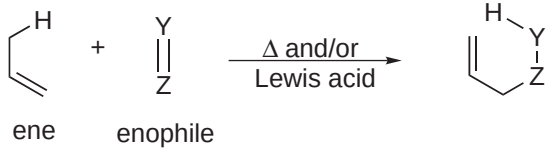
121. Ene Reaction (Alder-Ene Reaction); Conia-Ene Reaction

K. Alder *et al., Ber.* **76,** 27 (1943).

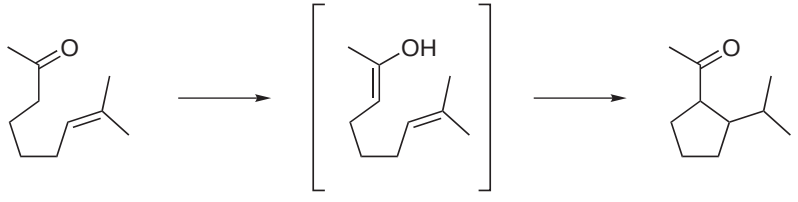
The addition of an alkene having an allylic hydrogen (ene) to a compound containing a multiple bond (enophile) to form a new bond between two unsaturated termini, with an allylic shift of the ene double bond, and transfer of the allylic hydrogen to the enophile. The mechanism is related to that of the Diels-Alder reaction, *q.v.*:



enophile = carbonyl and thiocarbonyl compounds, imines, alkenes, alkynes
Lewis acid = $BF_3 \bullet O(CH_2CH_3)_2$, $SnCl_4$, $Al(CH_2CH_3)Cl_2$, $Al(CH_3)_2Cl$

Lewis acid-promoted cyclization of 5-hexenals: J. A. Marshall, *Chemtracts: Org. Chem.* **5**, 1-7 (1992). Review of alkenes as enophiles: B. B. Snider, *Comp. Org. Syn.* **5**, 1-27 (1991). Review of carbonyl compounds as enophiles: *idem, ibid.* **2**, 527-561; in conjunction with asymmetric synthesis: K. Mikami, M. Shimizu, *Chem. Rev.* **92**, 1021-1050 (1992); K. Mikami *et al., Synlett* **1992**, 255-265.

The intramolecular Ene reaction of unsaturated ketones, in which the carbonyl functionality serves as the ene component, *via* its tautomer, and the olefinic moiety serves as the enophile, is known as the **Conia-Ene reaction**: F. Rouessac *et al., Tetrahedron Lett.* **6**, 3319 (1965).



A. S. Kende, R. C. Newbold, *Tetrahedron Lett.* **30**, 4329 (1989). J. J. Kennedy-Smith *et al., J. Am. Chem. Soc.* **126**, 4526 (2004). Q. Gao *et al., Org. Lett.* **7**, 2185 (2005). *Review:* J. M. Conia, P. Le Perchec, *Synthesis* **1975,** 1-19.