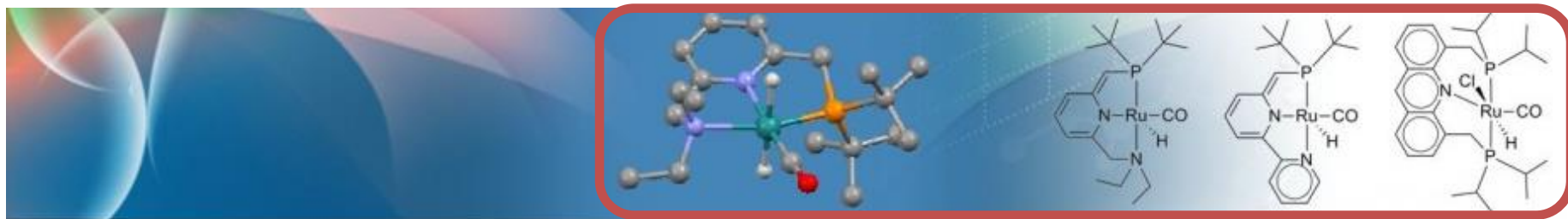


Milstein Catalyst

Reporter: Lin Zhou
Advisor: Prof. Zhao

2013-5-27

The Milstein Group



Department of Organic Chemistry

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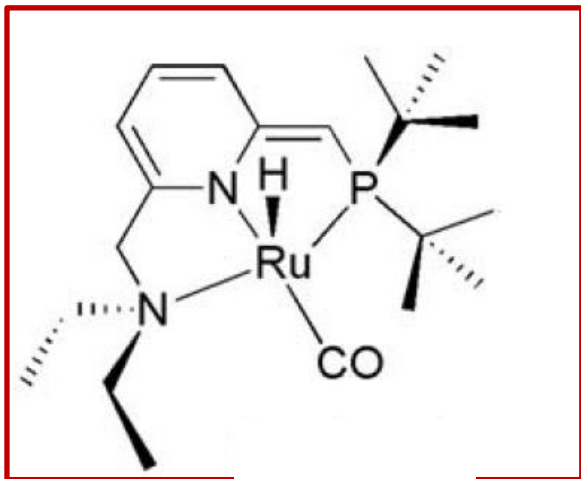


About the Author: David Milstein



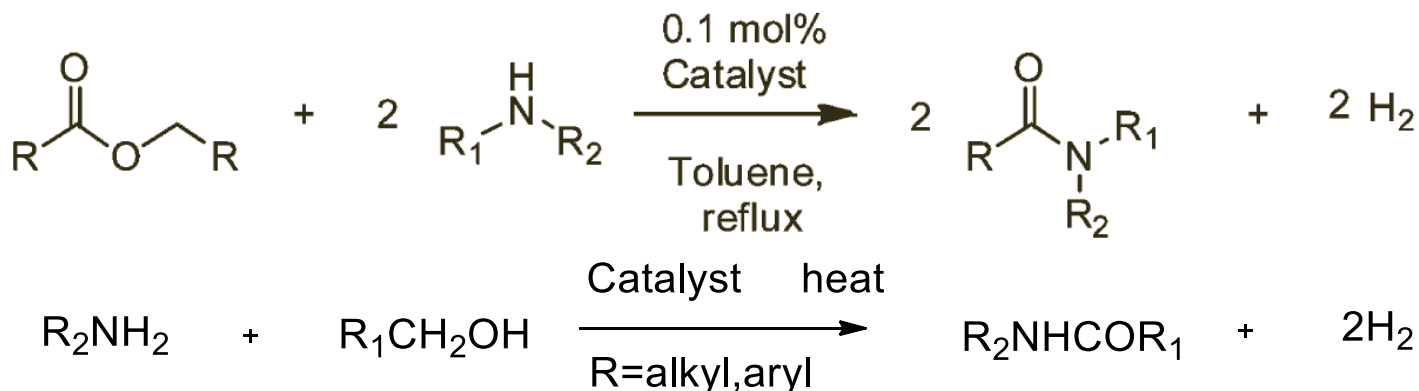
- PhD: Hebrew University of Jerusalem in 1976 with Prof Blum
- Postdoc: Colorado State University with John Stille
(Together with his advisor, he discovered the Stille Reaction)
- Group leader: DuPont Company in Wilmington in 1979
- Professor: Weizmann Institute of Science in 1987

Dehydrogenation: Amide Formation



The Milstein Catalyst

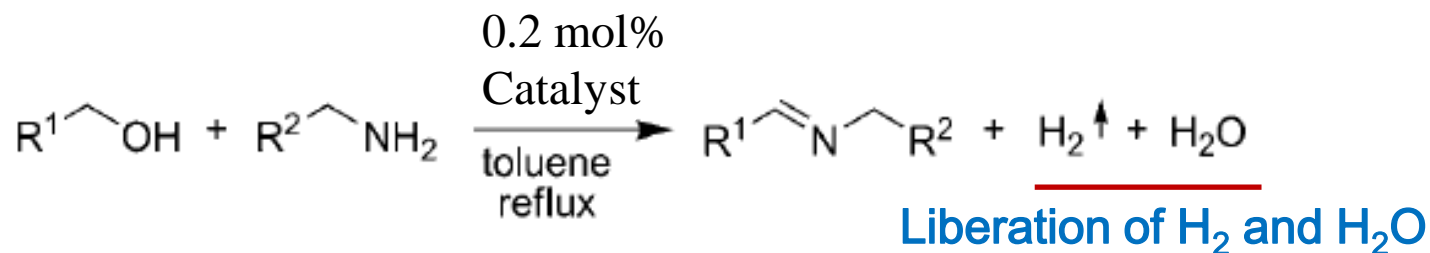
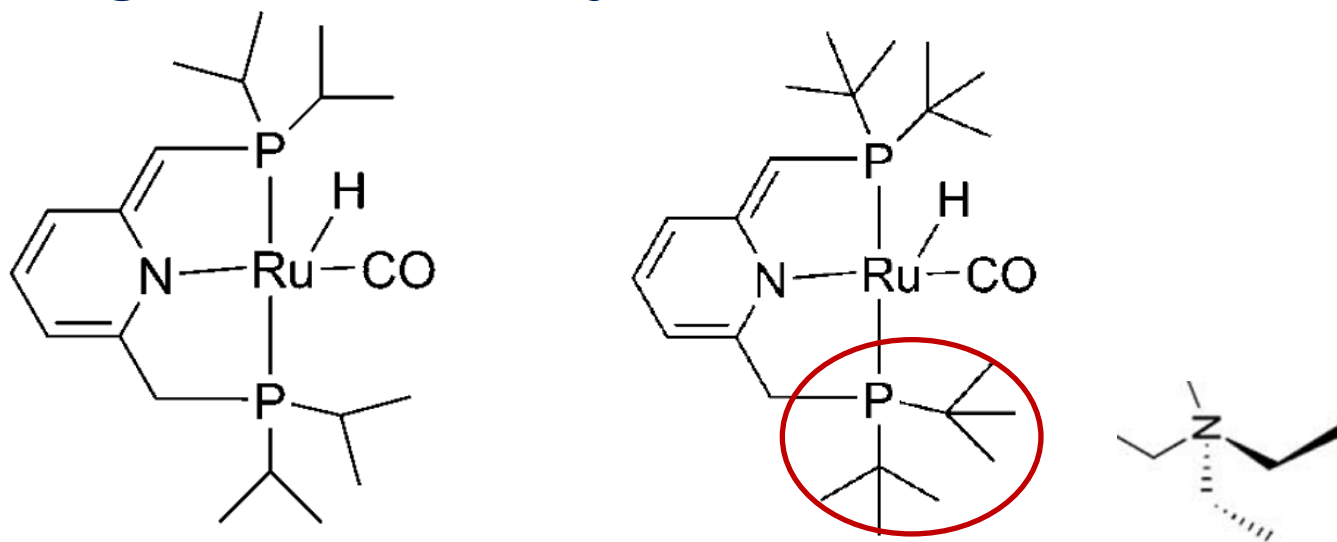
CAS: 863971-63-5



Direct dehydrogenative acylation of amines with alcohols and esters can occur.

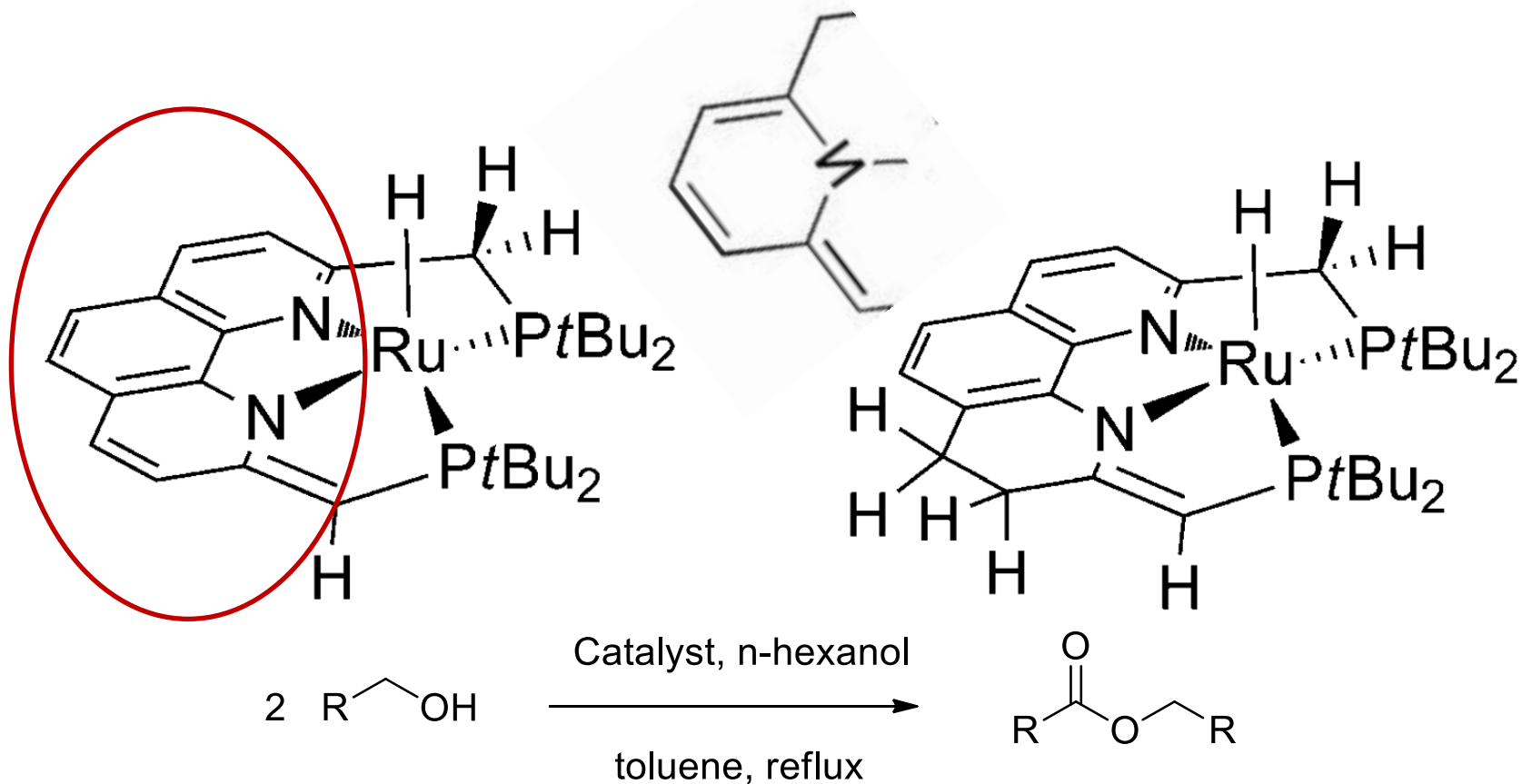
Chidambaram Gunanathan; Yehoshoa Ben-David; David Milstein *Science* 2007, 317, 790.
Gnanaprakasam, B.; Milstein, D. *J. Am. Chem. Soc.* 2011, 133, 1682-1685.

Dehydrogenation : Synthesis of Imines



The reaction proceeds under neutral conditions without a hydrogen acceptor.

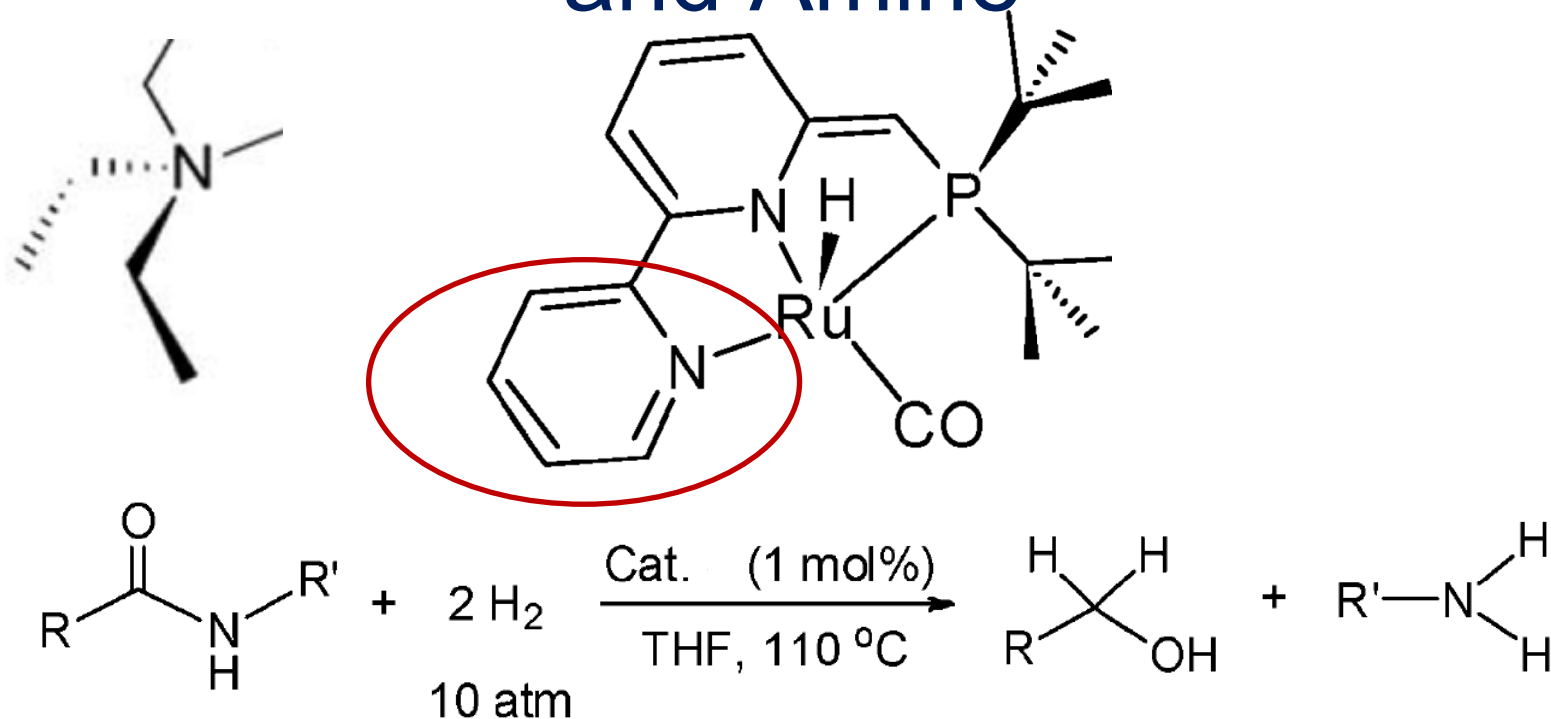
Dehydrogenation: Synthesis of Esters



The dehydrogenation of primary alcohols to form esters happens without the need of a hydrogen acceptor.

Langer, R.; Fuchs, I.; Vogt, M.; Balaraman, E.; Diskin-Posner, Y.; Shimon, L. J. W.; Ben-David, Y.; Milstein, D. *Chem.-Eur. J.* 2013, 19, 3407-3414.

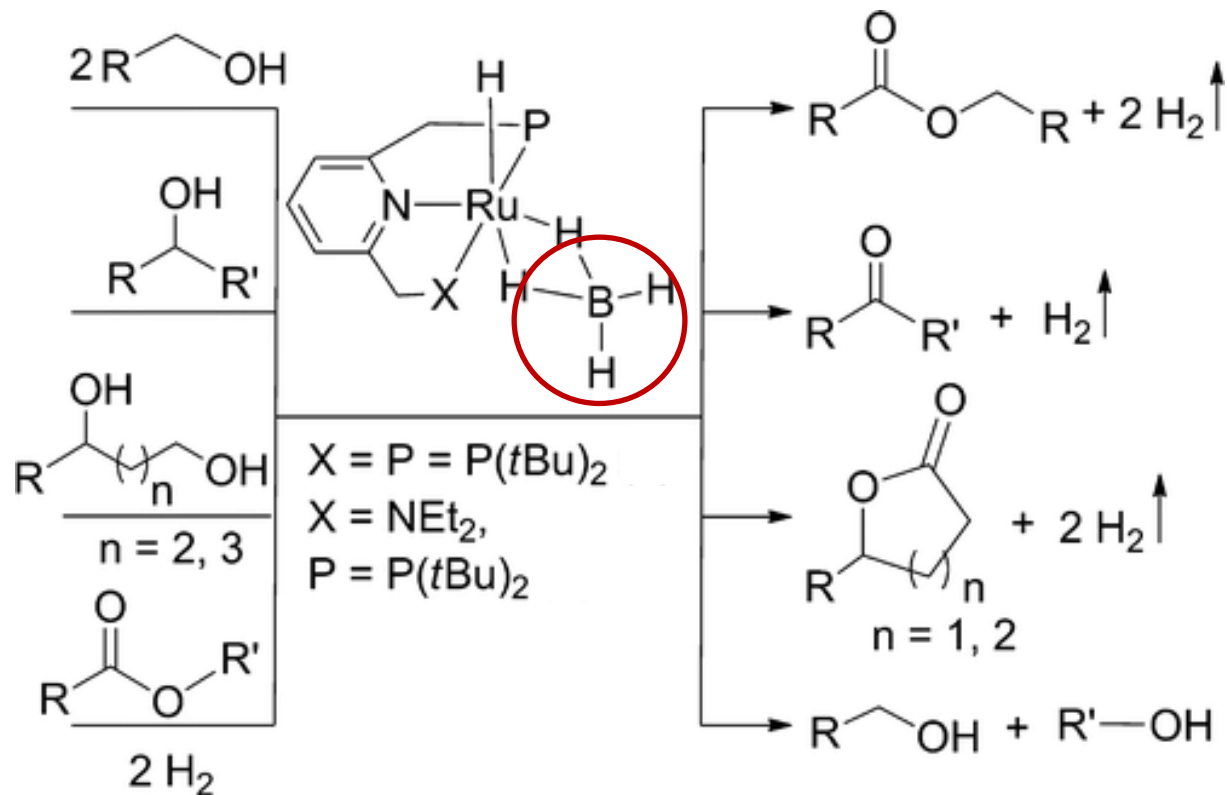
Hydrogenation: Formation of Alcohol and Amine



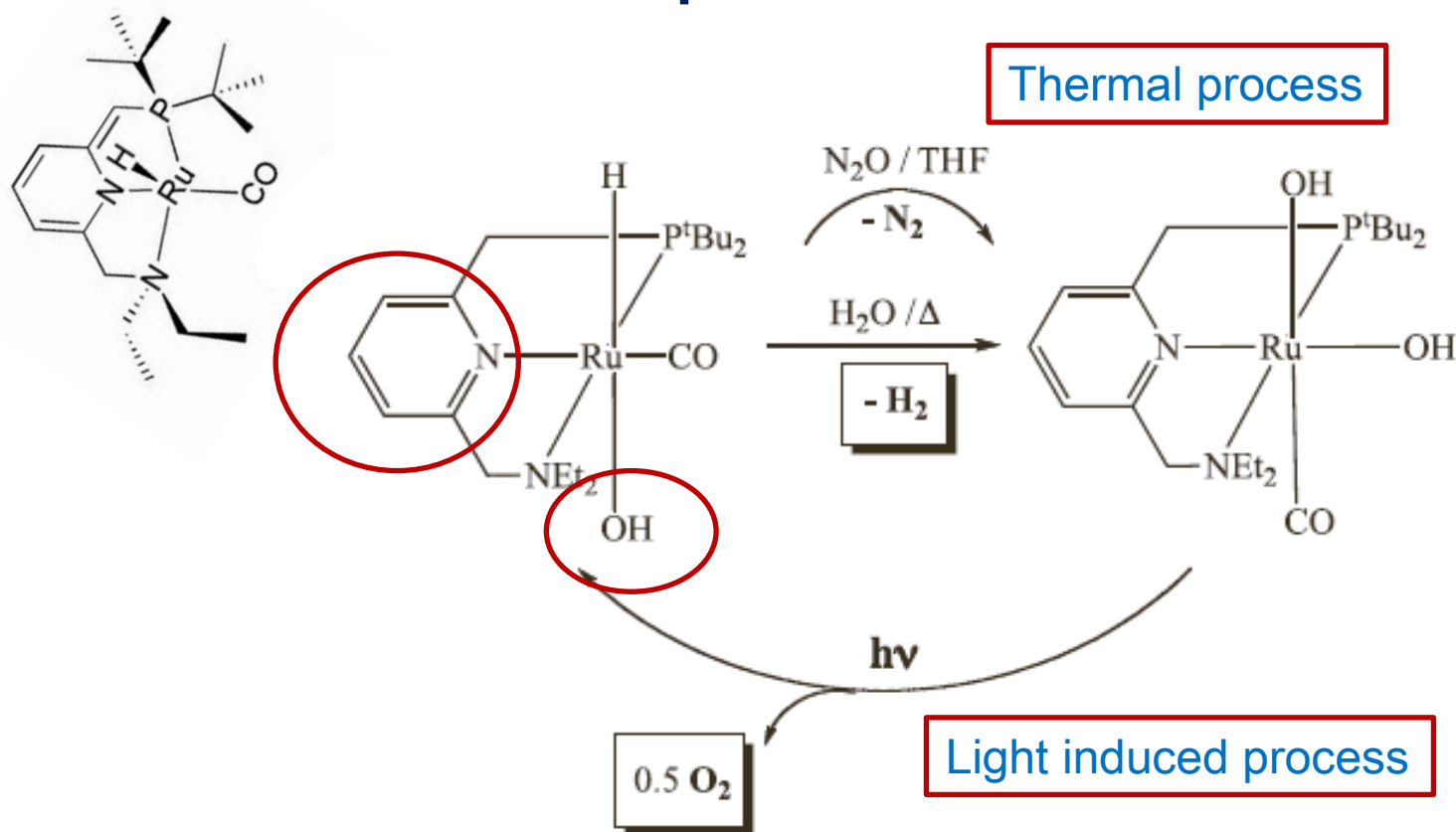
R = Aryl, and alkyl
R' = Aryl, alkyl, and Arylalkyl

Hydrogenation can also happen by using another ruthenium catalyst, leading to the formation of alcohol and amine.

Dehydrogenation and Hydrogenation (Under the Same Catalyst)



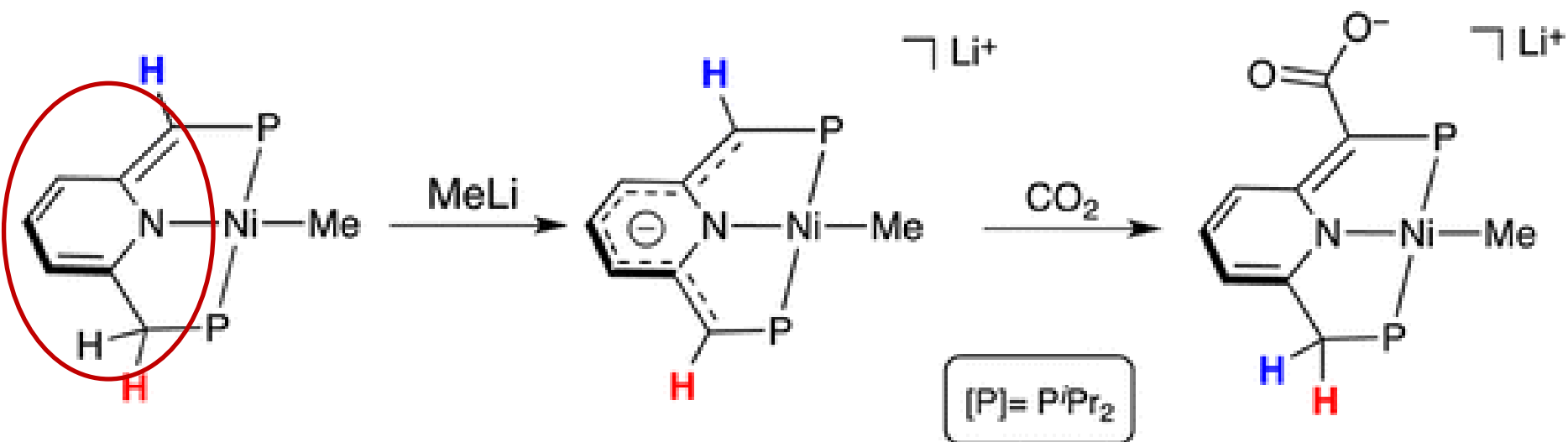
Decomposition of Water



Consecutive thermal H_2 and light induced O_2 evolution from water is promoted by a ruthenium based metal complex.

Kohl, S. W.; Weiner, L.; Schwartsburd, L.; Konstantinovski, L.; Shimon, L. J. W.; Ben-David, Y.; Iron, M. A.; Milstein, D. *Science* 2009, 324, 74-77.

Ni-based catalyst



The Ni-based catalyst can react with CO₂ to form an anionic Ni complex.

Vogt, M.; Rivada-Wheelaghan, O.; Iron, M. A.; Leitus, G.; Diskin-Posner, Y.; Shimon, L. J. W.; Ben-David, Y.; Milstein, D. *Organometallics* 2013, 32, 300-308.

THANK YOU FOR YOUR LISTENING!