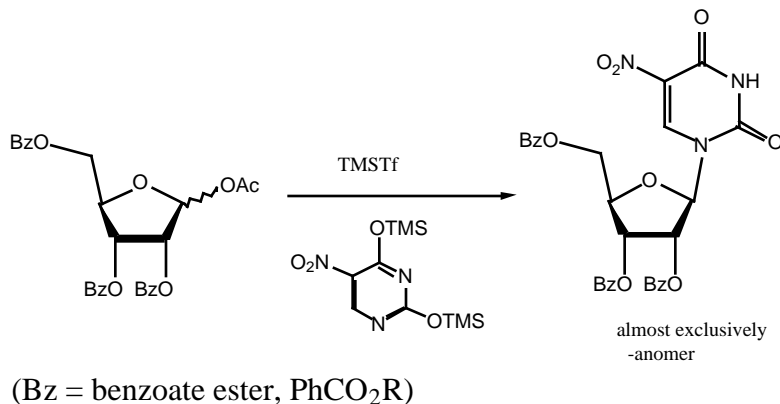


# Organic Cumulative Exam

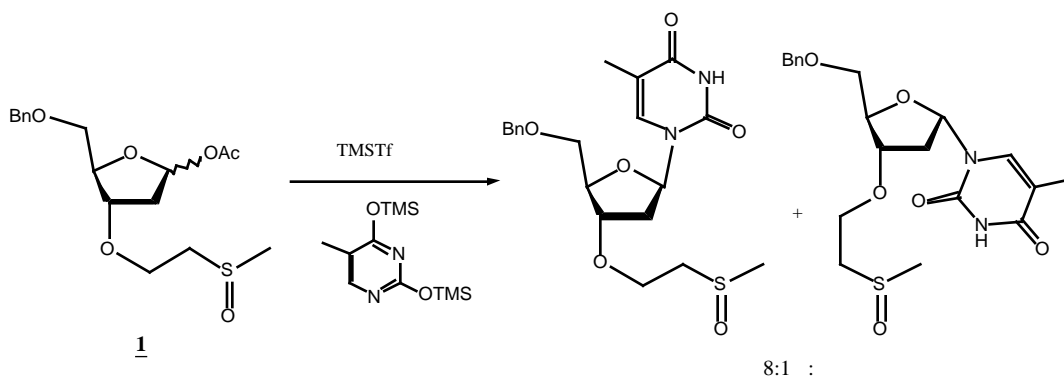
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Chemistry of N-Glycosylations  
Based upon: Wilson et al. *Synthesis* **1995**, 1465.

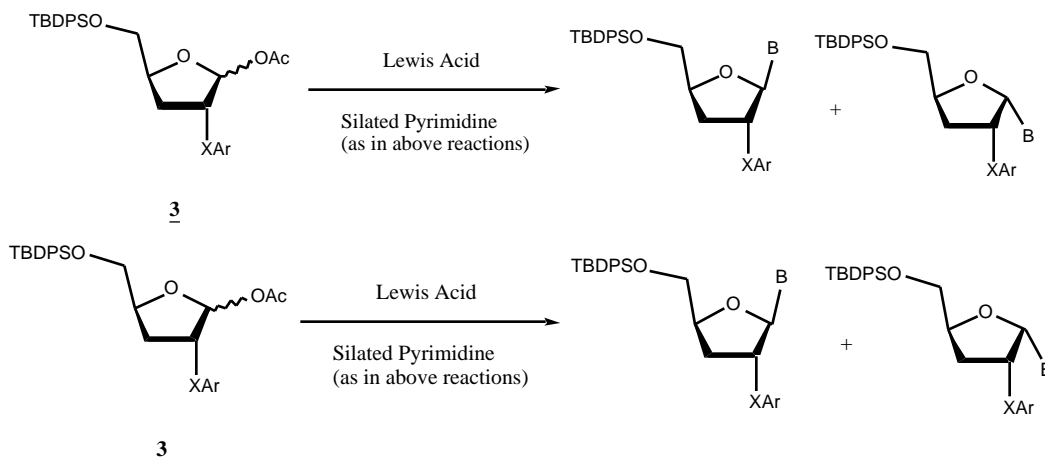
1. Explain the stereoselectivity of the reaction shown below. Of course, show chemical structures as part of your answer if it is useful.



2. The reaction shown above is useful for the preparation of ribonucleosides. However, 2'-deoxyribonucleosides cannot, generally, be prepared stereospecifically using this procedure. An exception is provided by the substituted 2'-deoxyribose derivative, **1**, which reacts with silylated nitrogen bases to provide an excess of the natural  $\beta$ -nucleoside anomer of a 2'-deoxyribonucleoside. Explain the stereochemical preference in this reaction.



3. Consider the reaction shown below:



Table

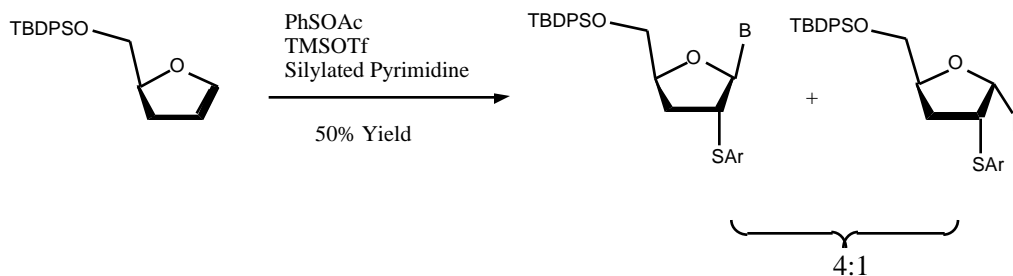
Note:

- When X=Se, a high preference for the  $\alpha$ -anomer is observed and the stereochemical outcome is not affected by the nature of the Lewis acid.
- When X=S the stereochemical outcome depends upon the Lewis acid and also can be affected by substitution on the S-Ar group.

a. Discuss the origin of the observed stereospecificity when X=Se. As always, show chemical structures where it is useful. Discuss all stereochemical and regiochemical issues.

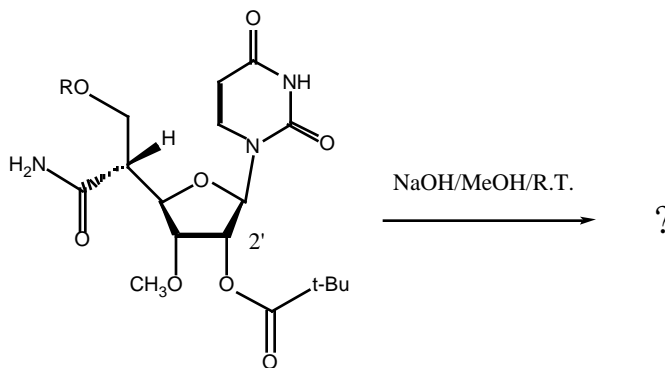
b. Discuss the origin of the observed stereospecificity when X=S. Note: When X=S, the reaction mechanism is different than when X=Se. The X=S reaction is affected by the Lewis acid and the X=Se reaction is not - make sure you suggest some possible reason(s) for this.

4. Interestingly, the dihydrofuran (glycal) shown below, when reacted with phenylsulfenyl acetate, affords products very similar to those obtained in the reaction of **3** (X=S) shown in the previous question.



Please show a mechanism for this reaction and discuss the important stereochemical and regiochemical issues for each step of the reaction.

5. Some related chemistry. Generally ribonucleosides are quite stable and removal of the hydroxyl protecting groups does not present a problem. However, the ribonucleoside natural product capuramycin decomposes under the basic conditions (methanolic KOH, R.T.) that were used to remove the 2'-pivaloyl protecting group. The products of this decomposition reaction have not been characterized. Assume that kinetic studies of the decomposition show that the reaction is unimolecular (does not depend upon the hydroxide concentration). Suggest what the products of the reaction might be and propose a pathway for their formation.



**Capuramycin**

In this question R is unimportant

6. Frank MacDonald (who spoke at Organic Chemistry Seminar last Spring) reported the synthesis of stavudine shown below. Please fill in the missing structures. For a chance at partial credit, please show how the products that you show arise.