One-Carbon Ring Expansions of Heterocycles

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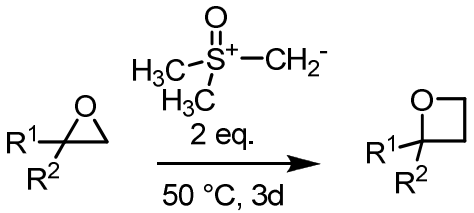
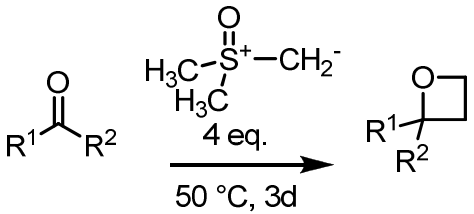
16 September 2009

Sulfoxonium Ylide



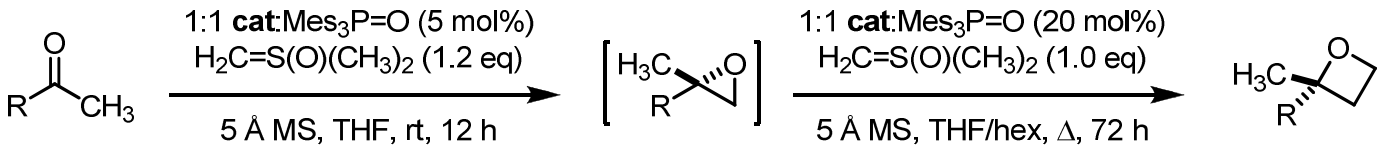
R^1	R^2	yield
H	Ph	94
Ph	Ph	99
Me	Ph	85



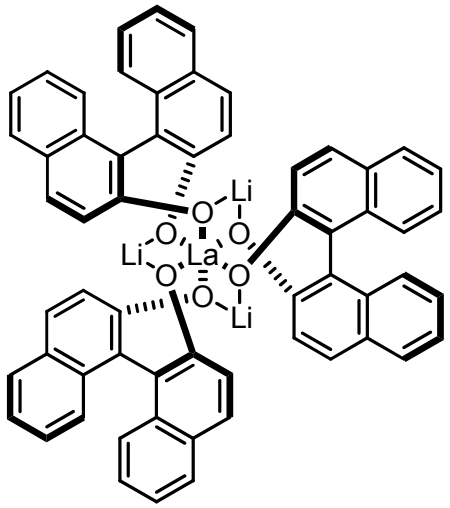
R^1	R^2	yield
H	Ph	93
Ph	Ph	97
Me	Ph	90

Okuma, K.; Tanaka, Y.; Kaji, S.; Ohta, H. *J. Org. Chem.* **1983**, *48*, 5133-5134.

… Made Enantioselective

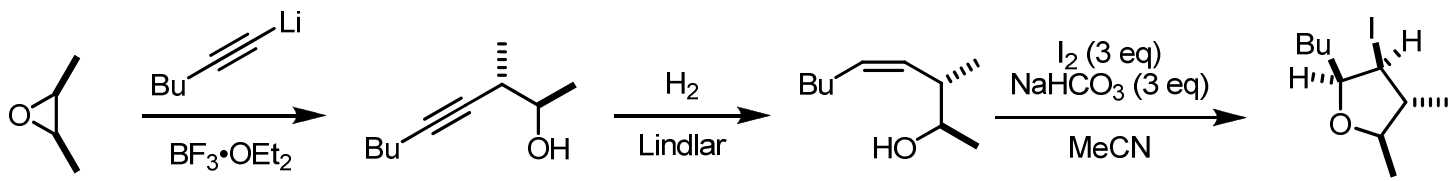


R	% Yield	% ee
Ph	74	99
naph	62	99
p-ClPh	86	99
n-octyl	88	99
Cy	58	>99.5



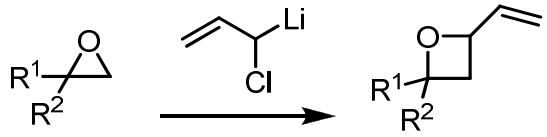
cat

Ok, a 2-carbon ring expansion



Barks, J. M.; Knight, D. W.; Seaman, C. J.; Weingarten, G. G. *Tetrahedron Lett.* **1994**, *35*, 7259-1262.

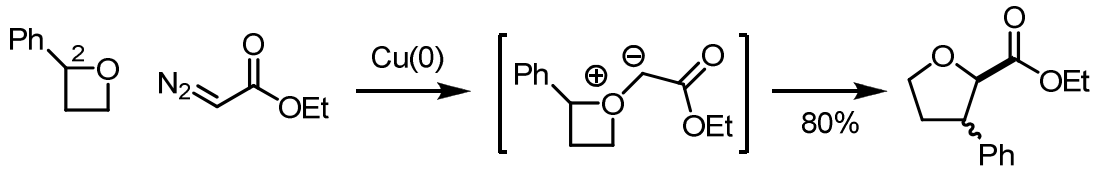
Chloroallyllithium as vinyl carbene

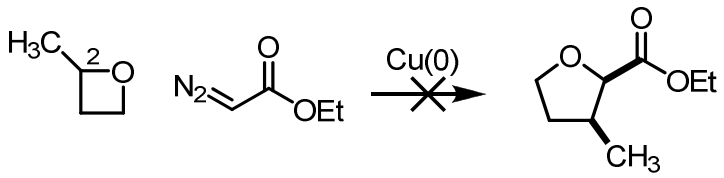


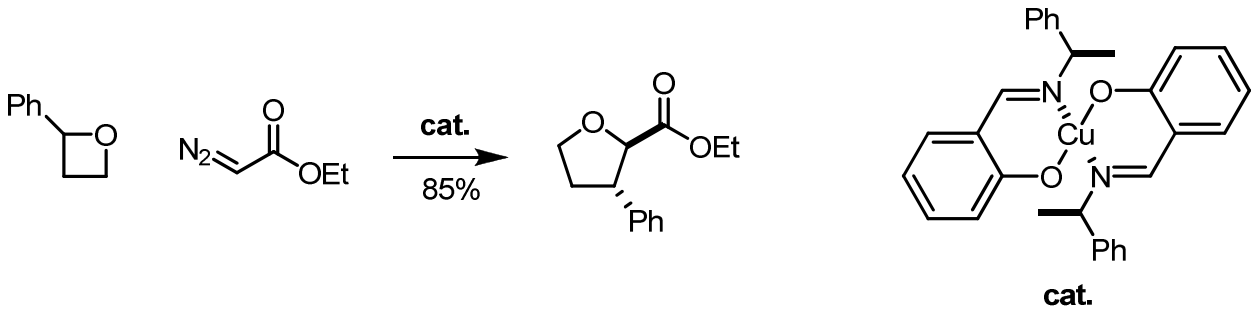
R^1	R^2	yield
Pr	Pr	40
Allyl	Allyl	52
Ph	H	36

Ongoka, P. Mauze, B.; Miginiac, L. *J. Organometal. Chem.* **1985**, *284*, 139-147.

Carbene-Induced Ring Expansion

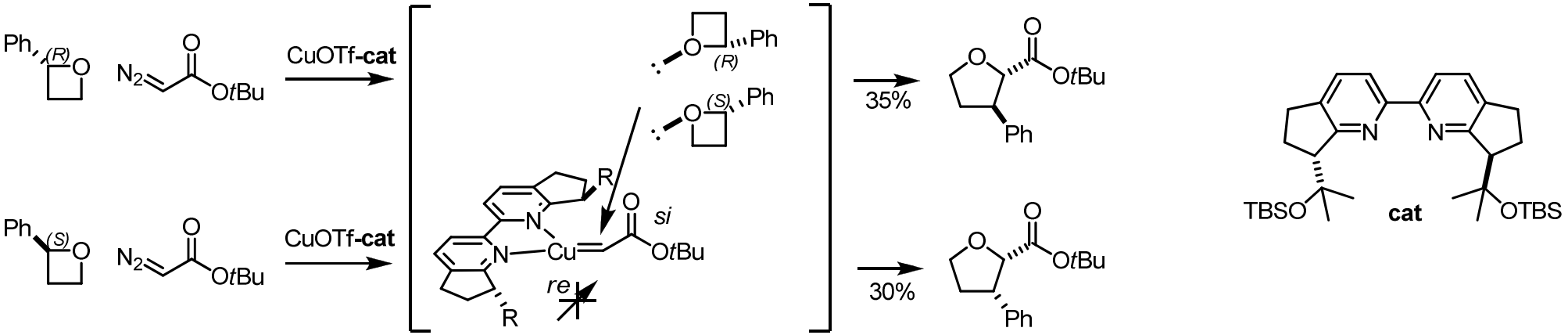


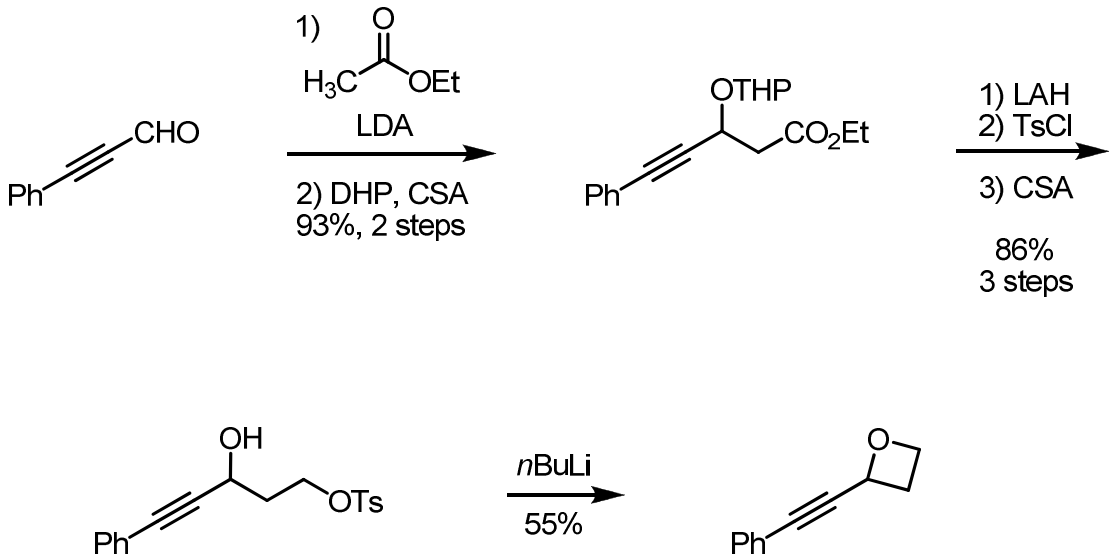




Nozaki, H.; Takaya, H.; Noyori, R. *Tetrahedron* **1966**, *22*, 3393-3401.
Nozaki, H.; Takaya, H.; Moriuti, S.; Noyori, R. *Tetrahedron* **1968**, *24*, 3655-3669.

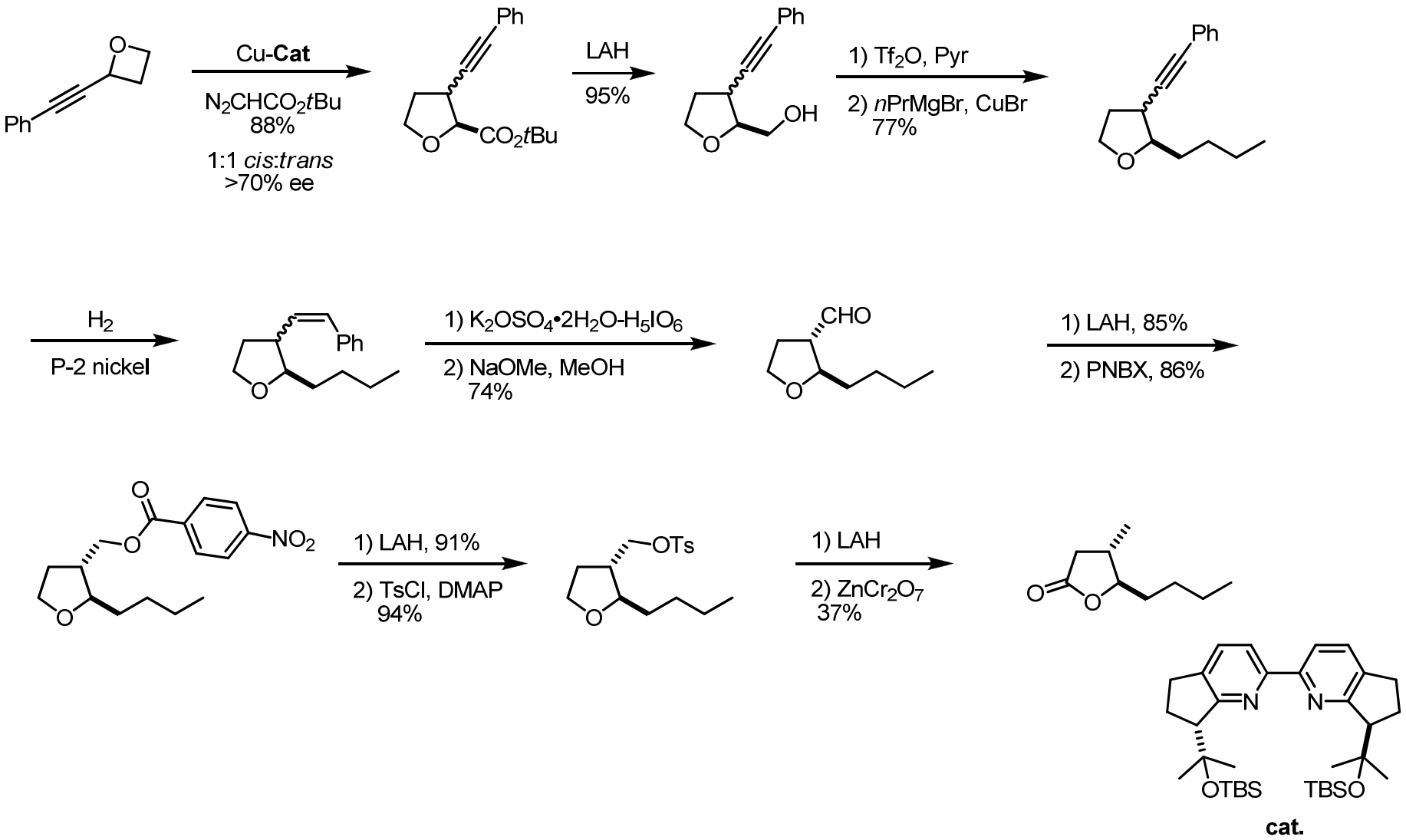
trans-Whiskey Lactone





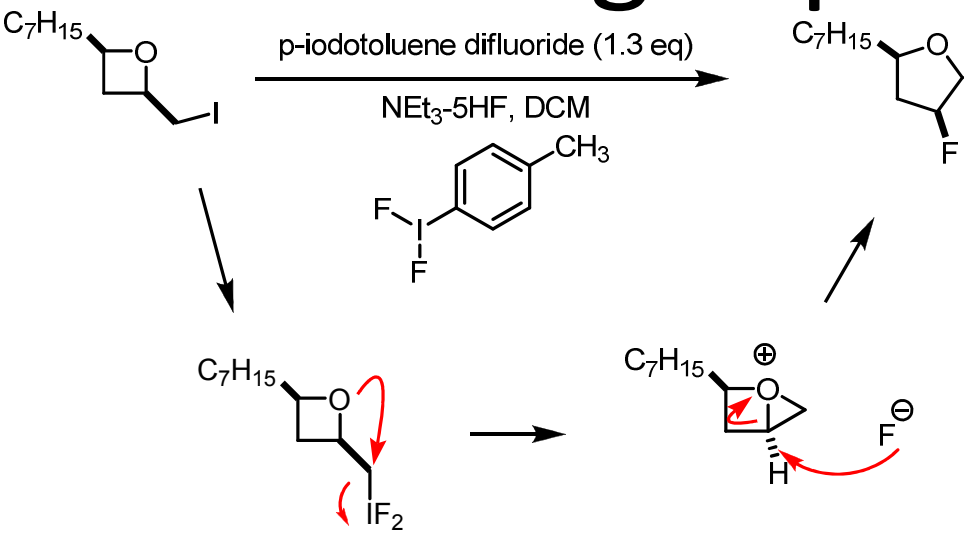
Ito, K.; Yoshitake, M.; Katsuki, T. *Tetrahedron* **1996**, *52,* 3905-3920.

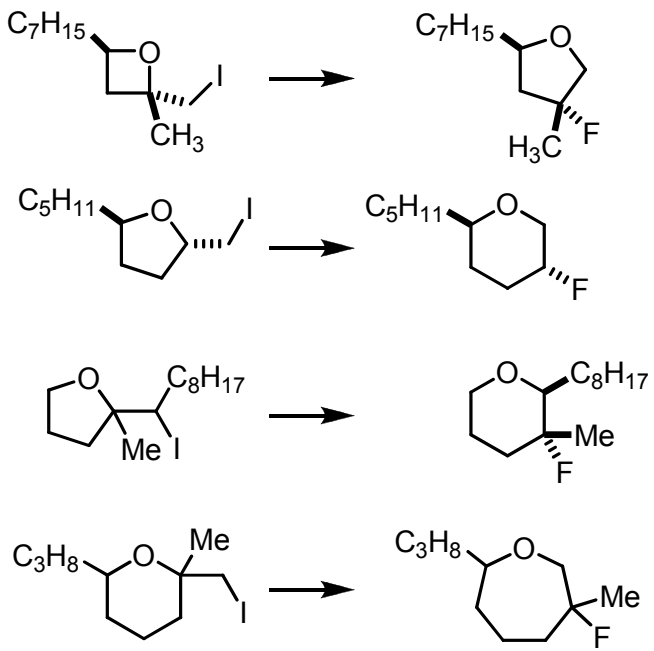
trans-Whiskey Lactone



Ito, K.; Yoshitake, M.; Katsuki, T. *Tetrahedron* **1996**, *52,* 3905-3920.

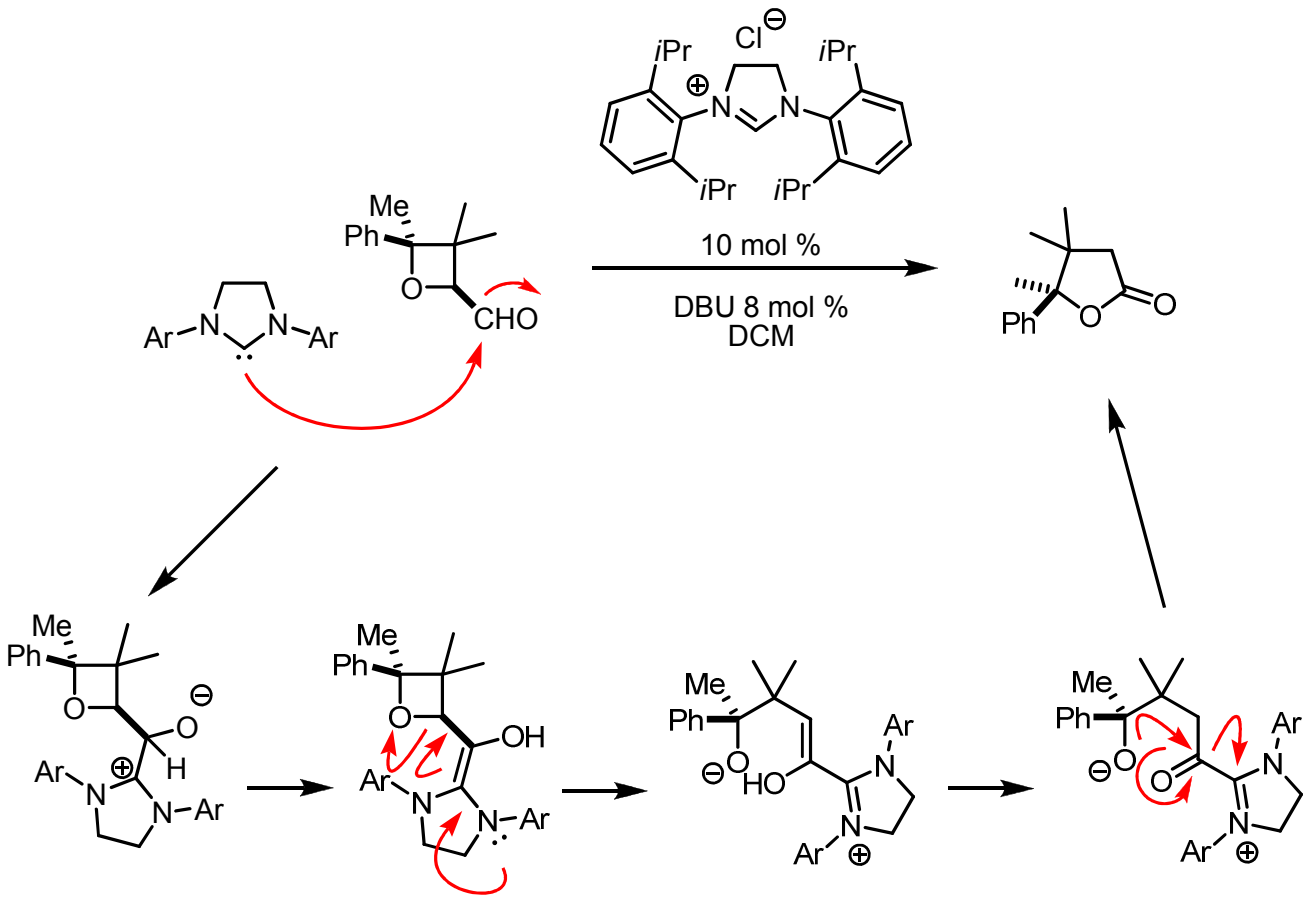
Flourinative Ring Expansion





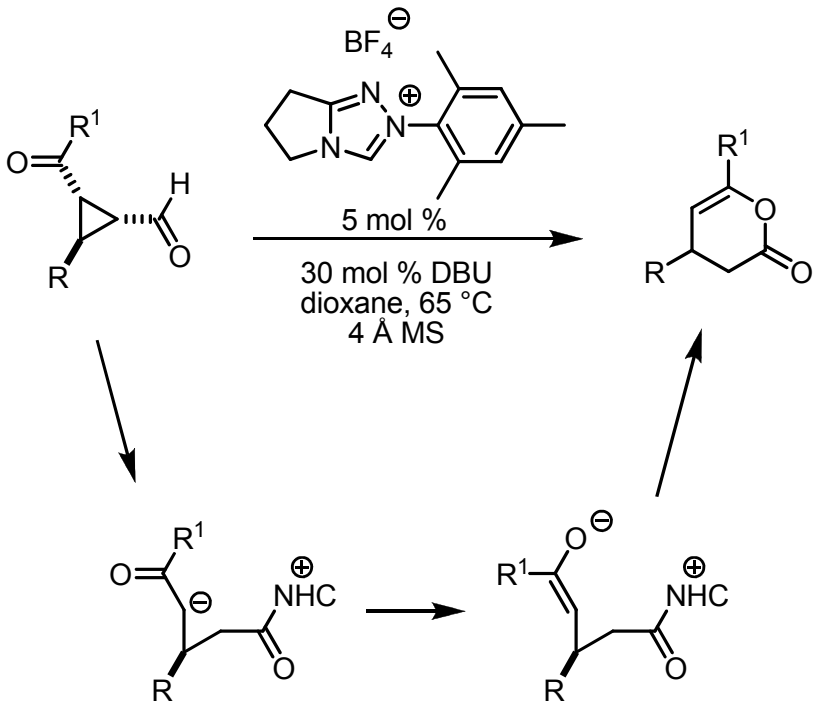
Inagaki, T.; Nakamura, Y.; Sawaguchi, M.; Yoneda, N.; Ayuba, S.; Hara, S. *Tetrahedron Lett.* **2003**, *44,* 4117–4119.

NHC-catalyzed Ring Expansion



Wang, L.; Thai, K.; Gravel, M. *Org. Lett.* **2009**, *11,* 891-893.

NHC Also Works for Cyclopropanes

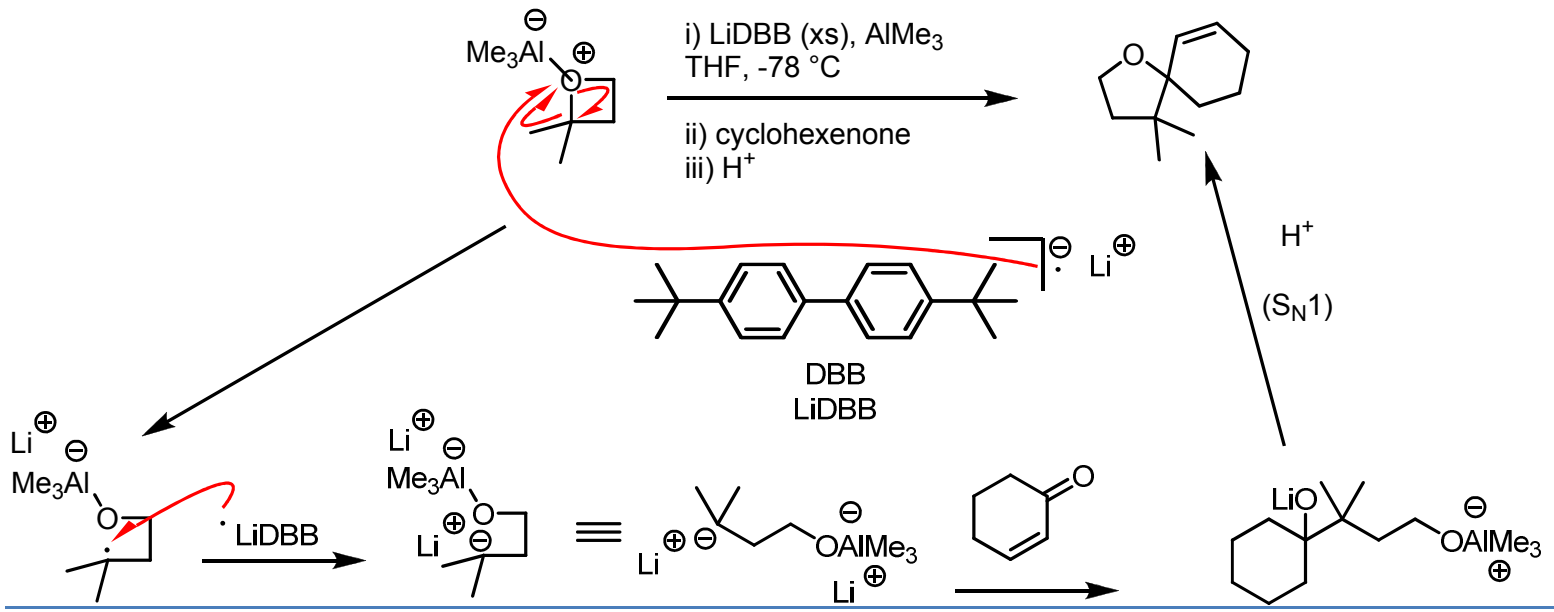


entry	7	R^1, R^2	time (h)	8, yield (%)[b]
1[c]	**7a**	C_6H_5, C_6H_5	24	**8a**, 92
2	**7b**	C_6H_5, *p*-MeO-C_6H_4	6	**8b**, 85
3	**7c**	C_6H_5, *p*-Br-C_6H_4	6	**8c**, 75
4	**7d**	C_6H_5, *m*-Cl-C_6H_4	5	**8d**, 78
5	**7e**	C_6H_5, H	8	**8e**, 50
6	**7f**	C_6H_5, Me	3	**8f**, 55
7	**7g**	C_6H_5, ^{n}Pr	4	**8g**, 63
8	**7h**	*p*-Br-C_6H_4, C_6H_5	7	**8h**, 73
9	**7i**	*p*-Me-C_6H_4, C_6H_5	10	**8i**, 70
10	**7j**	*p*-MeO-C_6H_4, C_6H_5	10	**8j**, 68
11[d]	**7k**	^{t}Bu, C_6H_5	12	**8k**, 30

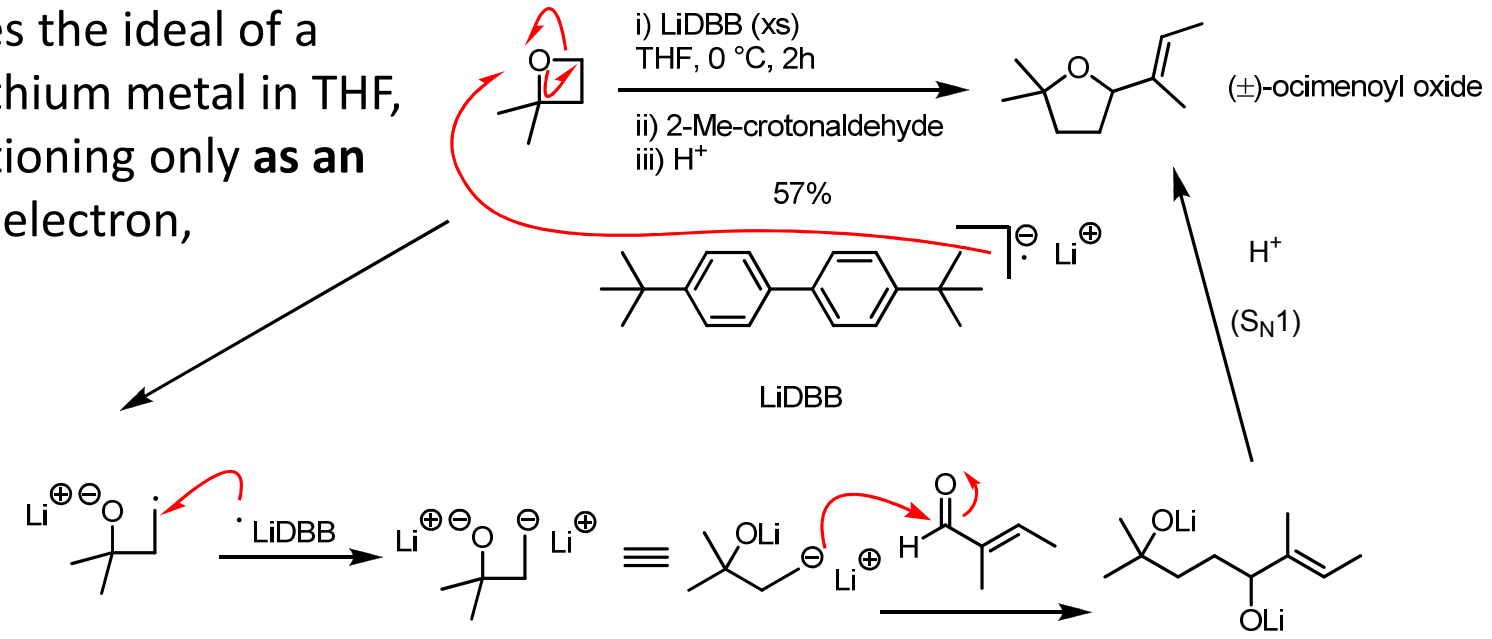
[a] Reaction conditions: **7** (1.0 mmol), 5 mol % **5**, 30 mol % DBU, 4 Å MS (0.1 g) in dioxane (5.0 mL) at 65 °C. [b] Isolated yields. [c] 2 mol % **5** and 5 mol % DBU were used. [d] **8l** was isolated in 30% yield.

Li, G.-Q.; Dai, L.-X.; You, S.-L. *Org. Lett.* **2009**, *11,* 1623-1625.

LiDBB & the Total Synthesis of (±)-Ocimenoyl Oxide

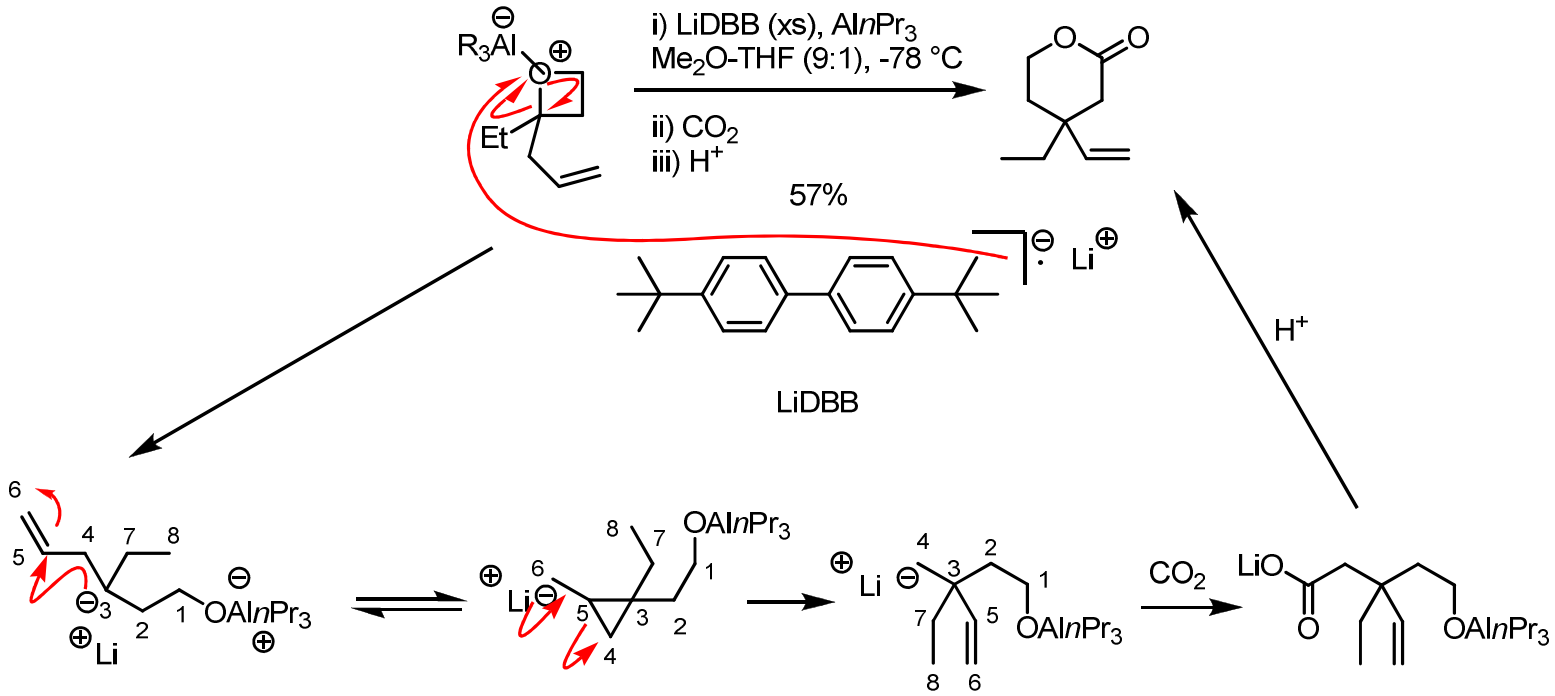


LiDBB closely approaches the ideal of a homogeneous solution of lithium metal in THF, with the DBB moiety functioning only **as an inert carrier** of an electron,



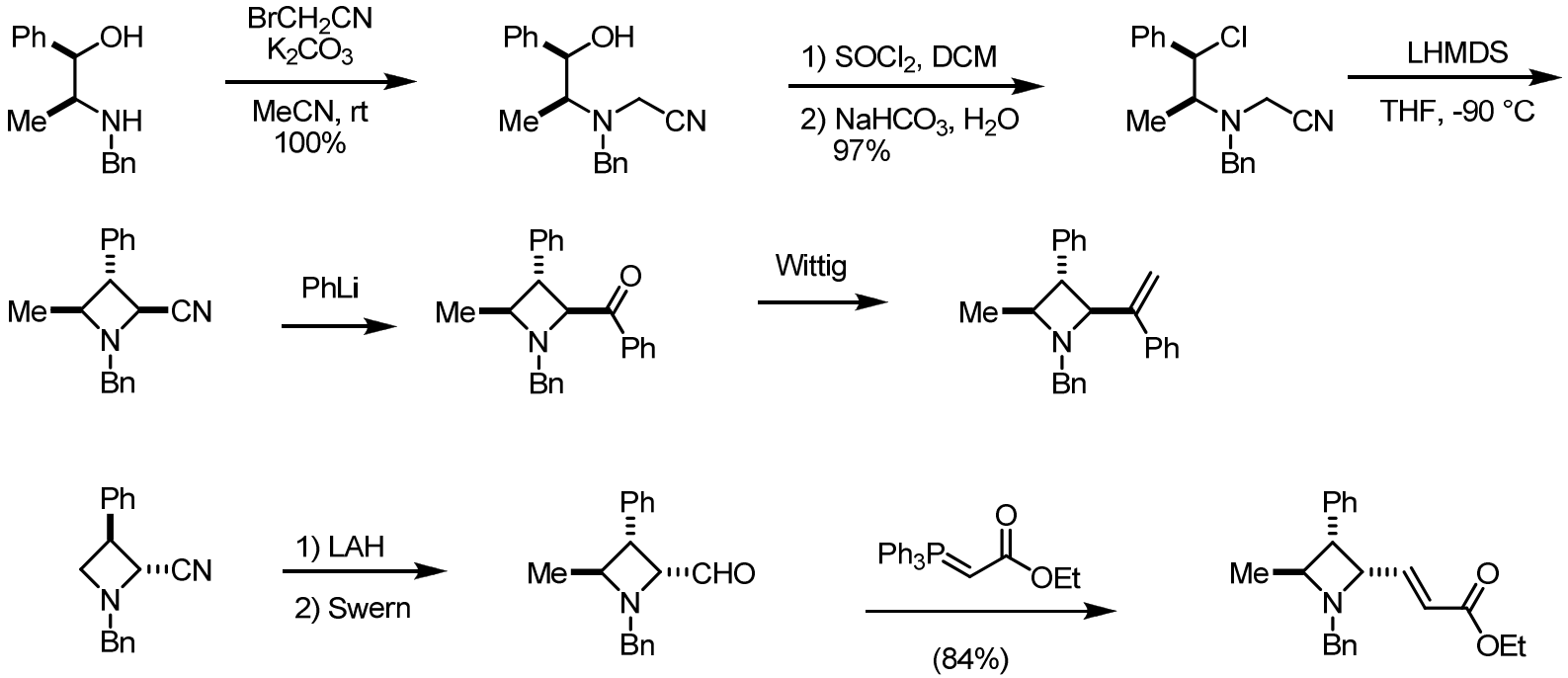
Mudryk, B.; Cohen, T. *J. Org. Chem.* **1991**, *56,* 5760-5761.

More LiDBB



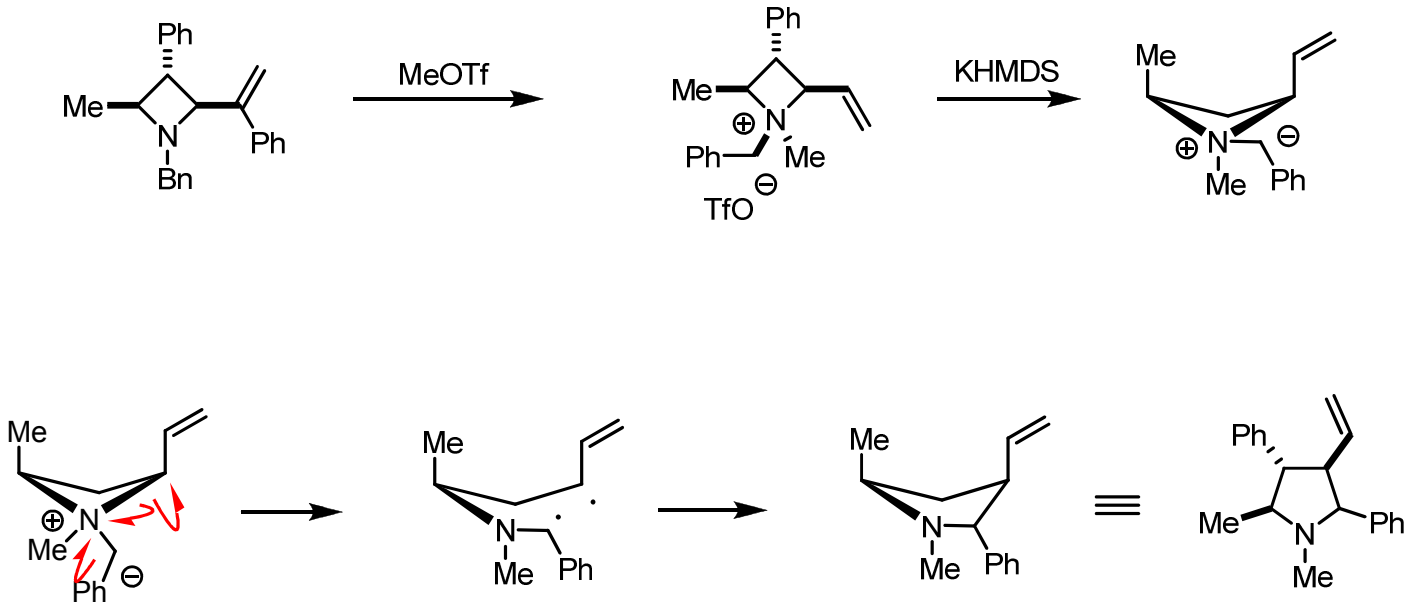
Mudryk, B.; Cohen, T. *J. Org. Chem.* **1991**, *56,* 5760-5761.

Pyrrolidines and Azepanes



Couty, F.; Durrat, F.; Evano, G.; Marrot , J. *Eur. J. Org. Chem.* **2006**, 4214–4223.

Pyrrolidines and Azepanes



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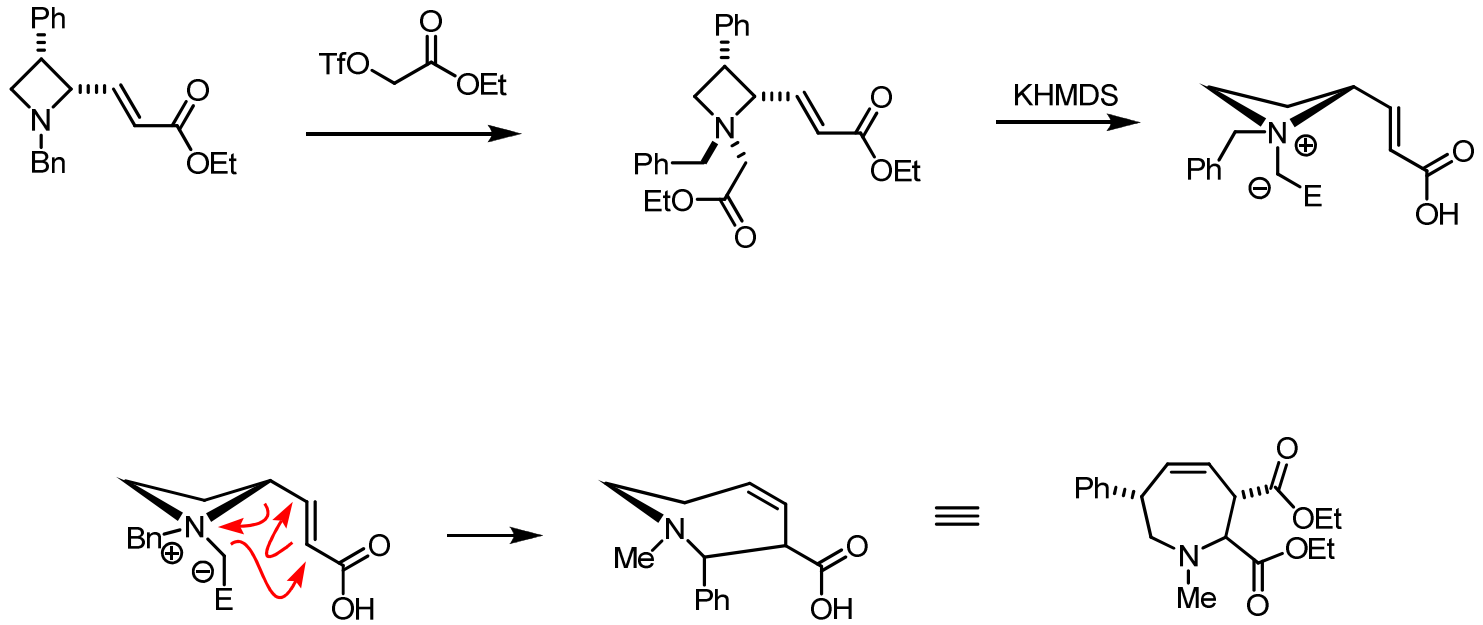
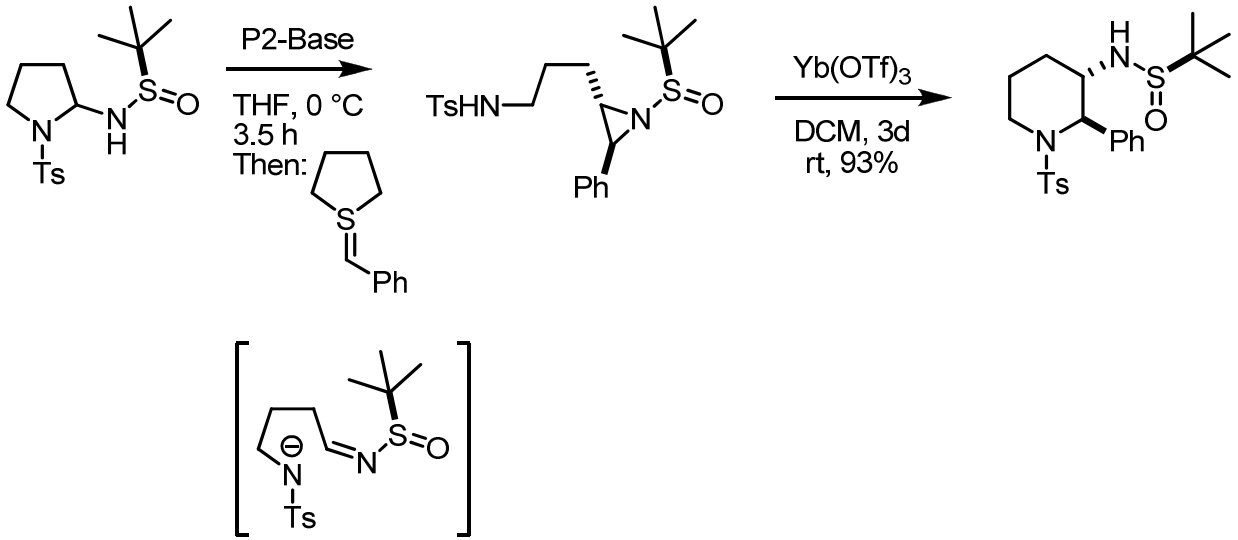
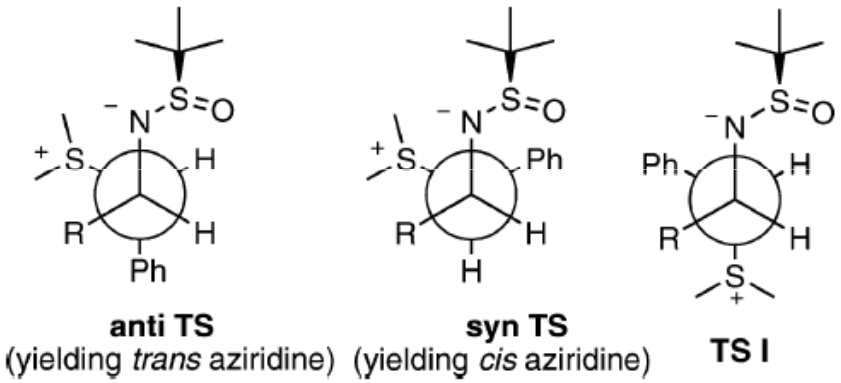
Pyrrolidines and Azepanes

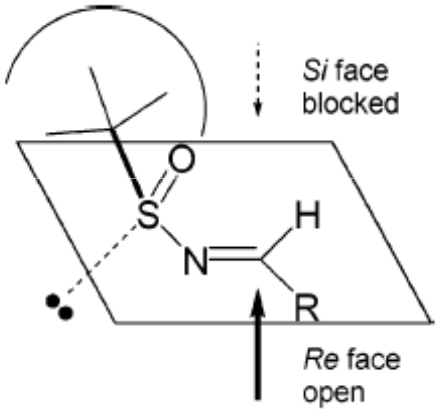


Couty, F.; Durrat, F.; Evano, G.; Marrot , J. *Eur. J. Org. Chem.* **2006**, 4214–4223.

Aminals to Piperidines

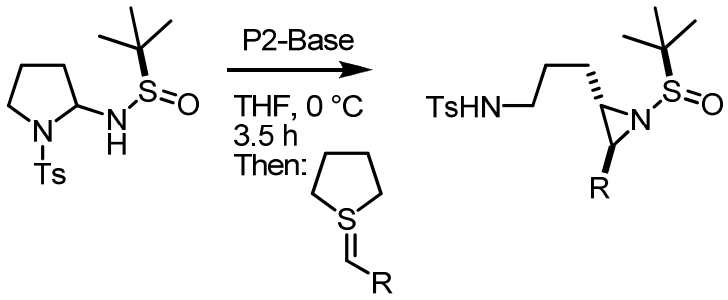




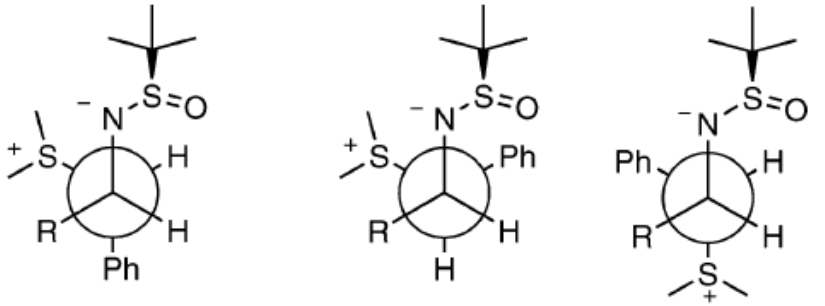


Kokotos C. G.; Aggarwal, V. K. *Org. Lett.* **2007**, *9*, 2099-2102.

Aminals to Piperidines



R =	trans:cis
Ph	13:1
4-(MeO)-Ph	4.5:1
4-Cl-Ph	11.5:1
HC=CH2	1.3:1
C(O)NHPh	1.1:1



anti TS (yielding *trans* aziridine) **syn TS** (yielding *cis* aziridine) **TS I**