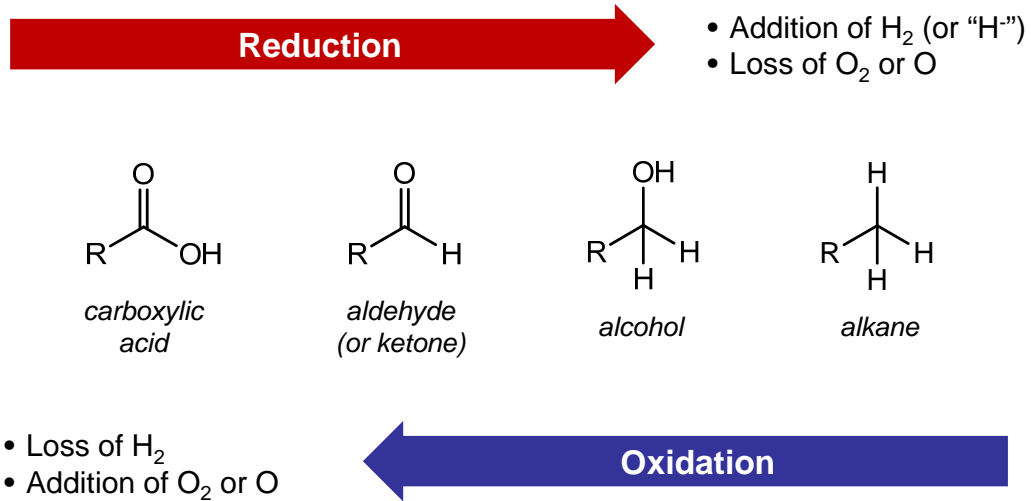
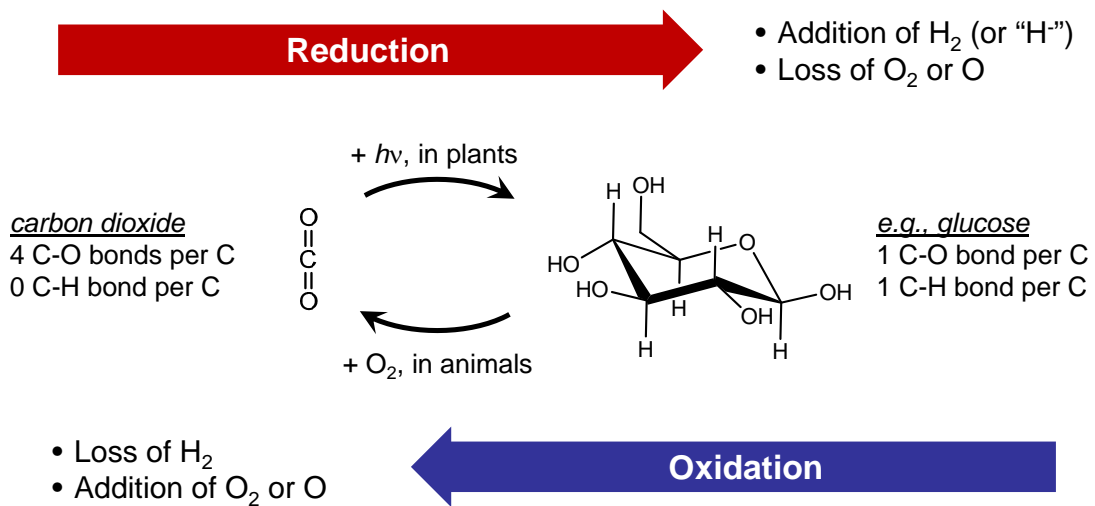


Oxidation States of Carbon



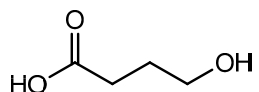
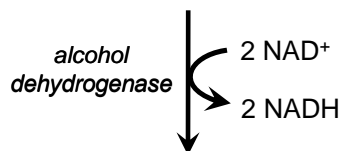
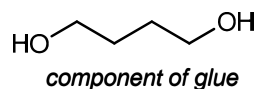
Neither oxidation nor reduction: Addition or loss of H⁺, H₂O, or HX

Oxidation and Reduction in Biology



Neither oxidation nor reduction: Addition or loss of H⁺, H₂O, or HX

Biological Oxidation Gone Wrong



gamma-hydroxybutyrate
(GHB, an intoxicant/
date rape drug)



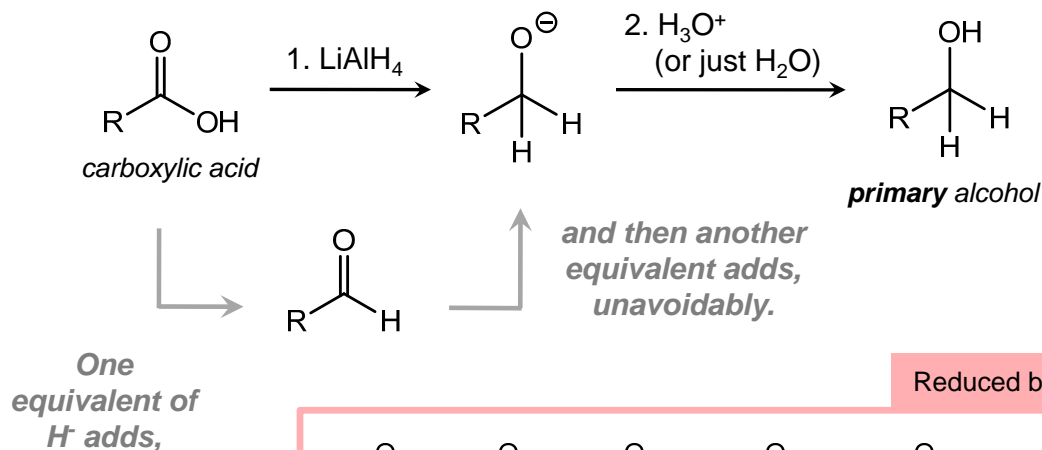
Dr. Kevin Carpenter, biochemical geneticist (specialist in pediatric metabolic disorders), Children's Hospital at Westmead (Sydney), Australia.

Behind him: The Agilent GC/MS used to analyze the Aqua Dots.

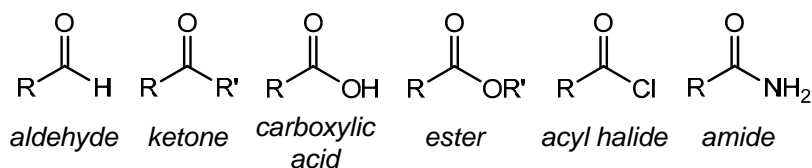
New York Times, Nov. 8, 2007
"Sleuthing for Danger in Toy Beads"

Hydrides as Reducing Agents

Lithium aluminum hydride (LiAlH_4) is a *strong* reducing agent. It will reduce any C=O containing functional group to an alcohol.

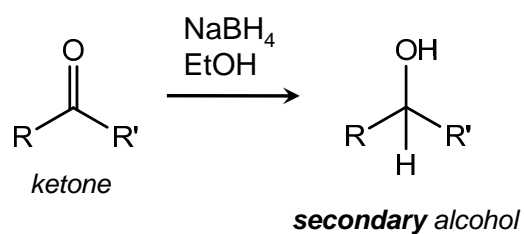
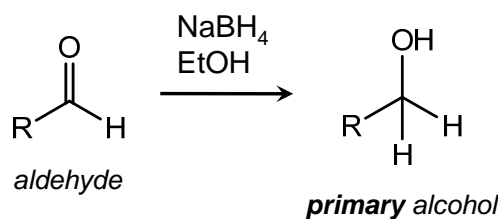


Reduced by LiAlH_4 :

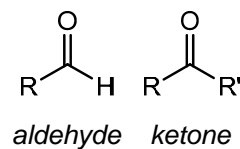


Hydrides as Reducing Agents

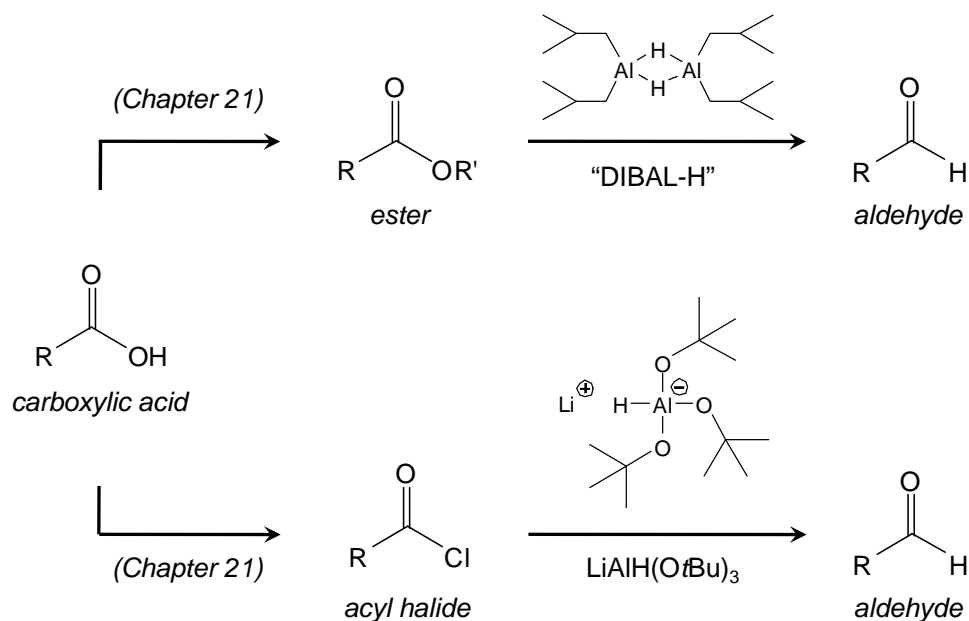
Sodium borohydride (NaBH_4) is a *mild* reducing agent. It is only capable of reducing aldehydes and ketones to alcohols.



Reduced by NaBH_4 :

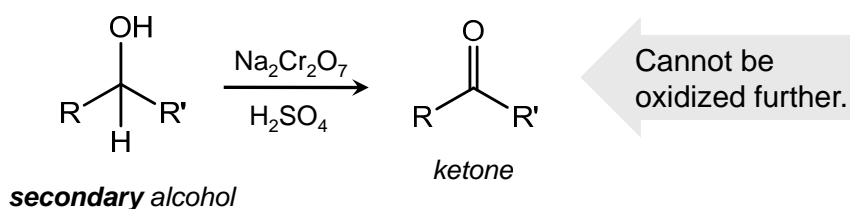


Hindered Reducing Agents Stop At Aldehyde



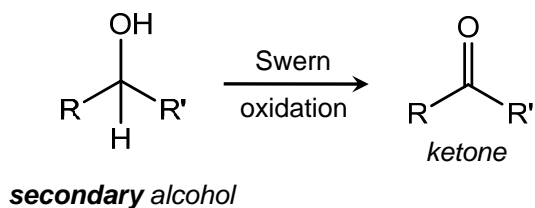
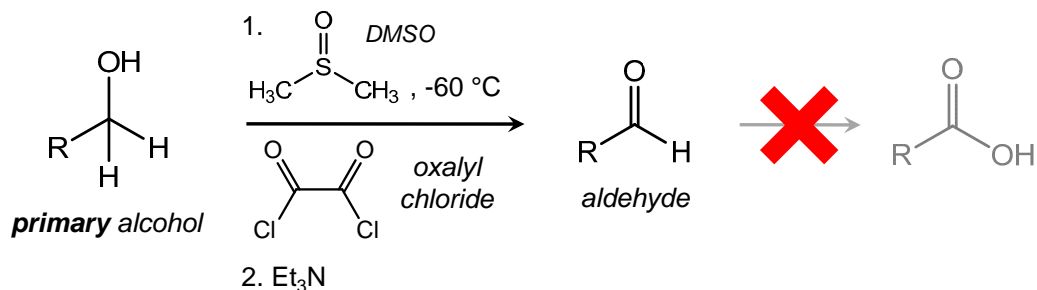
Strong Organic Oxidizers

Chromate (LiAlH_4) is a *strong* oxidizing agent; it oxidizes primary alcohols all the way to carboxylic acids, and secondary alcohols to ketones.



Mild Organic Oxidizers

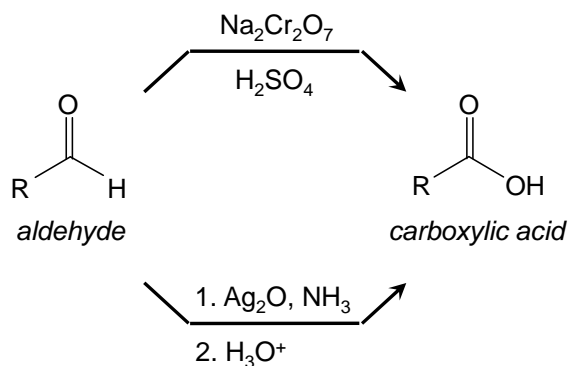
Swern oxidation is a *mild* oxidation process; it oxidizes primary alcohols just to aldehydes (and not all the way to carboxylic acids). It also oxidizes secondary alcohols to ketones.



Wade describes PCC as another mild oxidizing agent that achieves the same goal. The reagents and waste products from Swern oxidation are much less toxic; no one uses PCC any more.

Mild Organic Oxidizers

Ag₂O is a *mild* oxidizing agent; it interacts specifically with the C=O double bond (and not with alcohols), and oxidizes aldehydes to carboxylic acids.



Biological Cofactors as Redox Agents

Cofactor: A small-molecule “helper” that is required by an enzyme to catalyze a reaction. Many vitamins are cofactors.

