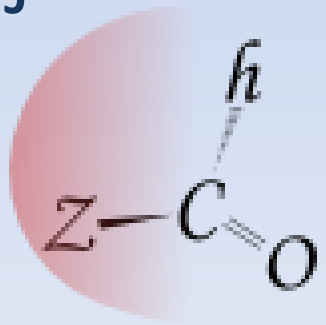
SYNTEZA ASYMETRYCZNA

Dr inż. Tomasz Rowicki

ZAKŁAD CHEMII ORGANICZNEJ



Konsultacje: pon. 14^{15}-16^{00}, pok. 135, G.Ch.

Zagadnienia na dziś

1. Utlenianie wiązań podwójnych C=C

   - asymetryczne epoksydowanie Katsuki-Sharpless'a

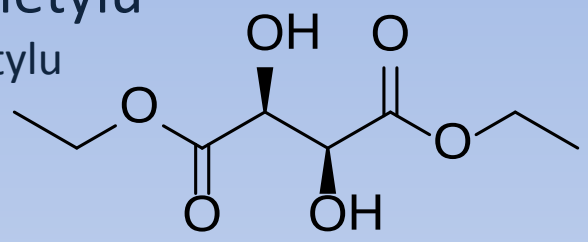
   - asymetryczne epoksydowanie Jacobsen'a-Katsuki

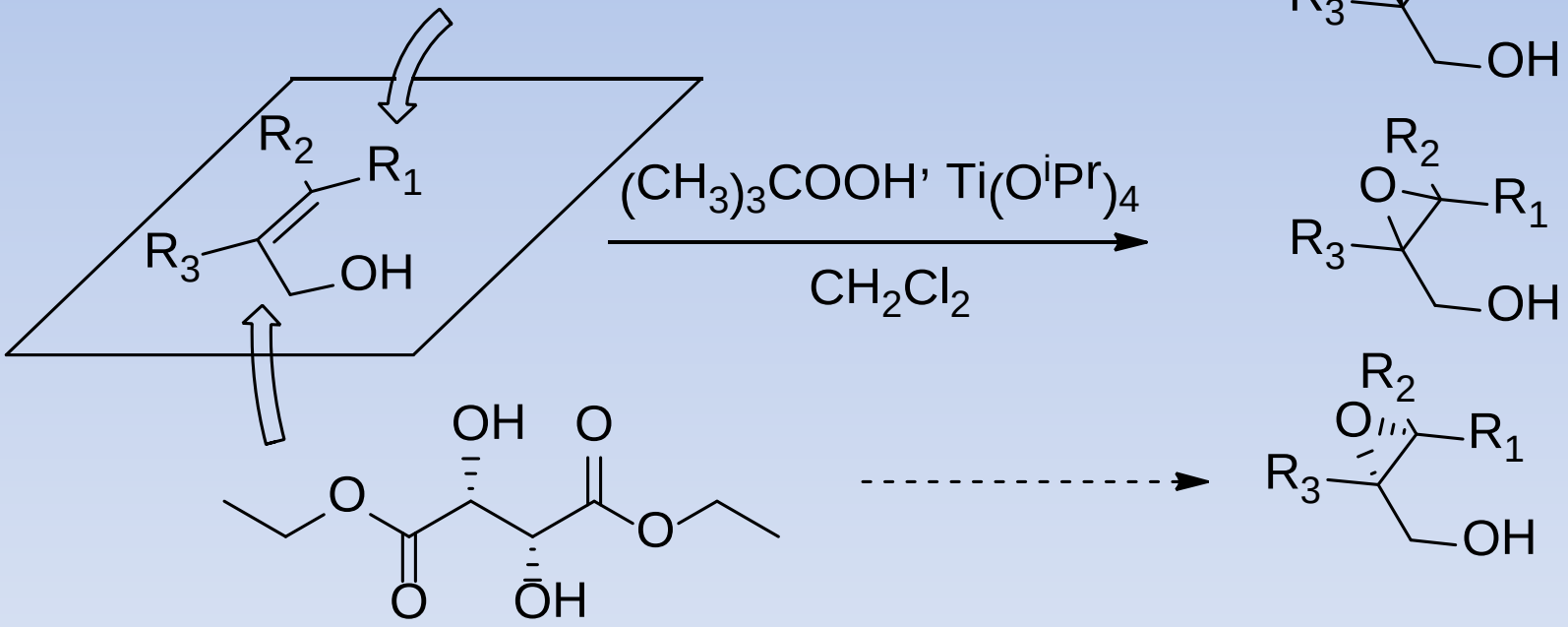
Epoksydowanie Katsuki-Sharpless'a

D-(-)-winian dietylu

(*2S,3S*)-winian dietylu

(nienaturalny)





L-(+)-winian dietylu

(*2R,3R*)-winian dietylu

(naturalny)

Epoksydowanie Katsuki-Sharpless'a

- Epoksydy są użyteczne do otrzymywania np.: dioli, eterów, aminoalkoholi, czyli w syntezie związków naturalnych
- Reakcja zachodzi dla szerokiego spektrum substratów
- Reakcja zapewnia wysokie nadmiary enancjomeryczne, bardzo często >90%
- Konfiguracja produktów przewidywalna w oparciu o zaproponowany model
- Dostępne handlowo, tanie reagenty

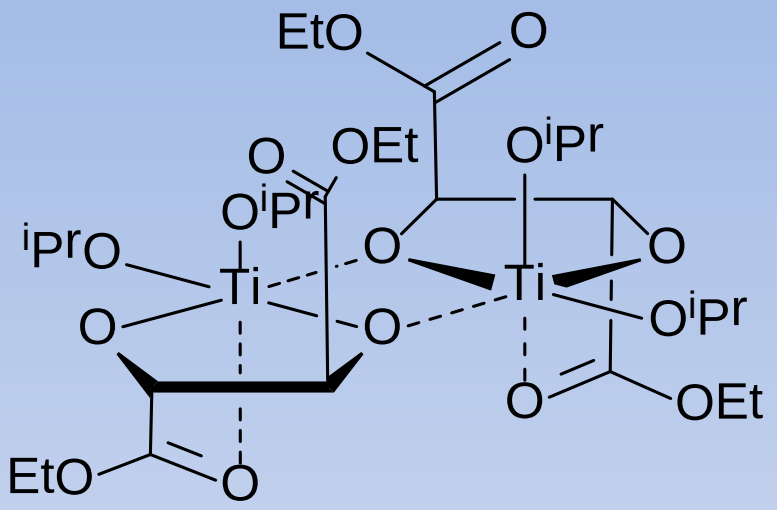
Nagroda Nobla 2001

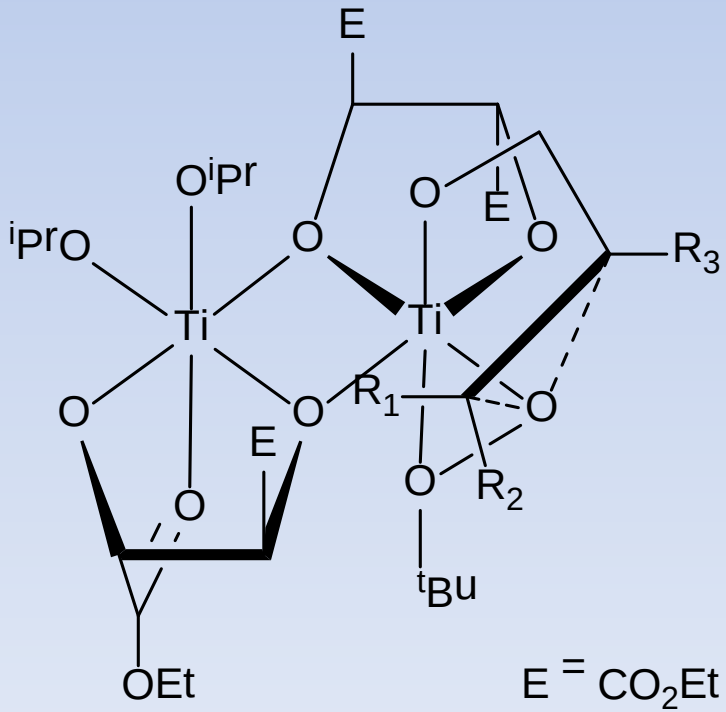
½ K. Barry Sharpless

'for his work on chirally catalysed oxidation reactions'

Epoksydowanie Katsuki-Sharpless'a

Katalizator jest dimerycznym kompleksem

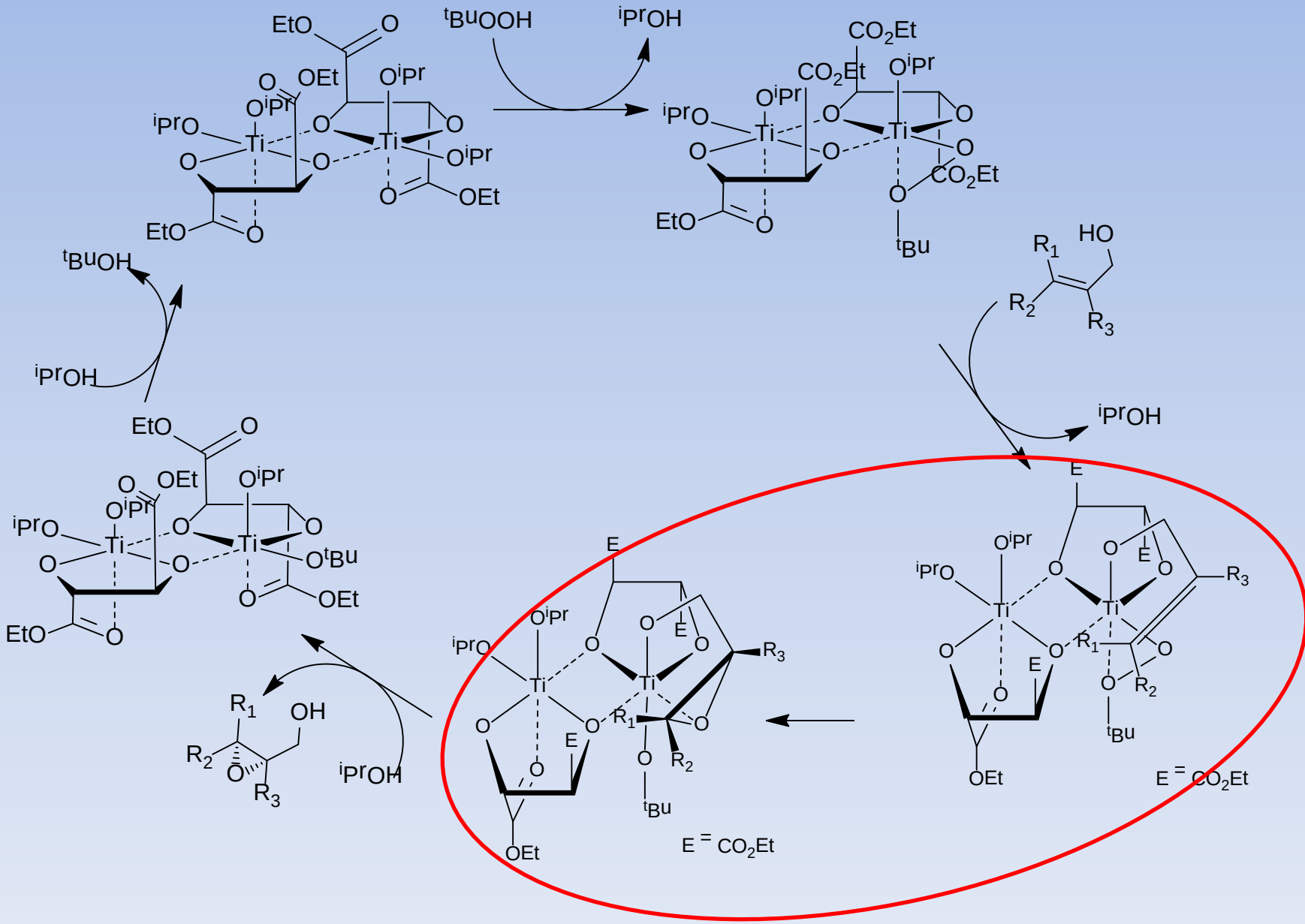




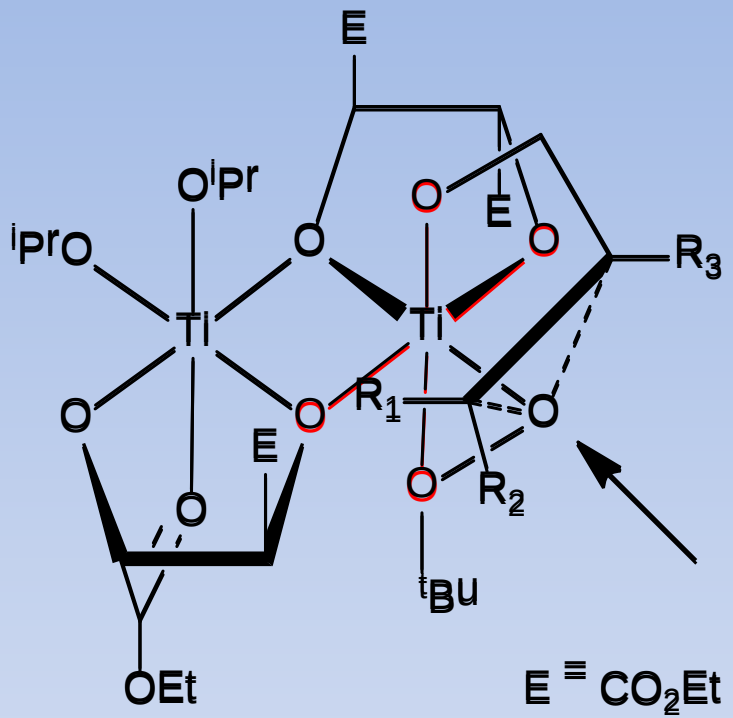
E = CO_2Et

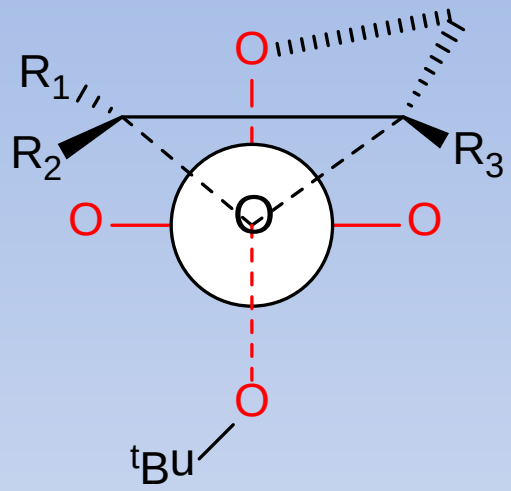
W stanie przejściowym zarówno ^{t}BuOOH jak i substrat są skoordynowane z katalizatorem

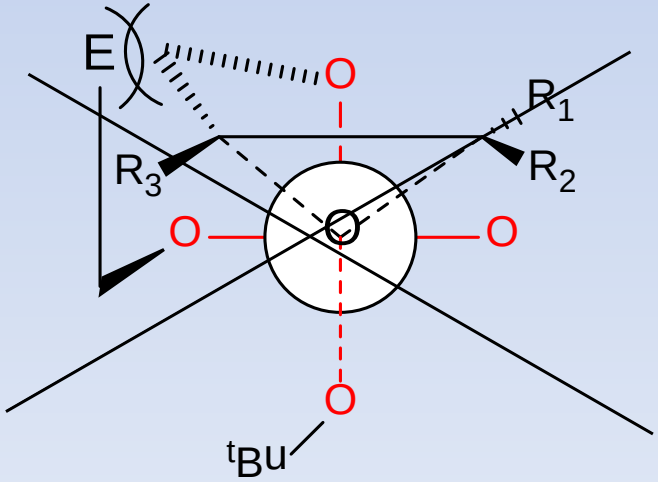
Epoksydowanie Katsuki-Sharpless'a



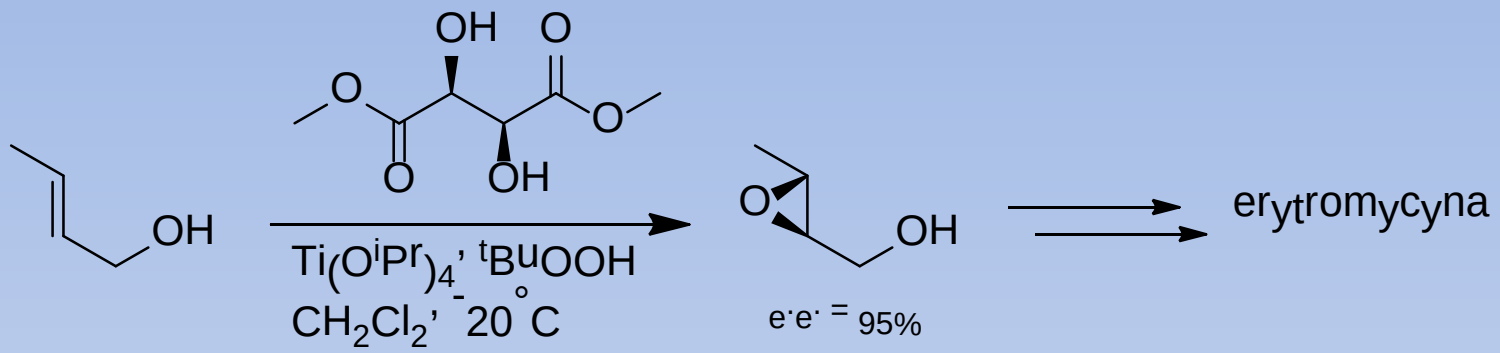
Epoksydowanie Katsuki-Sharpless'a

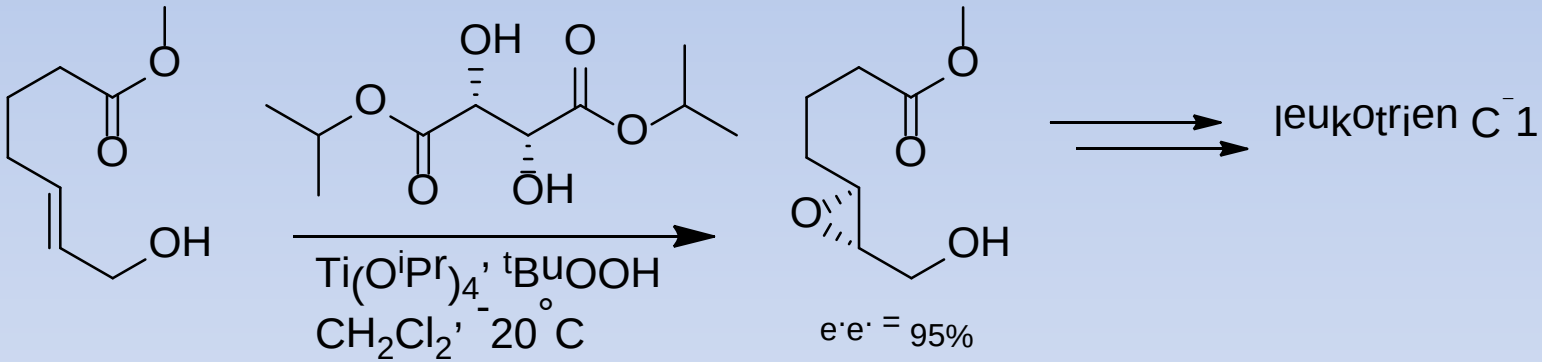


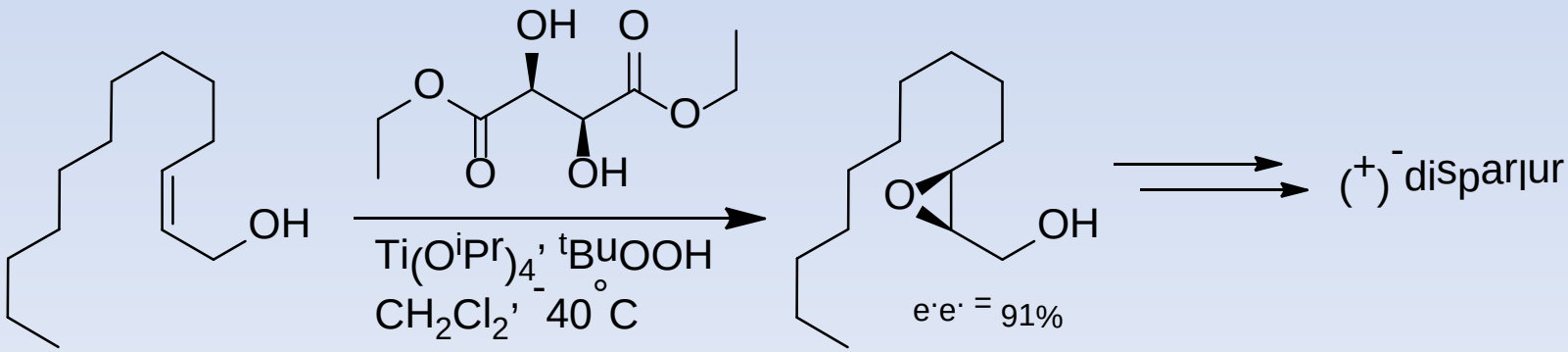




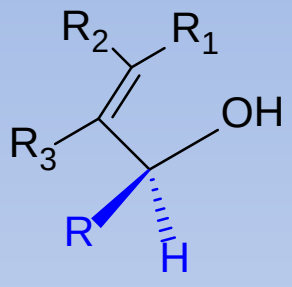
Epoksydowanie Katsuki-Sharpless'a



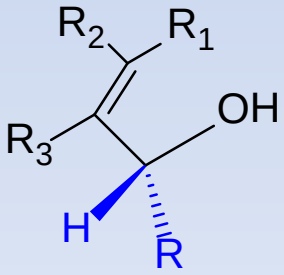


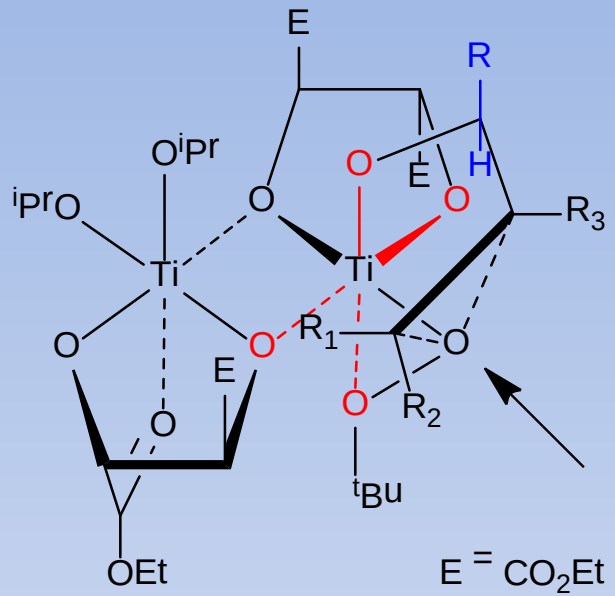


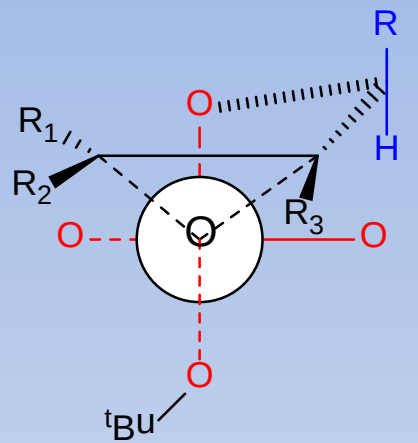
Kinetyczny rozdział alkoholi allilowych

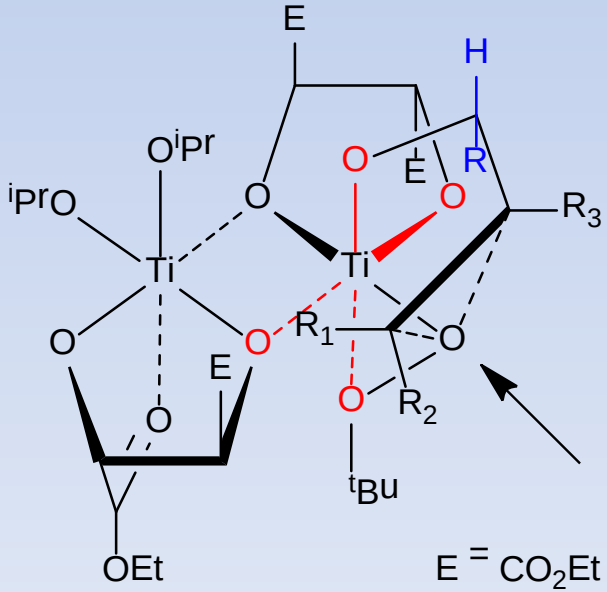


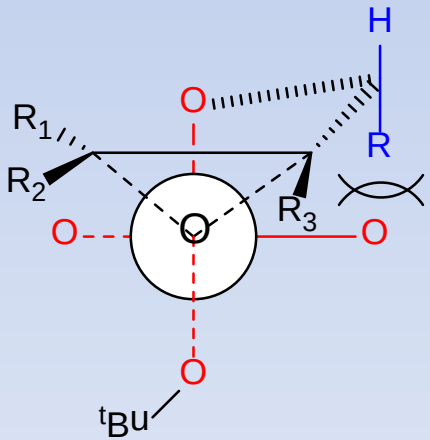
Wpływ obecnego w cząsteczce centrum asymetrii na przebieg epoksydowania Sharpless'a



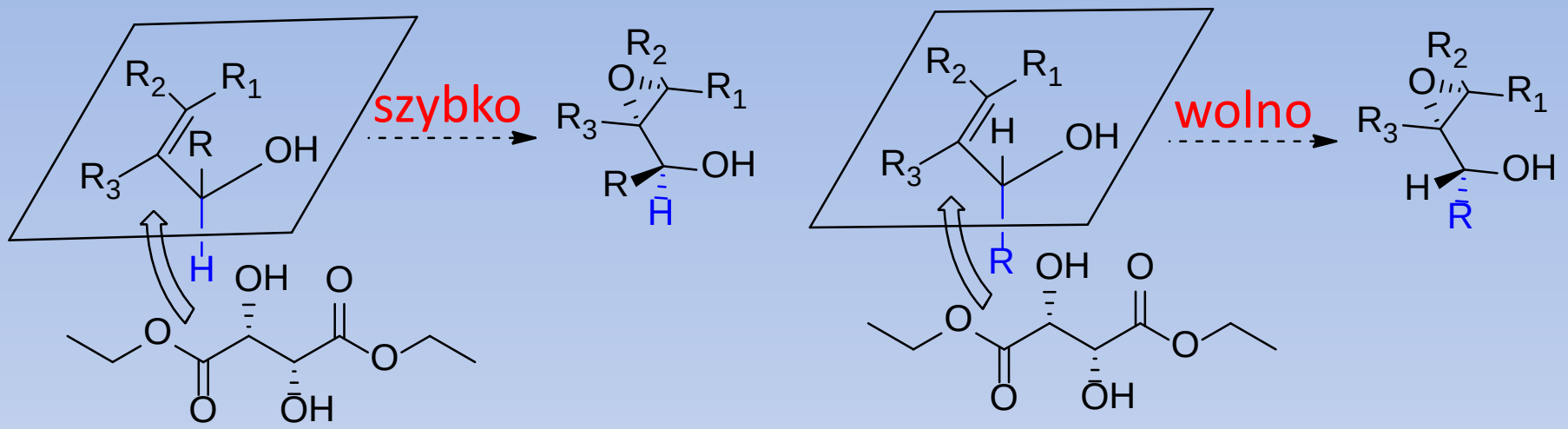




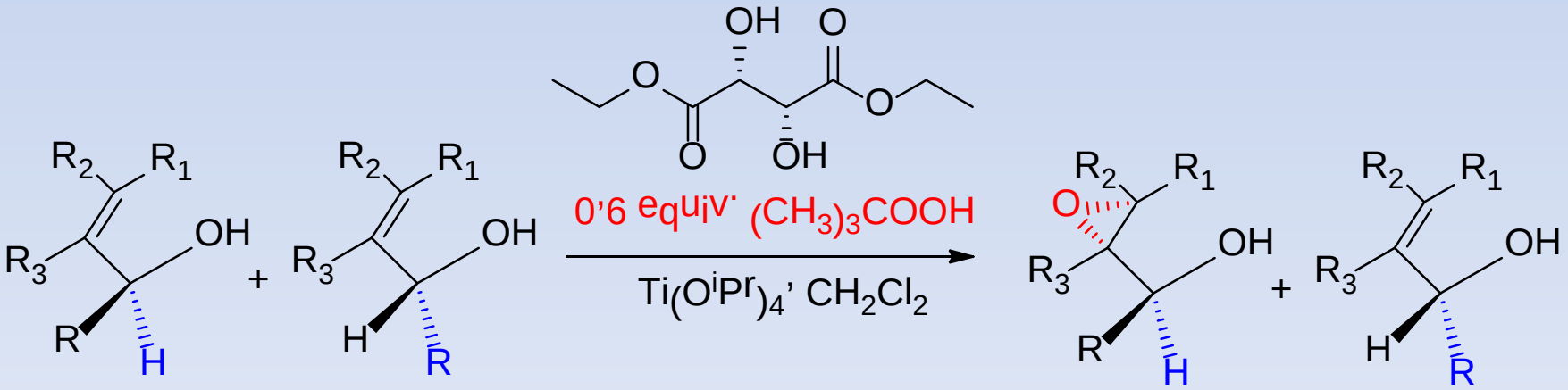




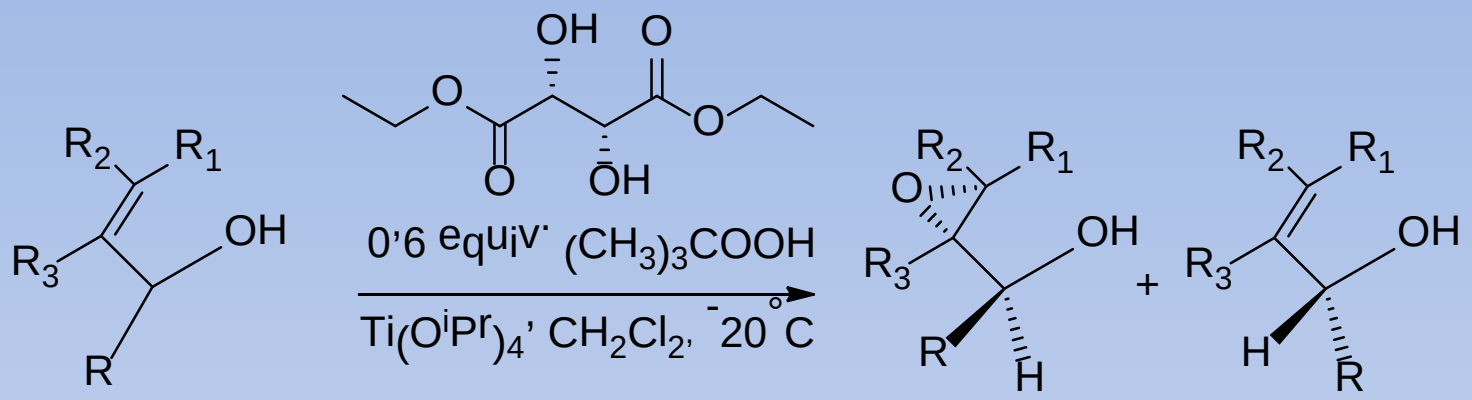
Kinetyczny rozdział alkoholi allilowych

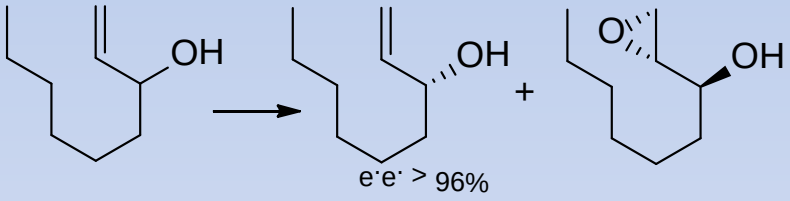


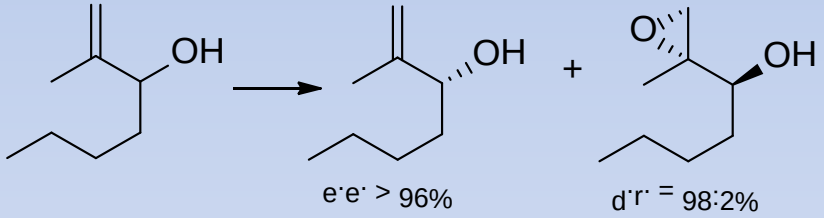
Różnice szybkości reakcji między enancjomerami rzędu 15-140 razy!

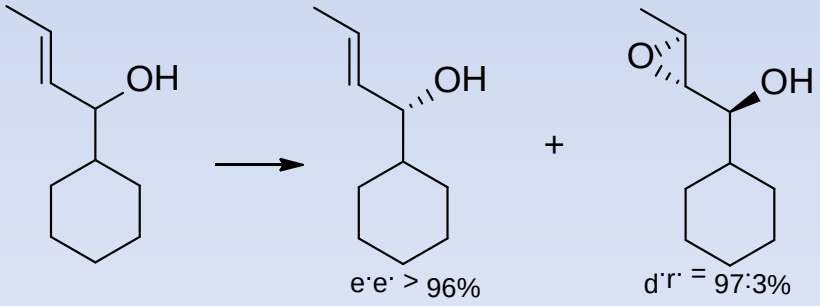


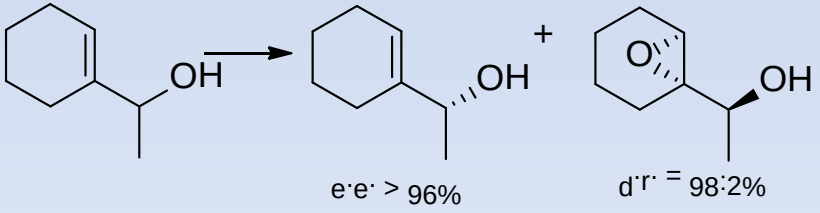
Kinetyczny rozdział alkoholi allilowych



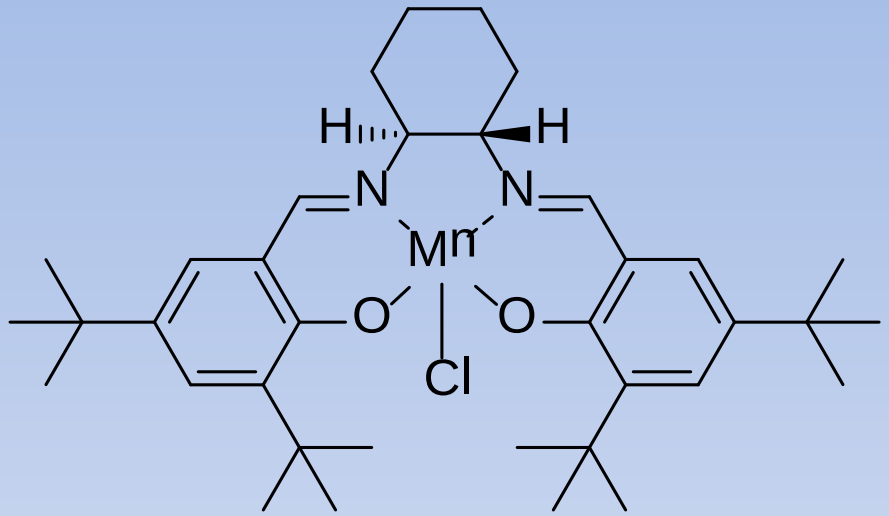


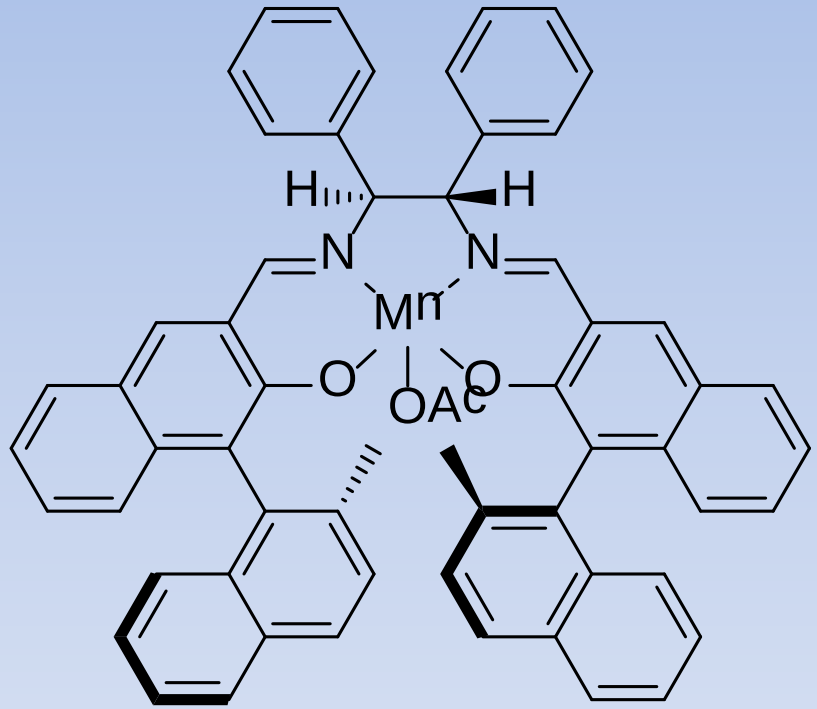






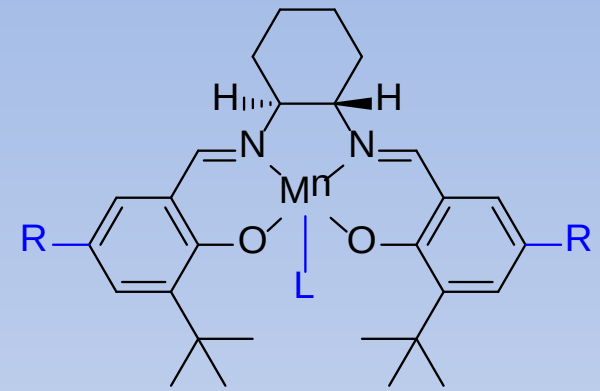
Epoksydowanie Jacobsen’a-Katsuki



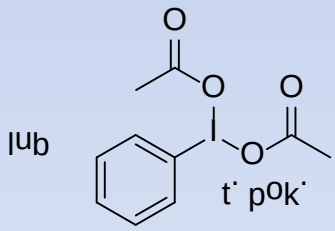


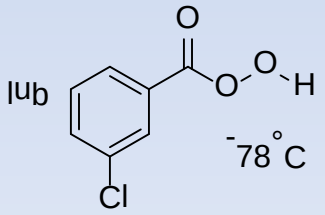
Asymetryczne epoksydowanie alkenów nieposiadających grup funkcyjnych

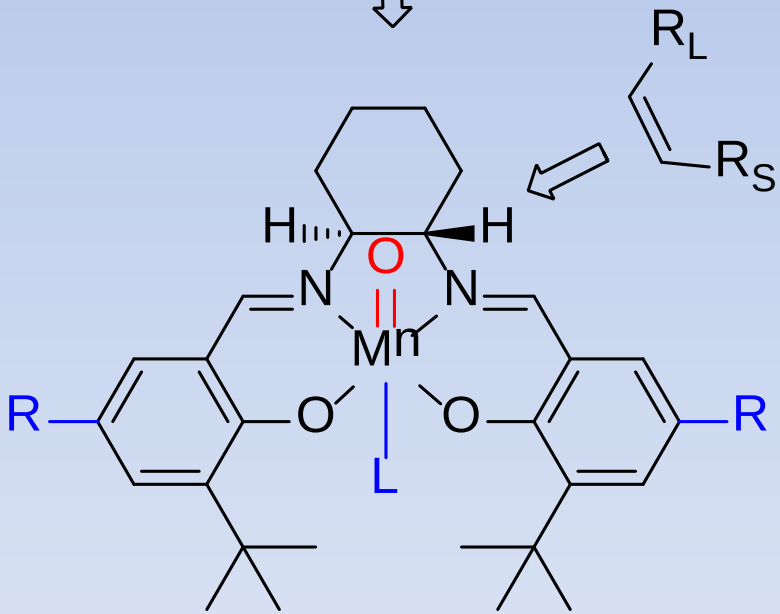
Epoksydowanie Jacobsen'a-Katsuki



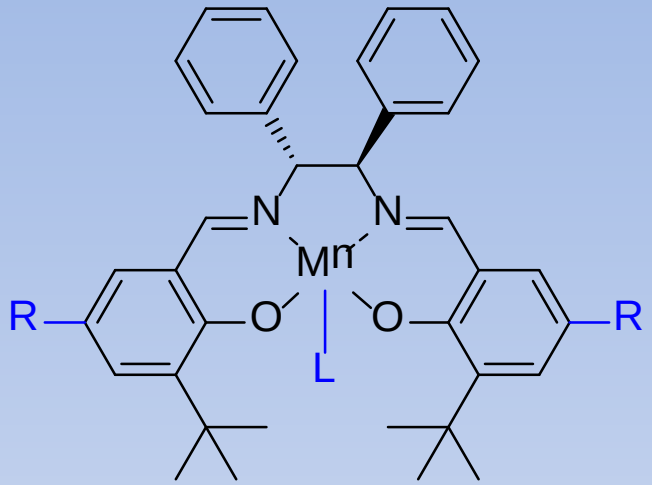
NaOCl, t. pok.

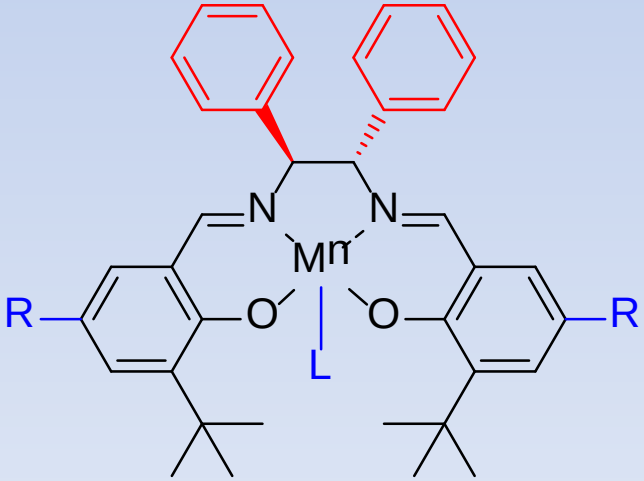


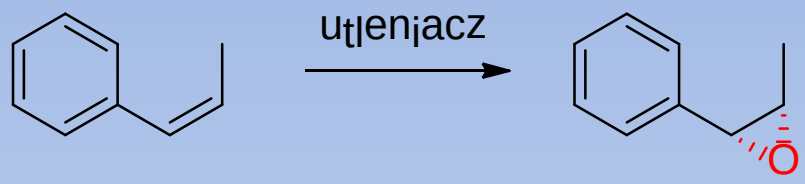




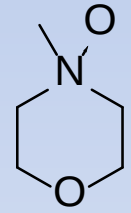
Epoksydowanie Jacobsen'a-Katsuki



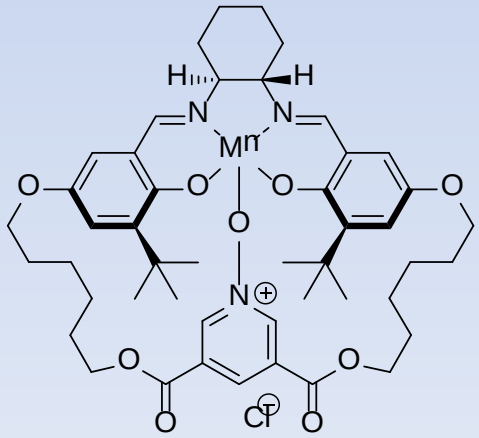




R	L	utleniacz	e.e. [%]
OCH_3	Cl	NaOCl	49
Br	Cl	NaOCl	71
NO_2	Cl	NaOCl	83
Br	Cl	Oxone, K_2CO_3	40
Br	NMO	Oxone, K_2CO_3	82

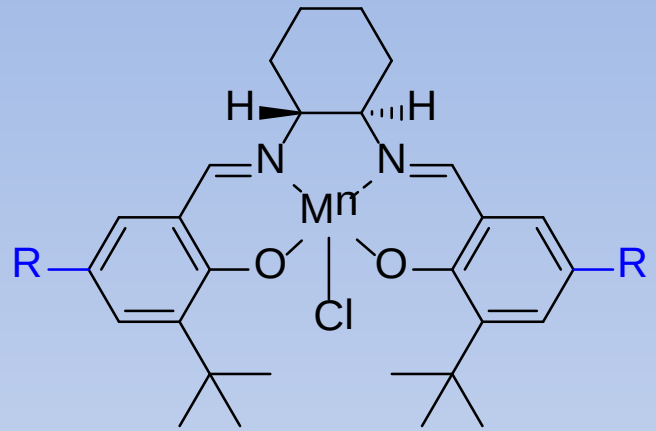


NMO

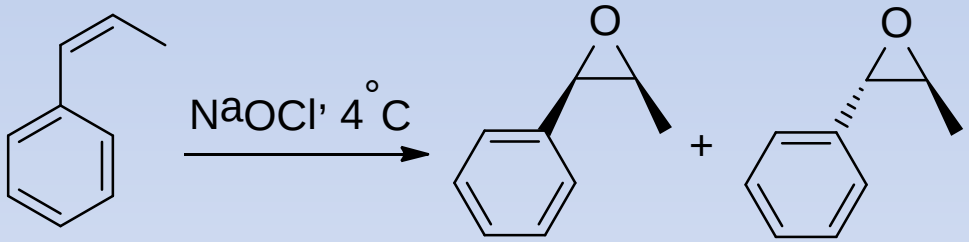


Brak wpływu dodatku NMO na e.e.

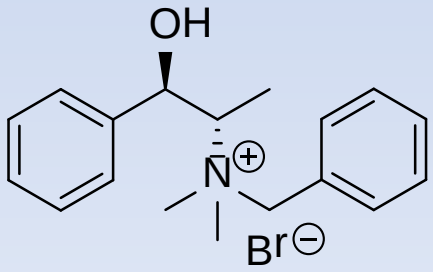
Epoksydowanie Jacobsen'a-Katsuki



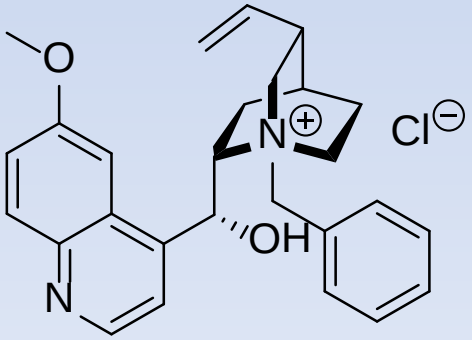
R	Rozp.	dodatek	cis/trans
^{t}Bu	CH_2Cl_2	---	92:8
$OSi(^{i}Pr)_3$	CH_2Cl_2	---	71:29
$OSi(^{i}Pr)_3$	PhCl	---	61:39
$OSi(^{i}Pr)_3$	PhCl	A	9:91
$OSi(^{i}Pr)_3$	PhCl	B	5:95



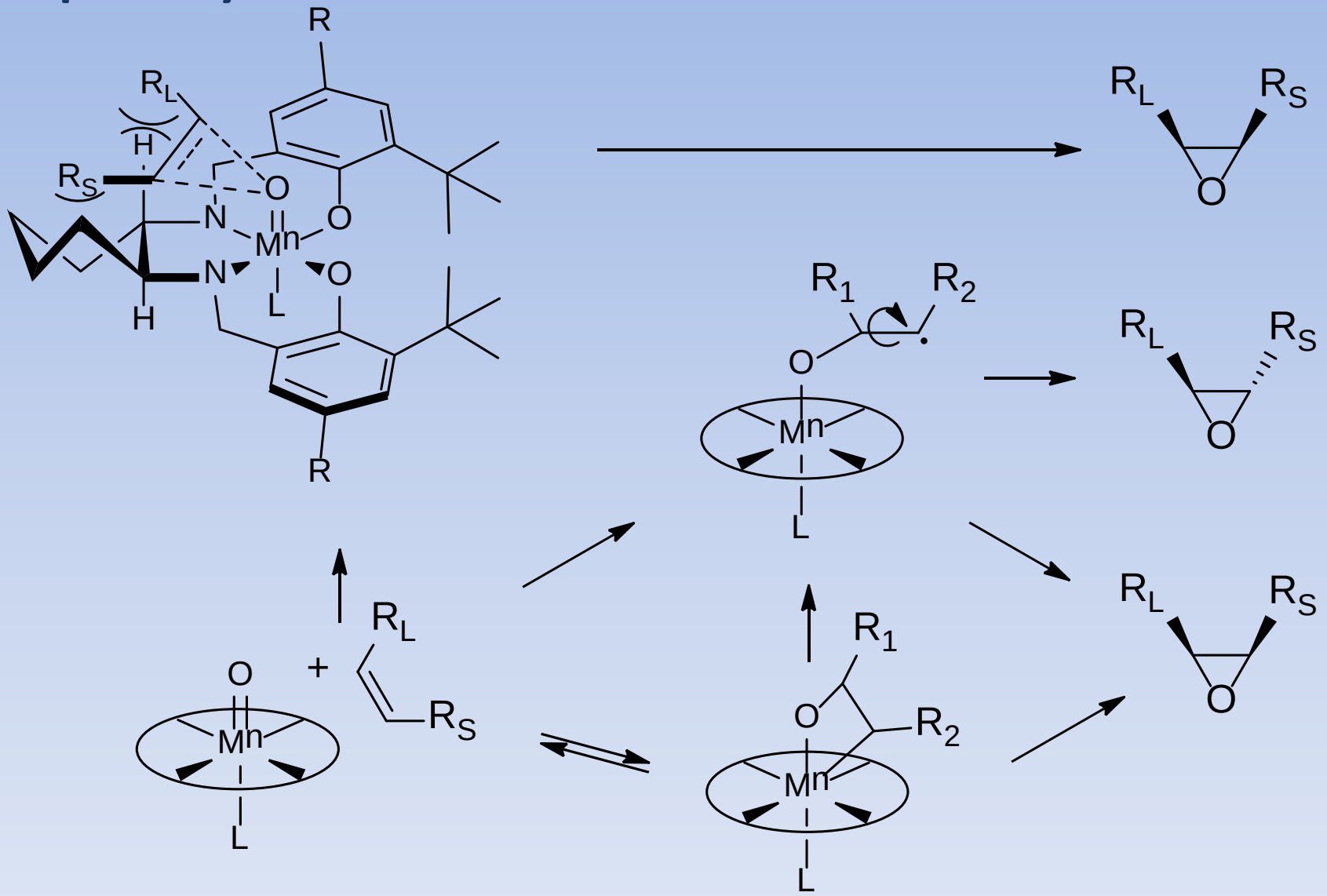
A =



B =

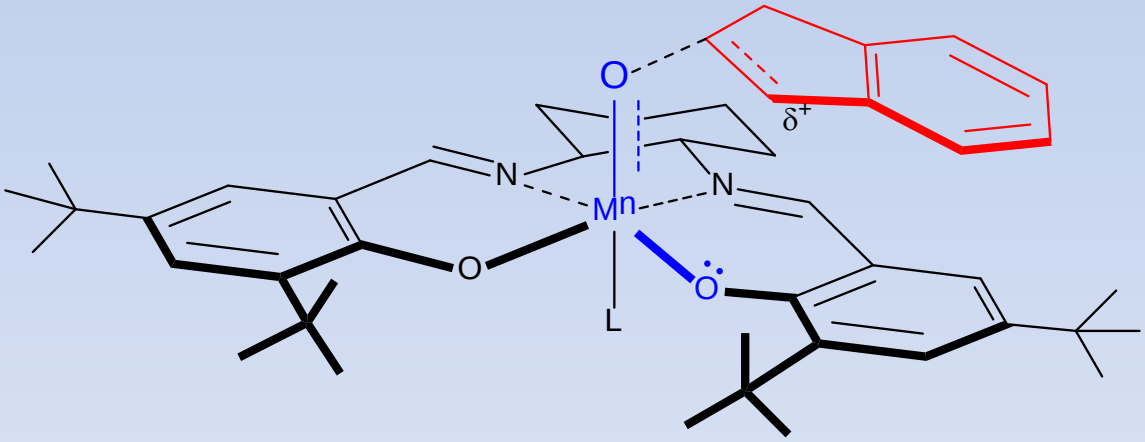


Epoksydowanie Jacobsen'a-Katsuki

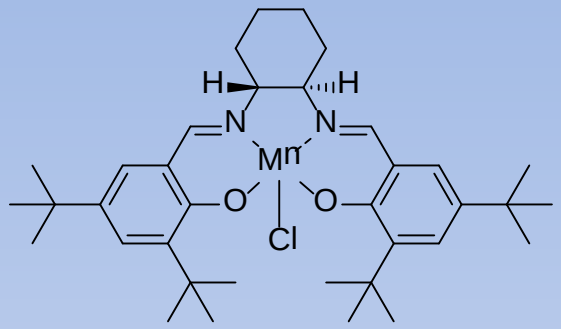


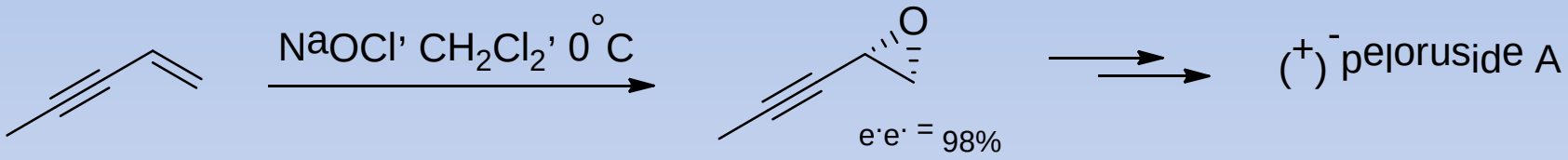
Epoksydowanie Jacobsen’a-Katsuki

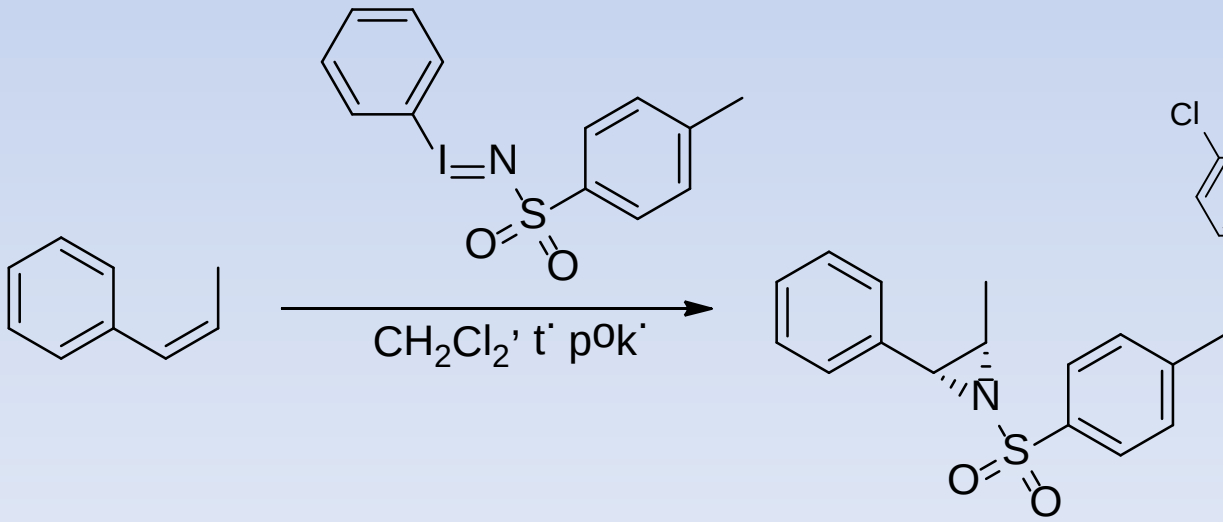
- Mechanizm uzgodniony
- Mechanizm rodnikowy
- Mechanizm z udziałem metaloksetanu
- ???



Epoksydowanie Jacobsen'a-Katsuki







Literatura do dzisiejszych zagadnień

1. T. Katsuki, K.B. Sharpless, *J. Am. Chem. Soc.*, **1980**, *102*, 5976-5978
2. V.S. Martin, S.S. Woodard, T. Katsuki, Y. Yamada, M. Ikeda, K.B. Sharpless, *J. Am. Chem. Soc.*, **1981**, *103*, 6237-6240
3. M.G. Finn, K.B. Sharpless, *J. Am. Chem. Soc.*, **1991**, *113*, 113-126
4. E. J. Corey, *J. Org. Chem.*, **1990**, *55*, 1693-1694
5. W. Zhang, J.L. Loebach, S.R. Wilson, E.N. Jacobsen, *J. Am. Chem. Soc.*, **1990**, *112*, 2801-2803
6. R. Irie, K. Noda, Y. Ito, N. Matsumoto, T. Katsuki, *Tetrahedron Lett.*, **1990**, *31*, 7345-7348
7. Z. Li, K.R. Conser, E. N. Jacobsen, *J. Am. Chem. Soc.*, **1993**, *115*, 5326-5327
8. S. Chang, J.M. Galvin, E.N. Jacobsen, *J. Am. Chem. Soc.*, **1994**, *116*, 6937-6938
9. N.S. Finney, P.J. Pospisil, S. Chang, M. Palucki, R.G. Konsler, K.B. Hansen, E.N. Jacobsen, *Angew. Chem. Int. Ed. Engl.*, **1997**, *36*, 1720-1723
10. T. Linker, *Angew. Chem. Int. Ed. Engl.*, **1997**, *36*, 2060-2062
11. L. Kürti, M.M. Blewett, E.J. Corey, *Org. Lett.*, **2009**, *11*, 4592-4595
12. M.A. McGowan, C.P. Stevenson, M.A. Schiffler, E.N. Jacobsen, *Angew. Chem. Int. Ed. Engl.*, **2010**, *49*, 6147-6150

SYNTEZA ASYMETRYCZNA

Dziękuję za uwagę

Konsultacje: pon. 14^{15}-16^{00}, pok. 135, G.Ch.