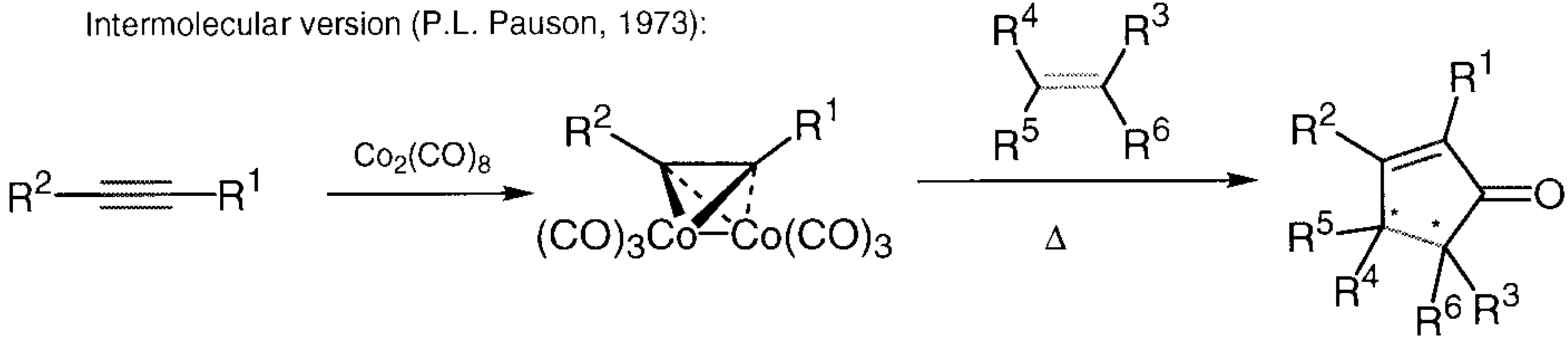
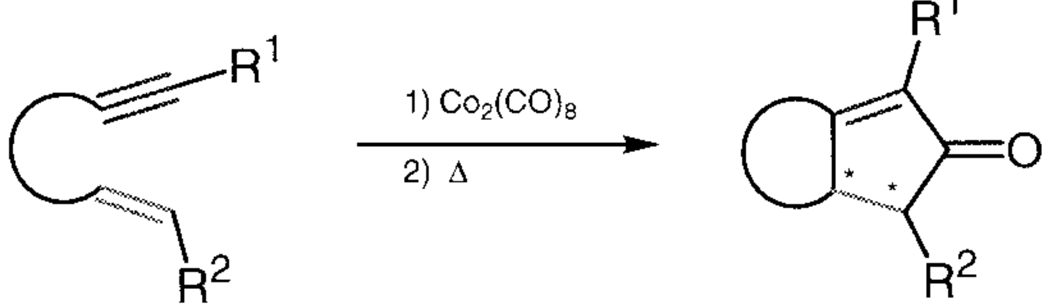
THE PAUSON-KHAND REACTION

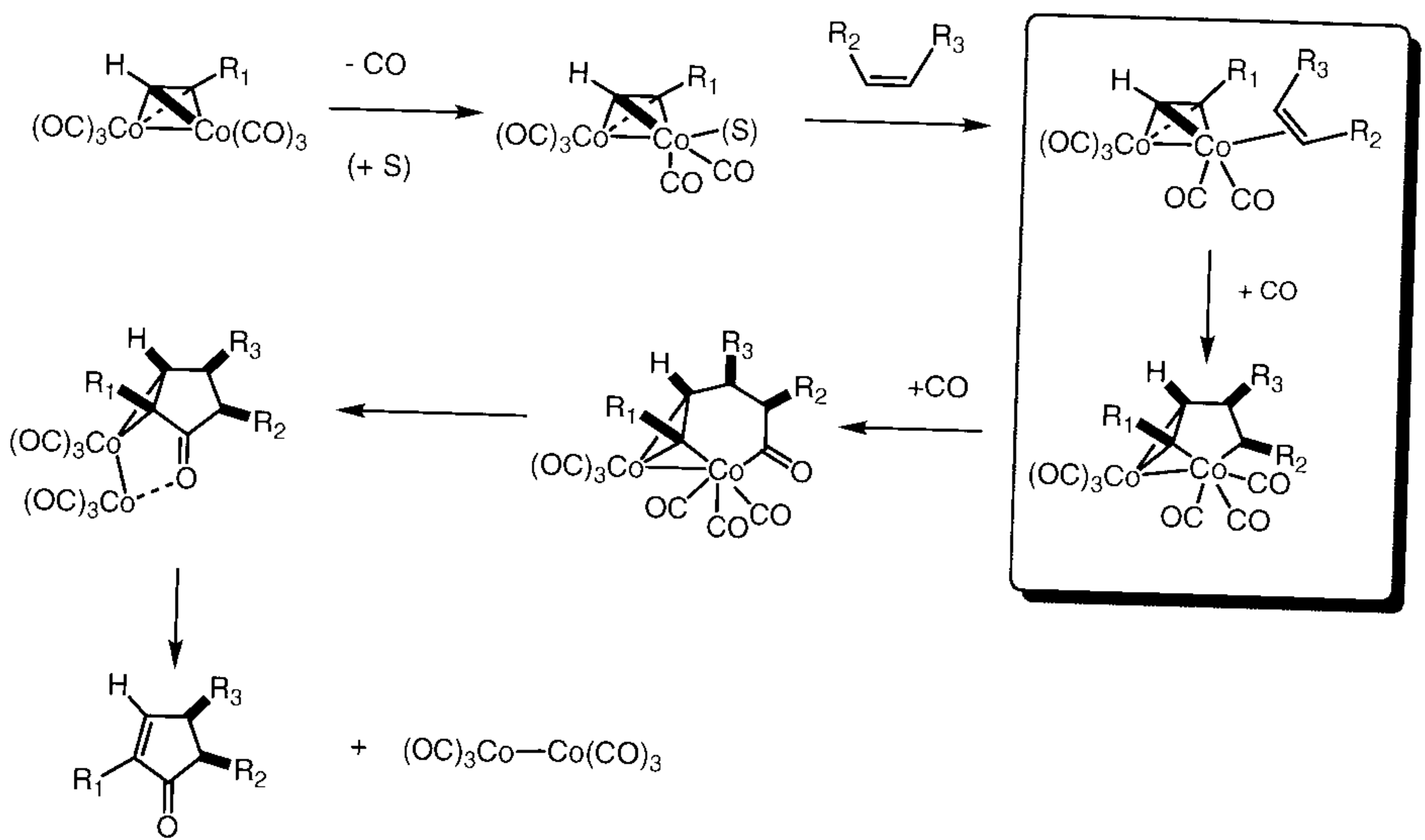
Intermolecular version (P.L. Pauson, 1973):



Intramolecular version (N.E. Schore, 1981):

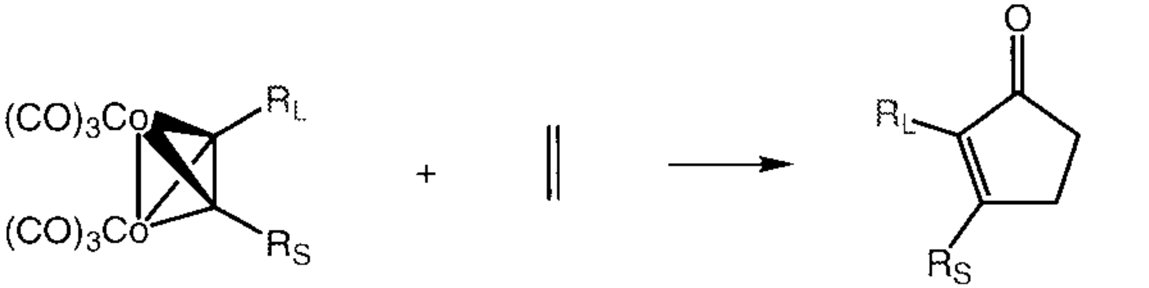


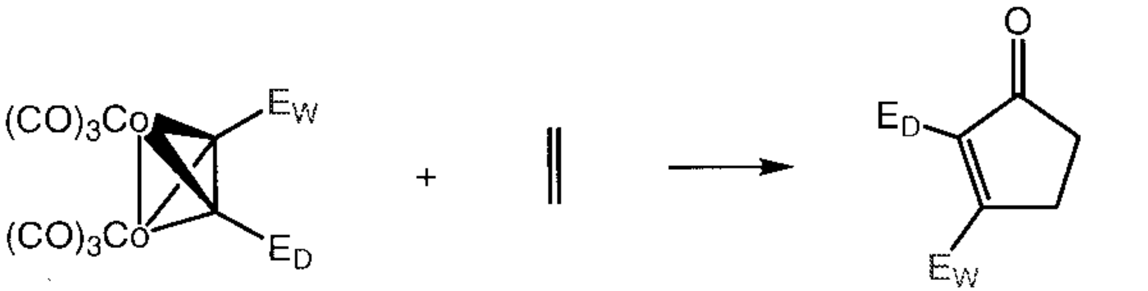
A PLAUSIBLE MECHANISM FOR THE PAUSON-KHAND REACTION



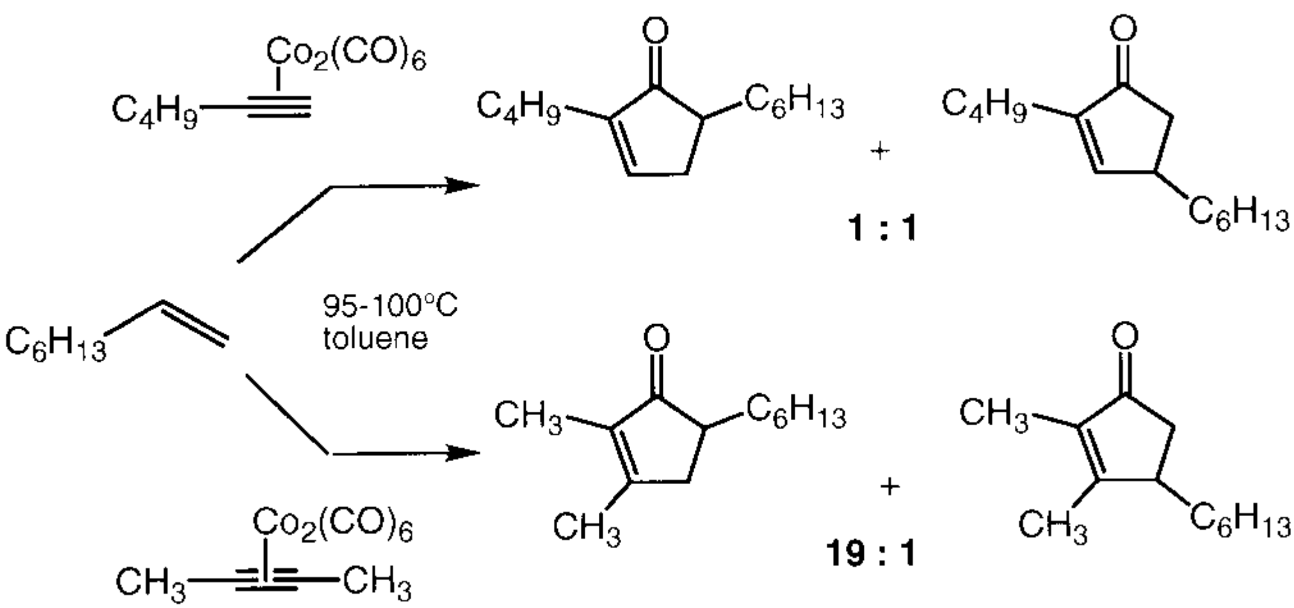
REGIOSELECTIVITY IN THE INTERMOLECULAR PAUSON-KHAND REACTION

ACETYLENE COMPONENT: STERIC AND ELECTRONIC EFFECTS

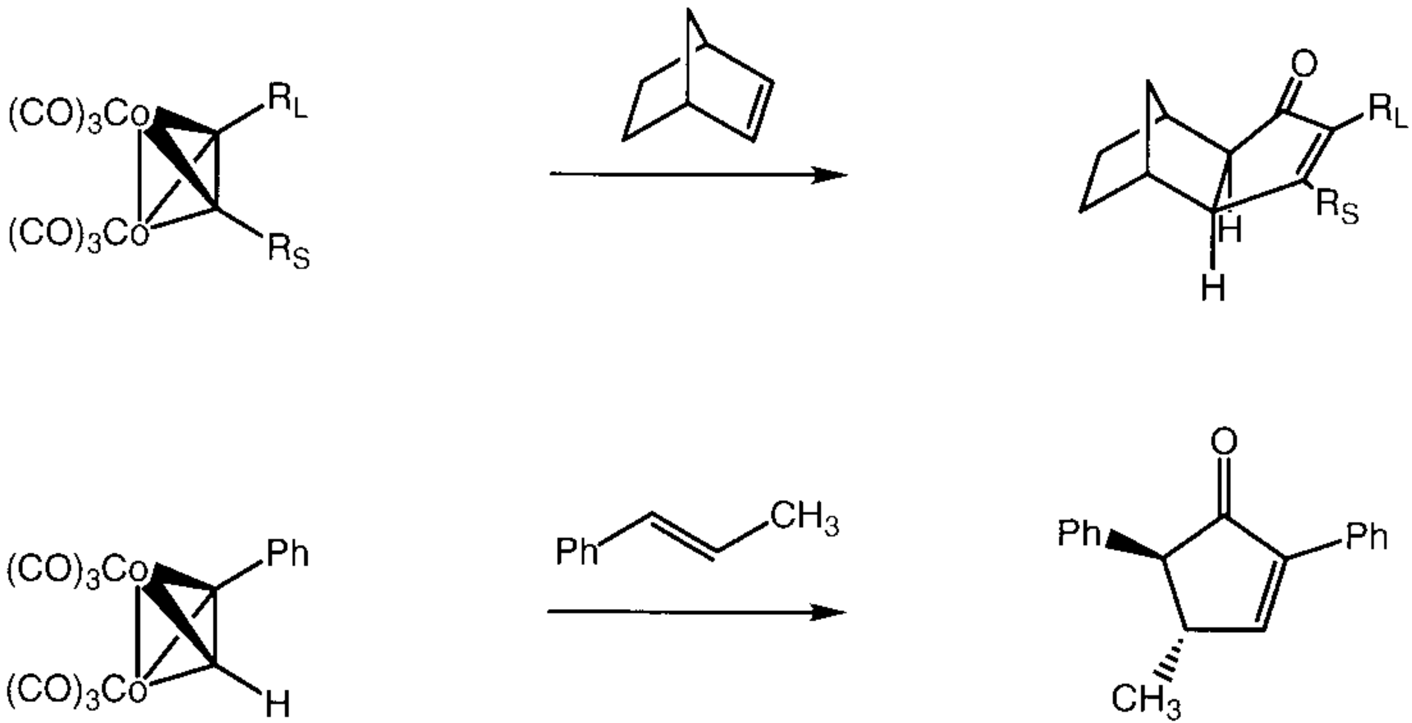




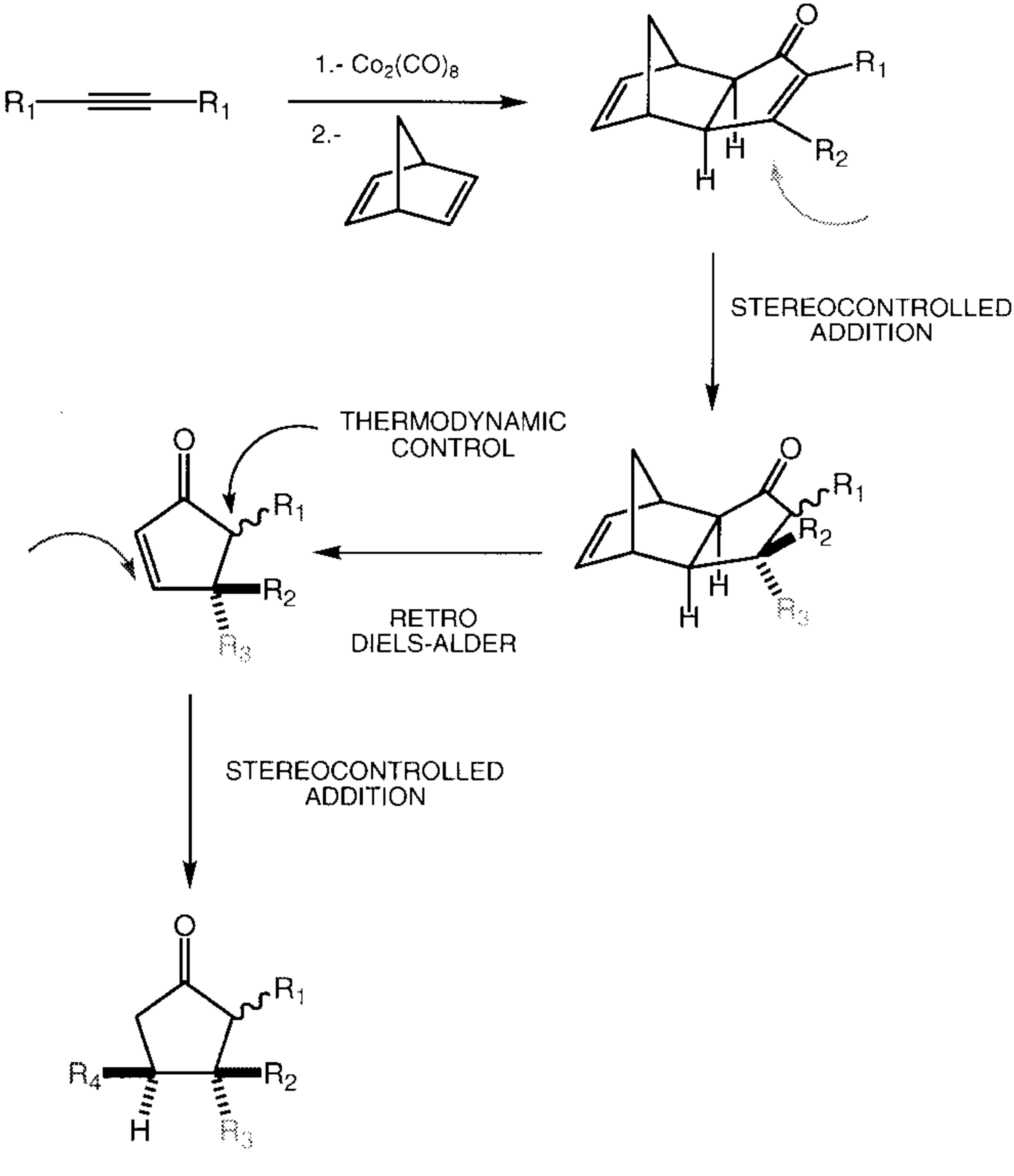
ALKENE COMPONENT



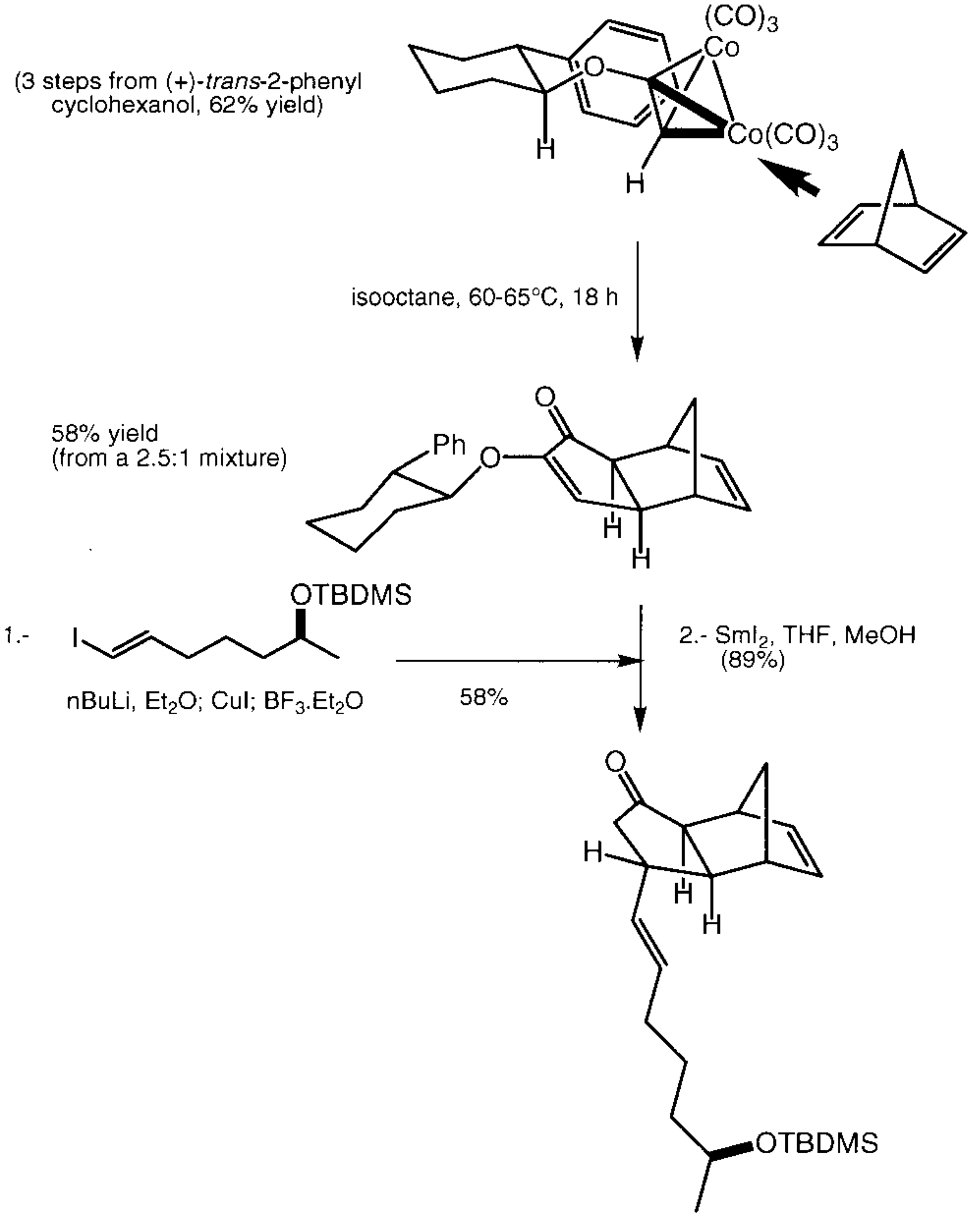
STEREOCHEMICAL PREFERENCES OF THE INTERMOLECULAR PAUSON-KHAND REACTION



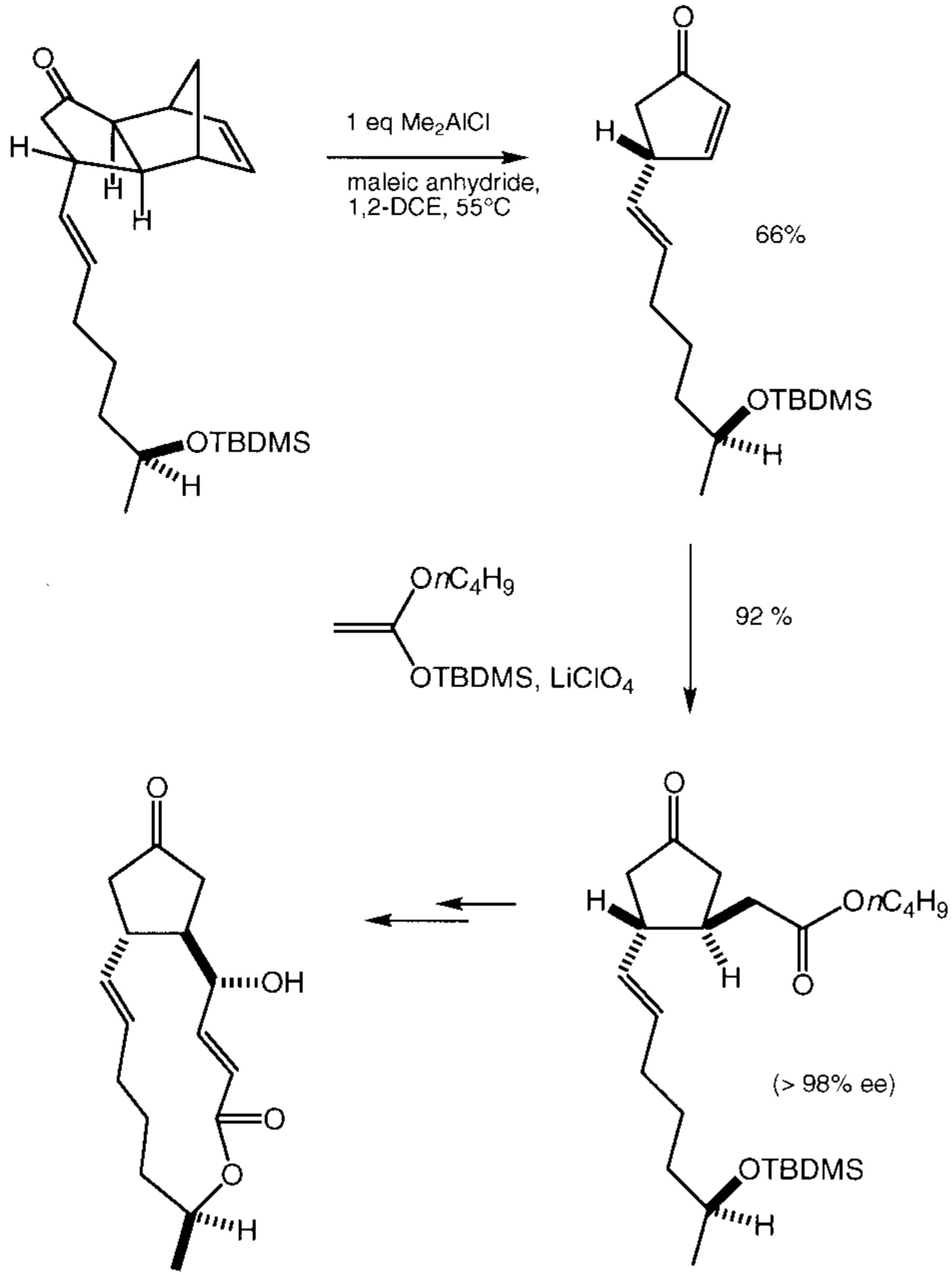
INTERMOLECULAR NORBORNADIENE PAUSON-KHAND ADDUCTS: VERSATILE SYNTHETIC INTERMEDIATES FOR CYCLOPENTANONES



ENANTIOSELECTIVE SYNTHESIS OF (+)-BREFELDIN A

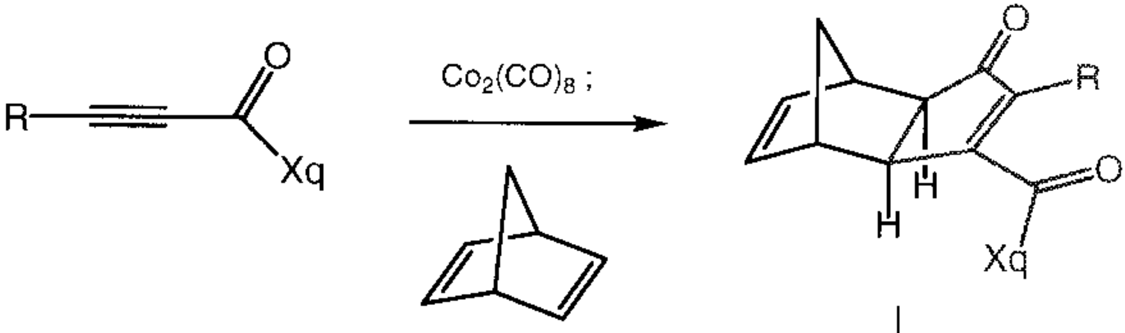


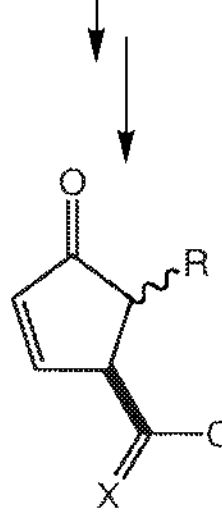
ENANTIOSELECTIVE SYNTHESIS OF (+)-BREFELDIN A

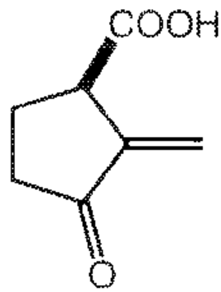


(+)-BREFELDIN A

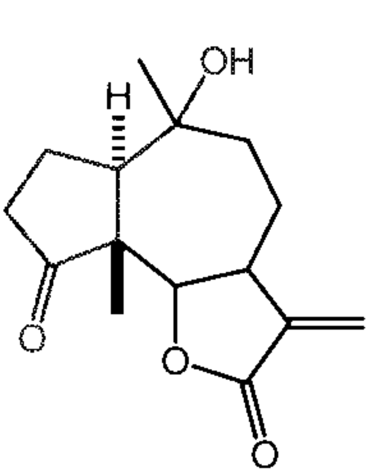
ASYMMETRIC PAUSON-KHAND REACTIONS OF ELECTRON-DEFFICIENT ALKYNES: AN ENANTIOSELECTIVE ENTRY TO FUNCTIONALIZED CYCLOPENTENONES

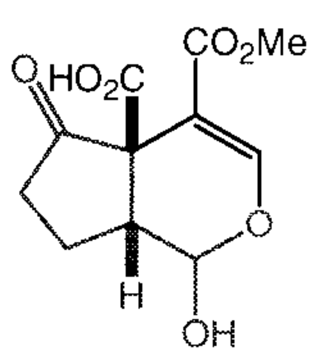


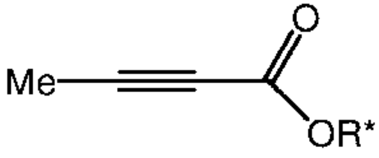


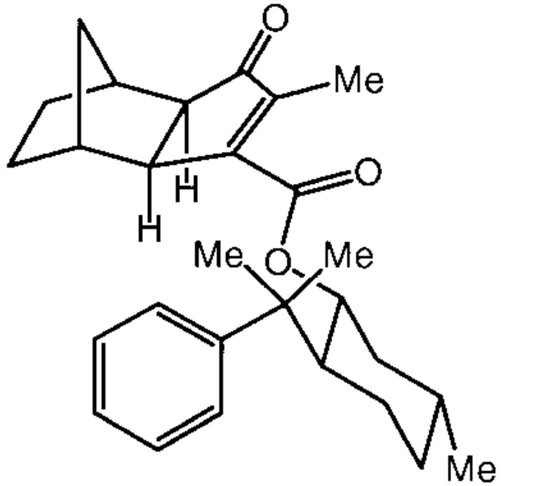


SARCOMYCIN

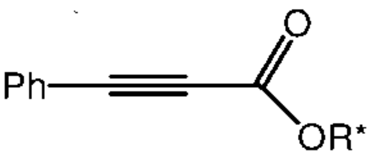


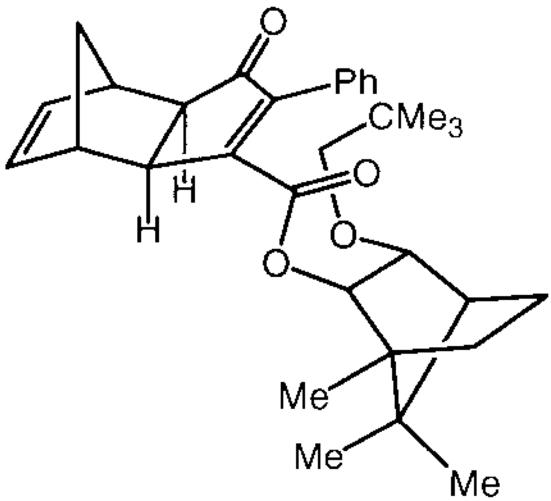






78% yield, 3.7:1 d.r.
(toluene, 40°C, 18 h)





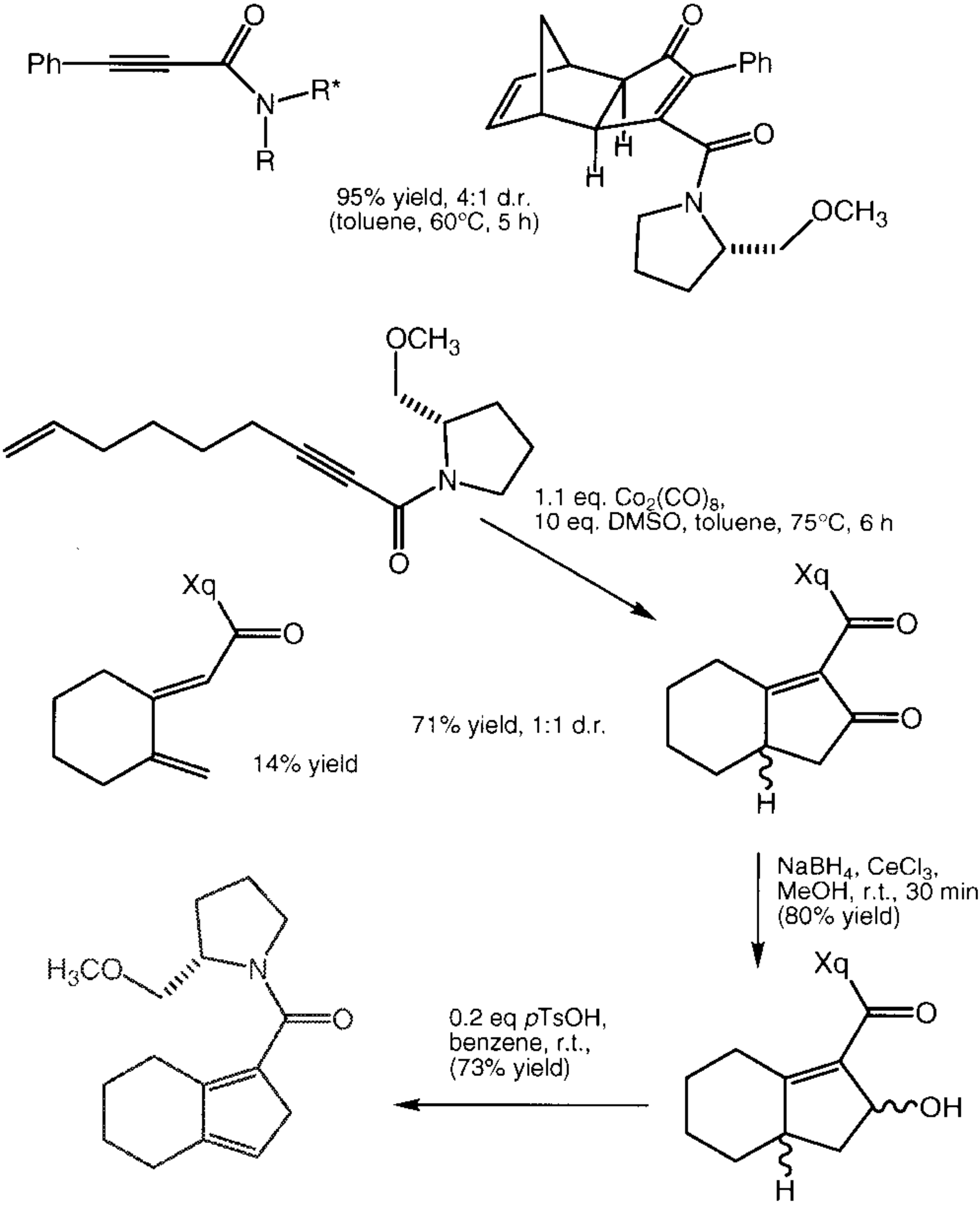
60% yield, 1.3:1 d.r.
(toluene, 40°C, 30 h)

Conclusions:
- Electronic effects control the regioselectivity of the process
- Diastereoselectivity levels are rather low

⇩

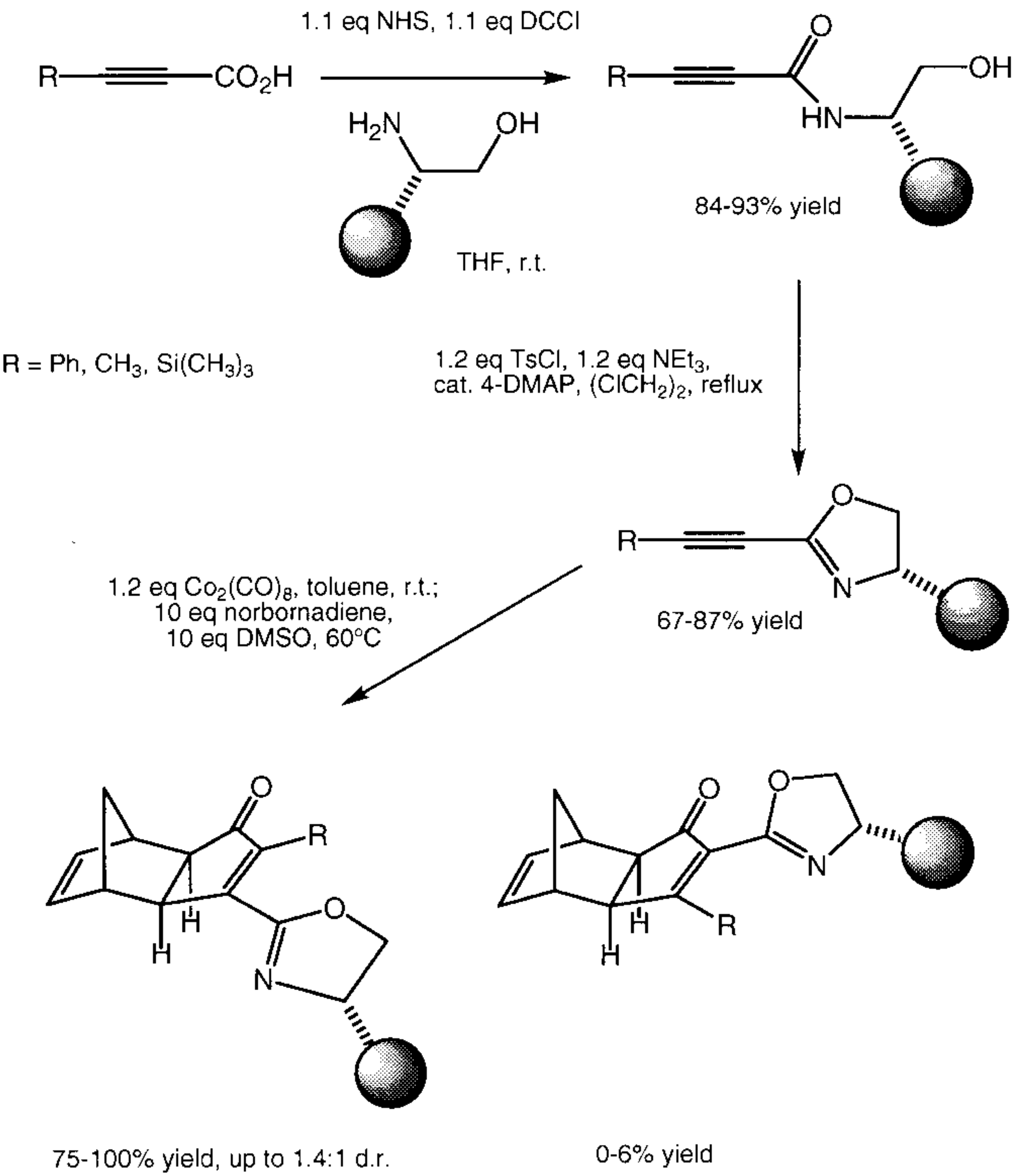
SUBSTITUTE ESTERS BY AMIDES

INTER- AND INTRAMOLECULAR PAUSON-KHAND REACTIONS OF CHIRAL 2-ALKYNAMIDES



A NEW SYNTHESIS OF CHIRAL CYCLOPENTADIENES

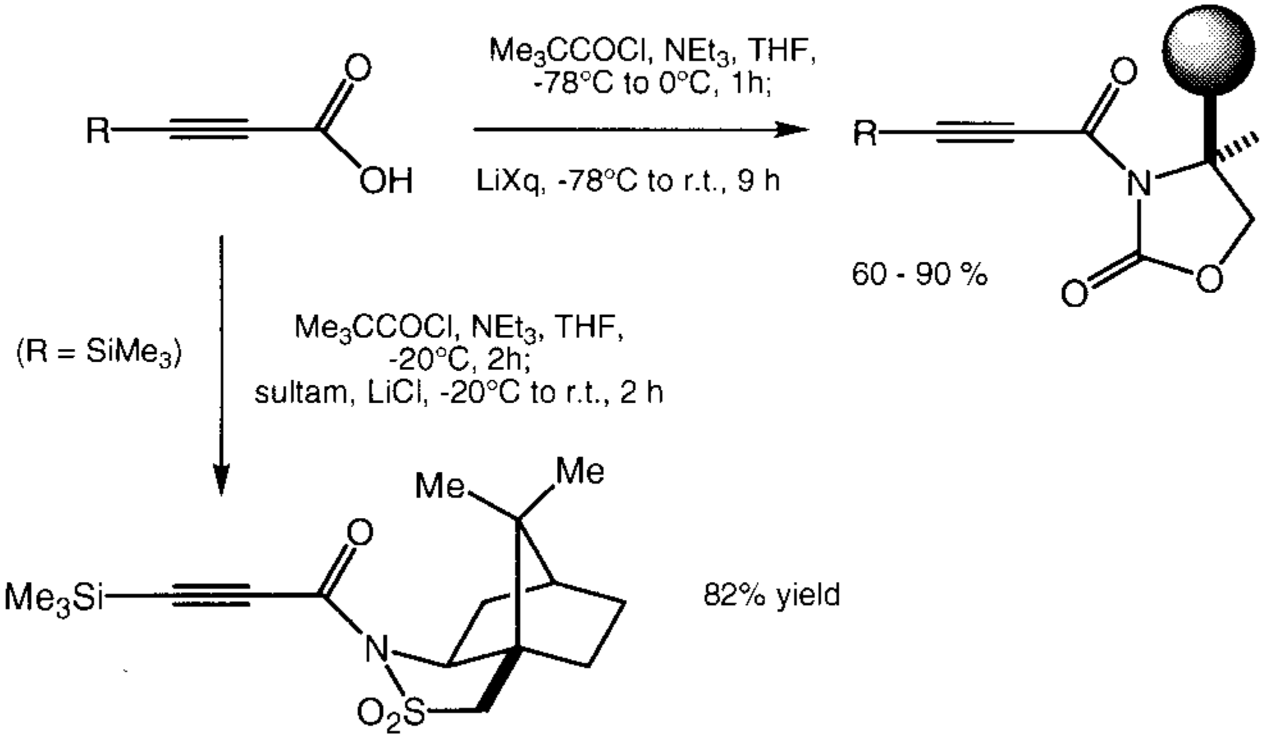
INTER- AND INTRAMOLECULAR PAUSON-KHAND REACTIONS OF CHIRAL 2-ALKYNYL-1,3-OXAZOLINES



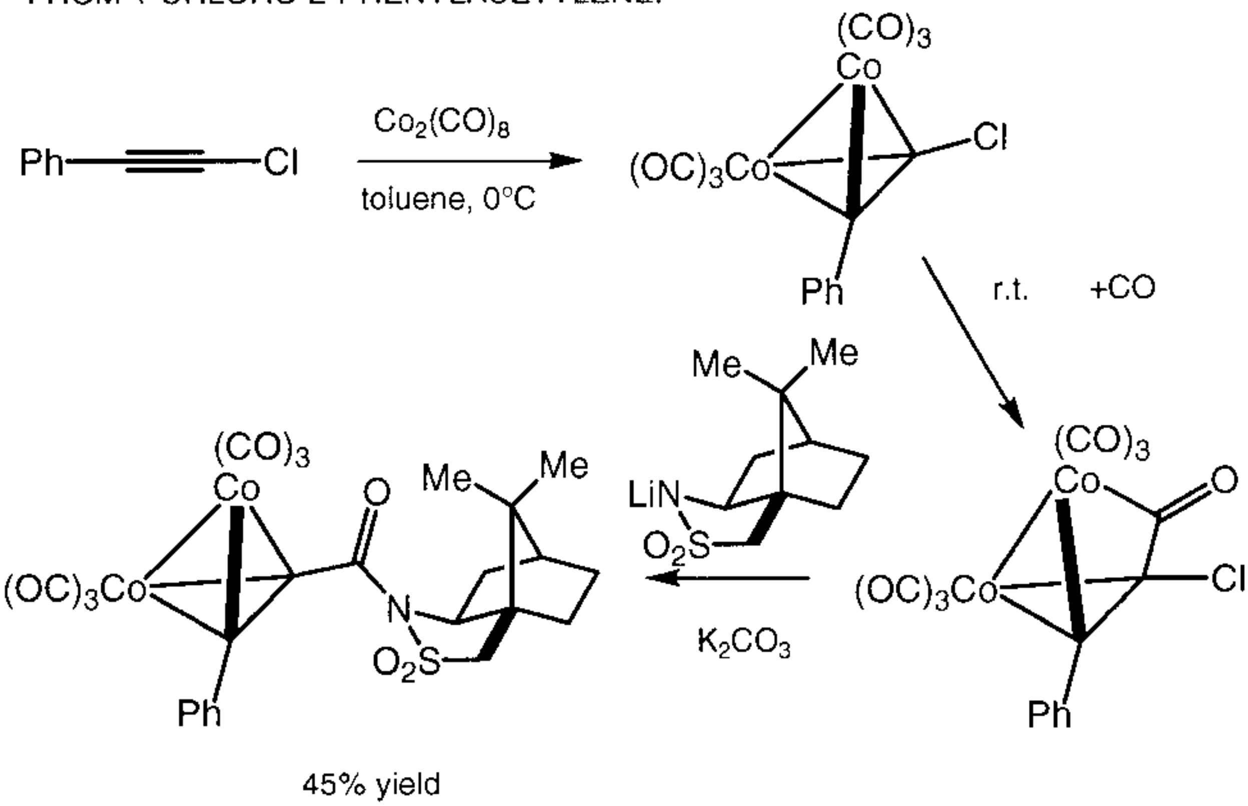
THE INTERMOLECULAR PAUSON-KHAND REACTIONS TAKE PLACE WITH GOOD YIELDS AND REGIOSELECTIVITY, BUT WITH LOW DIASTEREOSELECTIVITY

PREPARATION OF *N*-(2-ALKYNOYL)OXAZOLIDINONES AND SULTAMS

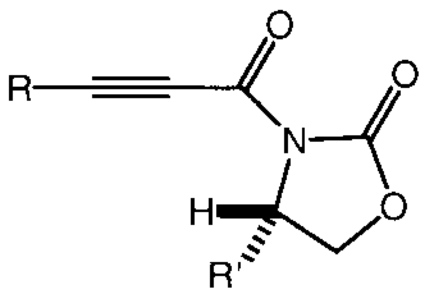
FROM 2-ALKYNOIC ACIDS:

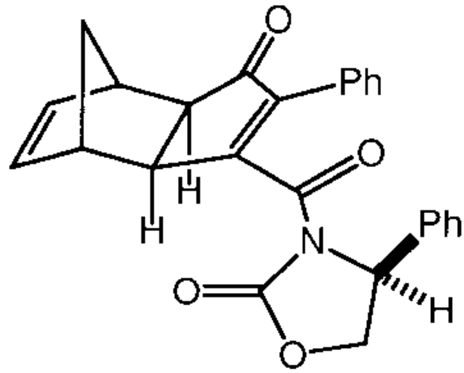


FROM 1-CHLORO-2-PHENYLACETYLENE:

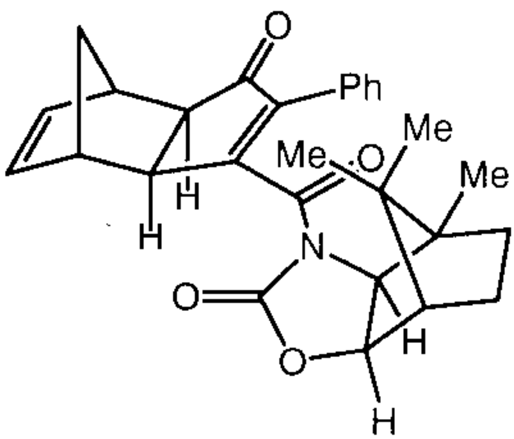


INTERMOLECULAR PAUSON-KHAND REACTIONS OF CHIRAL *N*-(2-ALKYNOYL)OXAZOLIDINONES

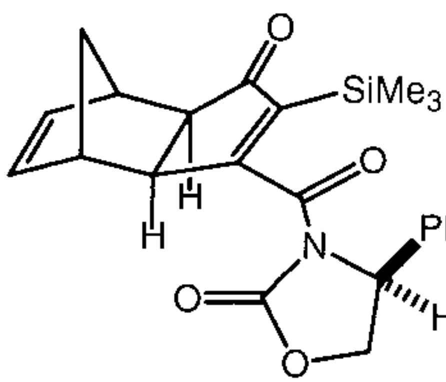




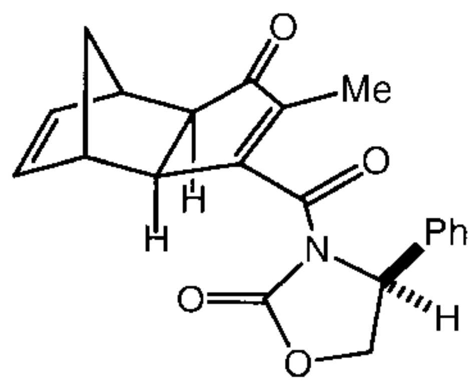
96 % yield, 5.2:1 d.r.
(toluene, r.t., 21 h)



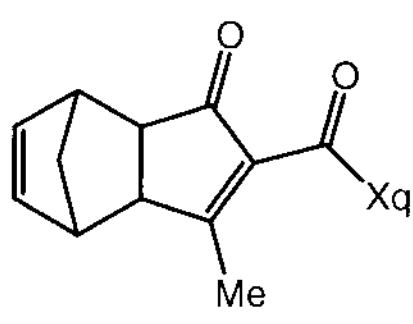
97 % yield, 14:1 d.r.
(toluene, r.t., 21 h)



88 % yield, 3.6:1 d.r.
(NMO, O_2, CH_2Cl_2, r.t., 14 h)

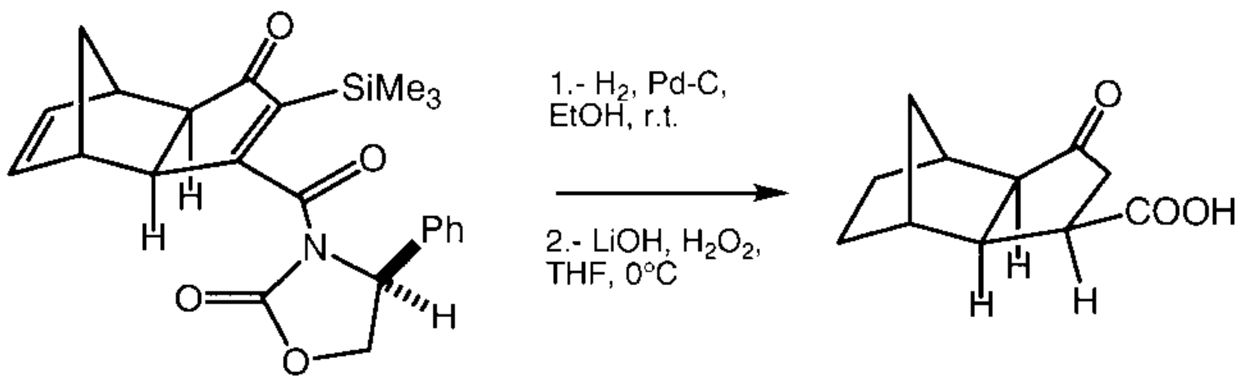


62 % yield, 7.9:1 d.r.
(NMO, CH_2Cl_2, -20°C, 18 h)

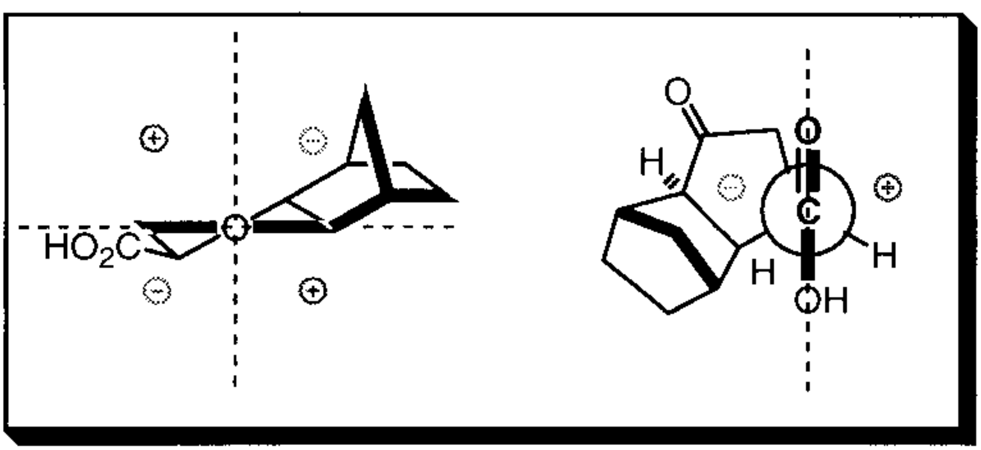


(38% yield, 1:1 d.r.)

DETERMINATION OF THE ABSOLUTE CONFIGURATION OF THE ADDUCTS



(major adduct)



THIS KETO ACID SHOWED TWO NEGATIVE COTTON EFFECTS AT 219 AND 300 NM

WHAT IS THE ORIGIN OF THE ASYMMETRIC INDUCTION?

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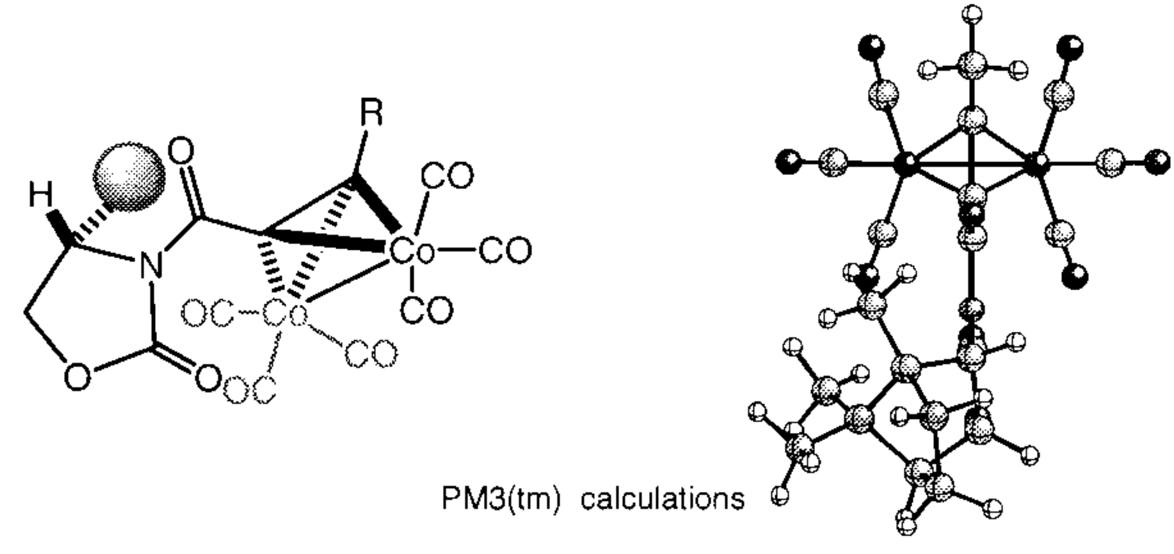
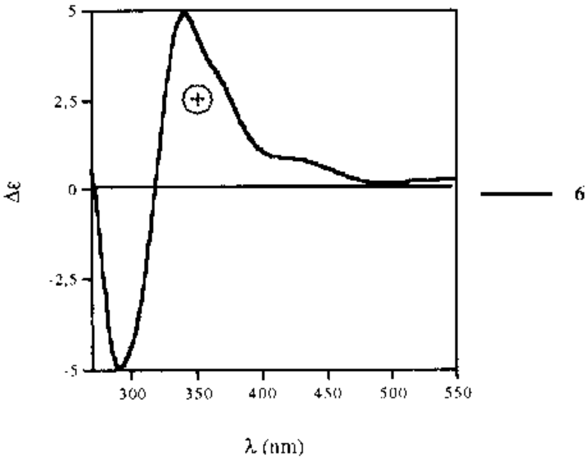
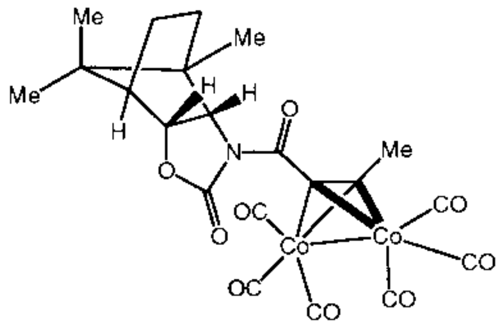
THE CHIRAL OXAZOLIDINONE MOIETY RENDERS ONE OF THE $Co(CO)_3$ GROUPS LESS ACCESSIBLE TO THE OLEFIN



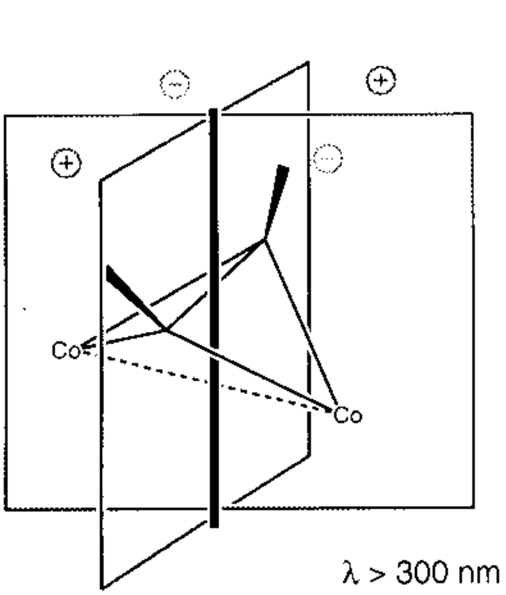
PM3(tm) calculations

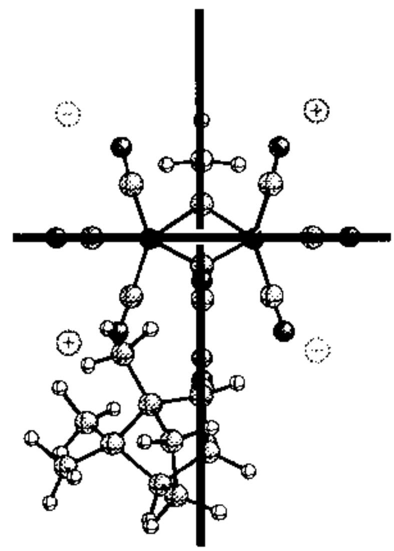




6

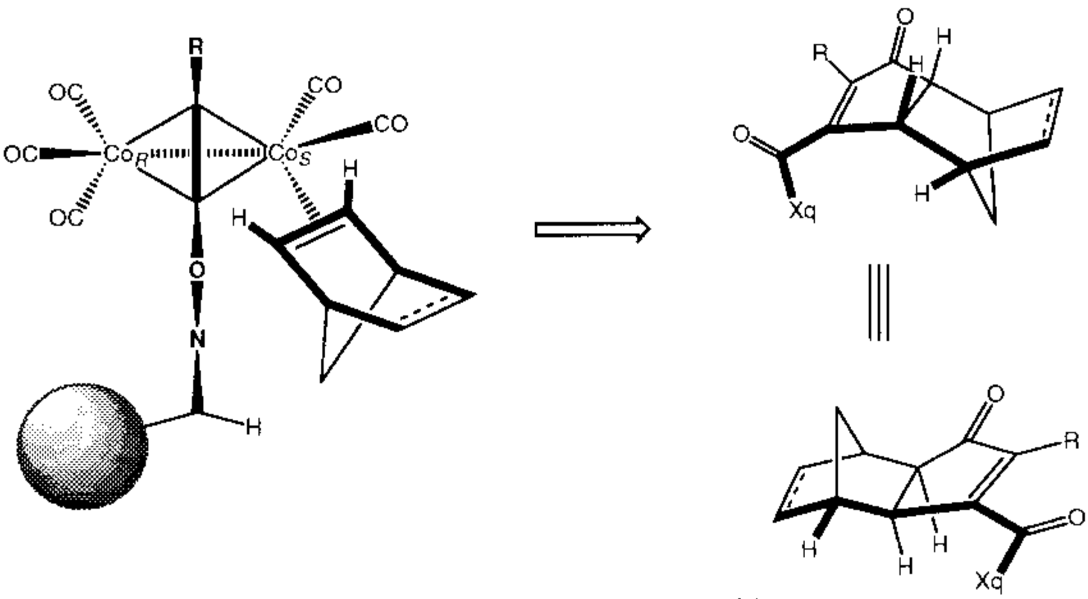
CD SPECTRUM OF COMPLEX **6**





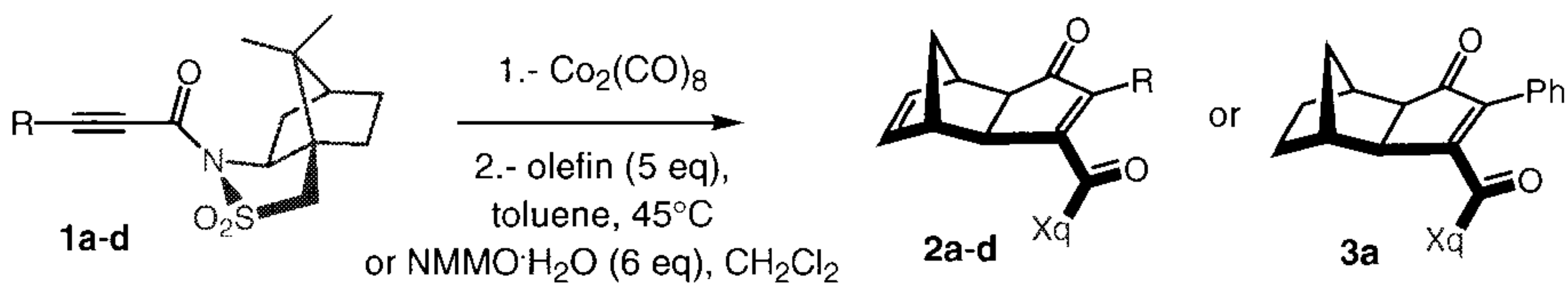
6

SECTOR RULE FOR CHIRAL ALKYNE(DICOBALTHEXACARBONYL) COMPLEXES



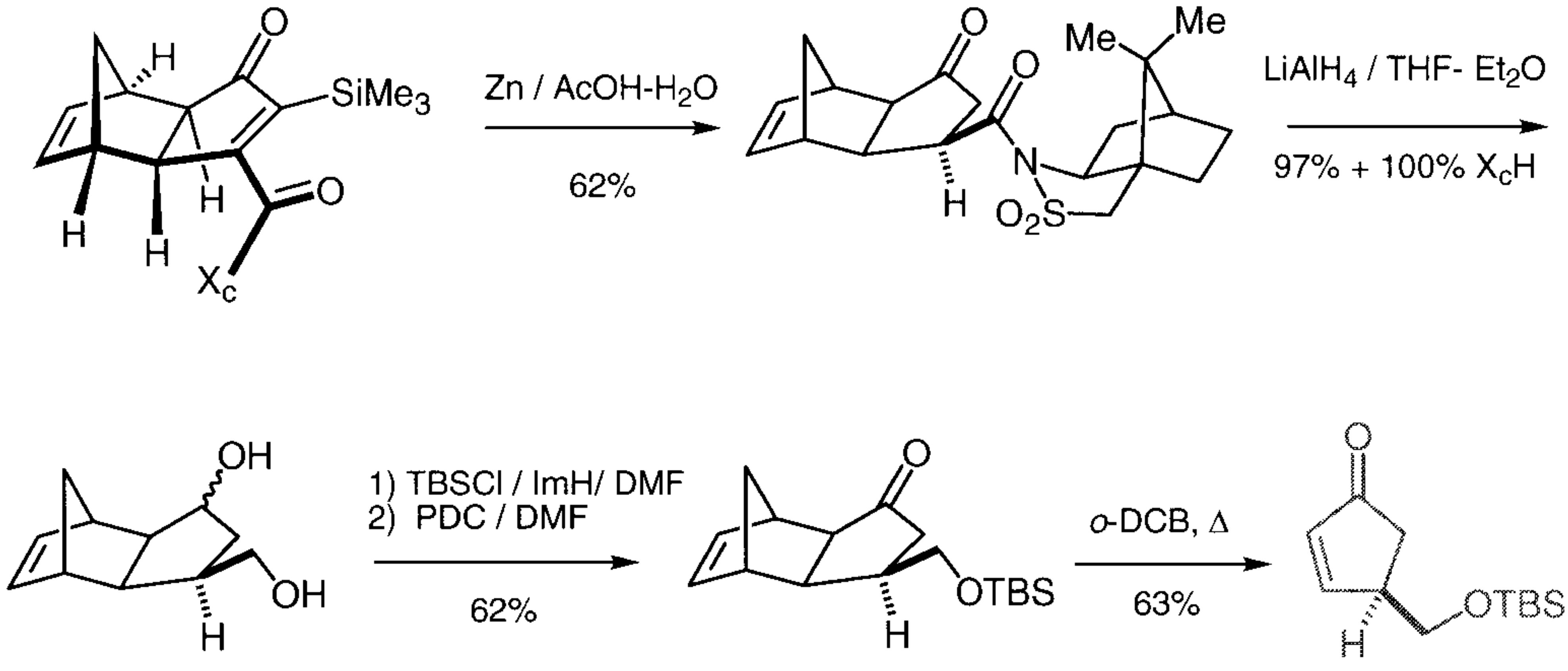
major adduct

INTERMOLECULAR PAUSON-KHAND REACTIONS OF CHIRAL *N*-ALKYNOYL SULTAMS SHOW UNPRECEDENTED HIGH LEVELS OF DIASTEREOSELECTIVITY



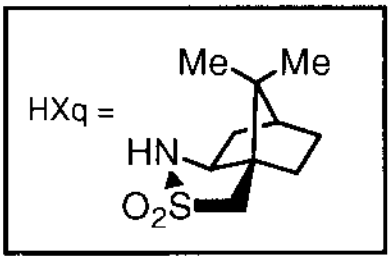
ALKYNE	OLEFIN	REACTION CONDITIONS	PRODUCT (YIELD)	D.R.
1a (R = Ph)	norbornadiene	CH_2Cl_2, 6 eq NMO.H_2O, 0°C to r.t., 1 h	**2a** (93%)	>800:1
1a (R = Ph)	norbornene	CH_2Cl_2, 6 eq NMO.H_2O, 0°C to r.t., 1 h	**3a** (54%)	125:1
1b (R = $SiMe_3$)	norbornadiene	CH_2Cl_2, 6 eq NMO.H_2O, 0°C to r.t., 18 h	**2b** (78%)	>800:1
1c (R = Me)	norbornadiene	toluene, 45°C, 12 h	**2c** (55%)	723:1
1d (R =CH_2OMe)	norbornadiene	toluene, 45°C, 12 h	**2d** (52%)	>800:1

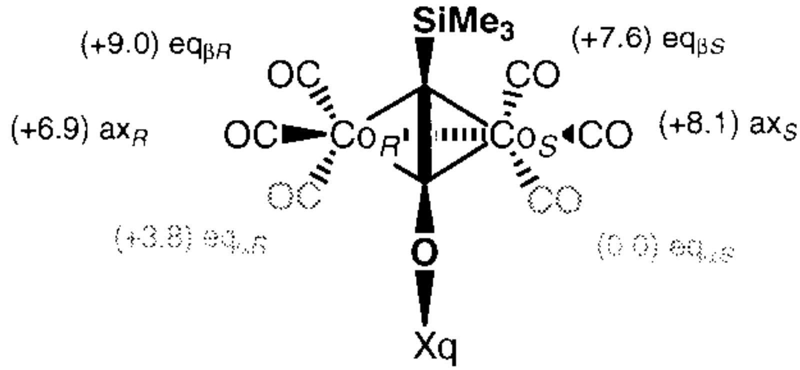
Synthetic Applications: Formal Total Synthesis of (+)-Sarcomycin



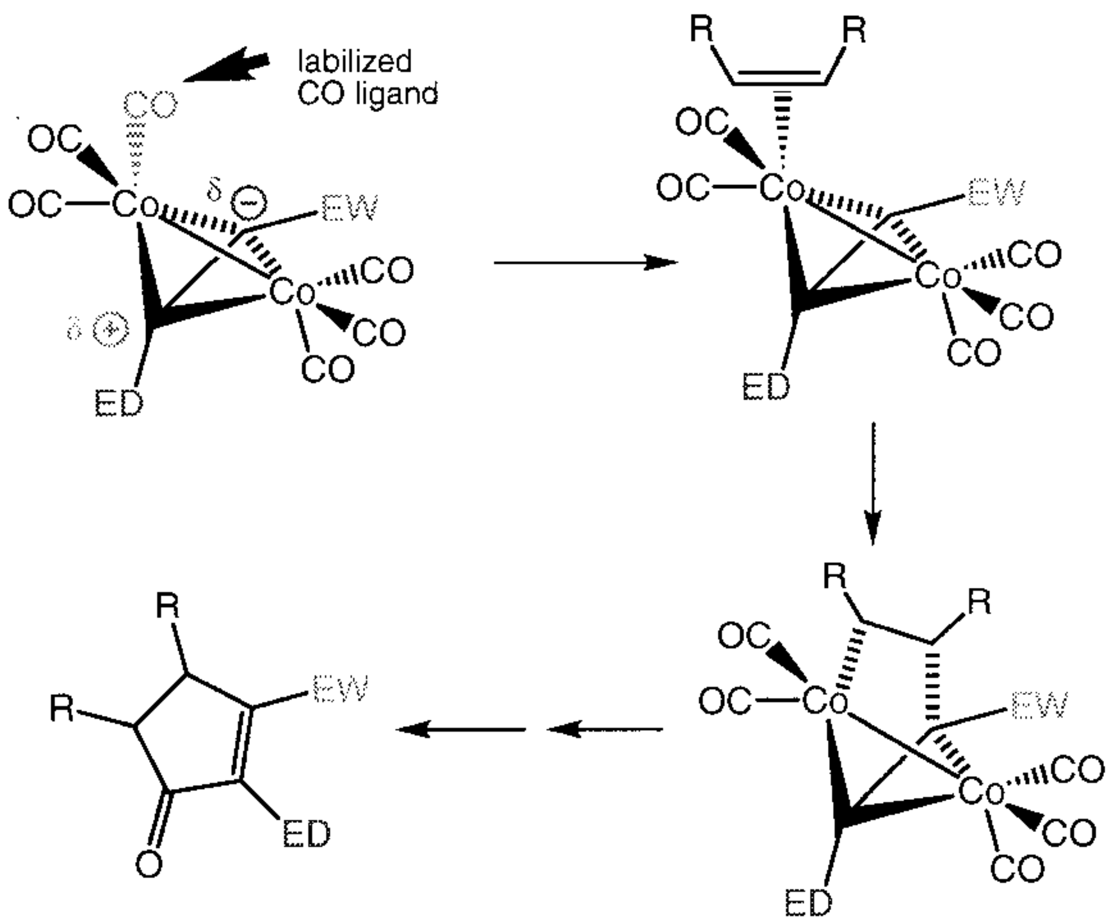
Previously converted to (+)-Sarcomycin

THE ORIGIN OF ASYMMETRIC INDUCTION IN THE INTERMOLECULAR PAUSON-KHAND REACTIONS OF *N*-(2-ALKYNOYL)SULTAMS

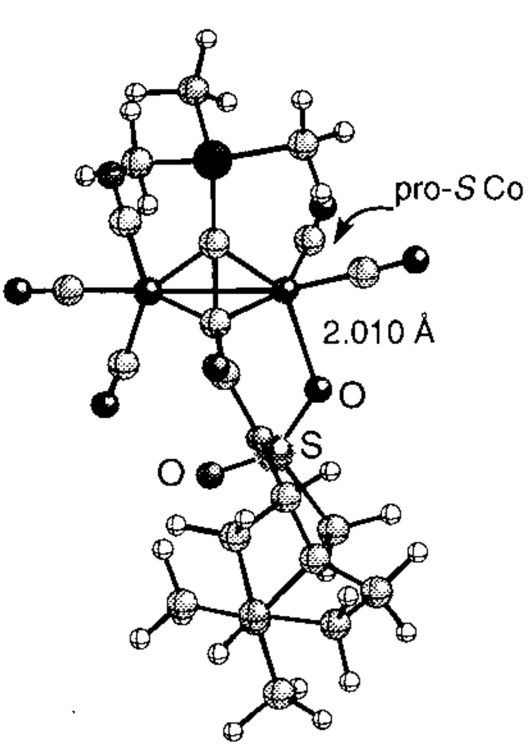




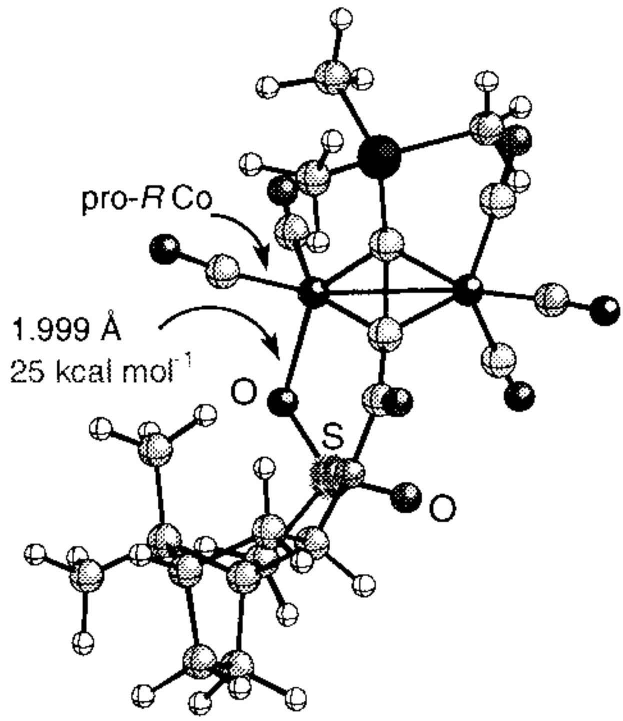
CALCULATED RELATIVE DISSOCIATION ENERGIES (PM_3(tm), kcal mol^{-1}) OF THE CO LIGANDS IN COMPLEX **5b:** DEMONSTRATION OF A *trans* EFFECT



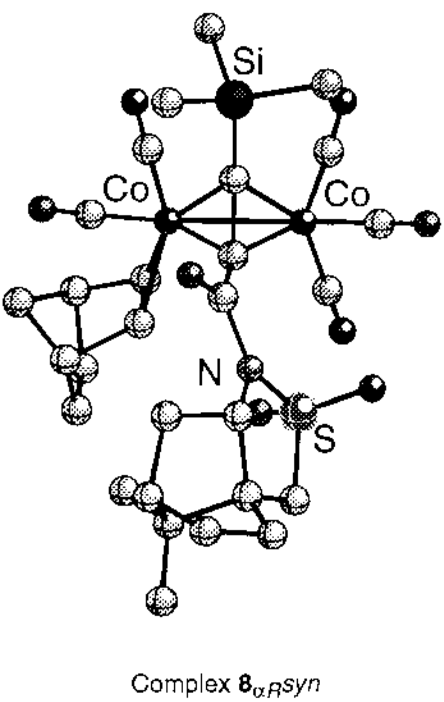
THE ORIGIN OF ASYMMETRIC INDUCTION IN THE INTERMOLECULAR PAUSON-KHAND REACTIONS OF *N*-(2-ALKYNOYL)SULTAMS



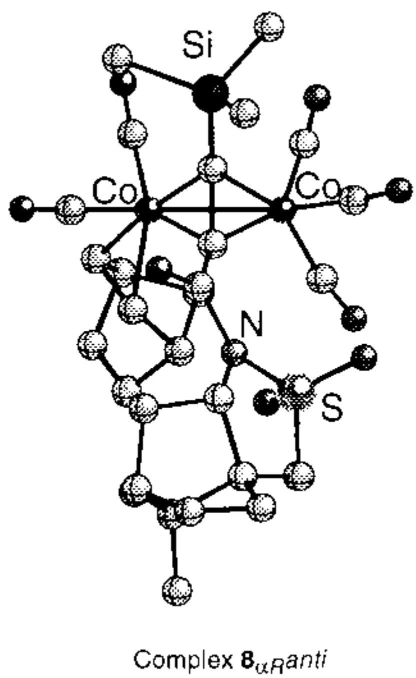
Intermediate **7**-I
E_{rel} = +6.7 kcal mol^{-1}



Intermediate **7**-II
E_{rel} = 0.0 kcal mol^{-1}



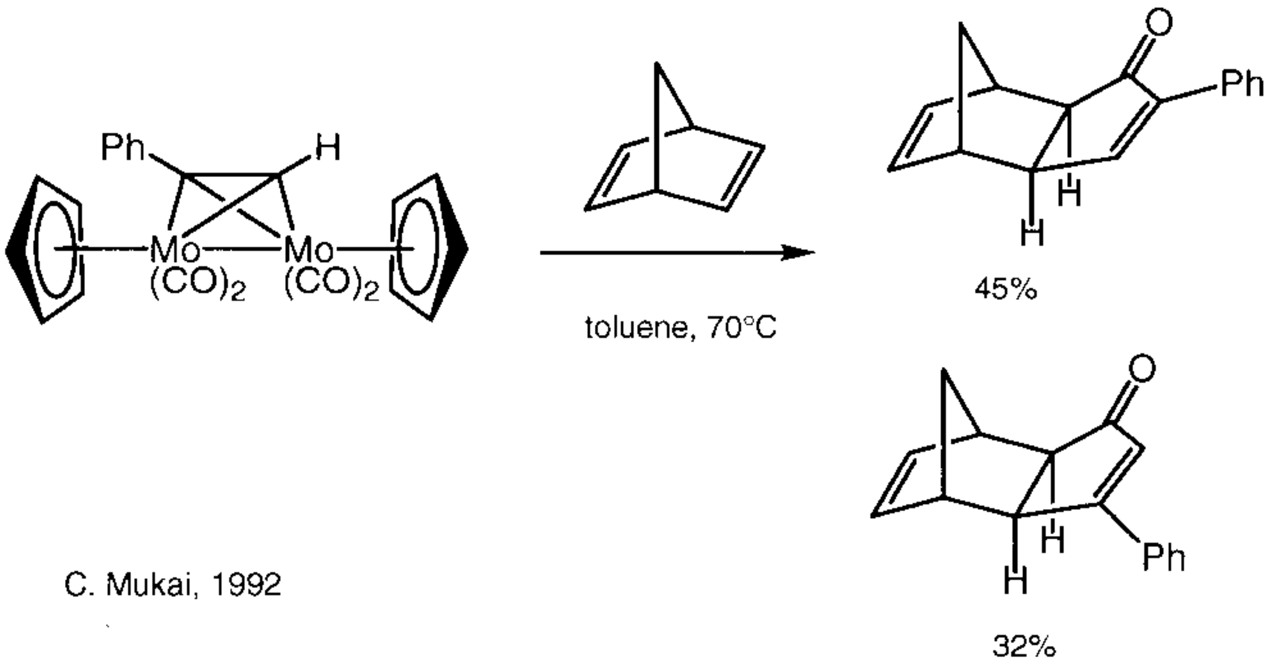
Complex $\mathbf{8}_{\alpha R}$*syn*
E_{rel} = 0.0 kcal mol^{-1} (PM3(tm))
0.0 kcal mol^{-1} (PM3(tm)//DFT)



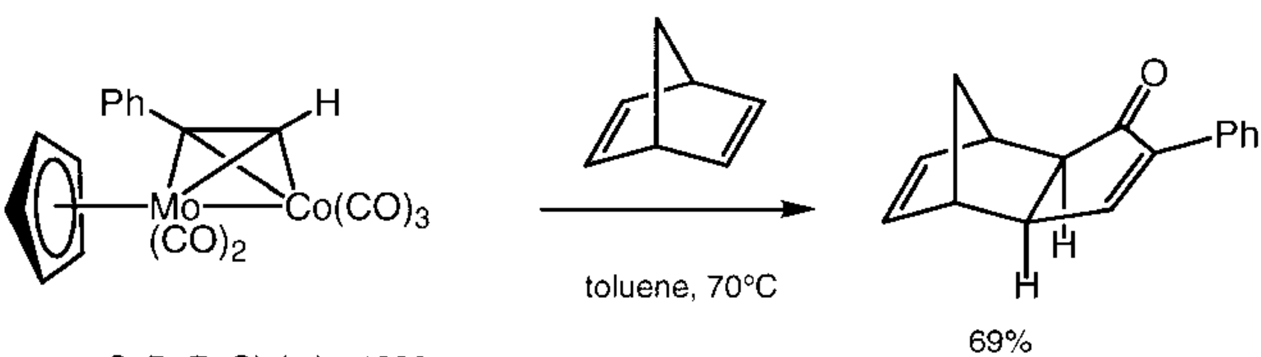
Complex $\mathbf{8}_{\alpha R}$*anti*
E_{rel} = +5.2 kcal mol^{-1} (PM3(tm))
+4.4 kcal mol^{-1} (PM3(tm)//DFT)

THE MOLYBDENUM-MEDIATED PAUSON-KHAND REACTION

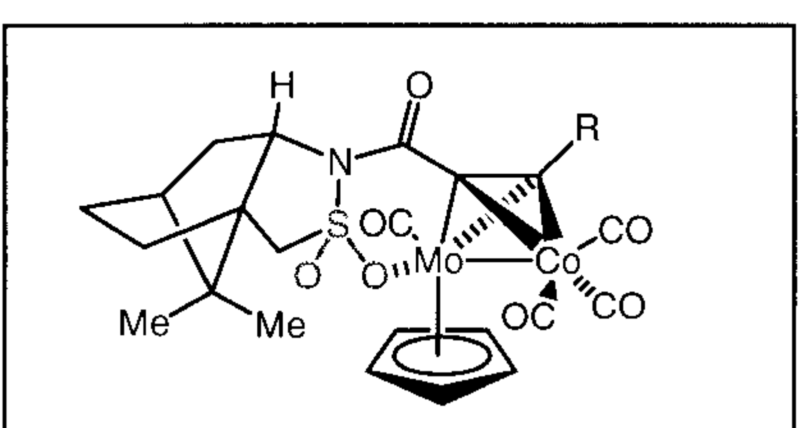
$Cp(CO)_2Mo(W)$ is isoelectronic with $Co(CO)_3$



C. Mukai, 1992

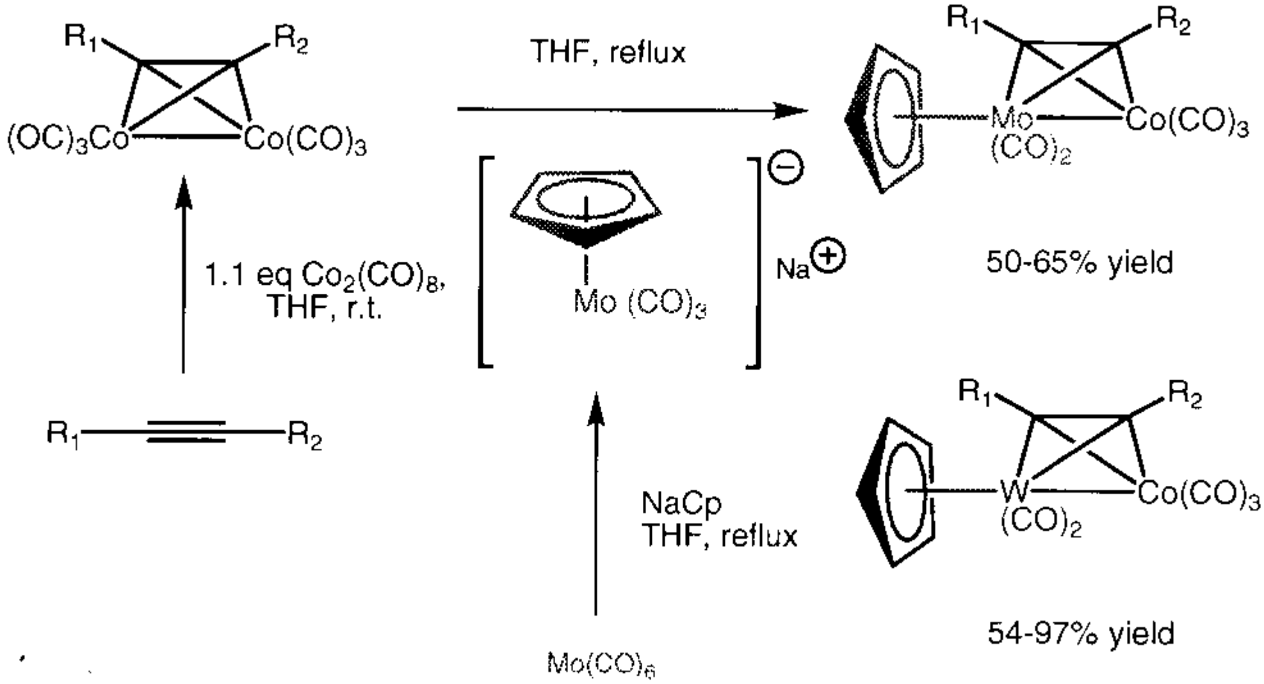


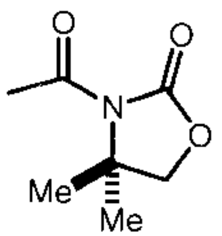
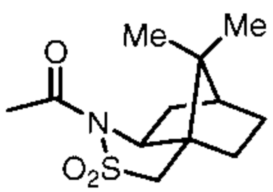
S. D. R. Christie, 1998



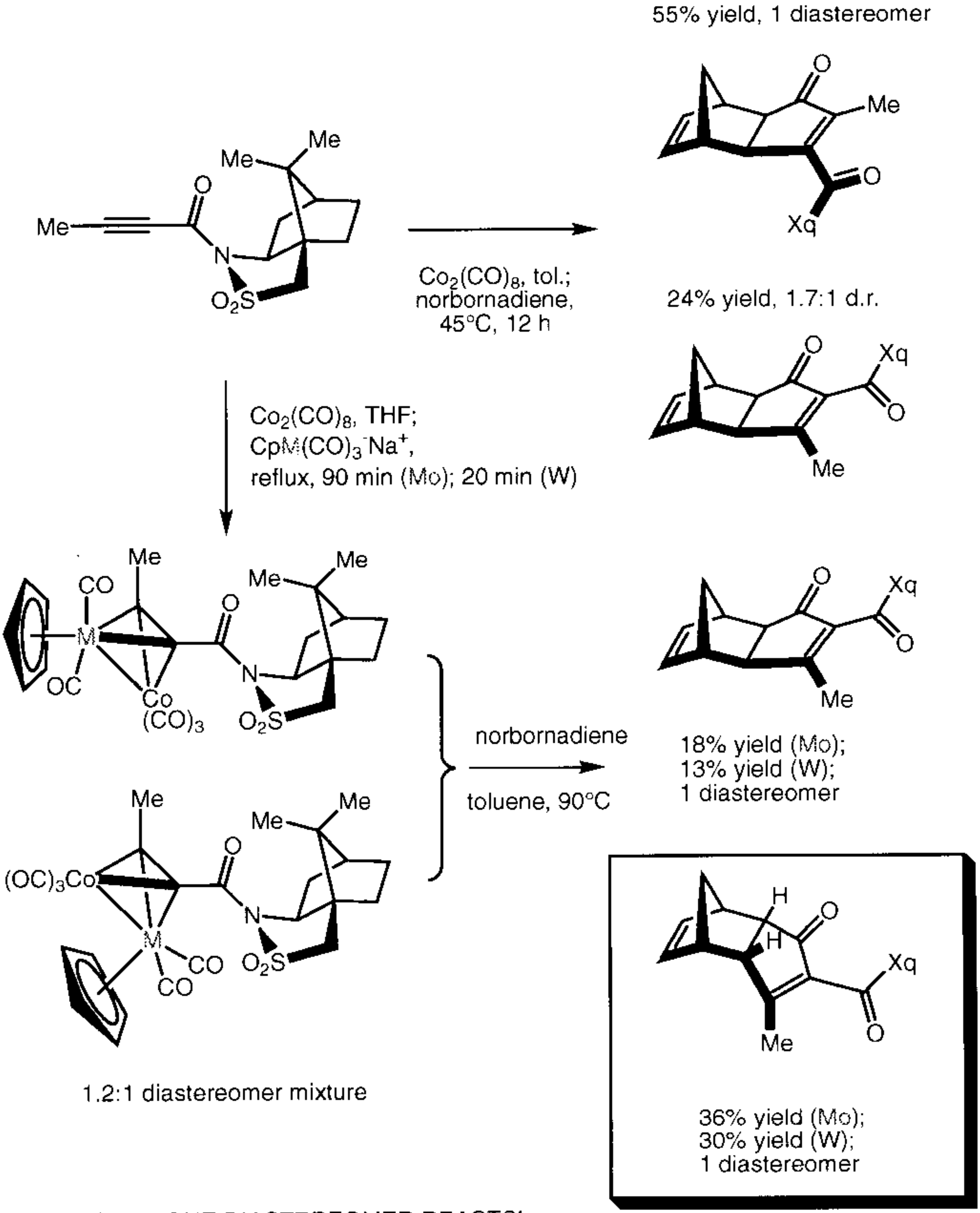
THE SUBSTITUTION OF Co BY Mo (OR W)
OUGHT TO STABILIZE THE CHELATED COMPLEX

SYNTHESIS OF HETEROBIMETALLIC (Co–Mo AND Co-W) ALKYNE COMPLEXES



R_1	R_2	temperature; reaction time (W)	Mo complex; % yield	W complex; % yield
n-Bu	H	r.t.; 24 h	61	69
Ph	H	reflux; 1.5 h	58	84
Ph	Ph	reflux; 1.5 h	65	97
	Me	reflux; 15 min	49	54
	Me	reflux; 20 min	64	62
			(1.2:1 d.r.)	

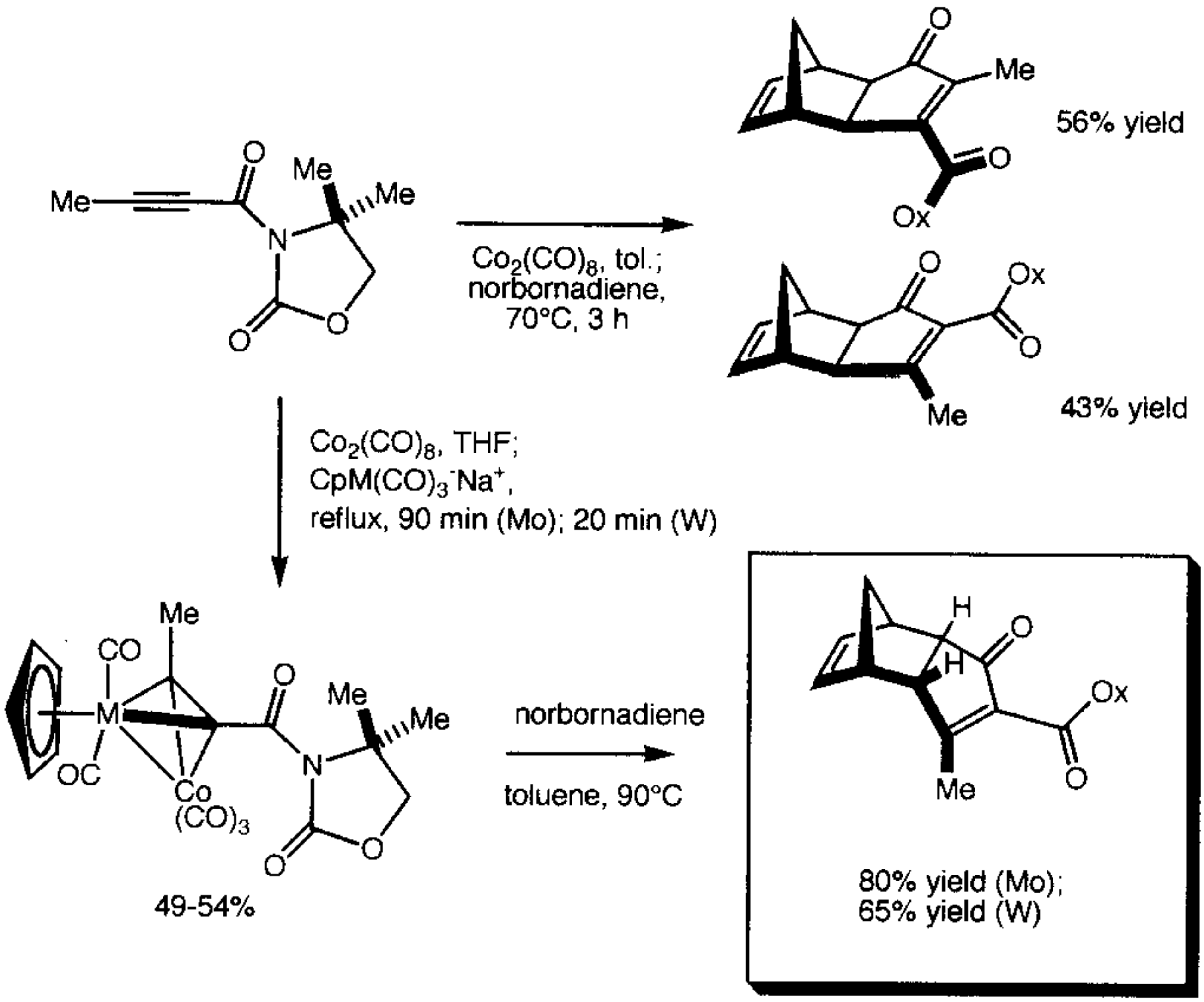
HETEROBIMETALLIC PAUSON-KHAND REACTIONS OF *N*-(2-ALKYNOYL)SULTAM



ONLY ONE DIASTEREOMER REACTS!

ENDO 1,3-ADDUCT

HETEROBIMETALLIC PAUSON-KHAND REACTIONS OF *N*-(2-ALKYNOYL)OXAZOLIDINONES



STRUCTURE DETERMINED BY X-RAY DIFFRACTION ANALYSIS

ENDO 1,3-ADDUCT

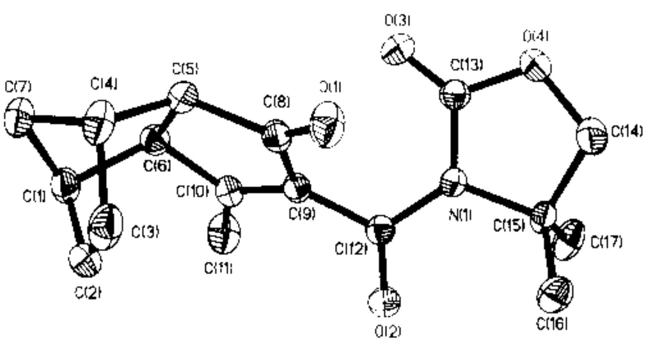
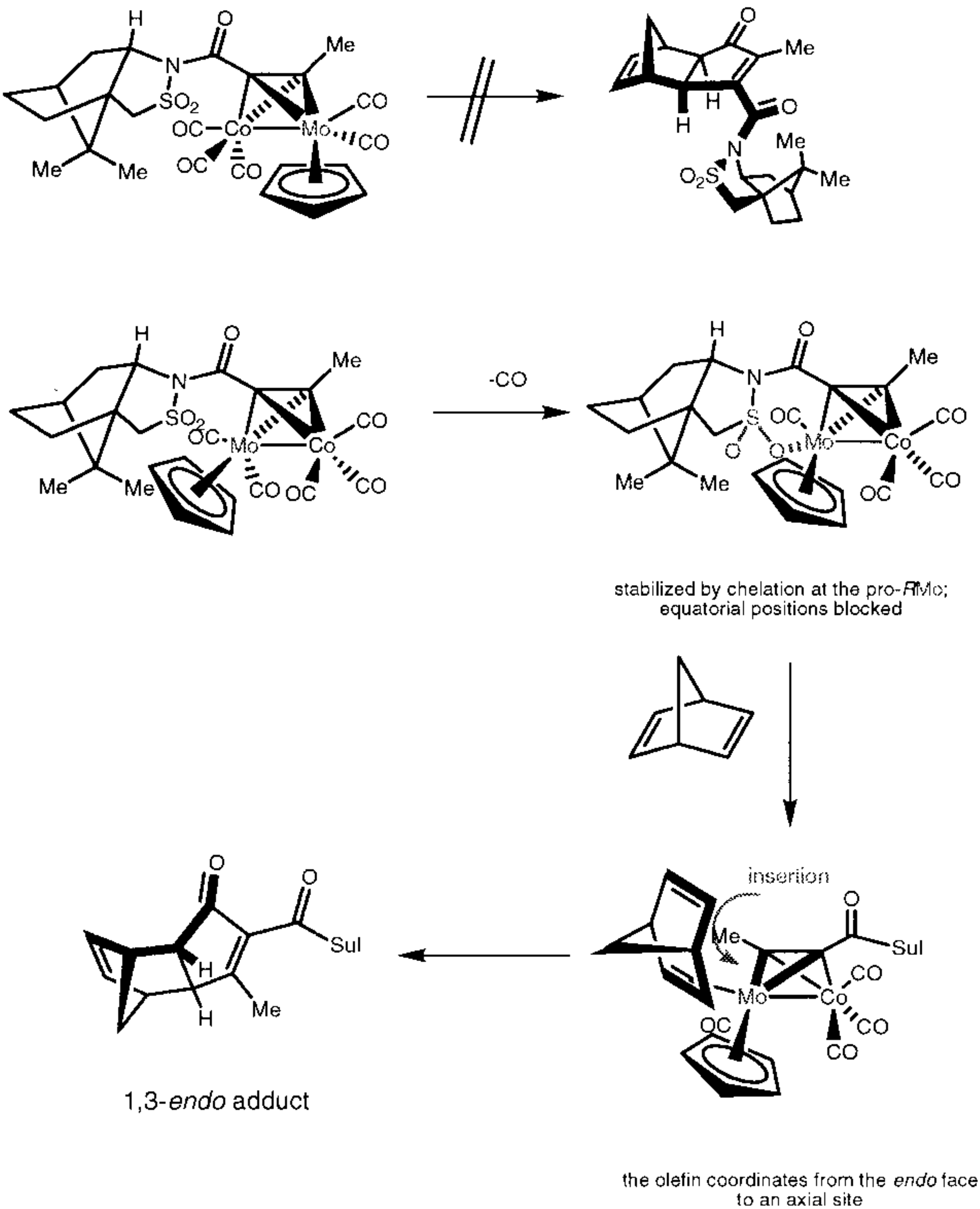
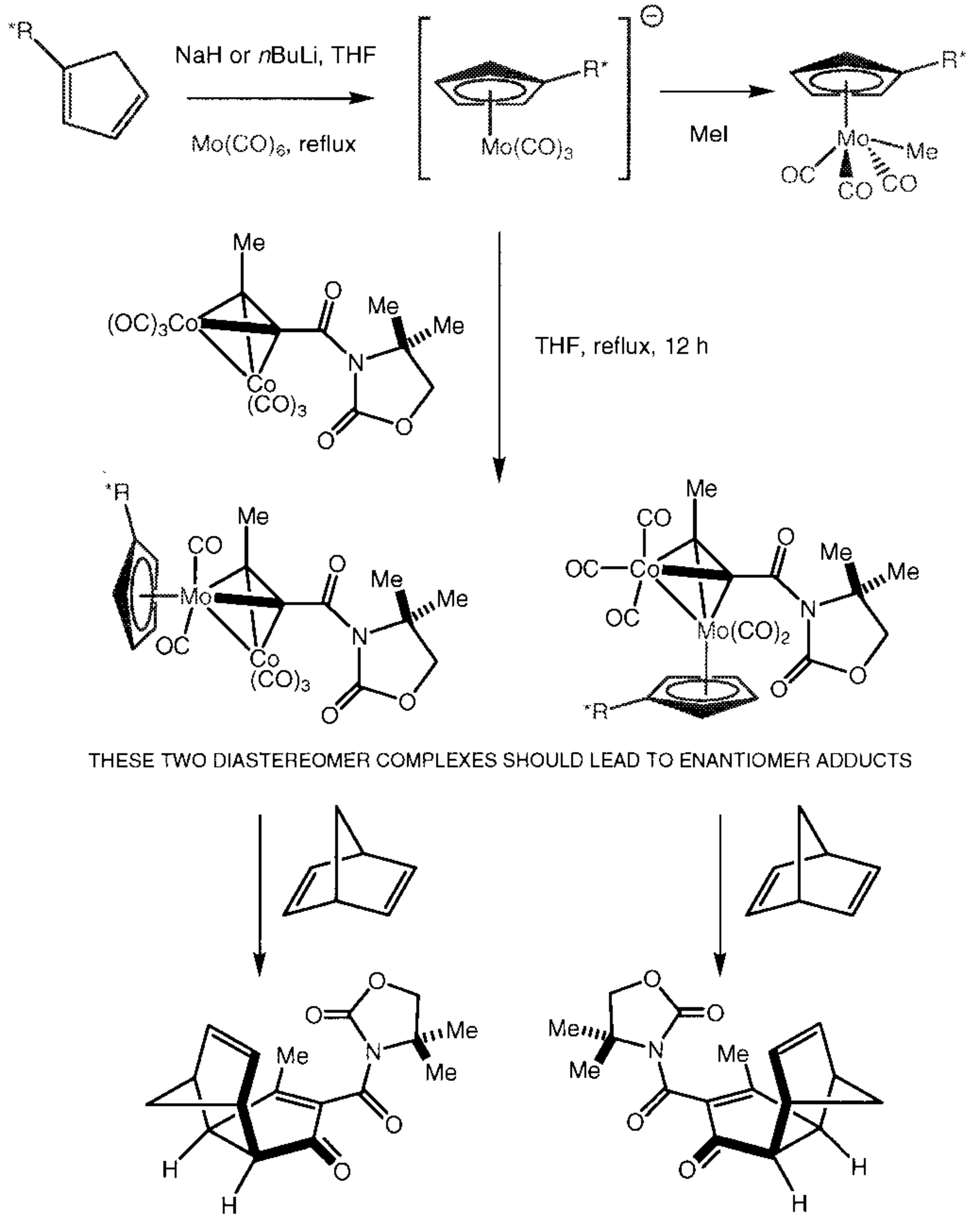


Figure 1. ORTEP drawing of **9** with thermal ellipsoids drawn at the 50% probability level. For clarity, the hydrogen atoms are omitted.

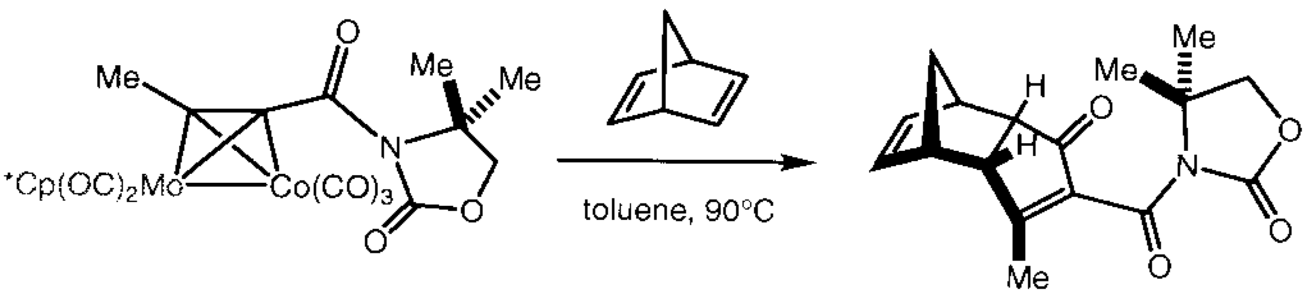
A MECHANISTIC HYPOTHESIS FOR THE HETEROBIMETALLIC INTERMOLECULAR PAUSON-KHAND REACTIONS OF *N*-(2-ALKYNOYL)SULTAMS

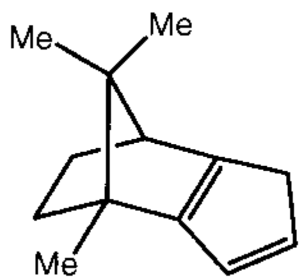
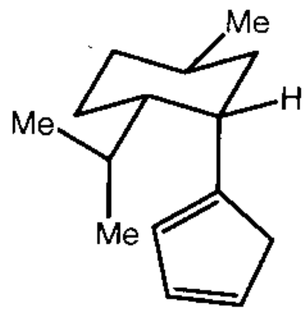
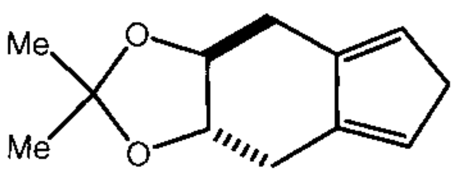
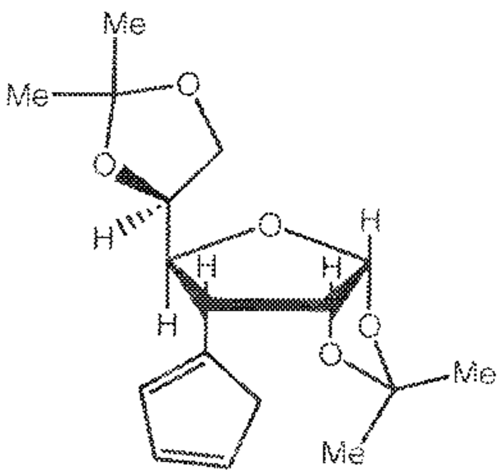


HETEROBIMETALLIC PAUSON-KHAND REACTIONS OF *N*-(2-ALKYNOYL)OXAZOLIDINONES: USE OF CHIRAL CYCLOPENTADIENES



HETEROBIMETALLIC PAUSON-KHAND REACTIONS OF *N*-(2-ALKYNOYL)OXAZOLIDINONES: USE OF CHIRAL CYCLOPENTADIENES



	complex (yield, d.r.)	PK adduct (yield, e.e.)
	56%, 1.1:1, n.s.	40% , 0% ee
	53%, 2:1, n.s.	23% , 21% ee
	75%, 1:1, n.s.	84% , 12% ee
	53%, 1.3:1, separable	75%, 100% ee (major) 60%, > -90% ee (minor)

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