

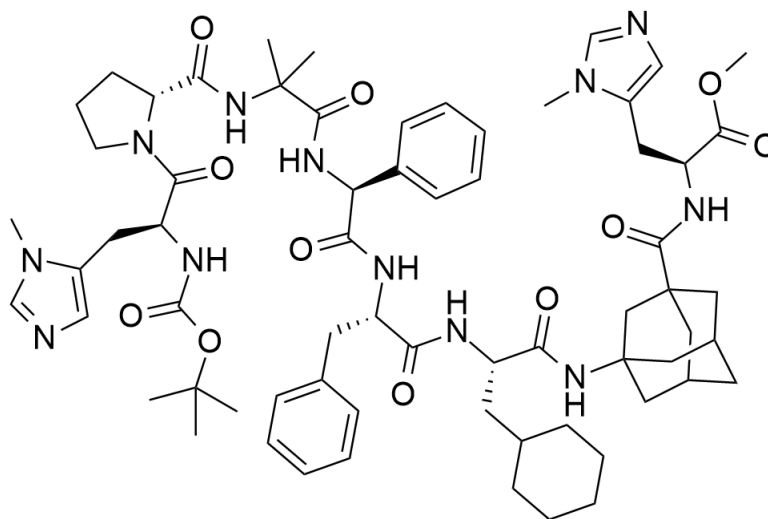
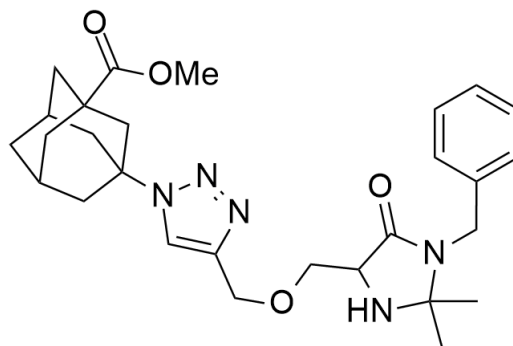
Erweiterung des Multikatalysekonzepts

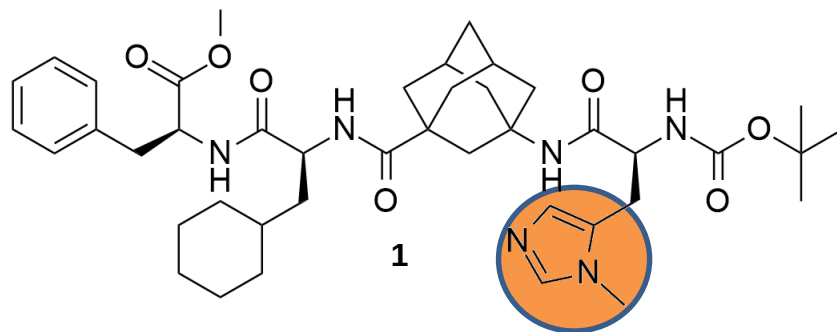
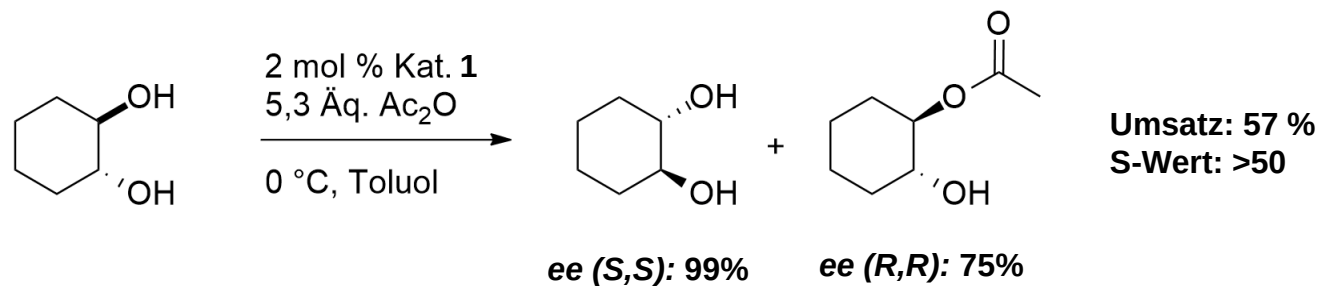
R229

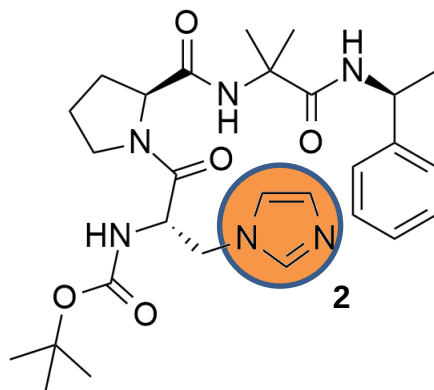
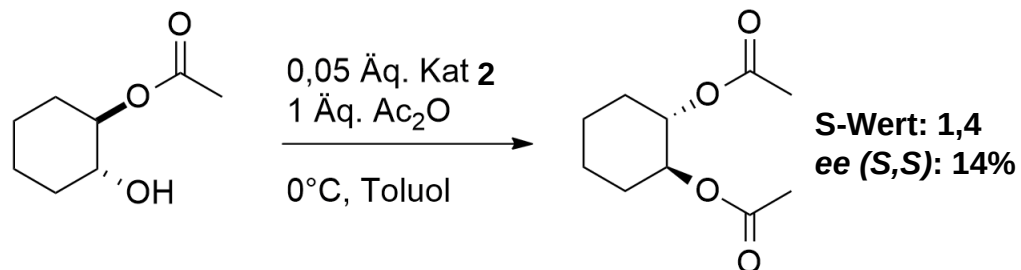
16.05.2014

Jan M. Schümann

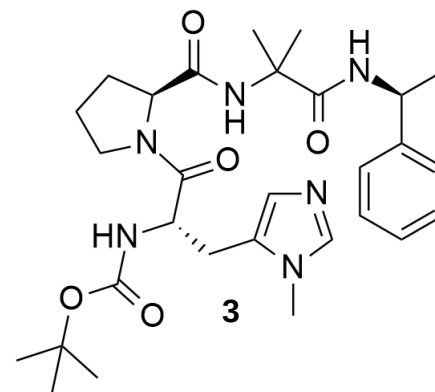
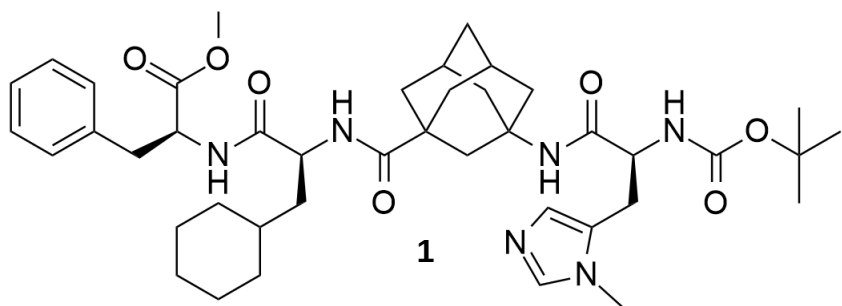
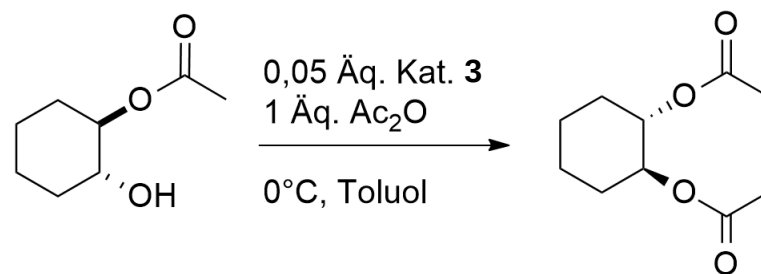
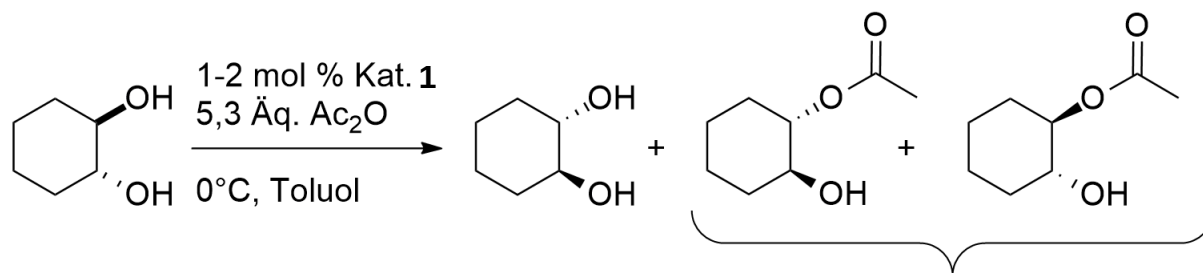
*Institut für Organische Chemie
Justus-Liebig-Universität
35435 Giessen, Germany*



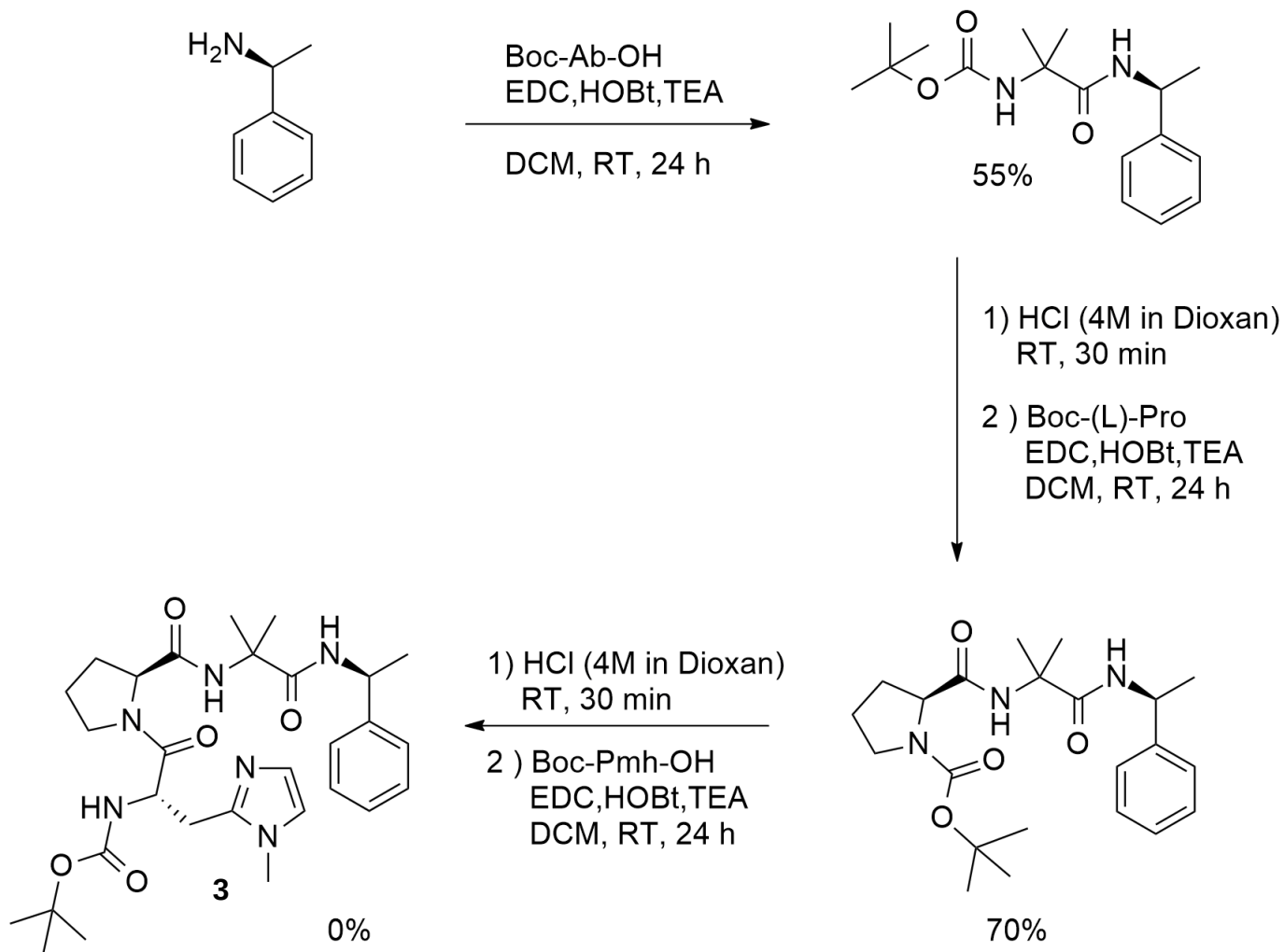




Müller-Miller-Multikatalyse

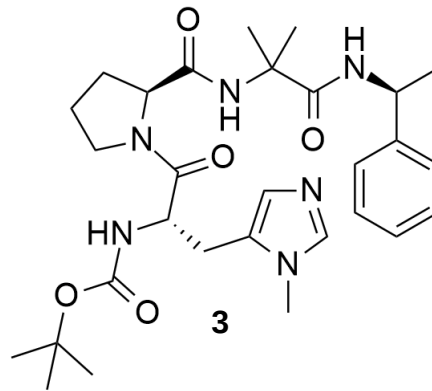
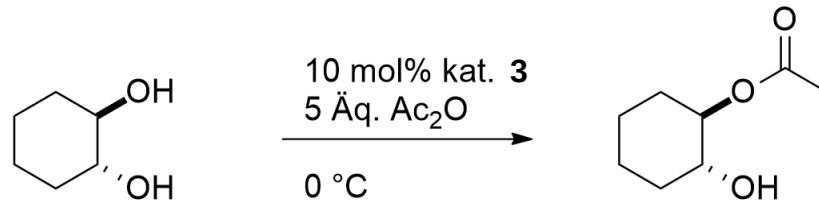


Darstellung des pmH-Miller Katalysators



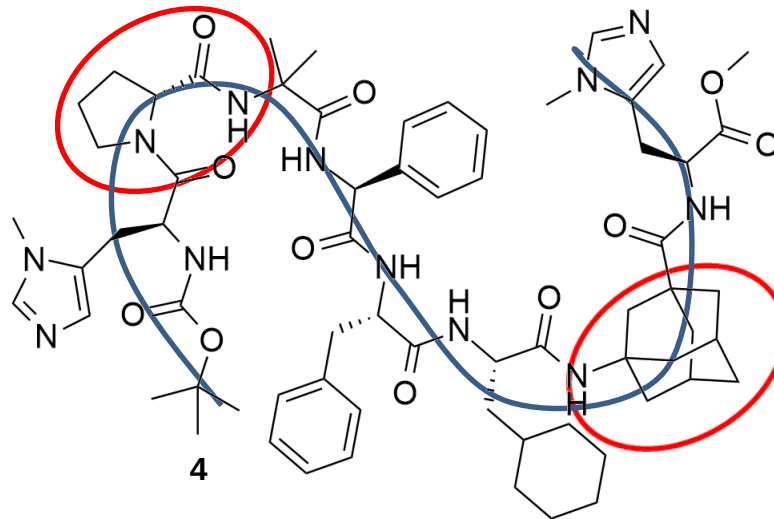


- Auswirkung des Katalysators auf *rac trans* Diol





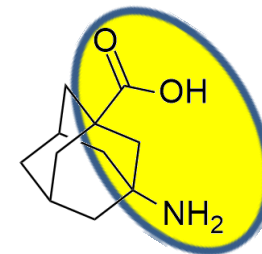
- Mögliche Kombination der beiden Katalysatoren für die Multikatalyse





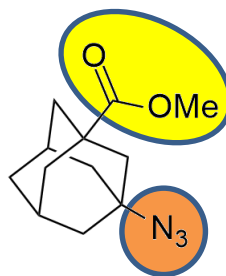
- Bisher: Verbindung zweier katalytischer Motive über Amid Bindungen

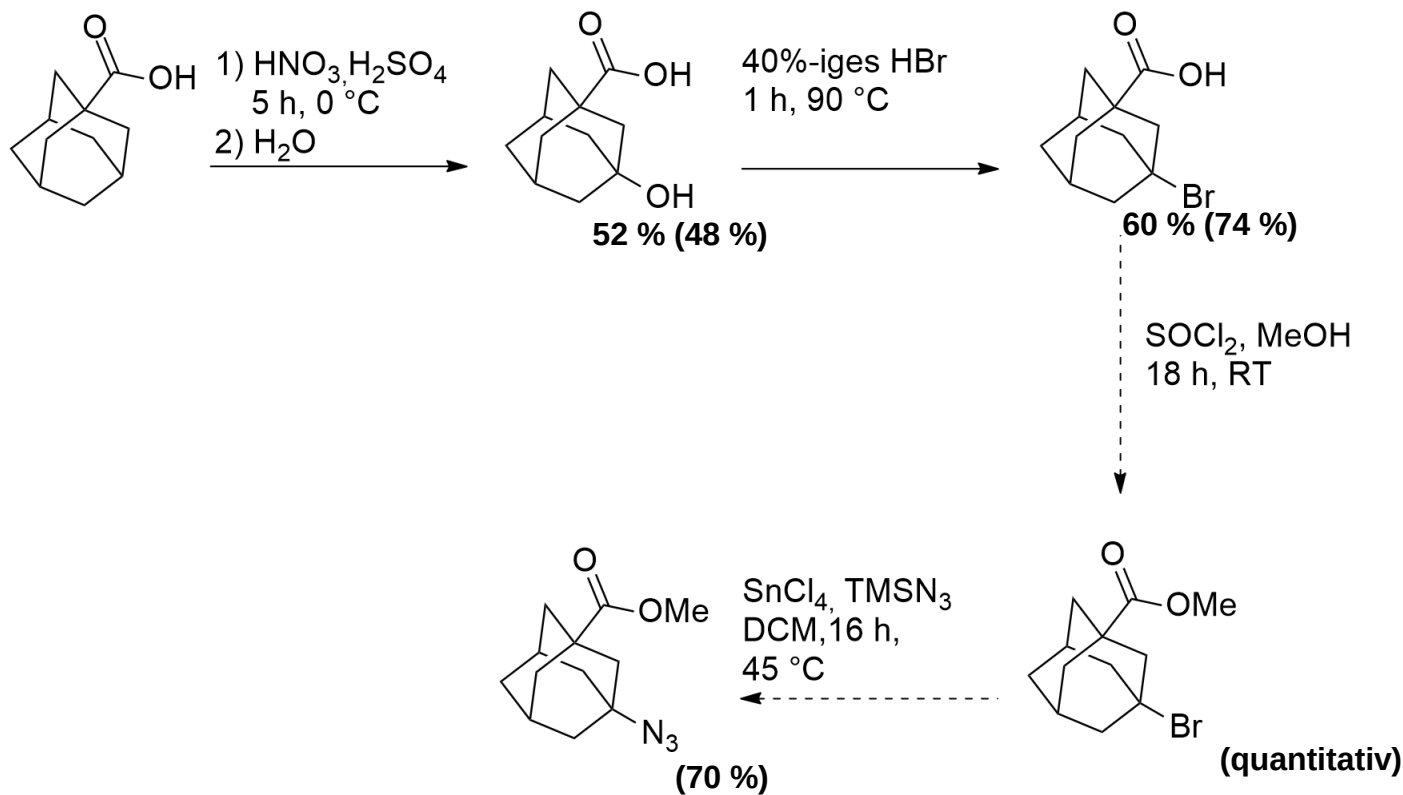
1. Acylierung $\Rightarrow$ Oxidation
2. Epoxidation $\Rightarrow$ Öffnung $\Rightarrow$ Acylierung
3. Oxidation $\Rightarrow$ Acylierung



- Neu: Kombination von „Clickbaren“ Motiven und Aminosäure Motiven

– Cycloaddition $\Rightarrow$ Epoxidierung $\Rightarrow$ Öffnung $\Rightarrow$ Acylierung

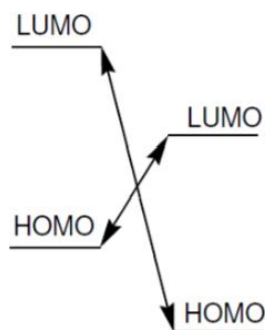




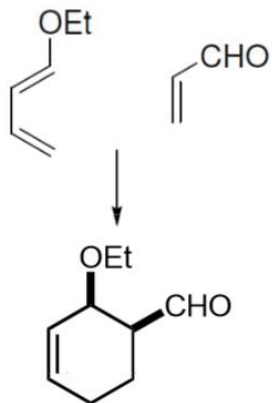
[4+2] Cycloaddition: Diels-Alder Reaktionen



Normaler
Elektronenbedarf

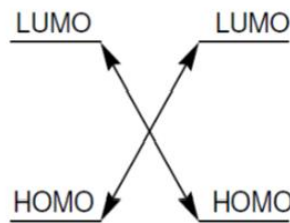


Dien Dienophil

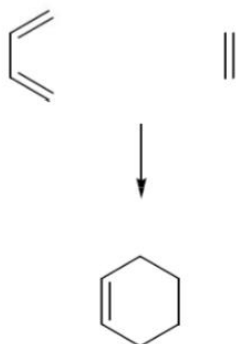


Neutraler
Elektronenbedarf

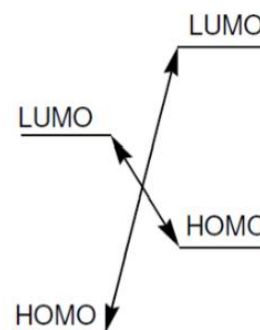
am ungünstigsten



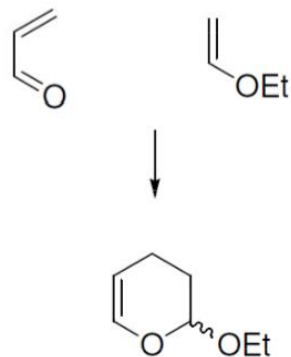
Dien Dienophil

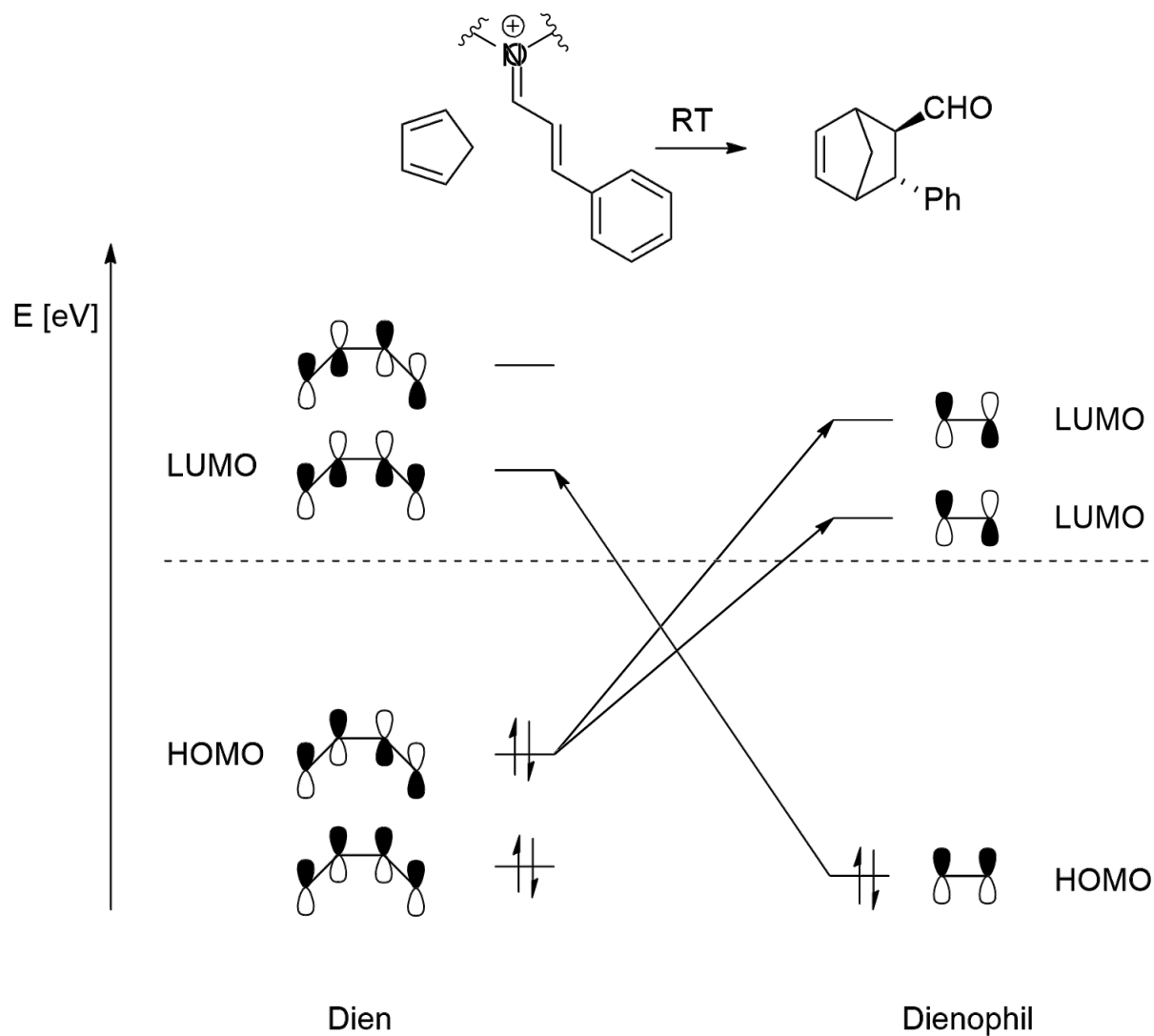


Inverser
Elektronenbedarf

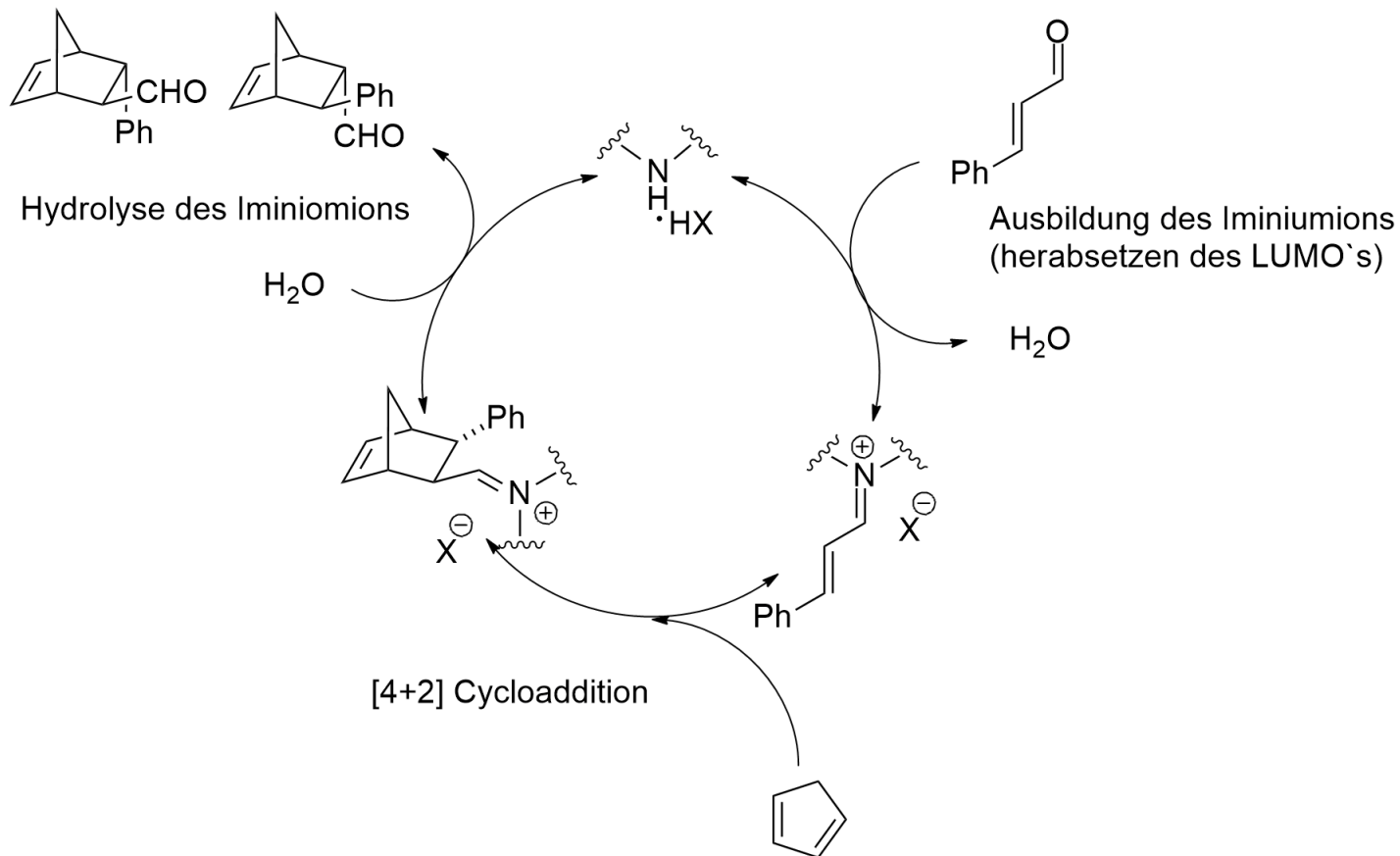


Dien Dienophil



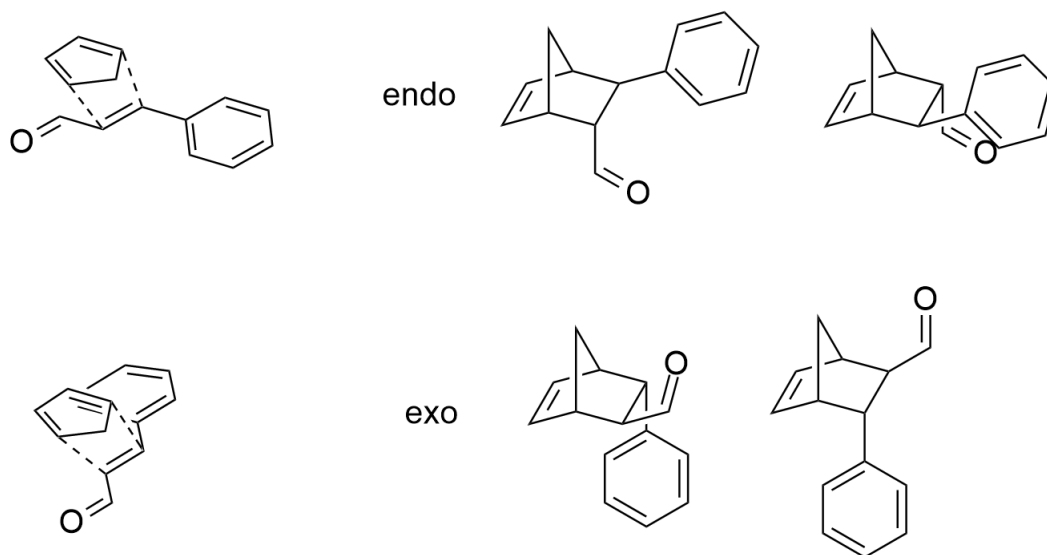


Katalysezyklus der Diels-Alder Reaktion

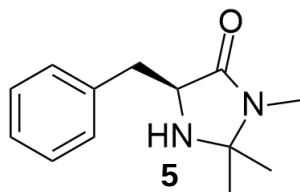
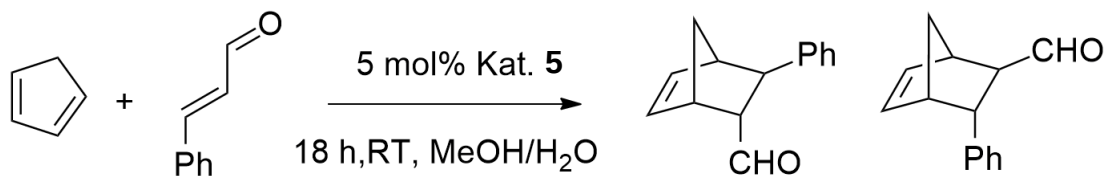




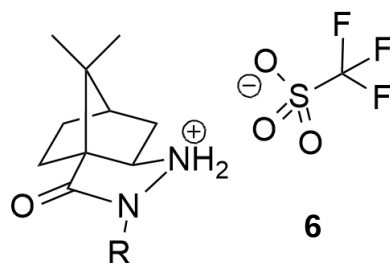
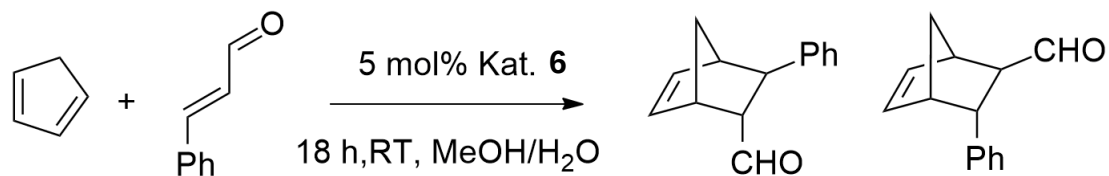
- *trans* Dienophil liefert auch immer das *trans* D.A. Produkt



- *endo*-Cycloadditionsprodukte sind kinetisch bevorzugt
- *exo*-Produkte sind thermodynamisch stabiler entstehen jedoch kaum

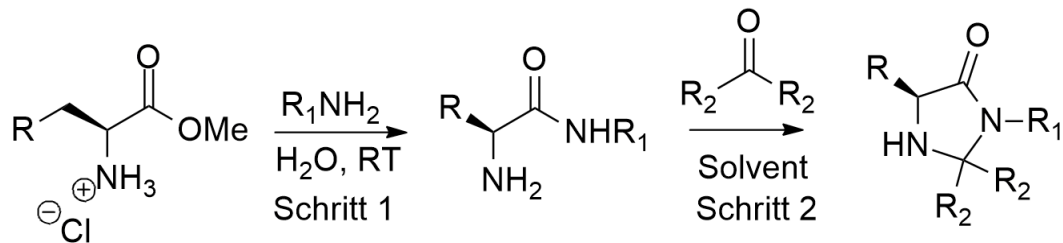


Ausbeute [%]	<i>exo:endo</i>	<i>exo ee</i> [%]
99	1,3:1	93

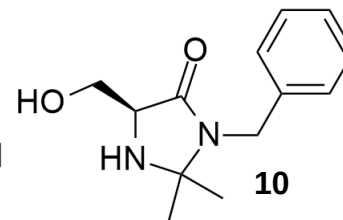
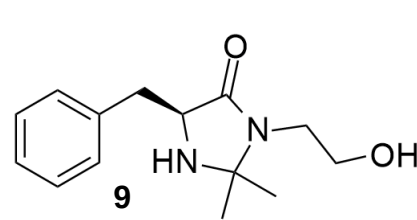
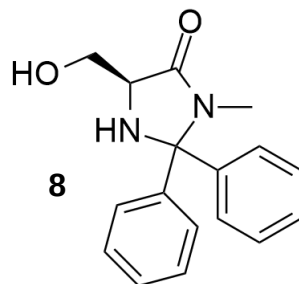
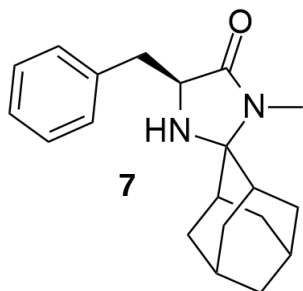


R	Ausbeute [%]	<i>exo:endo</i>	<i>endo</i> ee [%]
Ph	25	1,1:1	60
Bn	90	2,1:1	82

Synthese der MacMillan-Katalysatoren



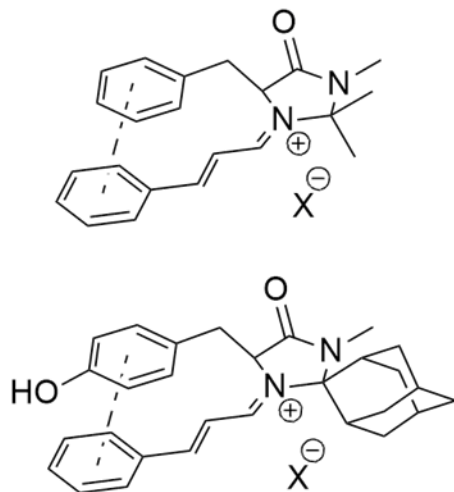
R	R ₁	R ₂	Lösungsmittel Schritt 2	Temperatur Schritt 2	Ausbeute [%]
Ph	EtOH	Me	Aceton/MeOH (9:1)	56 °C	54
OH	Bn	Me	Aceton/MeOH (9:1)	56 °C	55
Ph	Me	Ad-2-on	MeOH/n-Hexan (2:3)	65 °C	n.d
Ph	Me	Ad-2-on	EtOH/Cyclohexan (2:3)	78 °C	n.d
Ph	Me	Ad-2-on	H ₂ O/Dioxan (2:3)	100 °C	n.d
OH	Me	Ph	MeOH	65 °C	n.d



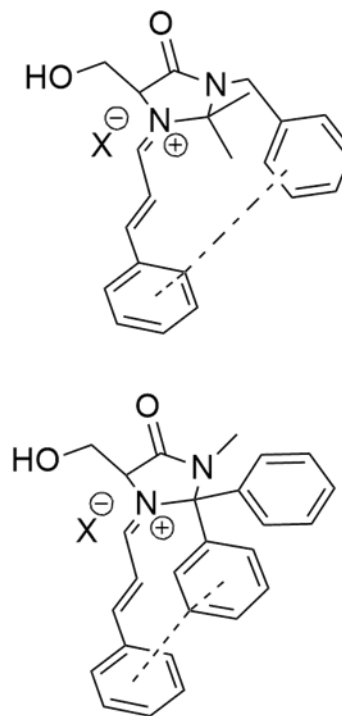
Mögliche Beeinflussung durch Wechselwirkungen ?



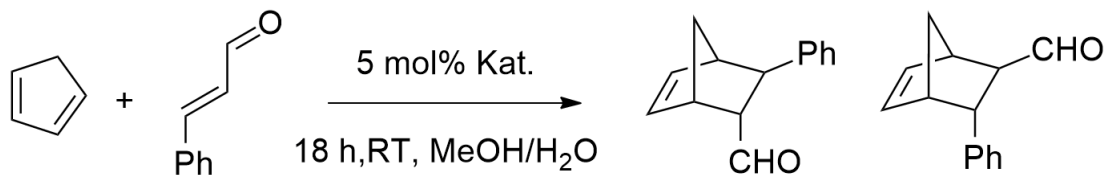
Si face addition



Re face addition?

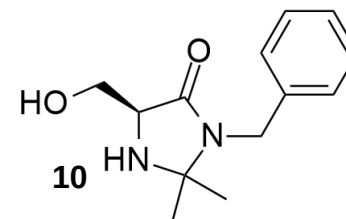
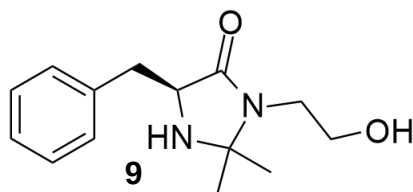
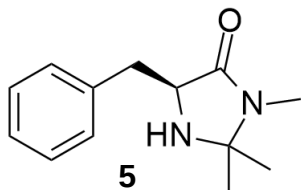


Katalyse der Diels-Alder Reaktion



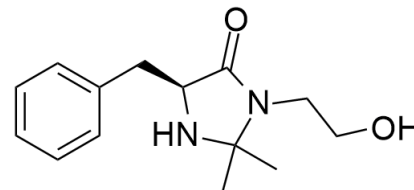
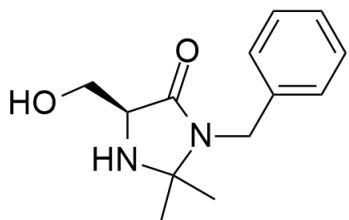
Katalysator	Ausbeute [%]	<i>exo:endo</i>	<i>exo ee</i> [%]	<i>endo ee</i> [%]
-	2	3,8:1	0	2
5 ·HCl	92	1,3:1	91	84
9 ·HCl	87	1,7:1	86	n.d.
9 ·TFA	130*	1,54:1	95	n.d.
10 ·HCl	122*	1,63:1	n.d.	n.d.
10 ·TFA	140*	1,57	64	63

* Aufreinigung mittels Säulenchromatographie nicht optimal

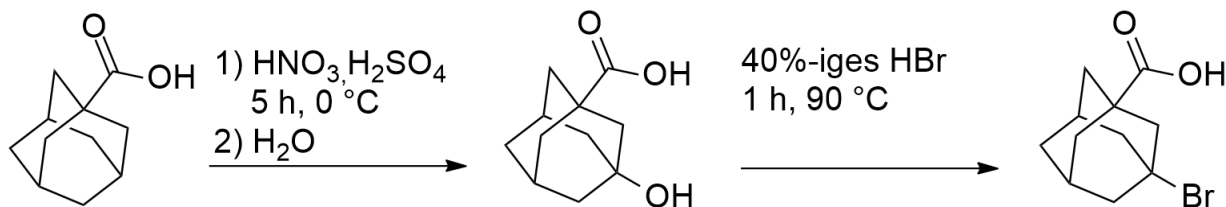




- Modifikation schwierig aufgrund von Löslichkeitsproblemen
- Die erzeugten Katalysatoren funktionieren
- Neue Katalysatoren möglich!

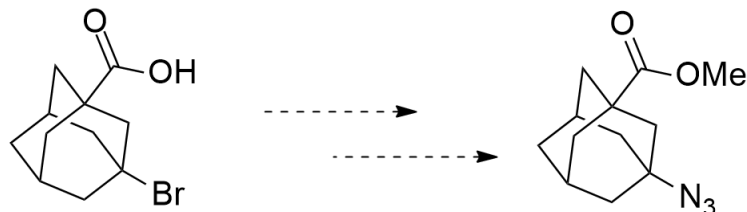


- Strukturgebendes Element zur Hälfte nachgekocht



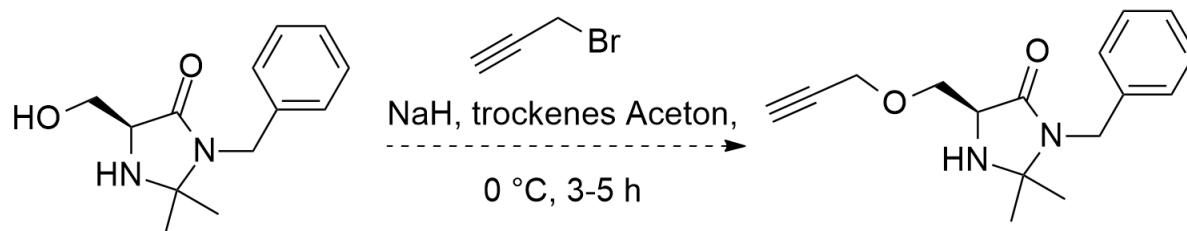


- Synthese von „clickbarem“ strukturgebendem Element vervollständigen

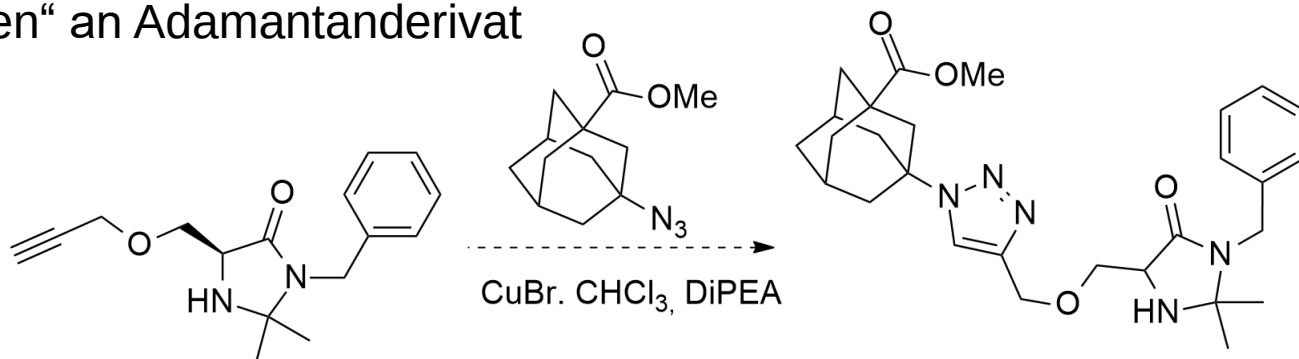


- Vorbereiten der Katalysatoren für die Clickchemie:

- Propagierung der Katalysatoren



- „Clicken“ an Adamantanderivat





Danke für die Aufmerksamkeit !

