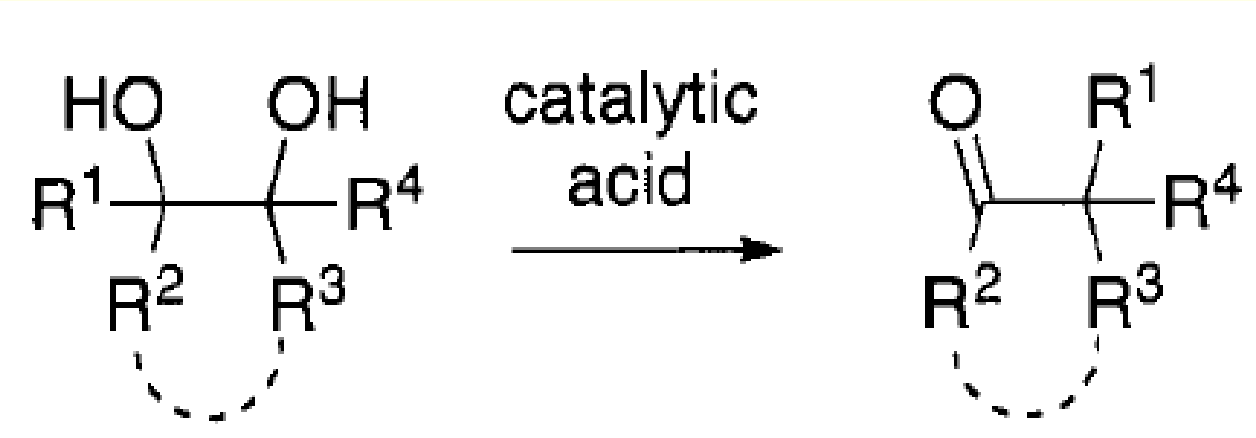
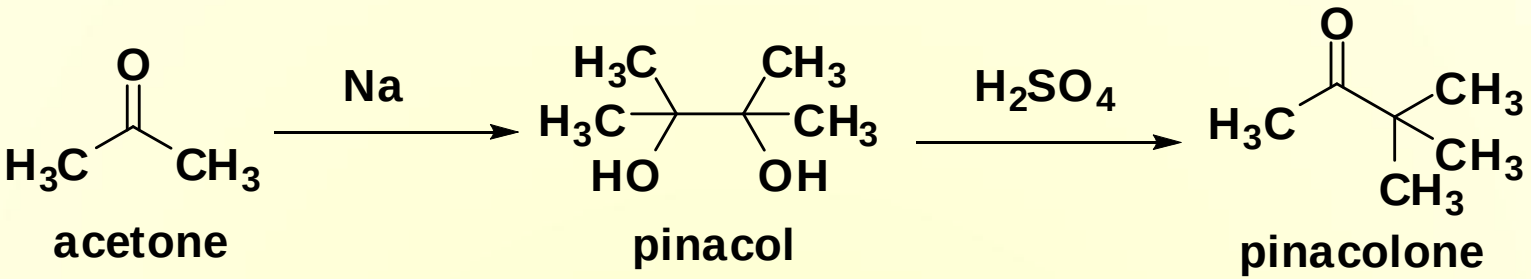
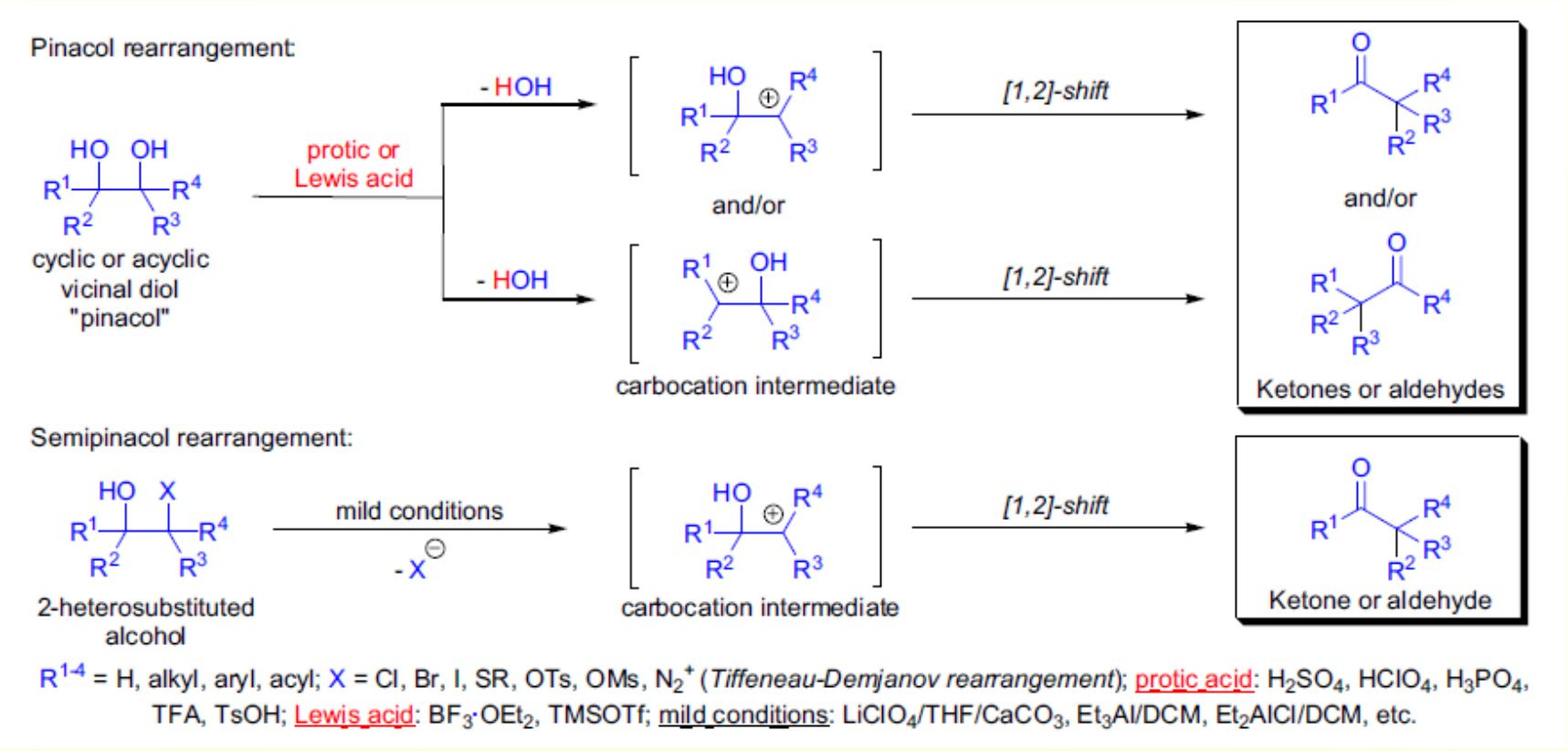
PINACOL AND SEMIPINACOL REARRANGEMENT



The **pinacol–pinacolone rearrangement** is a method for converting a 1,2-diol to a carbonyl compound in organic chemistry. The 1,2-rearrangement takes place under acidic conditions. The name of the rearrangement reaction comes from the rearrangement of pinacol to pinacolone. ---- wikipedia





邻二醇酸催化下E1类型脱水/ 邻位C-C键[1,2]-迁移产生醛、酮称为pinacol重排

如果离去基团不是水分子称为Semipinacol重排

4) the product is usually formed *via* the most stable carbocation intermediate when the glycol substrate is unsymmetrical;

5) the reaction can be highly regioselective and the regioselectivity is determined by the relative migratory aptitudes of the substituents attached to the carbon adjacent the carbocation center;

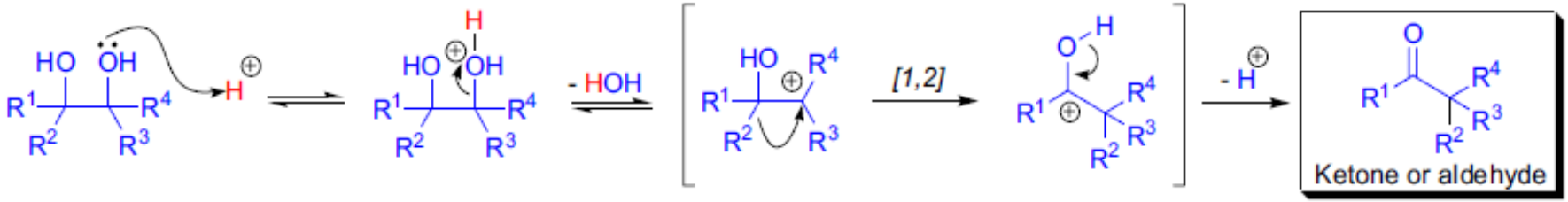
7) the relative migratory aptitudes are: aryl ~ H ~ vinyl (alkenyl) > *t*-Bu >> cyclopropyl > 2° alkyl > 1° alkyl;

9) cyclic systems may rearrange *via* both ring-expansion and ring-contraction and the course of the rearrangement is strongly influenced by the ring size;

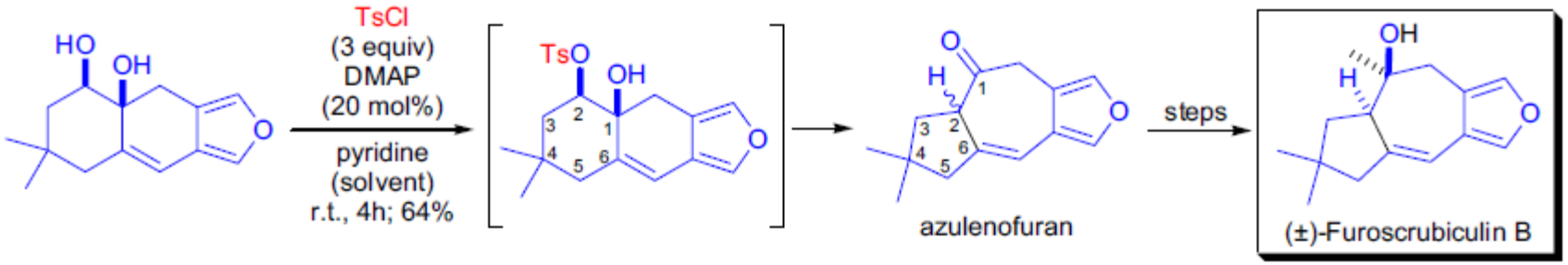
10) most often a cold aqueous solution of sulfuric acid (25% H_2SO_4) is used to effect the rearrangement; however, other acids such as perchloric acid and phosphoric acid have also been utilized;[10] and

Mechanism

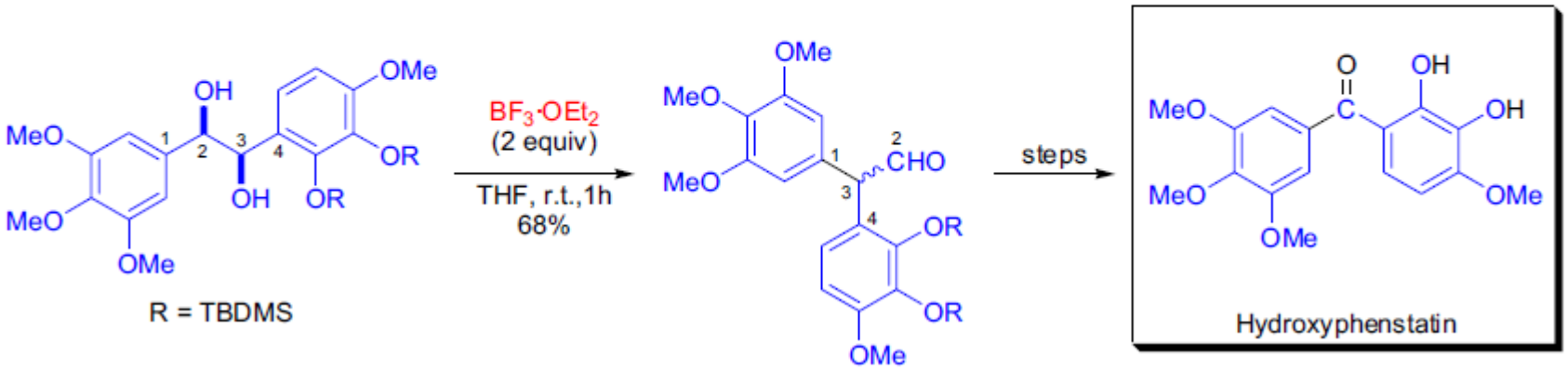
The first step of the process is the protonation of one of the hydroxyl groups, which results in the loss of a water molecule to give a carbocation intermediate. This intermediate undergoes a *[1,2]*-shift to give a more stable carbocation that upon the loss of proton gives the product. The pinacol rearrangement was shown to be exclusively intramolecular, and both inversion and retention were observed at the migrating center.



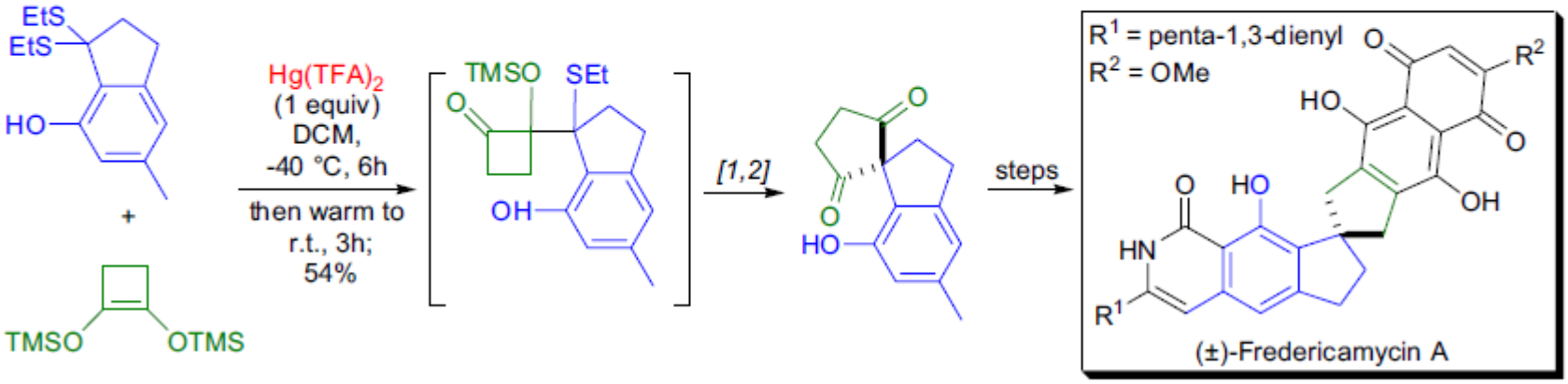
The total synthesis of (±)-furoscrobiculin B, a lactarane sesquiterpene isolated from basidiomycetes of mushrooms, was accomplished in the laboratory of H. Suemune and K. Kanematsu using a *furan ring transfer reaction* and a *semipinacol rearrangement* as key steps.[55] The secondary hydroxyl group of the tricyclic *cis*-vicinal diol substrate was converted to the corresponding tosylate that *in situ* underwent a ring-expansion reaction to afford an azulenofuran in good yield.



G.R. Pettit and co-workers converted a highly substituted *trans*-stilbene derivative to the strong cancer cell growth inhibitor and antimitotic agent hydroxyphenstatin.[56] The key step of the synthesis was a $BF_3{\cdot}OEt_2$-catalyzed *pinacol rearrangement* of an optically active vicinal diol to afford a substituted diphenylacetaldehyde in racemic form. From this key intermediate, several derivatives were prepared in addition to the target molecule.



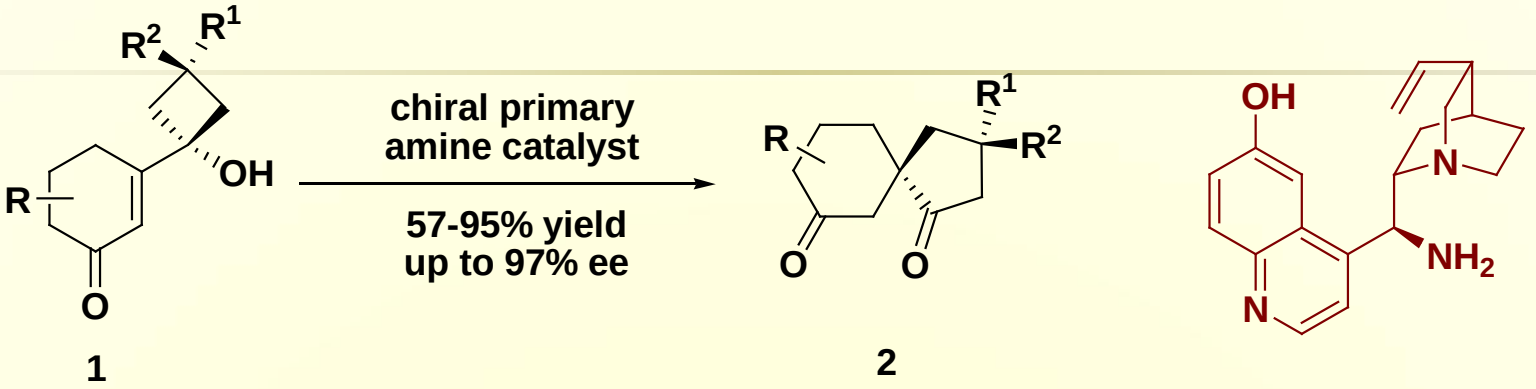
During the total synthesis of (±)-fredericamycin A, the spiro 1,3-dione center was introduced by R.D. Bach et al. utilizing a mild *mercury-mediated semipinacol rearrangement* that involved a *[1,2]*-acyl shift.[57] The indanone dithioacetal was reacted with 1,2-*bis*[(trimethylsilyl)oxy]cyclobut-1-ene in the presence of mercuric trifluoroacetate and the rearrangement took place *in situ*.



Indanone **10** was synthesized from *m*-cresol by an adaptation of a literature procedure.[23] Dithioacetal **11** was synthesized and subsequently treated with mercuric trifluoroacetate in the presence of 1,2-bis((trimethylsilyl)oxy)cyclobut-1-ene in methylene chloride at –40 °C. Upon warming to 25 °C the acyl migration afforded spiro diketone **13**, the complete CDE ring system, in a one-pot reaction (54% from **10**, Scheme 6). This spiroexpansion protocol involving a cyclobutanone intermediate was developed earlier by Kuwajima and his co-workers[24] and most recently improved upon by Burnell and co-workers.[25]

Kuwajima, I.; Nakamura, E. Org. Synth. 1987, 65, 17.

Burnell, D. J.; Jenkins, T. J. J. Org. Chem. 1994, 59, 1485.



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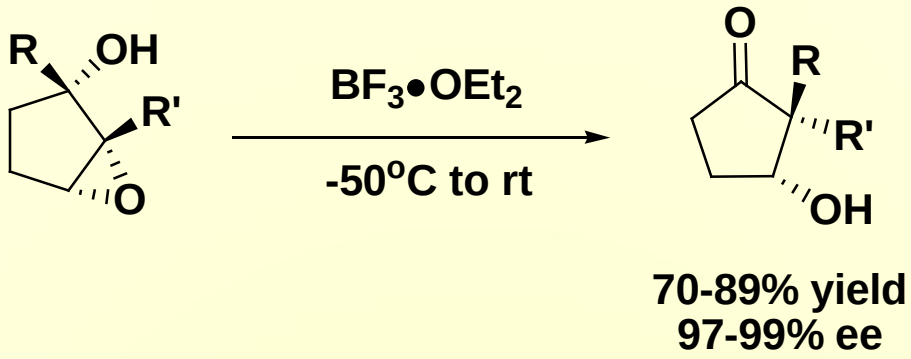

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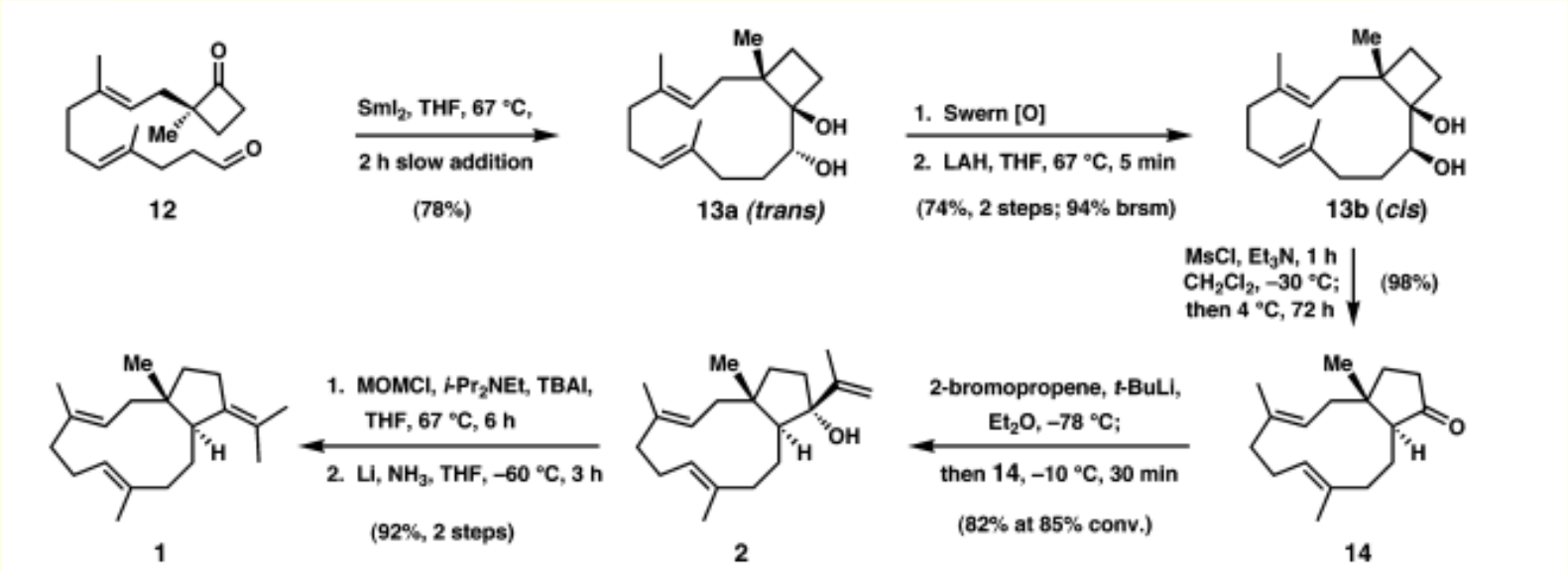

J. AM. CHEM. SOC. 2005, 127, 13813-13815