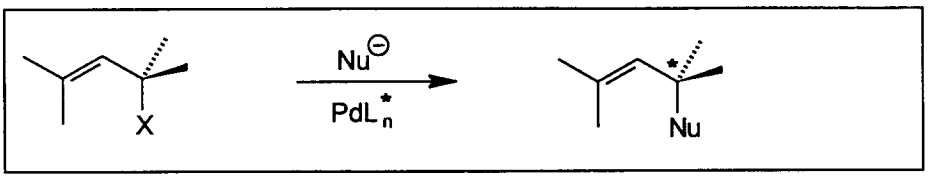
Tsuji, Trost



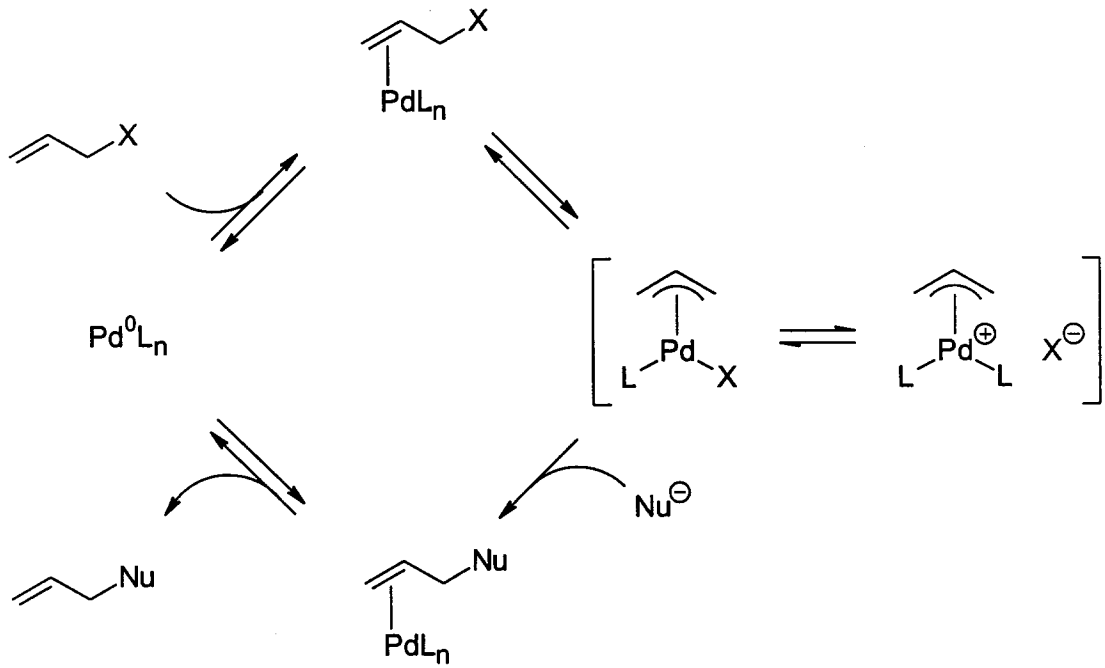
Ligand Finding / Improvement

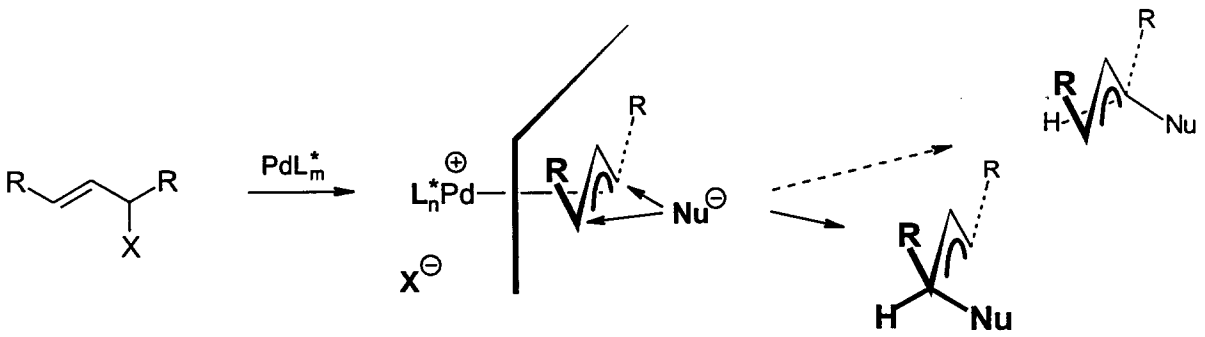
- Chance / Screening
- Combinatorics / Evolution
- Mechanism based

Ligand Structure / Properties

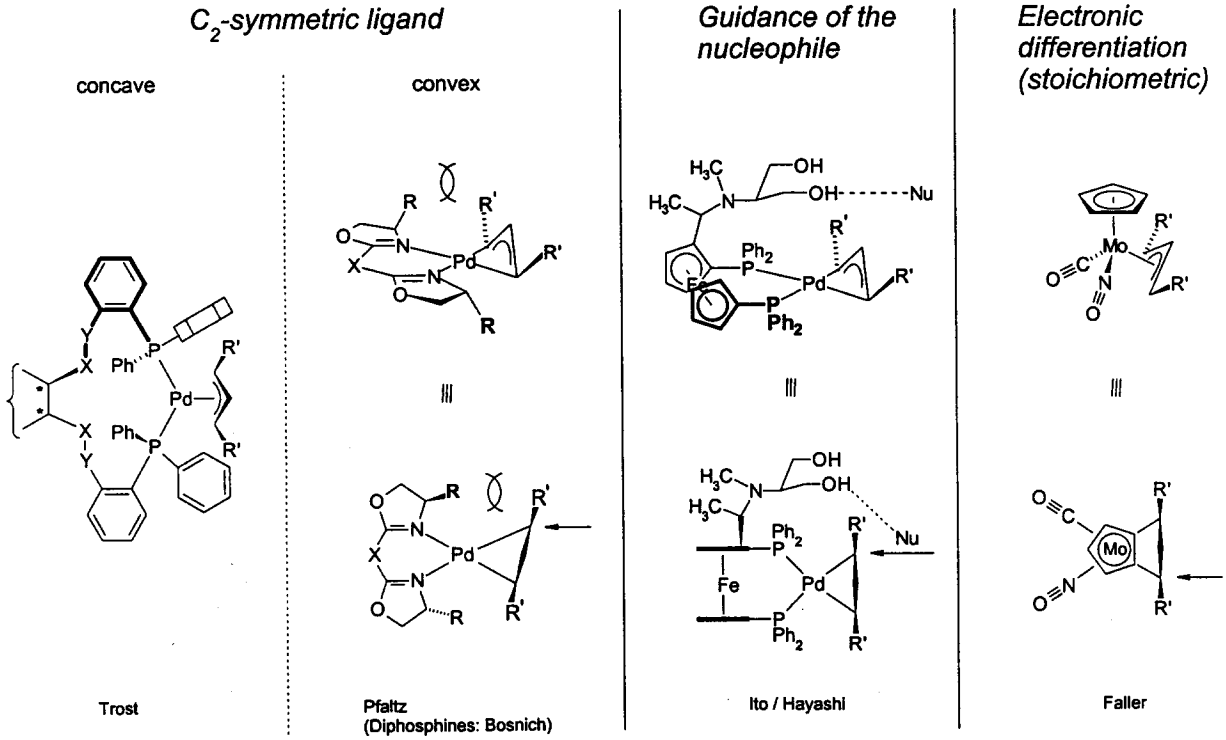
- Modularity
- Tunability electronic / steric
- Accessibility
- Stability

Catalytic Cycle of the Pd-catalyzed Allylic Substitution

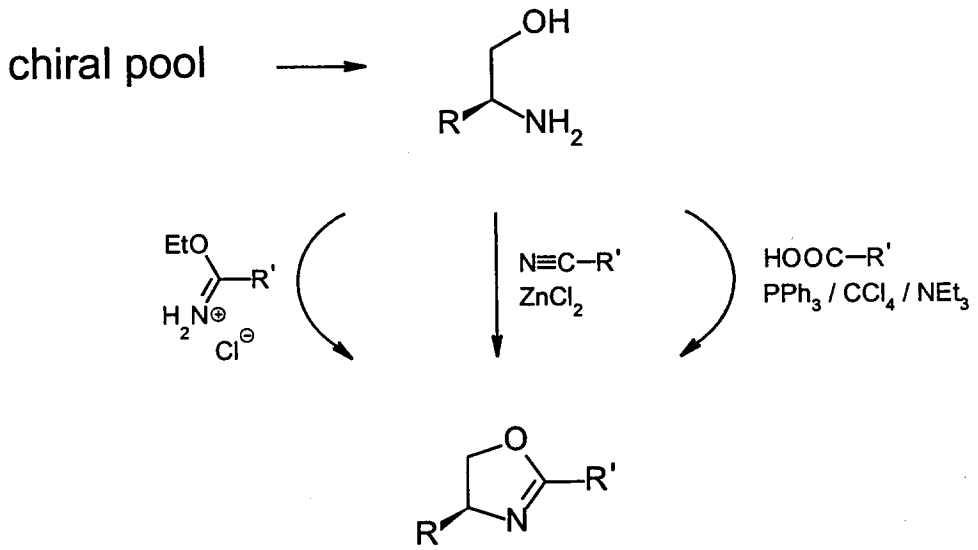




Transmittance of Chiral Information



Syntheses of Oxazolines

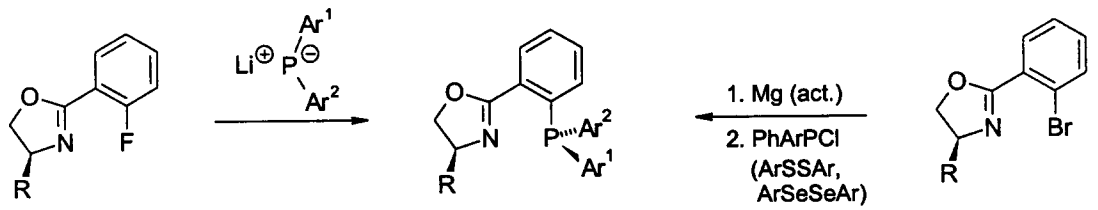


T.G. Gant, A.I. Meyers, *Tetrahedron* **1994,** *50,* 2297-2360

Synthesis of Phosphines

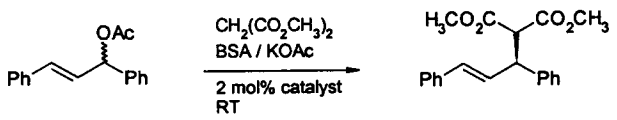
Nucleophilic phosphorus

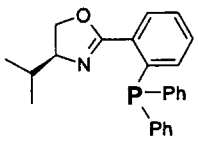
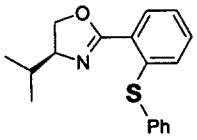
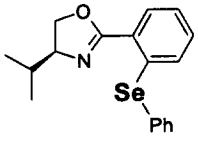
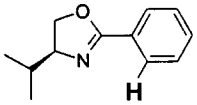
Electrophilic phosphorus (S, Se)



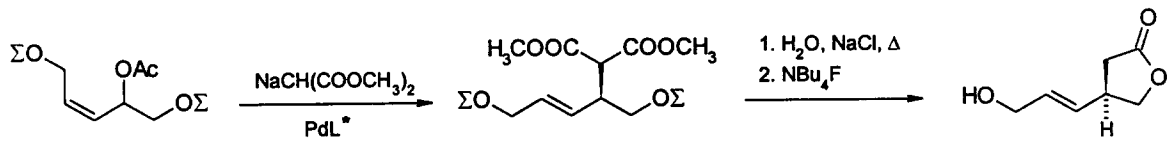
Ph	Ph
Ph	1-Np
1-Np	Ph
Ph	2-Bp
2-Bp	Ph

Allylic Alkylation with Dimethylmalonate



Ligand				
Time [h]	**1**	**96**	**72**	**120**
Yield [%]	98	49	50 - 84	3
Enantio-selectivity [%ee]	98 (*S*)	79 (*S*)	95 (*S*)	2 (*S*)

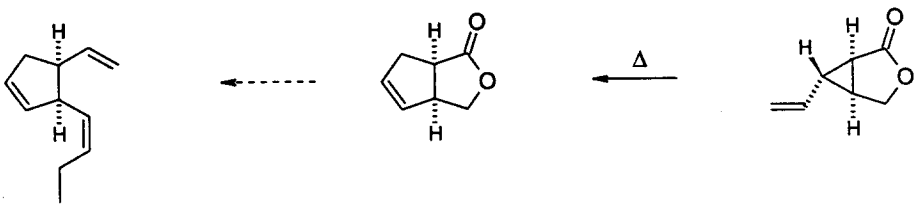
A Formal Synthesis of Multifidene



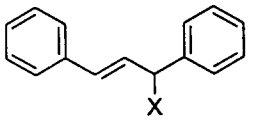
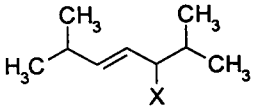
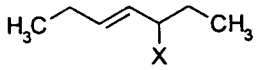
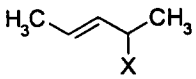
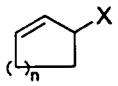
Σ = $SiMe_2$*t*-Bu

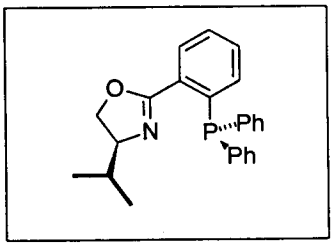
95 % ee (98 %)

1. MesCl, Py
2. P_4 - *t*Bu



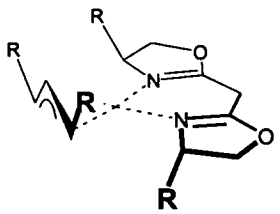
Multifidene

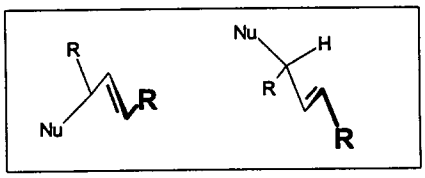
	% ee
	98.5
	94
	74
	56
	0 - 10



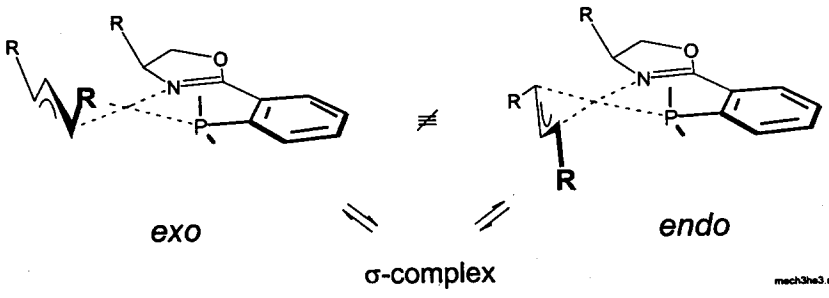
Mechanistic Aspects

C_2-symmetric ligand



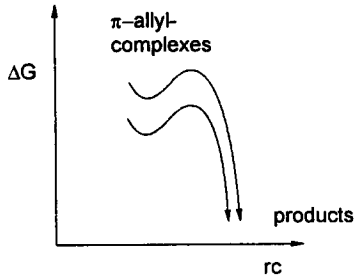


asymmetric ligand



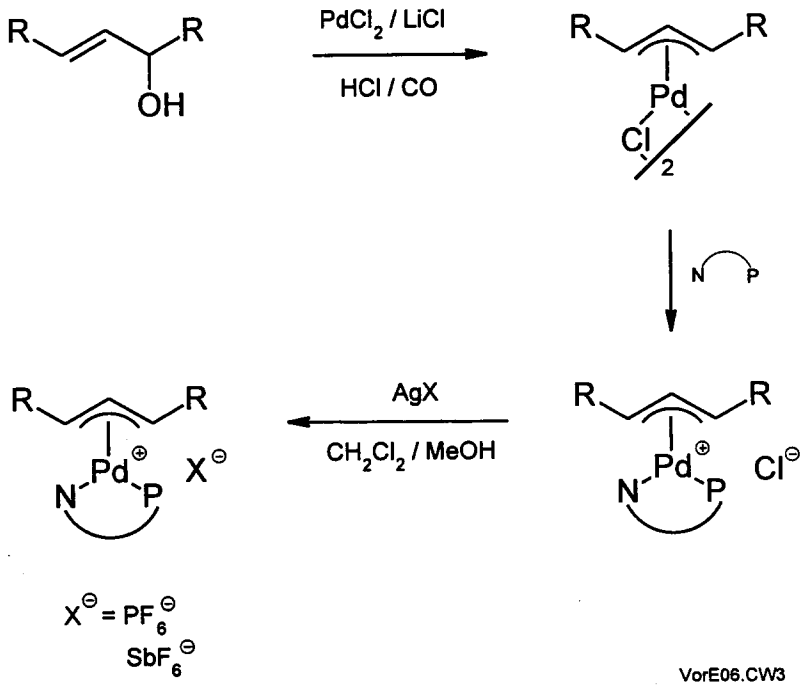
Bosnich´s Hypothesis

- The reaction traverses an early transition state because of the Hammond Postulate
- The more abundant diastereomer is the more reactive



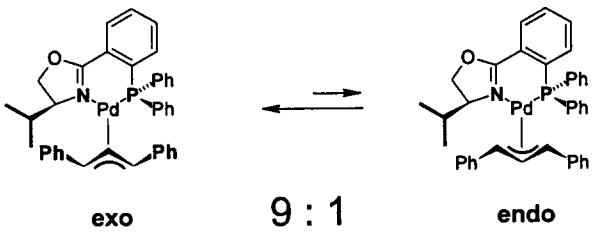
exo *endo*

Preparation of π-Allylpalladium Complexes

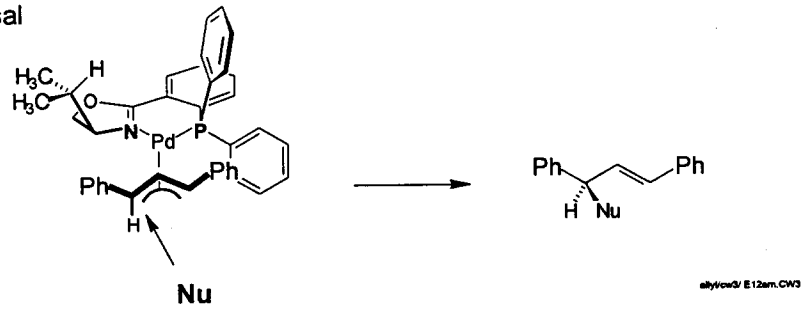


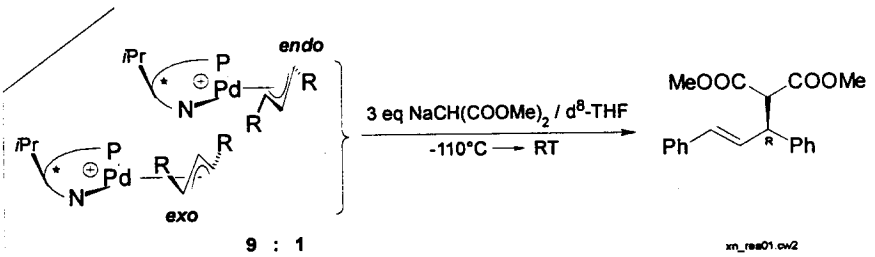
VorE06.CW3

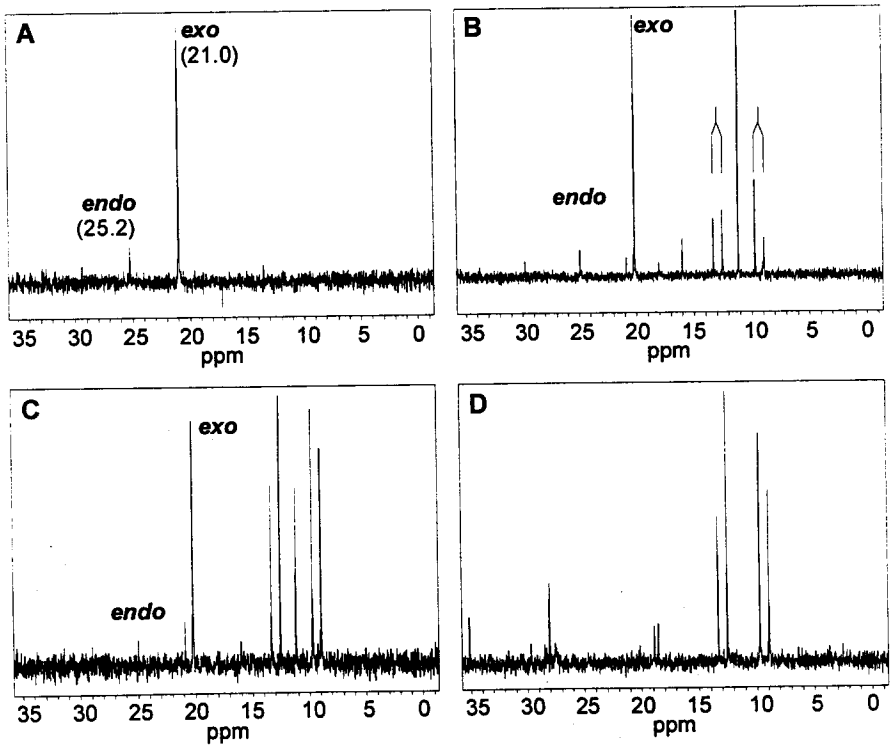
Diastereomers in solution (NMR, $CDCl_3$)

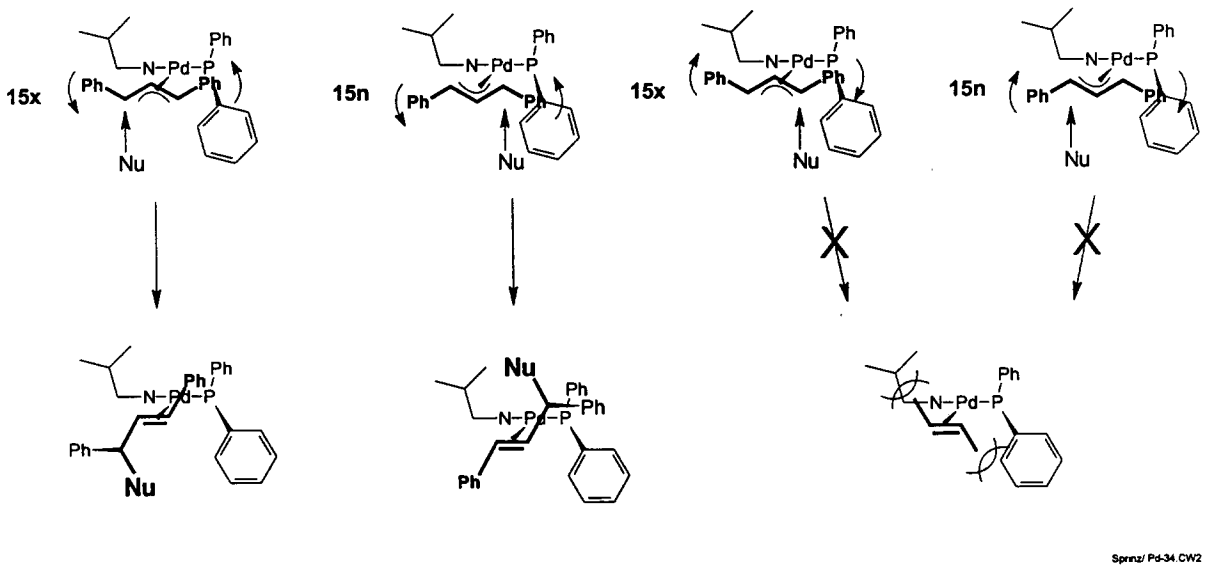


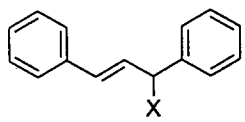
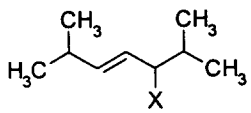
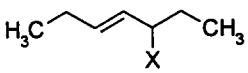
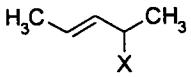
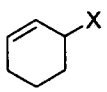
Proposal

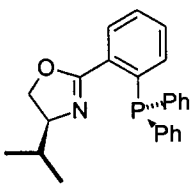


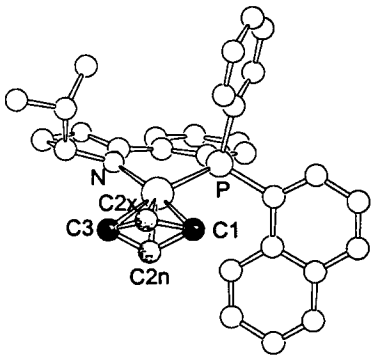


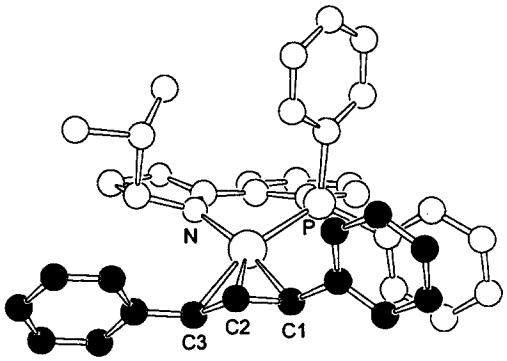




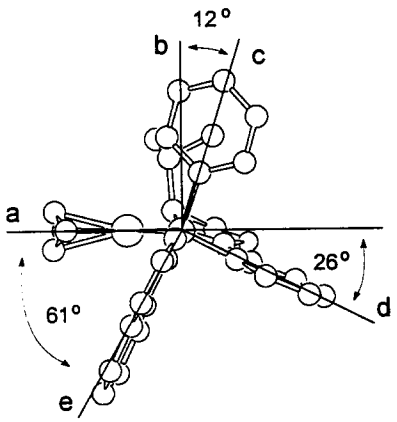
	% ee	er	exo : endo (NMR)
	98.5	99 : 1	90 : 10
	94		
	74		
	56	80 : 20	80 : 20
	0	50 : 50	64 : 36

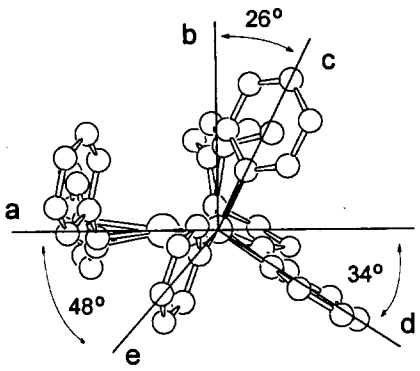


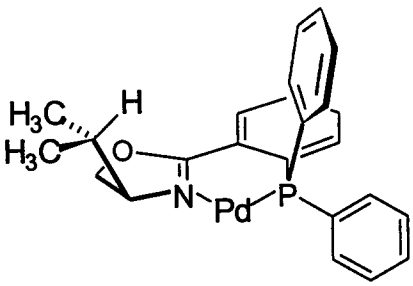


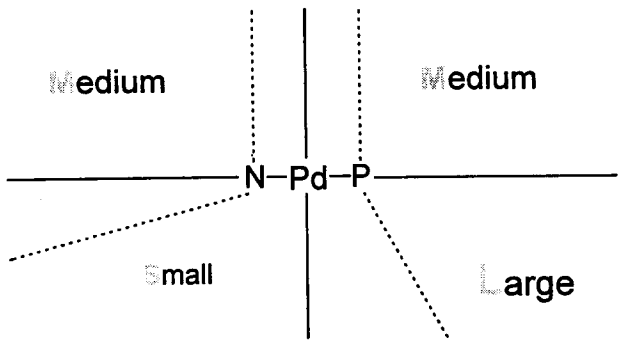


- Non-planarity of chelate cycle
- Non-equivalence of P_{Ar} group
- Ar_{ax} edge-on Ar_{eq} face-on
- Axial disposition of isopropyl group

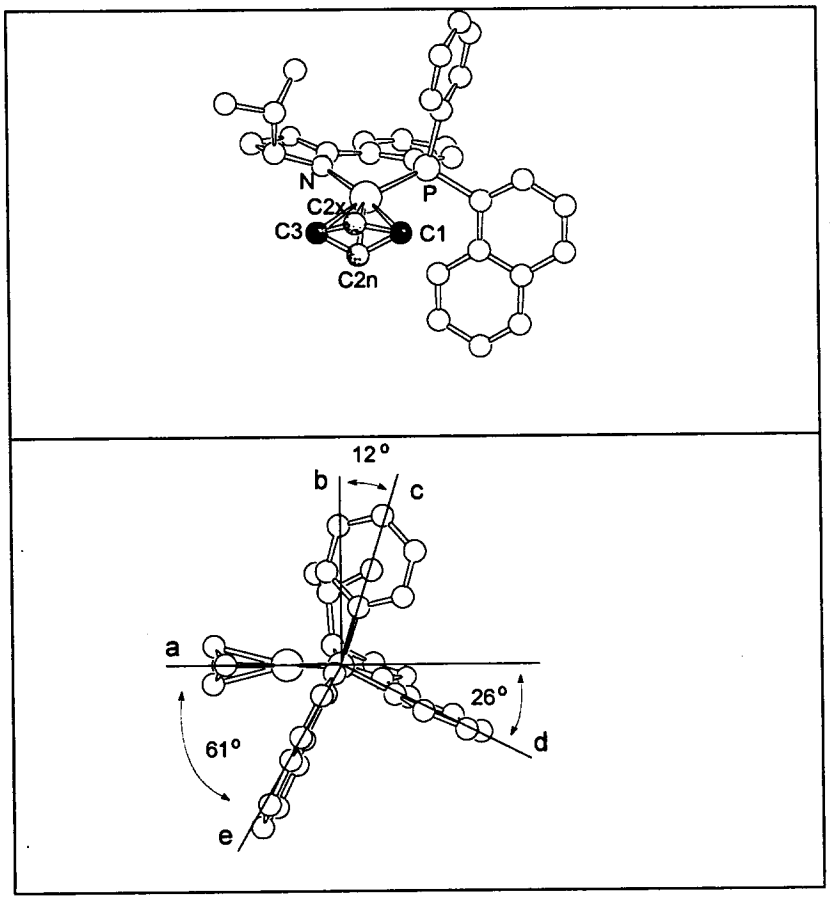


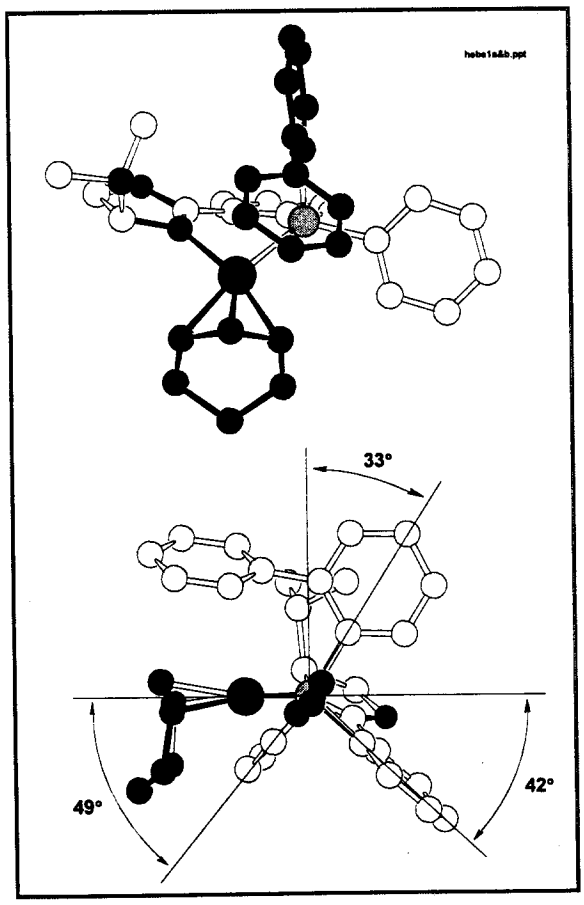




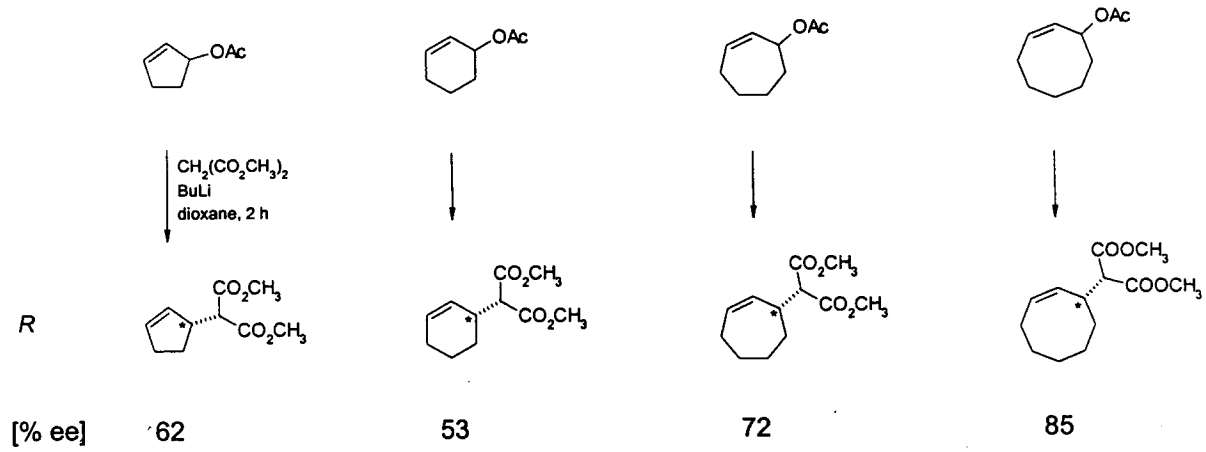


vorträge/allyl/alsek.cw2


N
P
C2x
C3
C1
C2n
12°
b
c
a
26°
61°
d
e

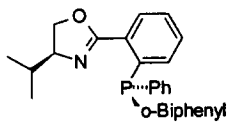

33°
49°
42°

Influence of Ring Size

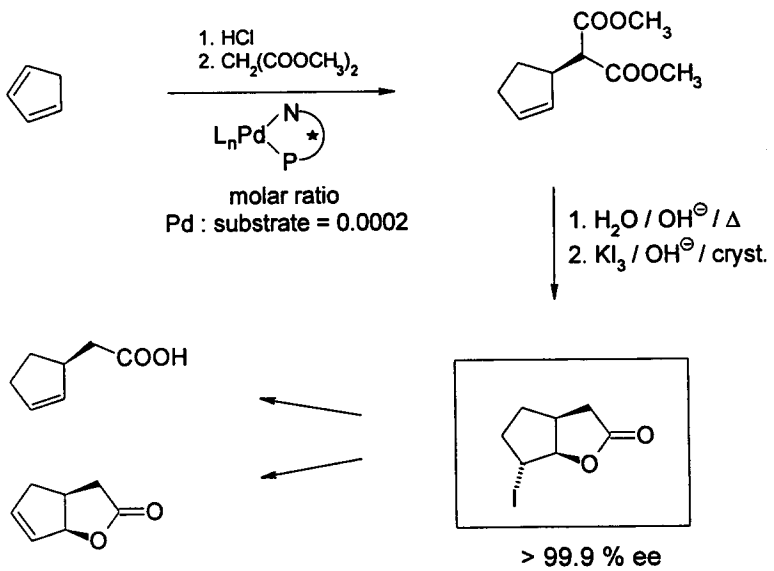


[% ee]	62	53	72	85

Catalyst: $[\pi\text{-}C_3H_5\text{-}PdCl]_2$
1 mol% Pd / in situ

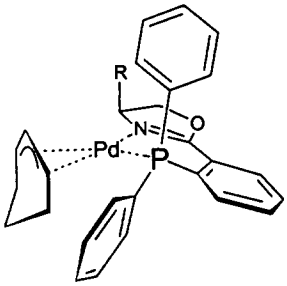


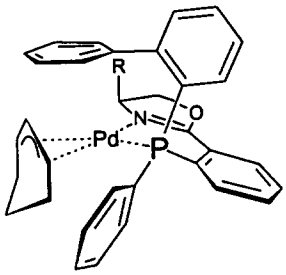
Allyl / E11q.CW3

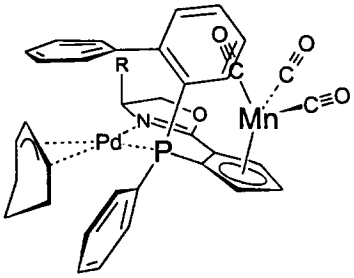


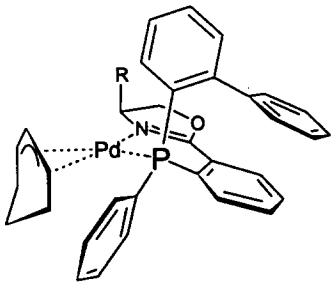
> 99.9 % ee

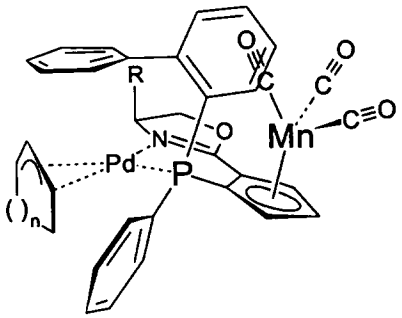
P. Sennhenn, B. Gabler, G. Helmchen, *Tetrahedron Lett.*, **1994**, 859

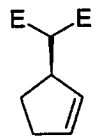
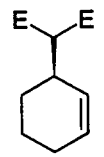
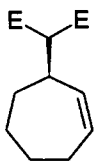


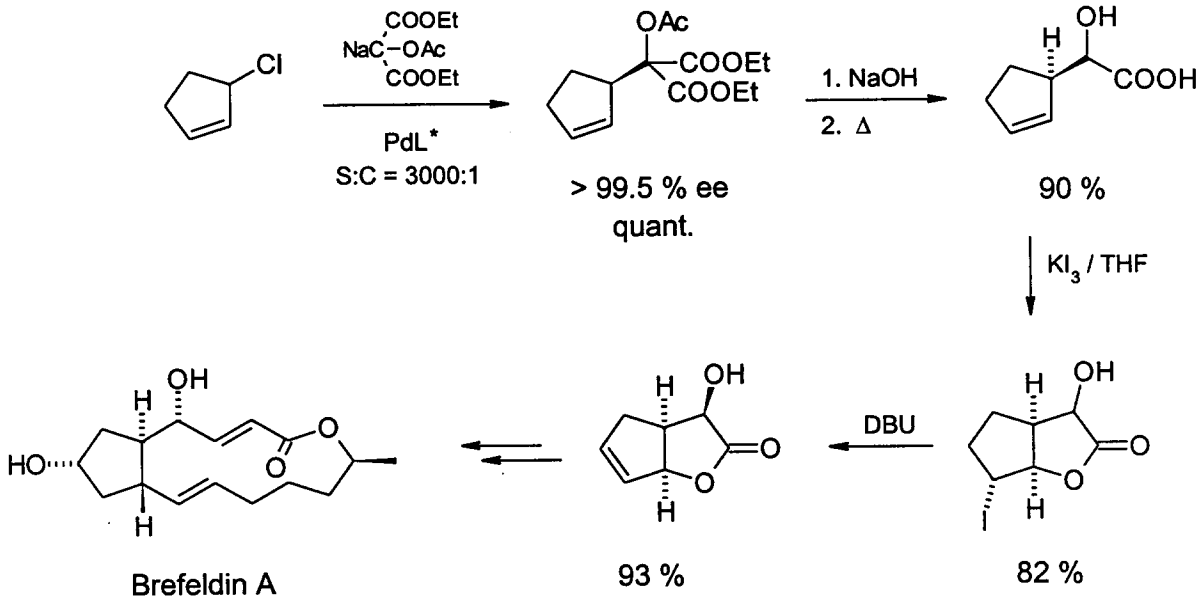


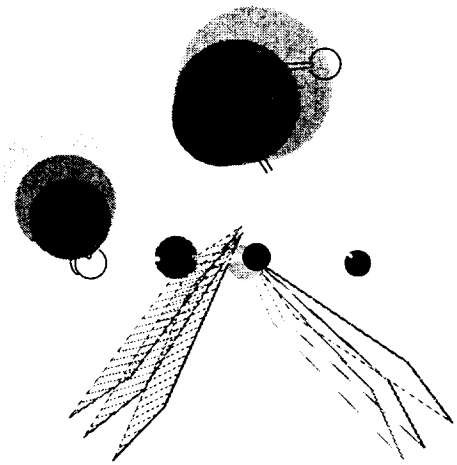


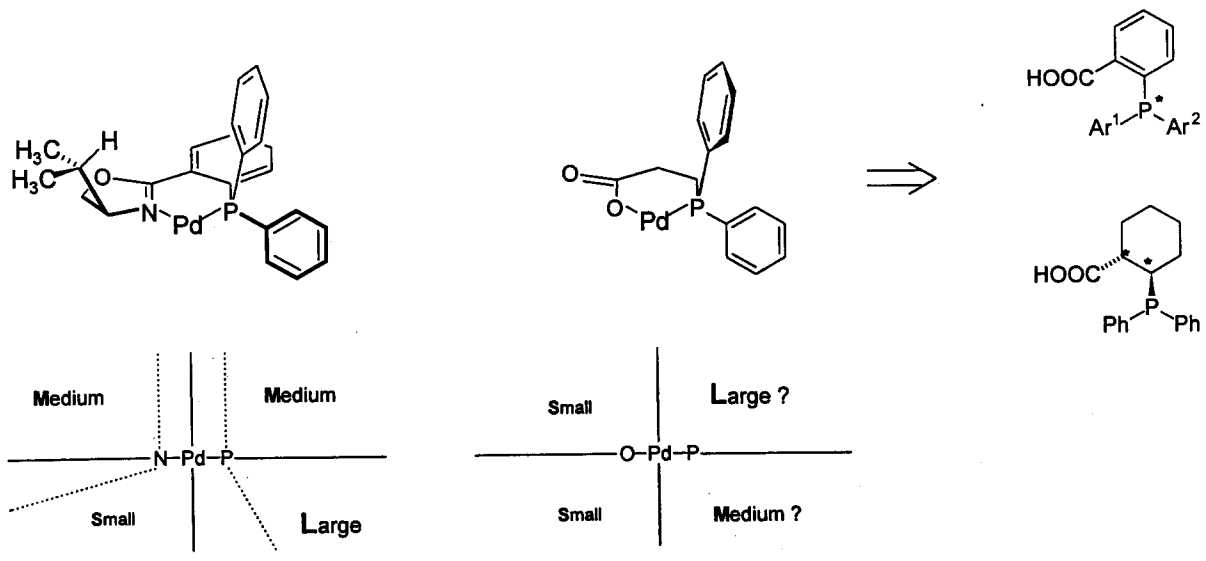


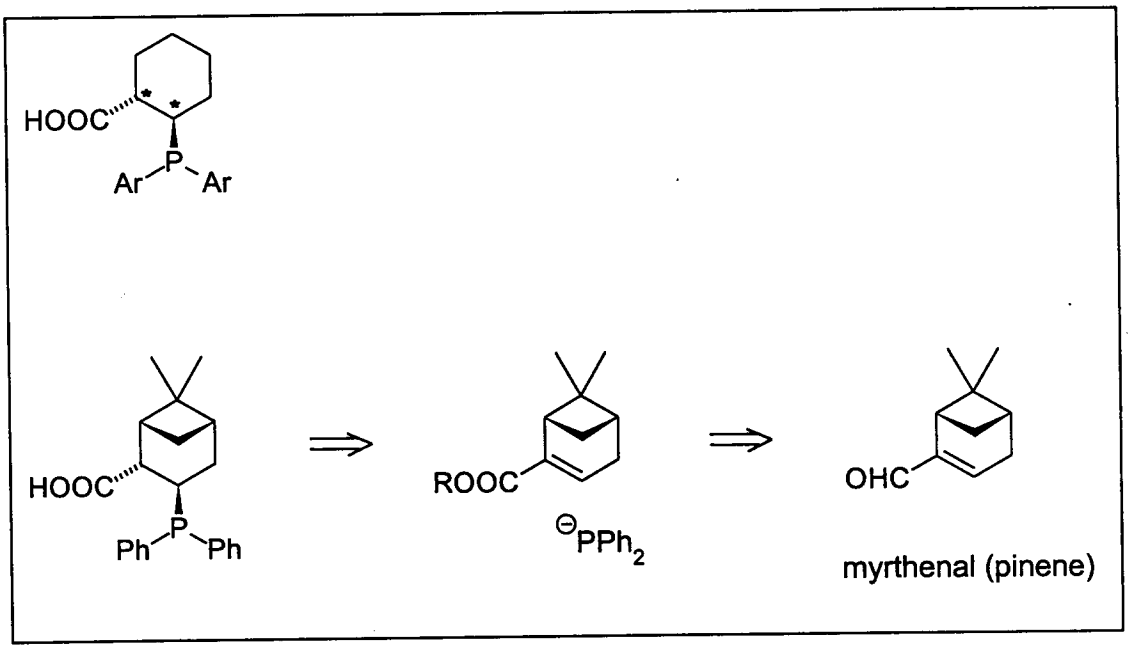


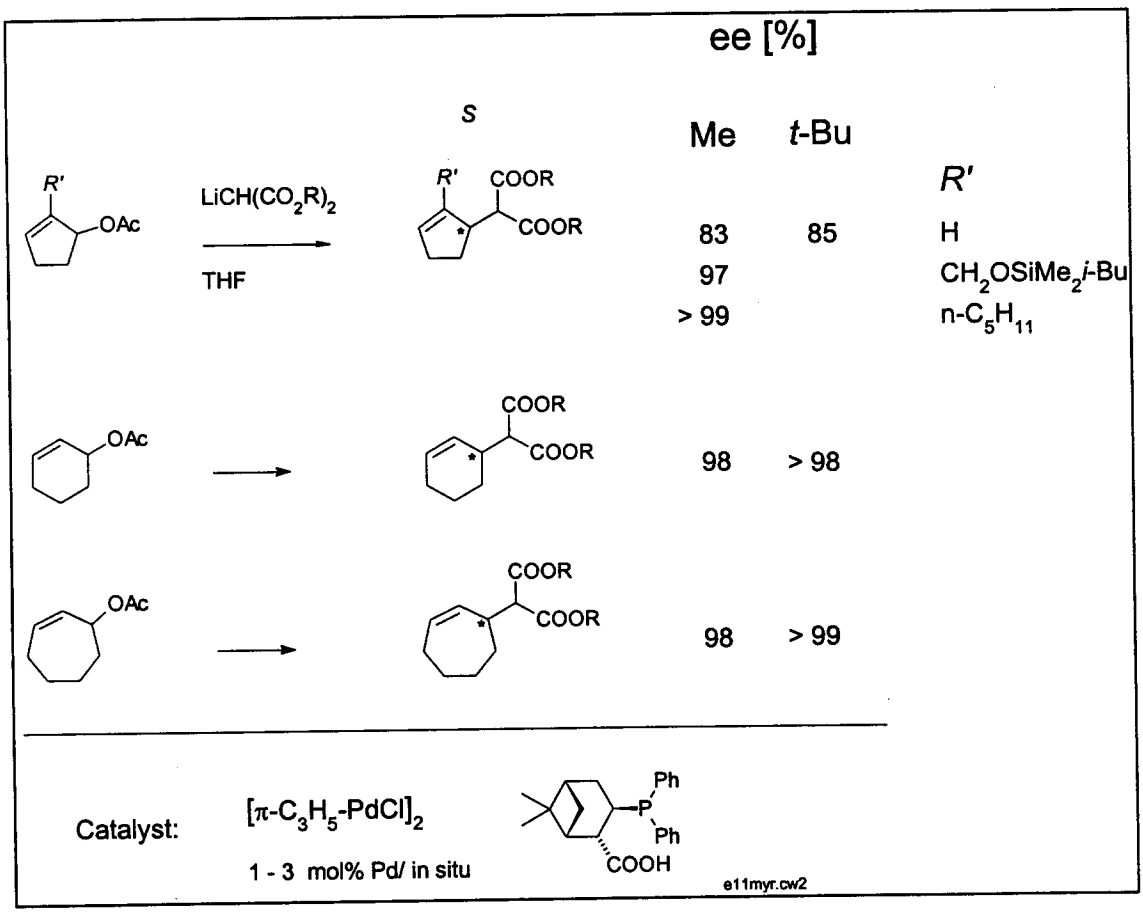
	% ee	yield [%]
	96	95
	94	93
	> 99	98

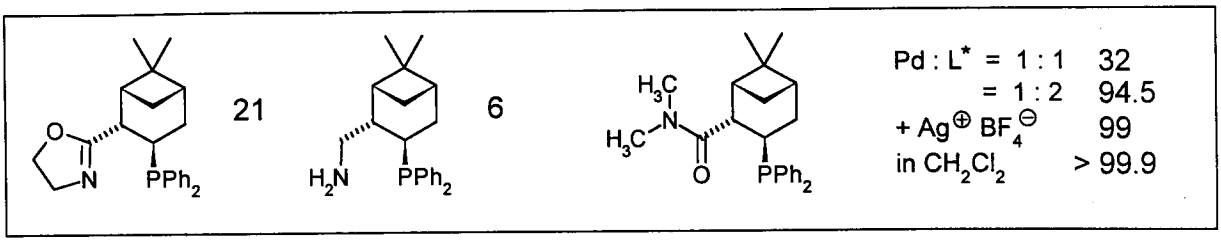

COOEt
NaC–OAc
COOEt
PdL*
S:C = 3000:1
> 99.5 % ee
quant.
1. NaOH
2. Δ
90 %
KI3 / THF
DBU
82 %
93 %
Brefeldin A

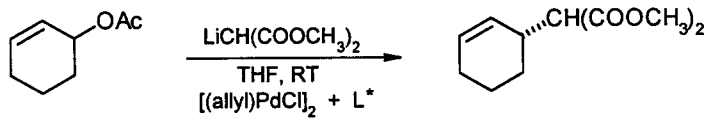



Medium
Medium
Small
Large
Small
Large ?
Small
Medium ?
HOOC
Ar1
Ar2
HOOC
Ph
Ph


HOOC
Ar
P
Ar
HOOC
Ph
P
Ph
ROOC
⊖PPh2
OHC
myrthenal (pinene)

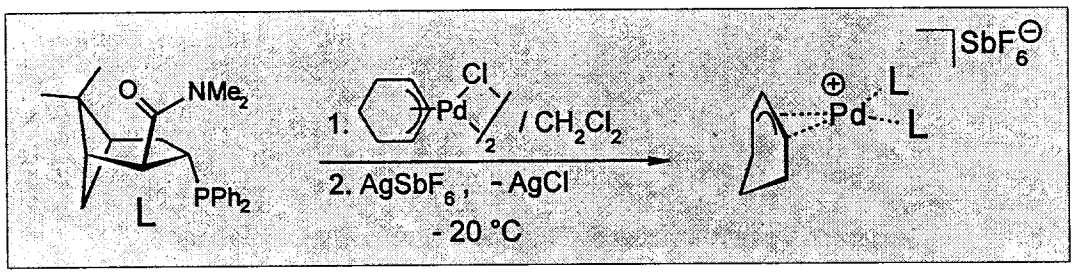

ee [%]
S
Me
t-Bu
R'
R'
OAc
LiCH(CO2R)2
THF
R'
COOR
COOR
83
85
H
97
CH2OSiMe2i-Bu
> 99
n-C5H11
OAc
COOR
COOR
98
> 98
OAc
COOR
COOR
98
> 99
Catalyst:
[π-C3H5-PdCl]2
1 - 3 mol% Pd/ in situ
Ph
P
Ph
COOH
e11myr.cw2





hst001.cw2

Preparation η^3-Pd(Cyclohexenyl)$(L)_2$

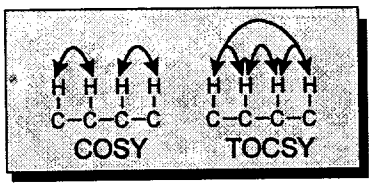


^{31}P {^1H} NMR, d^8-THF, 238K

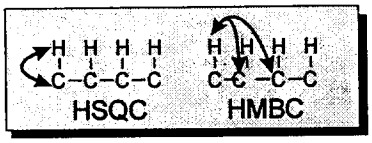
Hst03sw.cdr

Assignment of η^3-Pd(Cyclohexenyl)$(L)_2$
— 2D-NMR Strategy —

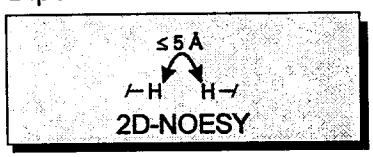
Homonuclear Correlations



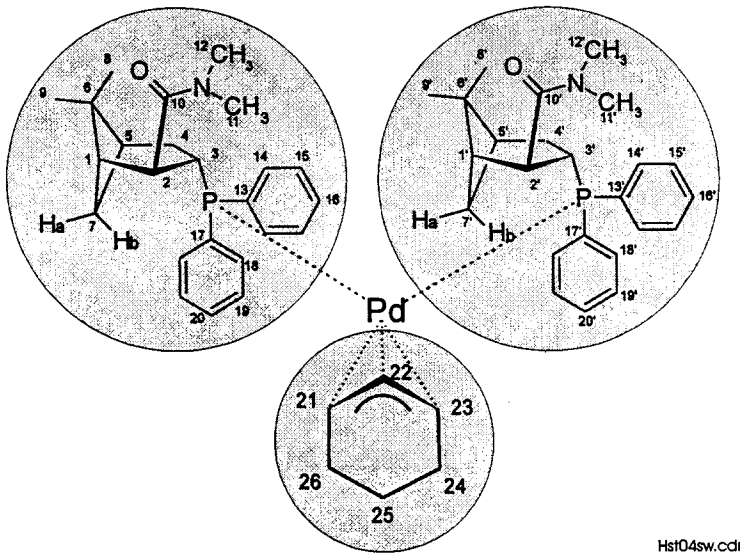
Heteronuclear Correlations



Dipolar Correlations

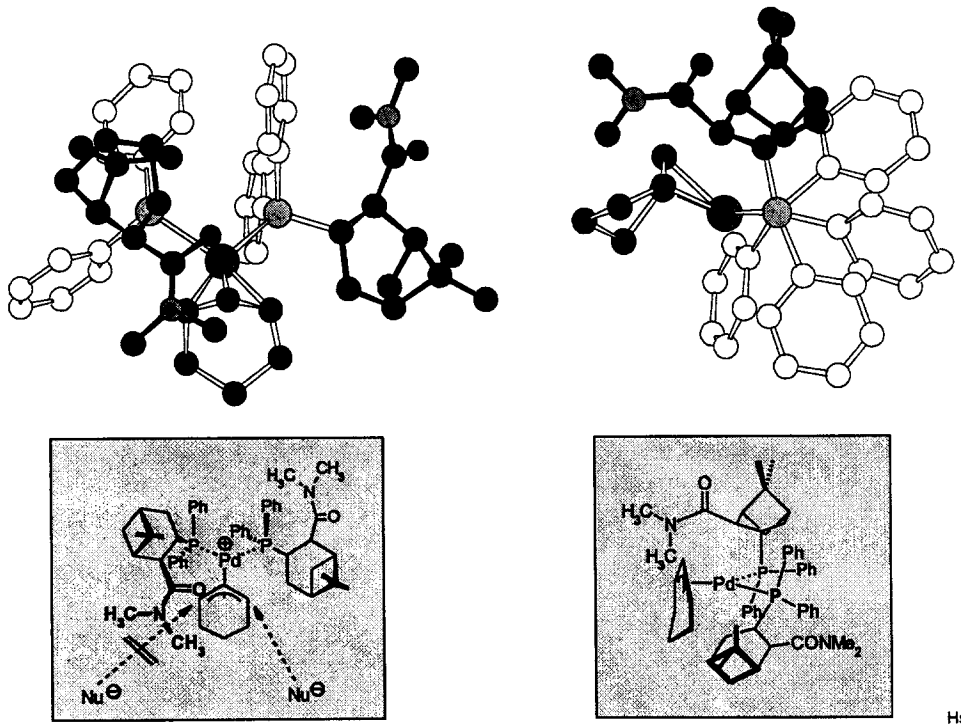


3 Main Spinsystems

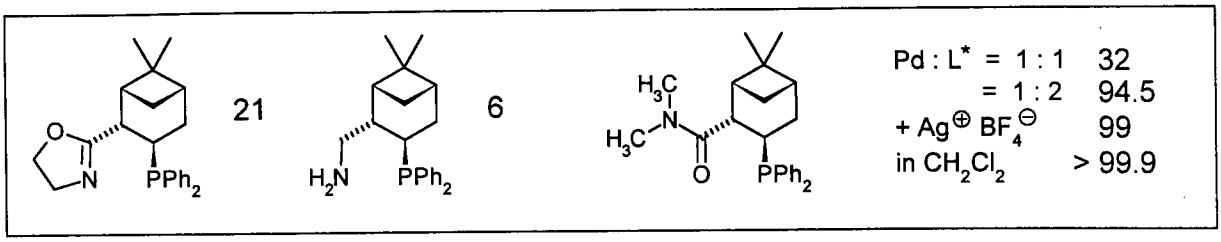


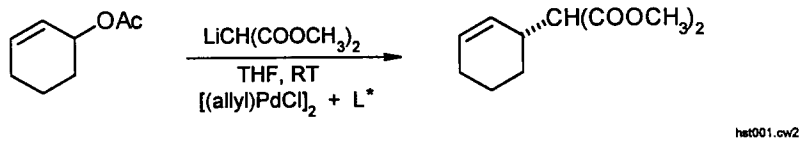
Hst04sw.cdr

Structure Determination by Distance Geometry Calculations

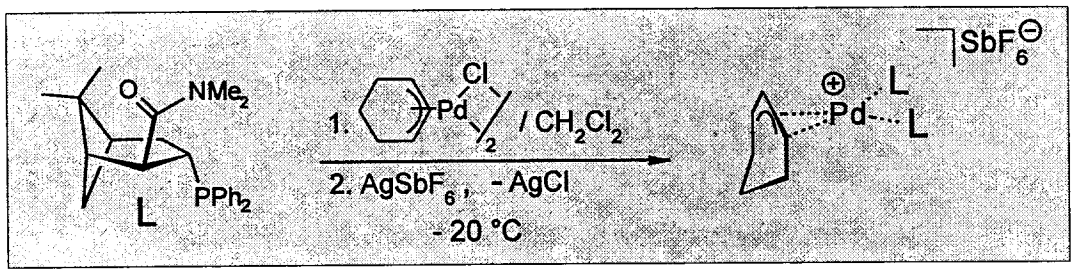


Hst06sf2asw.cdr



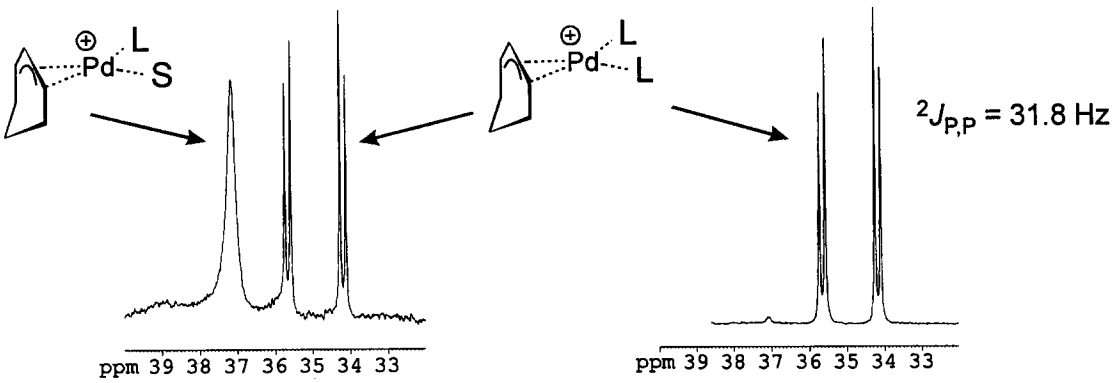


Preparation η^3-Pd(Cyclohexenyl)$(L)_2$



L / Pd = 1 / 1

L / Pd = 2 / 1



^{31}P $\{^1H\}$ NMR, d^8-THF, 238K

Hst03sw.cdr