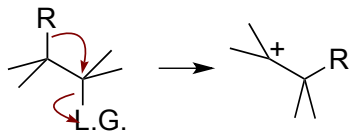
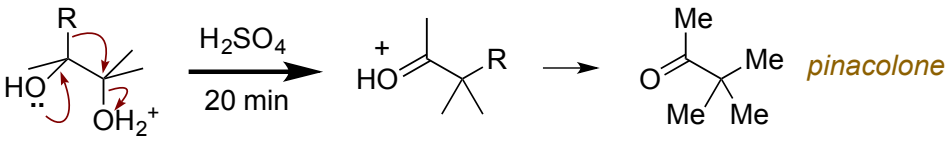
Topic 11: Migratory Displacements



Sigma bond antiperiplanar to L.G. migrates

Pinacol Rearrangement



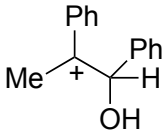
Hill, G. A.; Flosdorf, E. W.
Org Synth, Coll. Vol. I **1941**, 462.

- Sigma bond **antiperiplanar to L.G.** migrates
- Migrating bond weakened by $n_O \rightarrow \sigma^*_{C\text{-}C}$ donation

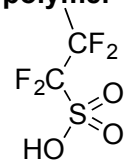
- **Migratory aptitude**: **Ar > C=C > H > 3° > 2° > 1°**

(Recall: phenonium ion.)

not via carbocations...

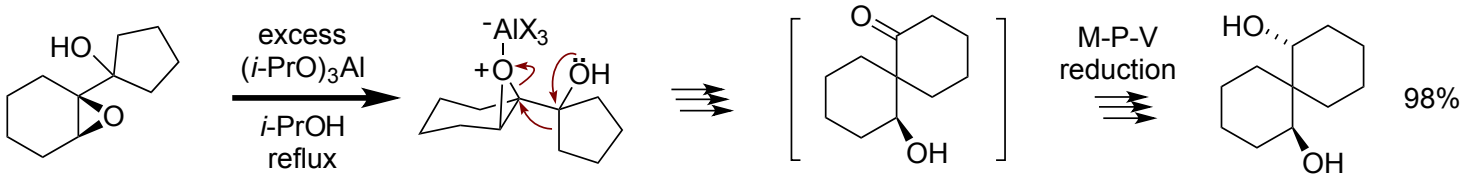


NAFION H =
polymer



Mukaiyama, T.; Echigo, Y.; Shiono, M. *Chem. Lett.* **1977**,

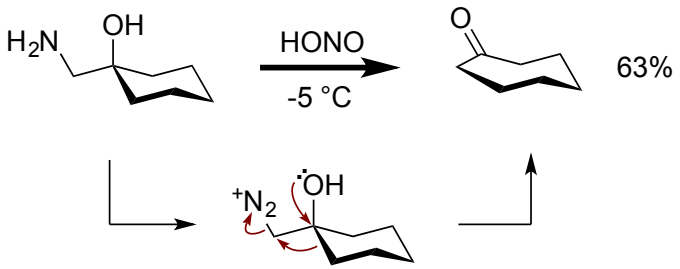
- Lewis acids can promote pinacol rearrangements



Tu, Y. Q.; Yang, L. M.; Chen, Y. Z. *Chem Lett.* **1998**, 285.

Tiffeneau-Demjanov Reaction

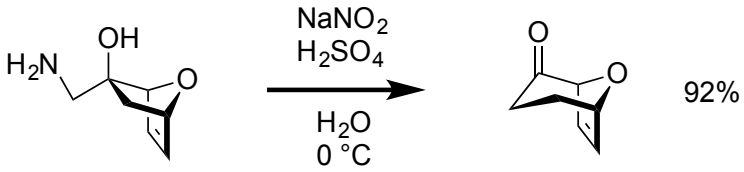
■ Formation of **diazonium** from amino groups occurs under mild reaction conditions



Dauben, H. J.; Ringold, H. J.; Wade, R. H.; Anderson, A. G. *JACS* **1951**, 73,

Org. Syn. Coll. Vol. IV **1963**, 221.

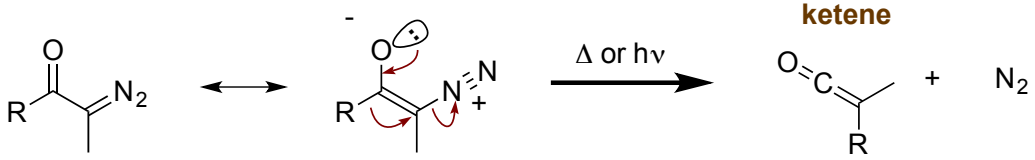
■ You can't buy nitrous acid. You make it in situ.



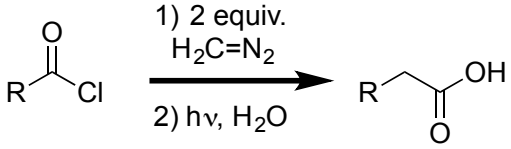
Fattori, D.; Henry, S.; Vogel, P. *Tetrahedron* **1993**, *49*, 1649.

Wolff Rearrangement

■ α-Diazocarbonyls undergo Wolff rearrangement under thermal or photochemical conditions. You really need an enolate resonance structure to understand orbital alignment and bond weakening.

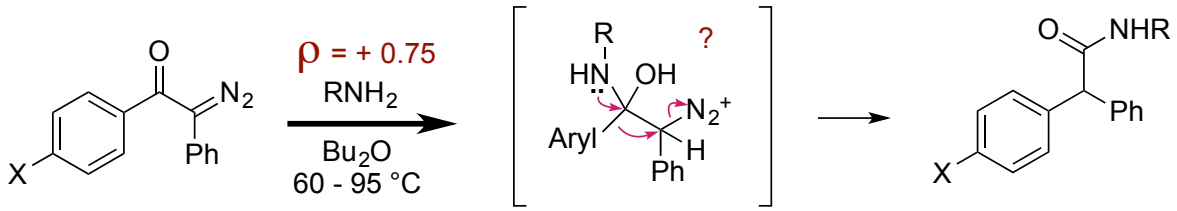


■ Part of the classic **Arndt-Eistert homologation** sequence:



W. E. Bachmann and W. S. Struve *Organic Reactions* **1942**, *1*, 38.

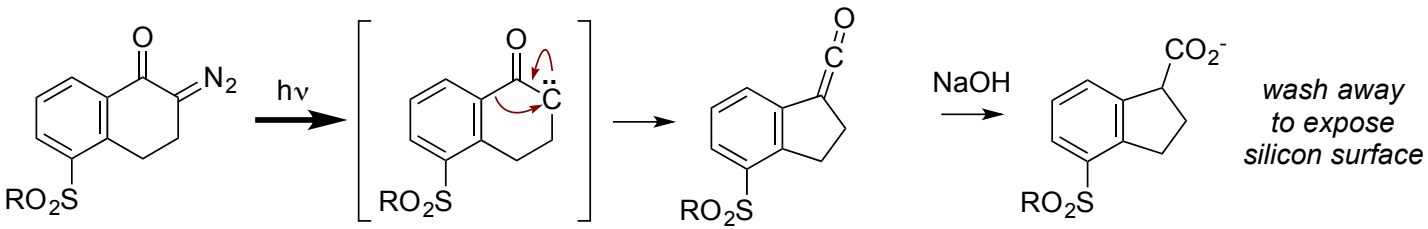
■ Apparent Wolff when heated with Nu. Reaction favors EWG on aryl.

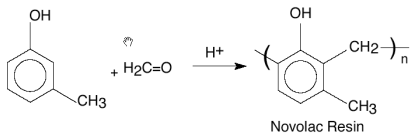


Chem 202 stuff
ρ is the slope from a Hammett plot.
About T.S.:
ρ>0 positive charge is lost
ρ<0 negative charge is lost

Jugelt, W.; Schmidt, D. *Tetrahedron* **1969**, *25*, 969.

■ Photochemical process can generate **free carbenes R_2C:**
Novolac/DNQ = Key reaction in photolithographic production of microchips





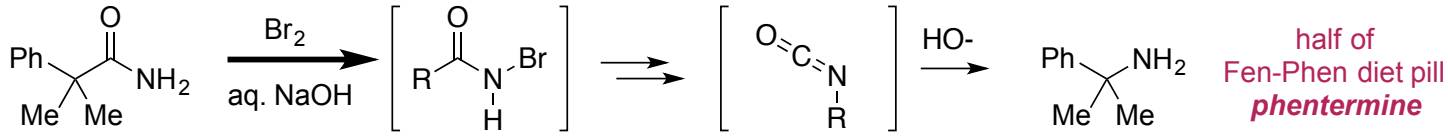
Hofmann and Curtius Rearrangements

■ Hofmann and Curtius rearrangements occur under similar conditions. You really need an enolate resonance structure to understand orbital alignment and bond weakening.

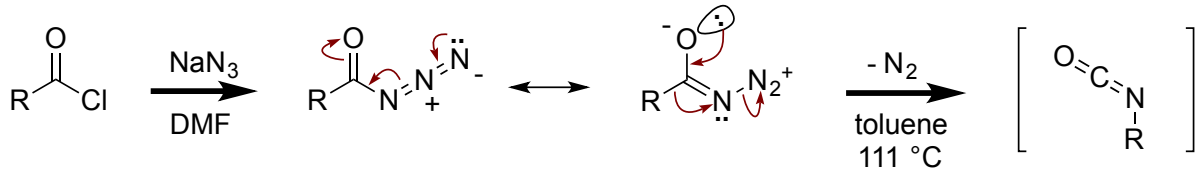
■ Chirality of migrating R group is preserved.

■ Older literature incorrectly refers to free nitrenes.

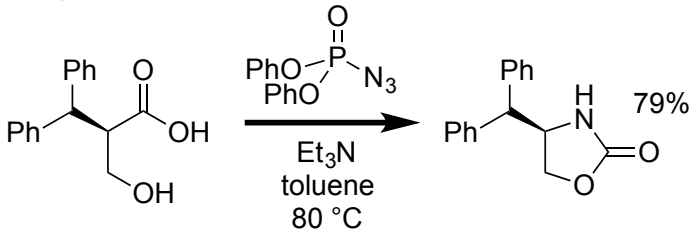
■ **Hofmann Rearrangement:** *N*-bromoamide is formed *in situ*



■ **Curtius Rearrangement:** Acyl azides usually not stored (explosive)



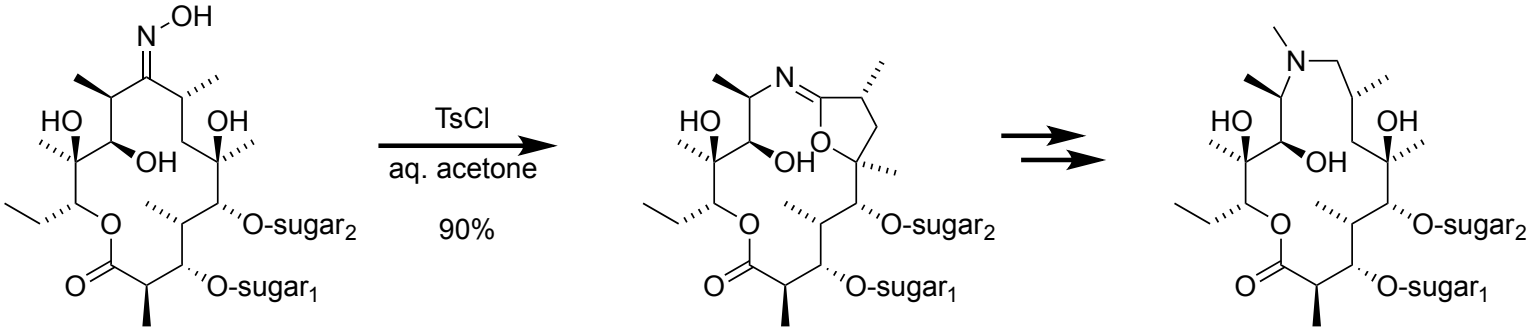
■ Acyl azides can be formed and rearranged *in situ* with DPPA



Takacs, J. M.; Jaber, M. R.; Vellekoop, A. S. *J. Org. Chem.* **1998**, *63*, 2742.

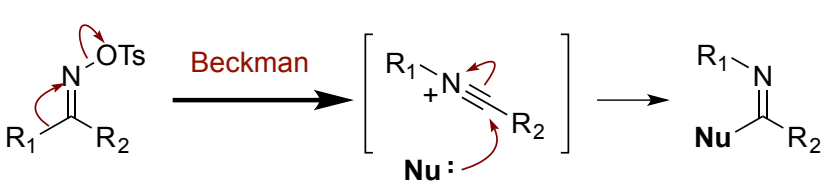
Beckman Rearrangement

■ Beckman rearrangement in the synthesis of Pfizer Zithromax®

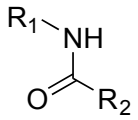


Djokic, S.; Kobrehel, G.; Lazarevski, G.; Lopotar, N.; Tamburasev, Z. *J. Chem. Soc., Perkin Trans 1.* **1986**, 1881

oxime formation = 90:10 *E/Z*, but *Z* is unstable



if **Nu** = H_2O...

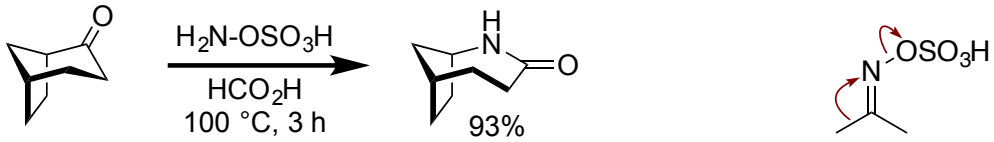


■ Chirality of migrating R group is preserved

■ R group ***anti*** to L.G. migrates

■ Difficult to make oximes stereoselectively; usually get *E* + *Z*

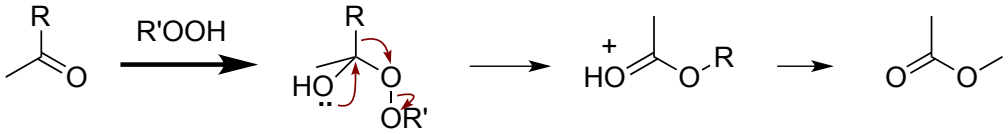
■ Oxime *O*-sulfonates can be formed *in situ*



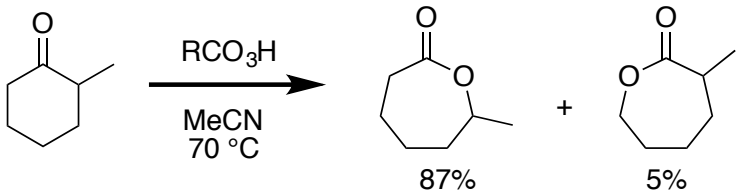
Krow, G. R.; Szczepanski, S. *J. Org. Chem.* **1982**, *47*, 1153.

Baeyer-Villiger Reaction and Criegee Rearrangement

- O-O bonds are easy to break
- Baeyer-Villiger = carbonyl + peroxy reagent

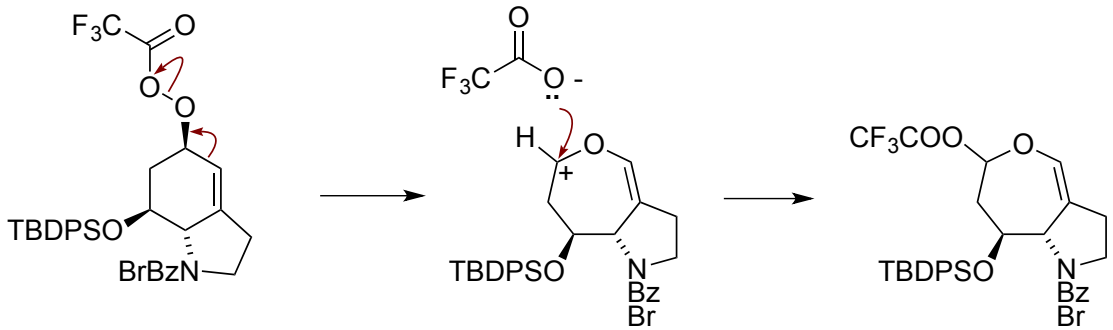


- Migratory aptitude: **3° > 2° ≈ Ph > 1°**



Hirano, M.; Yakabe, S.; Satoh, A.; Clark, J. J.; Morimoto, T. *Synth Commun.* **1996**, *26*, 4591.

- Criegee rearrangment



Goodman, R. M.; Kishi, Y. *J. Am. Chem. Soc.* **1998**, *120*, 9392.