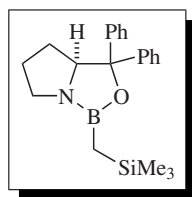


(S)-3,3-Diphenyl-1-[trimethylsilylmethyl]-tetrahydro-1H,3H-pyrrolo[1,2-c][1,3,2]-oxazaborole¹

[174004-13-8] C₂₁H₂₈BNOSi (MW 349.35)
 InChI = 1/C21H28BNOSi/c1-25(2,3)17-22-23-16-10-15-20(23)
 21(24-22,18-11-6-4-7-12-18)19-13-8-5-9-14-19/h4-9,11-
 14,20H,10,15-17H2,1-3H3/t20-/s2
 InChIKey = OBWYSZFYGYDSL B-GNLP SFAGBS

(enantioselective carbonyl reduction¹)

Solubility: soluble in most organic solvents but the reactions are typically carried out in CH₂Cl₂.

Form Supplied in: colorless oil, not commercially available.

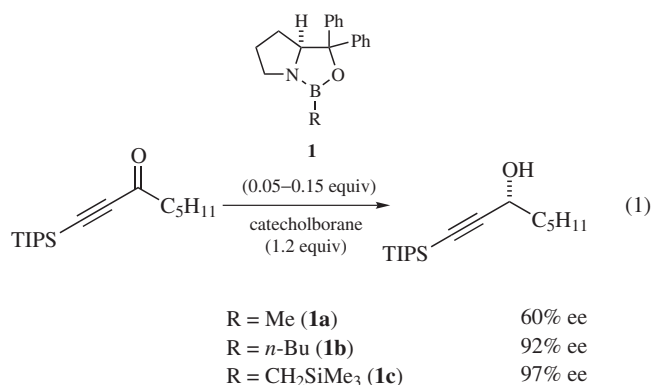
Analysis of Reagent Purity: NMR (¹H, ¹³C, ¹¹B).

Preparative Methods: the reagent is easily prepared from trimethylsilylmethylboronic acid^{2,3} and (S)-(-)-α,α-diphenyl-2-pyrrolidinemethanol^{1,3,4}. The other enantiomer is also readily available from (R)-(+)-α,α-diphenyl-2-pyrrolidinemethanol.

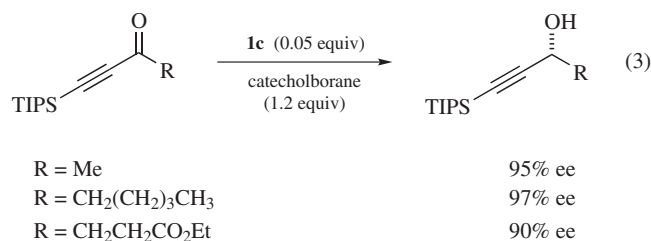
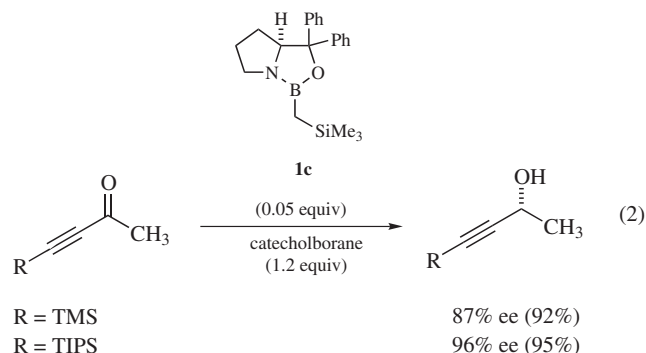
Purity: not easily purified since the reagent hydrolyzes slowly in the presence of moisture and slowly oxidizes in the presence of oxygen.

Handling, Storage, and Precautions: the reagent is stable when stored under an inert atmosphere. The catalyst is usually stored as a 0.2 M solution in toluene but the toluene is usually removed before the reaction solvent is added.

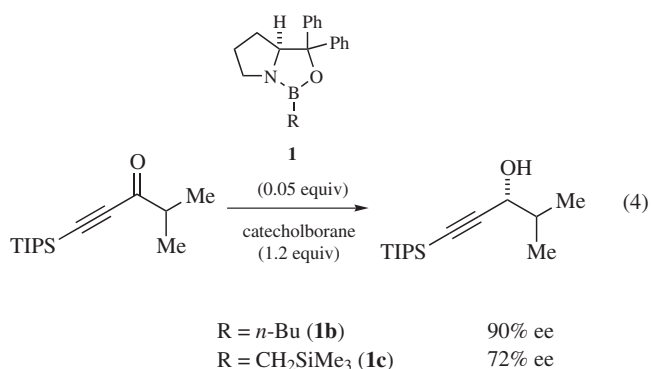
Enantioselective Reduction of α,β-Ynone. Oxazaborolidine ligands **1** are among the most effective catalysts for the enantioselective reduction of ketones to secondary alcohols.³ Substitution of the methyl or butyl group on boron by a trimethylsilylmethyl group led to a much improved catalyst for the catecholborane mediated reduction of α,β-yones. For example, the enantioselectivities for the reduction of an α,β-ynone was improved from 60% to 98.5% when the nature of the R group was modified (eq 1).³



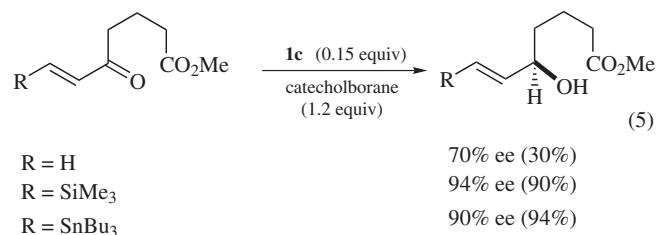
The level of enantioselectivity is quite dependant on the nature of the ketone and on the alkyne substituents. Sterically bulky substituents at the alkyne position usually give higher enantioselectivities (eq 2), whereas ketones bearing long alkyl chains are also reduced with higher enantiocontrol (eq 3).



However, it would appear that further substitution at the α-position is detrimental for the level of enantioselection. In those cases, the use of the butyl-substituted catalyst resulted in a substantial improvement in the enantioselectivity (eq 4).⁵



Enantioselective Reduction of α,β-Enones. Oxazaborolidine catalyst **1c** was also found to be a superior catalyst compared to **1a** and **1b** for the reduction of α,β-unsaturated ketone derivatives (eq 5).⁶ It is interesting to note that the presence of a bulky substituent at the β-position is mandatory for high enantiocontrol. This reaction has been used as a key step in the synthesis of atracyligenin.⁶ This catalyst has also been used to reduce α,β-unsaturated ketones bearing a trifluoromethyl group in 87% ee.⁷



- (a) Corey, E. J.; Helal, C. J., *Angew. Chem., Int. Ed. Engl.* **1998**, *37*, 1987.
(b) Carboni, B.; Monnier, L., *Tetrahedron* **1999**, *55*, 1197. (c) Fache, F.; Schulz, E.; Tommasino, M. L.; Lemaire, M., *Chem. Rev.* **2000**, *100*, 2159.
- (a) Matteson, D. S.; Majumdar, D., *J. Chem. Soc., Chem. Comm.* **1989**, 39. (b) Matteson, D. S., *Organometallics* **1983**, *2*, 236.
- Helal, C. J.; Magriotis, P. A.; Corey, E. J., *J. Am. Chem. Soc.* **1996**, *118*, 10938.

- (a) Corey, E. J.; Shibata, S.; Bakshi, R. K., *J. Org. Chem.* **1988**, *53*, 2861. (b) Mathre, D. J.; Jones, T. K.; Xavier, L. C.; Blacklock, T. J.; Reamer, R. A.; Mohan, J. J.; Jones, E. T. T.; Hoogsteen, K.; Baum, M. W.; Grabowski, E. J. J., *J. Org. Chem.* **1991**, *56*, 751. (c) Kanth, J. V. B.; Periasamy, M., *Tetrahedron* **1993**, *49*, 5127. (d) Delaunay, D.; Corre, M. L., *J. Chem. Soc. Perkin Trans I* **1994**, 3041. (e) Kaufman, T. S.; Ponzo, V. L.; Zinzuk, J., *Org. Prep. Proced. Int.* **1996**, *28*, 487.
- Corey, E. J.; Helal, C. J., *Tetrahedron Lett.* **1997**, *38*, 7511.
- Corey, E. J.; Guzman-Perez, A.; Lazerwith, S. E., *J. Am. Chem. Soc.* **1997**, *119*, 11769.
- Nenajdenko, V. G.; Smolko, K. I.; Balenkova, E. S., *Tetrahedron: Asymmetry* **2001**, *12*, 1259.

André B. Charette
Université de Montréal, Montréal, Québec, Canada