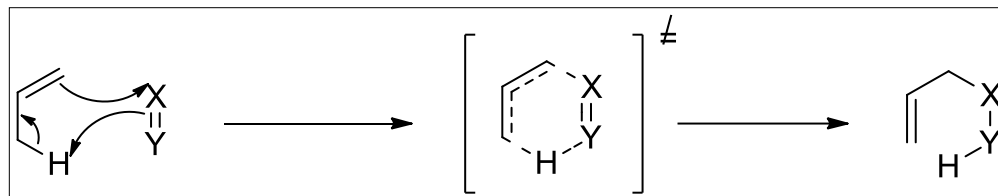
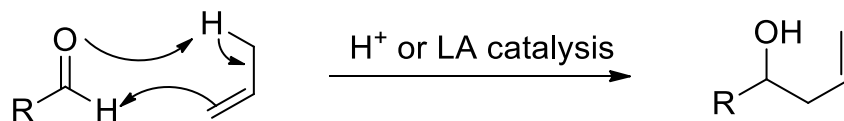


## 4.2.3. Other rearrangement: the Ene reaction or Alder-Ene reaction

The Ene-reaction is a  $2\pi + 2\sigma + 2\pi$  process



- Important specific example: the carbonyl Ene-reaction

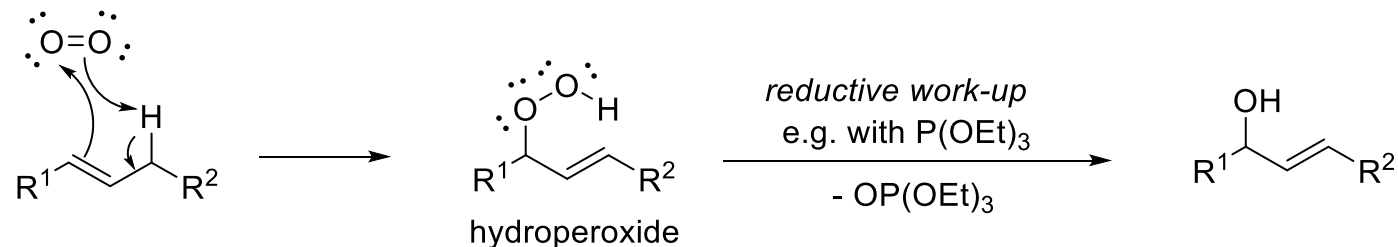


Applied in the technical synthesis of menthol by the Takasago company

## 4.2.3. the Ene reaction or Alder-Ene reaction

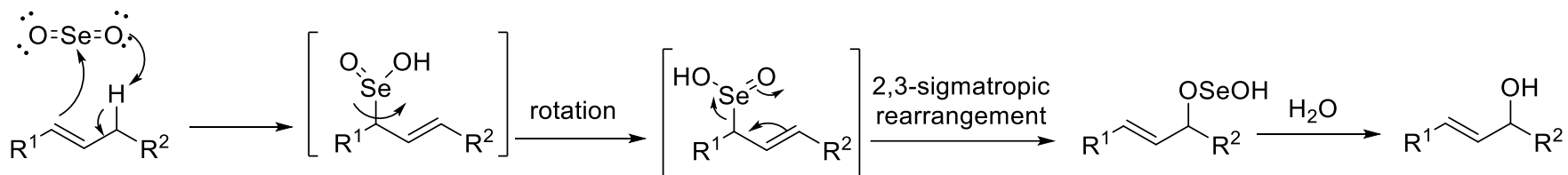
- Ene-reactions with singulett oxygen :

Singulett oxygen is formed by light from “normal” triplett oxygen with a photosensitizer



Overall, this is formally an allylic oxidation with a transposition of the double bond.

- Related reactivity is observed with  $\text{SeO}_2$ :



Overall, this is formally an allylic oxidation keeping the position of the double bond.

# 4.2.3. Technical synthesis of menthol (BASF menthol process)

