

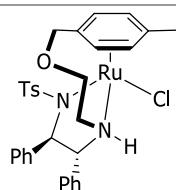
DENE[®]

DENE[®] is an oxo-tethered ruthenium complex *newly developed as a highly efficient asymmetric transfer hydrogenation catalyst*. This high-performance catalyst exceeds the conventional RuCl(arene)(N-sulfonylated diamine) systems not only in activity but also in scope of substrates. DENE[®] can produce remarkable improvement of catalytic activities and enantioselectivities in a wide range of substrates.

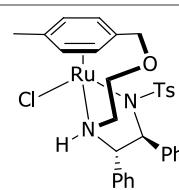
"DENE[®]" is a registered trademark or trademark of Takasago International Corporation in Japan and other countries.

(R,R)-Ts-DENE[®]

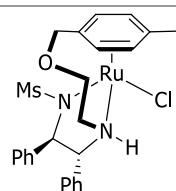
CAS No.	1333981-84-2
Formula	C ₃₁ H ₃₃ ClN ₂ O ₃ RuS
M.W.	650.19

**(S,S)-Ts-DENE[®]**

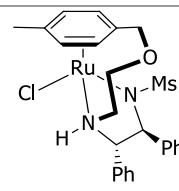
CAS No.	1384974-37-1
Formula	C ₃₁ H ₃₃ ClN ₂ O ₃ RuS
M.W.	650.19

**(R,R)-Ms-DENE[®]**

CAS No.	1333981-86-4
Formula	C ₂₅ H ₂₉ ClN ₂ O ₃ RuS
M.W.	574.10

**(S,S)-Ms-DENE[®]**

CAS No.	1361318-83-3
Formula	C ₂₅ H ₂₉ ClN ₂ O ₃ RuS
M.W.	574.10



Touge, T. *J. Am. Chem. Soc.* **2011**, 133, 14960–14963. doi: [10.1021/ja207283t](https://doi.org/10.1021/ja207283t)

Touge, T. *J. Am. Chem. Soc.* **2016**, 138, 10084–10087. doi: [10.1021/jacs.6b05738](https://doi.org/10.1021/jacs.6b05738)

Yuki, Y. *Adv. Synth. Catal.* **2018**, 360, 568–574. doi: [10.1002/adsc.201701227](https://doi.org/10.1002/adsc.201701227)

Touge, T. *Org. Process Res. Dev.* **2019**, 23, 452–461. doi: [10.1021/acs.oprd.8b00338](https://doi.org/10.1021/acs.oprd.8b00338)

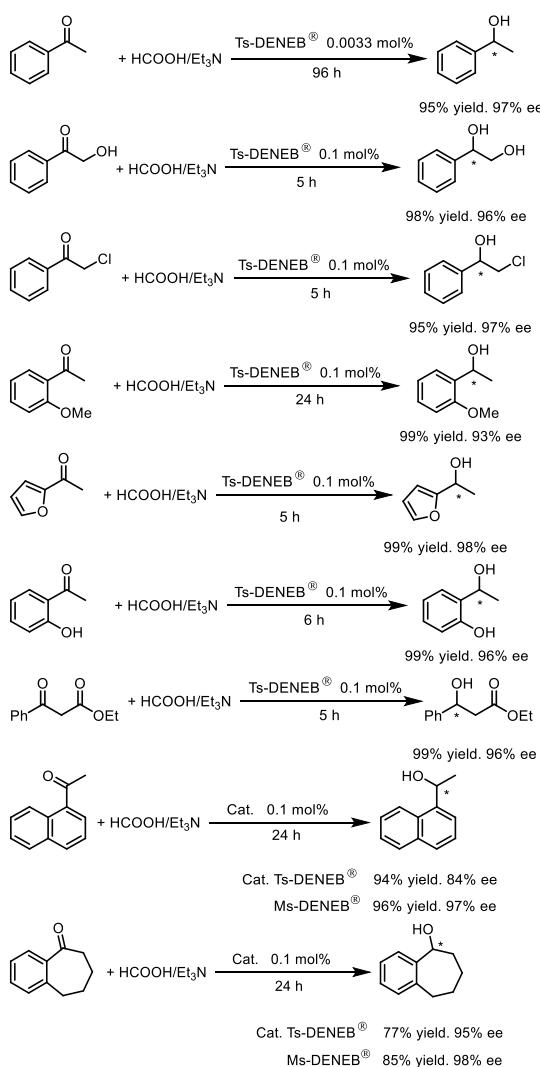
Touge, T. *J. Am. Chem. Soc.* **2019**, 141, 41, 16354–16361. doi: [10.1021/jacs.9b07297](https://doi.org/10.1021/jacs.9b07297)

Touge, T. *Org. Lett.* **2021**, 23, 3070–3075. doi: [10.1021/acs.orglett.1c00739](https://doi.org/10.1021/acs.orglett.1c00739)

JP5718178 B, CN103080118B, EP2609103B, KR101686162B, US9217005B, US9468919B, WO2012026201A (Takasago)

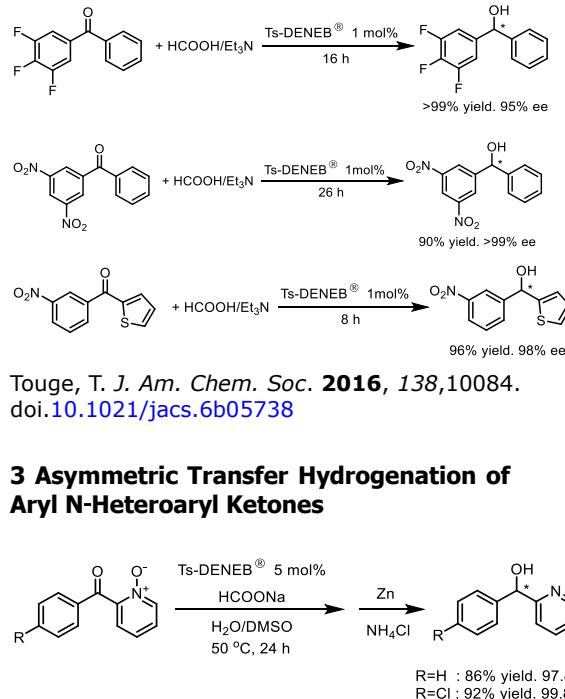
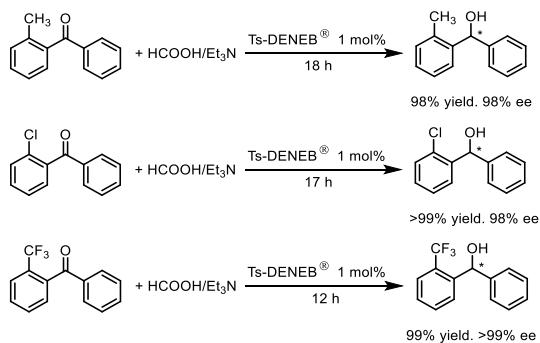
Tech Note

1 Asymmetric Transfer Hydrogenation of Ketones



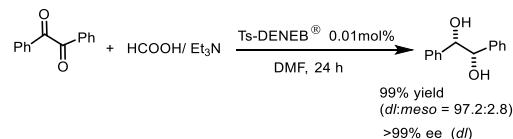
Touge, T. *J. Am. Chem. Soc.* **2011**, 133, 14960. doi: [10.1021/ja207283t](https://doi.org/10.1021/ja207283t)

2 Asymmetric Transfer Hydrogenation of Unsymmetrical Benzophenone

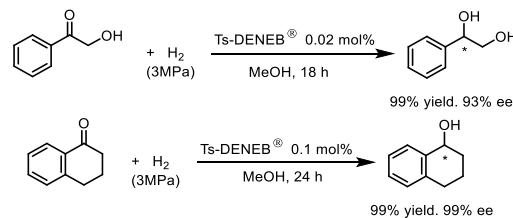


Wang, B. *Org. Lett.* **2017**, *19*, 2094.
doi: [10.1021/acs.orglett.7b00691](https://doi.org/10.1021/acs.orglett.7b00691)

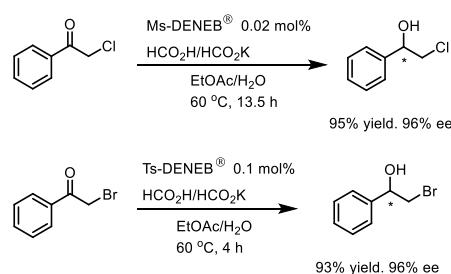
4 Dynamic Kinetic Resolution (DKR) of Diketone

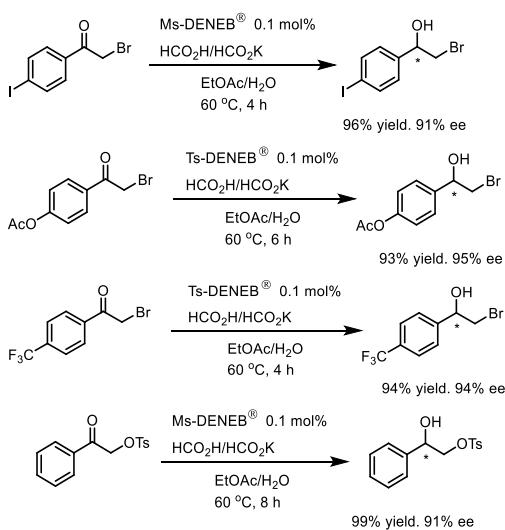


5 Asymmetric Hydrogenation of Ketones



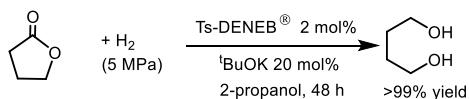
6 Asymmetric Transfer Hydrogenation of α -Substituted Ketone





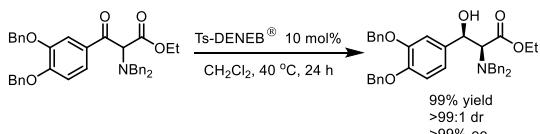
Yuki, Y. *Adv. Synth. Catal.* **2018**, *360*, 568.
doi: [10.1002/adsc.201701227](https://doi.org/10.1002/adsc.201701227)

7 Hydrogenation of γ -Butyrolactone



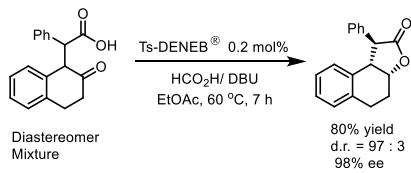
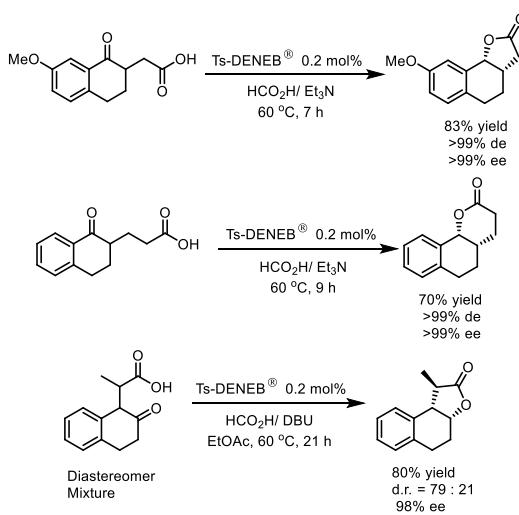
Touge, T. *J. Am. Chem. Soc.* **2011**, *133*, 14960.
doi: [10.1021/ja207283t](https://doi.org/10.1021/ja207283t)

8 syn- β -Hydroxy α -Dibenzylamino Esters via DKR Asymmetric Transfer Hydrogenation



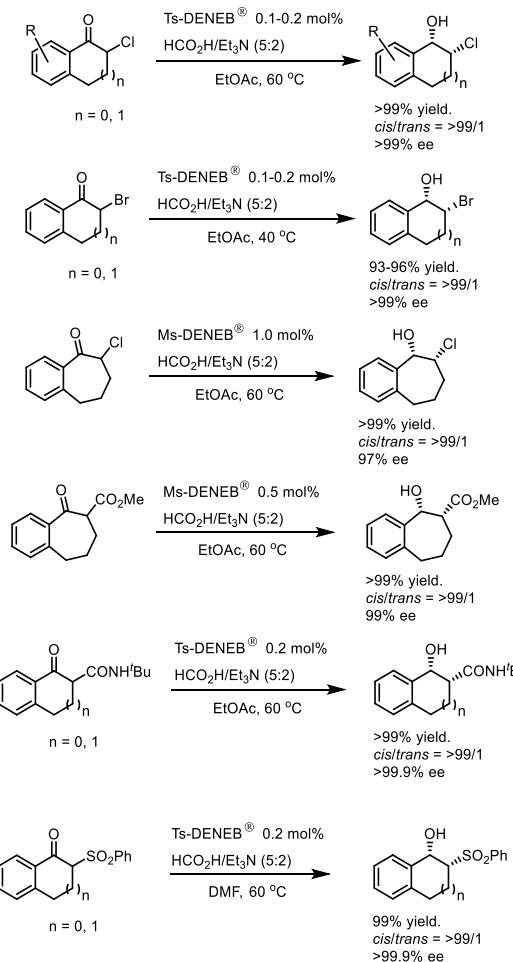
Wang, Z. *Org. Lett.*, **2017**, *19*, 4339.
doi: [10.1021/acs.orglett.7b01982](https://doi.org/10.1021/acs.orglett.7b01982)

9 Cascade Lactone Formation via DKR Driven by the Asymmetric Transfer Hydrogenation of Keto Acids



Touge, T., Sakaguchi, K., Tamaki, N., Nara, H., Yokozawa, T., Matsumura, K., Kayaki, Y. *J. Am. Chem. Soc.* **2019**, *141*, 41, 16354. doi: [10.1021/jacs.9b07297](https://doi.org/10.1021/jacs.9b07297)

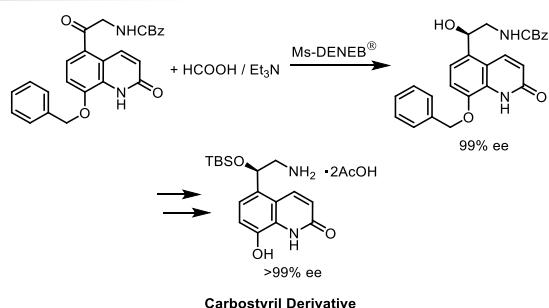
9 Asymmetric Transfer Hydrogenation of α -Halo, Ester, Carboxamide and sulfone substituted Cyclic Ketones via DKR



Touge, T., Nara, H., Kida, M., Matsumura, K., Kayaki, Y. *Org. Lett.* **2021**, *23*, 3070.
doi: [10.1021/acs.orglett.1c00739](https://doi.org/10.1021/acs.orglett.1c00739)

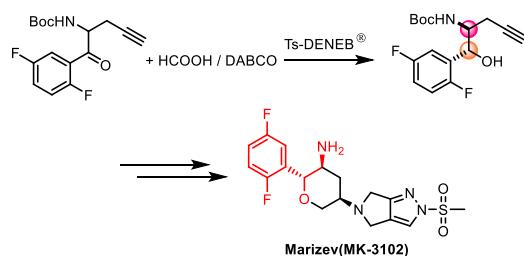
10 Applications

10.1 Asymmetric Synthesis of a Key Intermediate for the β 2-Adrenergic Receptor Agonist



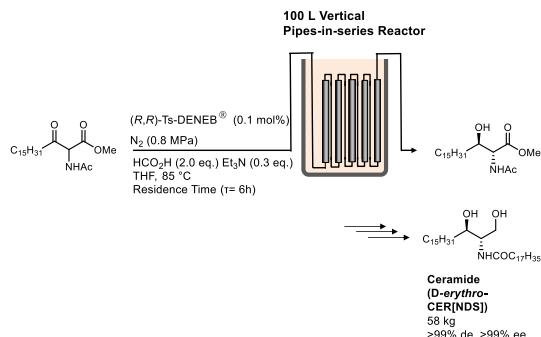
Komiyama, M. *Org. Process Res. Dev.*, **2015**, 19, 315.
doi: [10.1021/op500338d](https://doi.org/10.1021/op500338d)

10.2 Asymmetric Synthesis of a Key Intermediate for the Omarigliptin (MK-3102)



Chung, J. Y. L. *Org. Process. Res. Dev.*, **2015**, 19, 1760.
doi: [10.1021/acs.oprd.5b00267](https://doi.org/10.1021/acs.oprd.5b00267)

10.3 Transfer Hydrogenation in Flow for the Synthesis of a Ceramide



Touge, T. *Org. Process Res. Dev.*, **2019**, 23, 452.
doi: [10.1021/acs.oprd.8b00338](https://doi.org/10.1021/acs.oprd.8b00338)
EP2773611B, JP6048762B, WO2013065867A