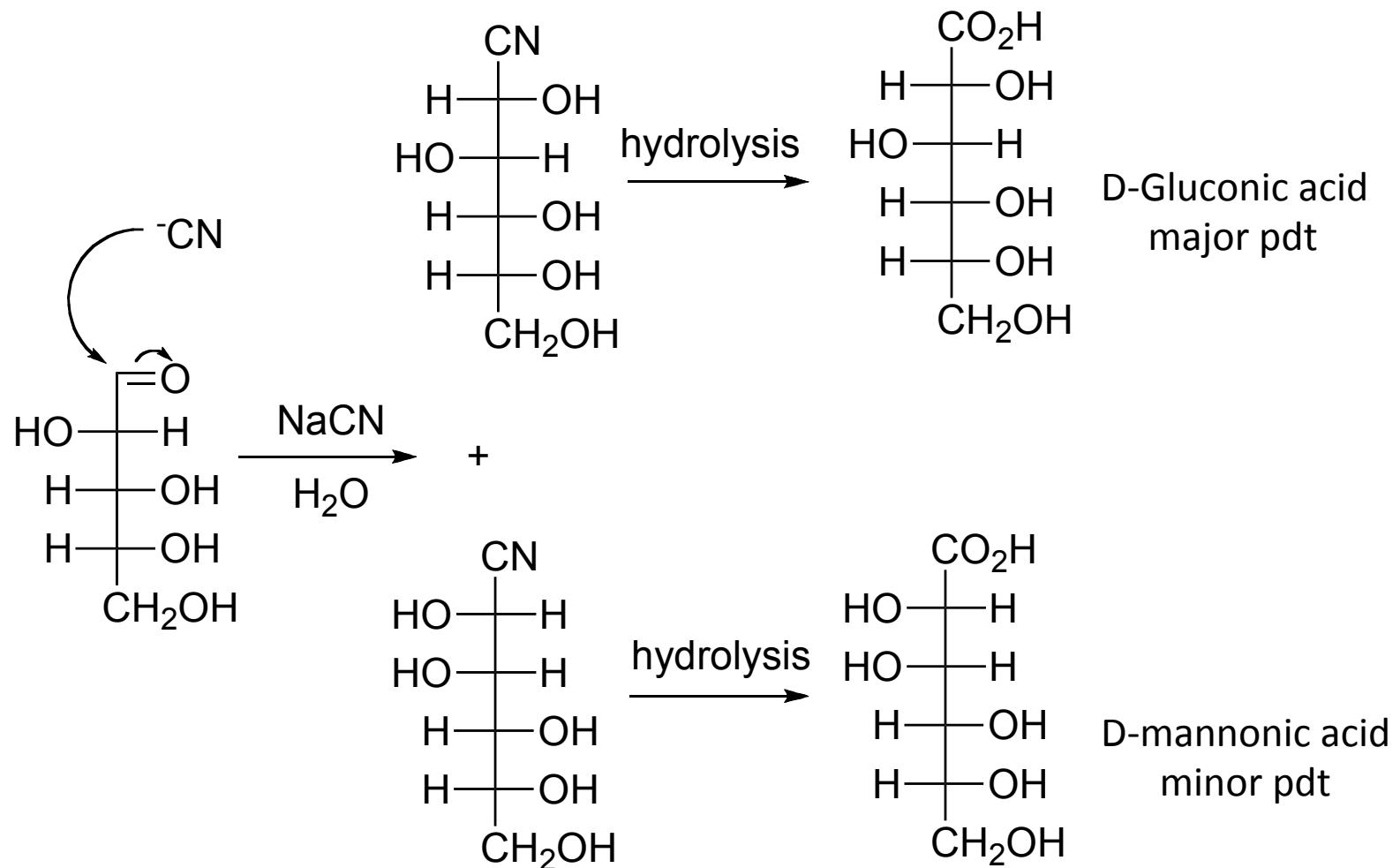
D-Arabinose

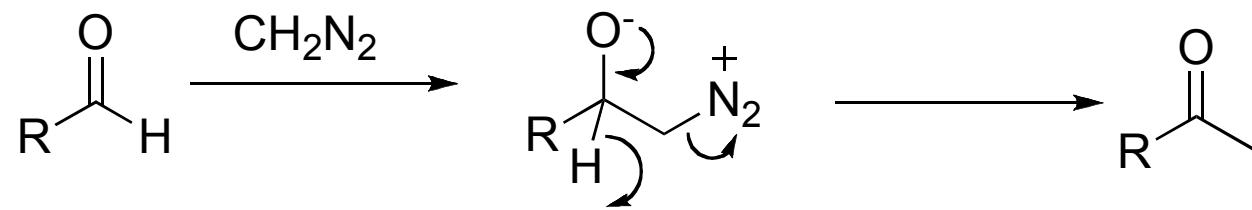
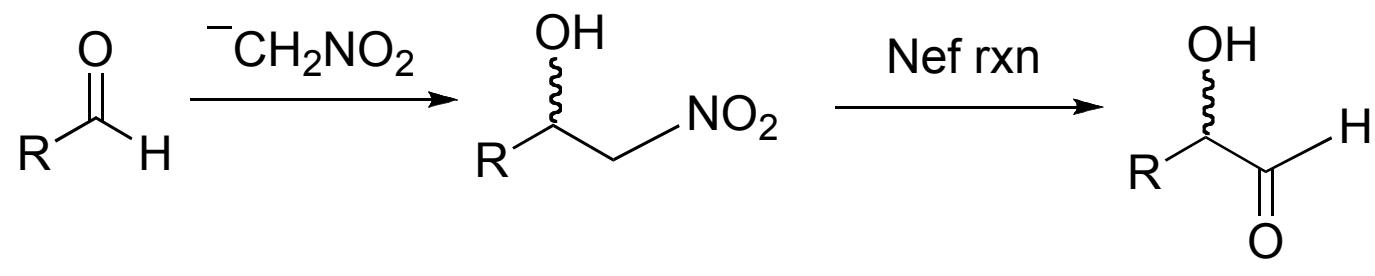
stable anion



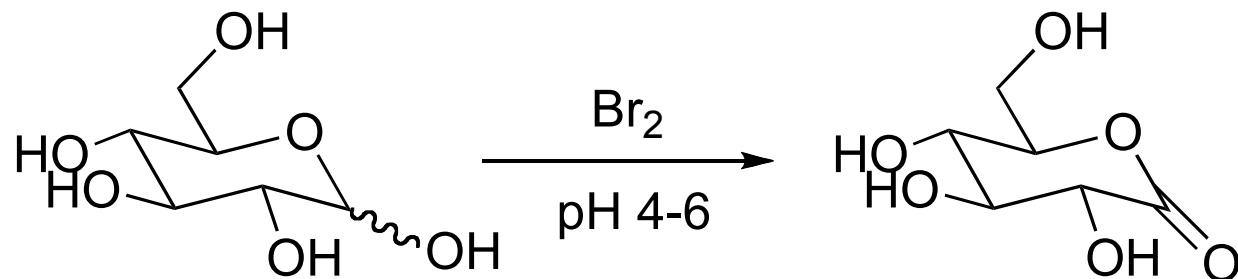
MCPBA
3-Chloroperoxybenzoic acid
meta-Chloroperbenzoic acid

6. Chain extension of sugars

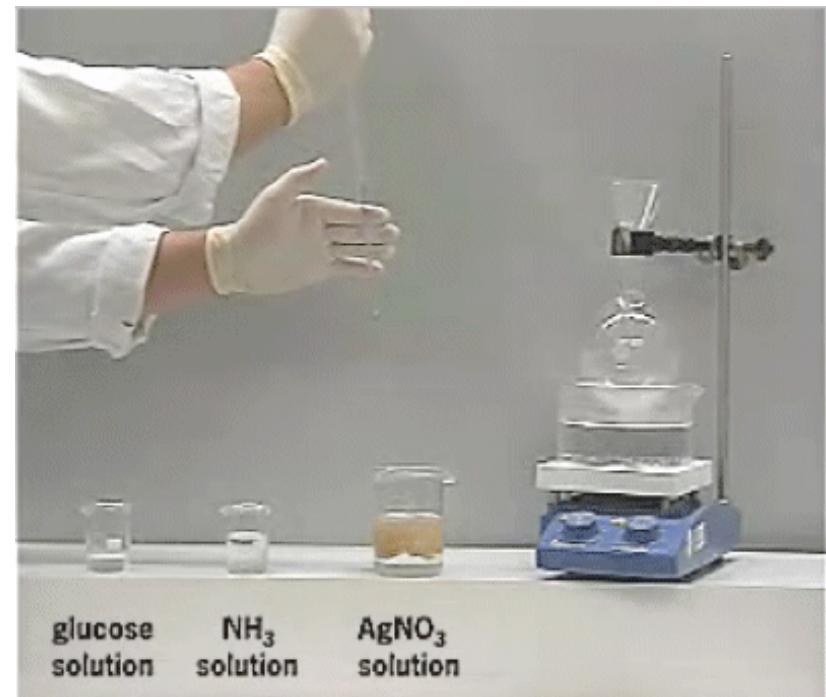




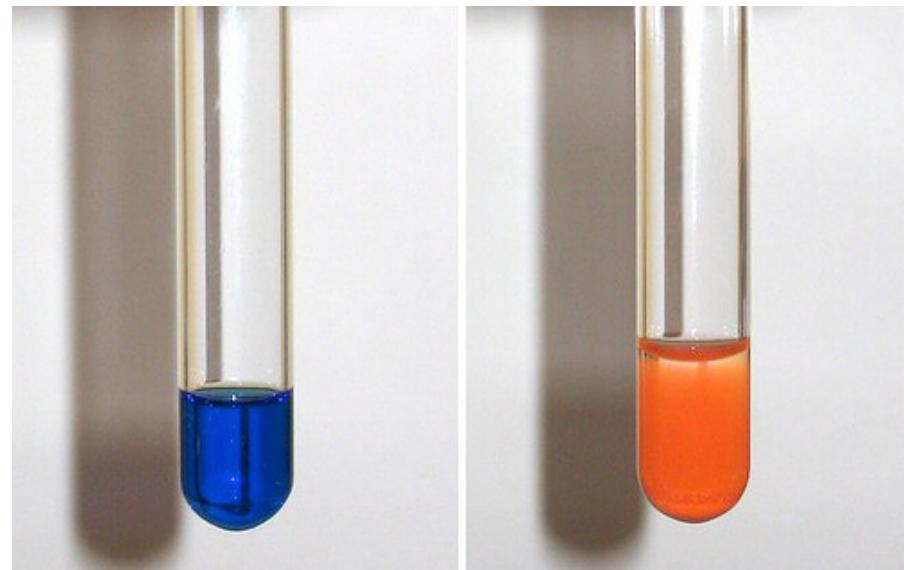
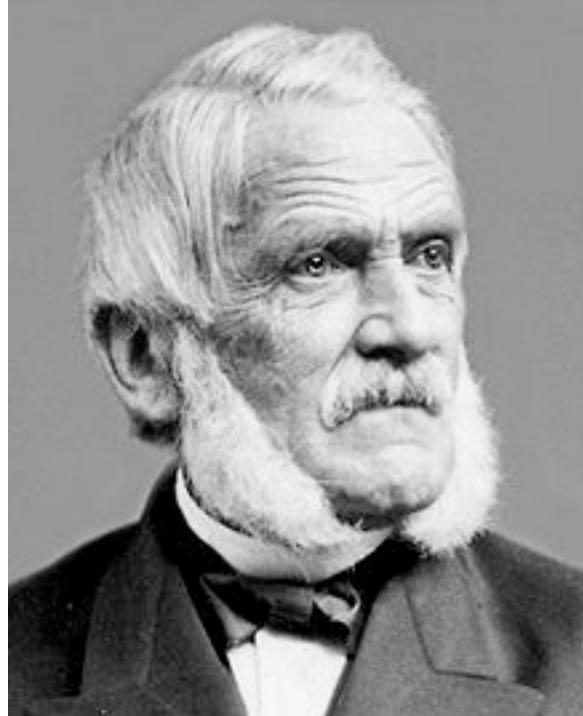
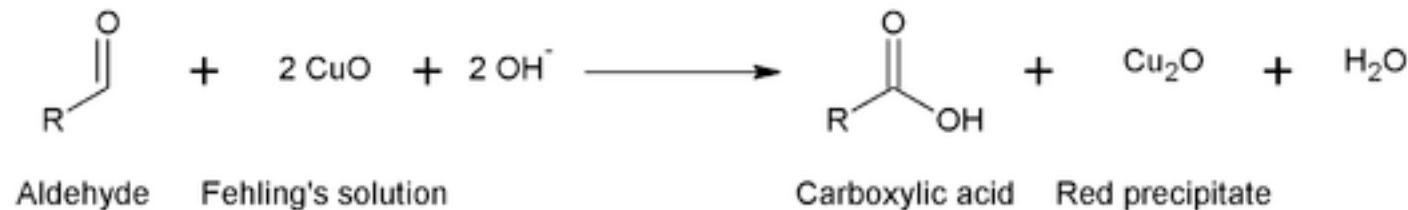
7. Oxidation/reduction reactions



Tollens Reaction - Silver Mirror Test



Hermann von Fehling



Reduction

