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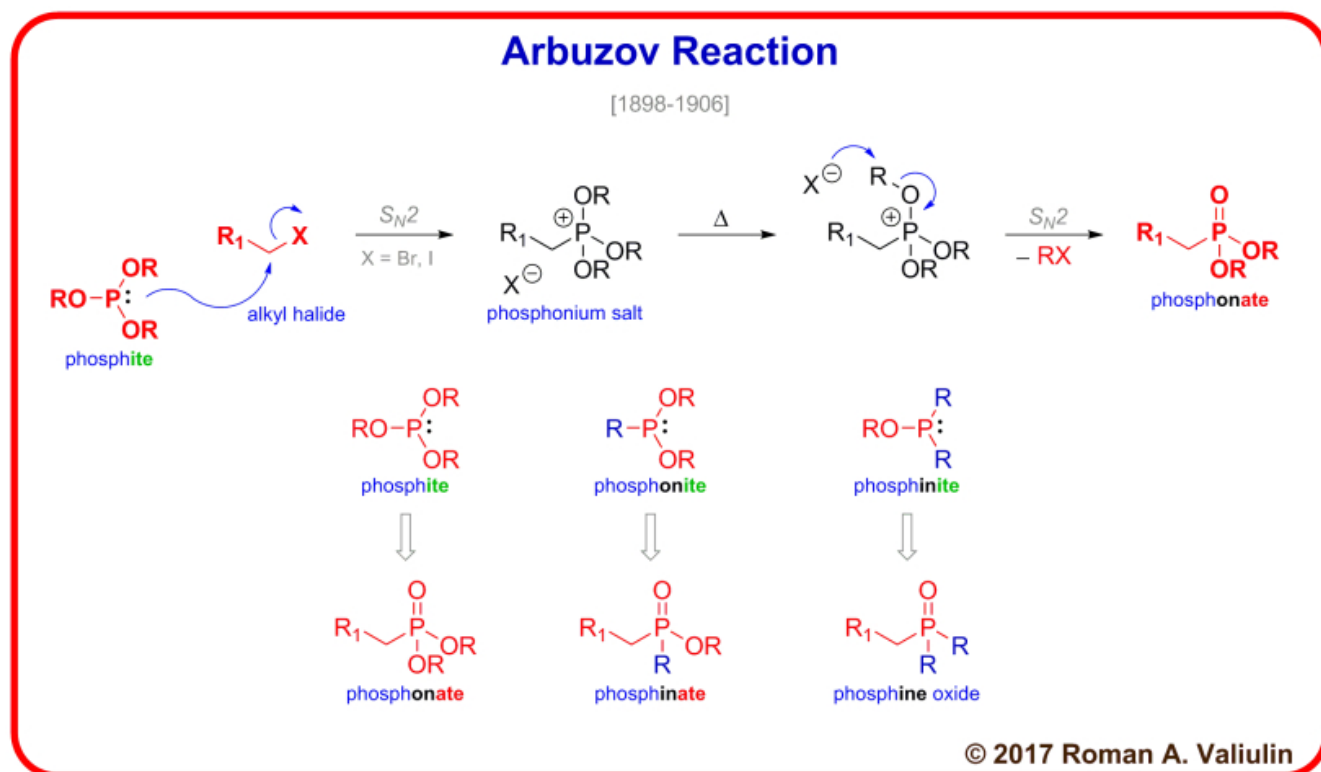
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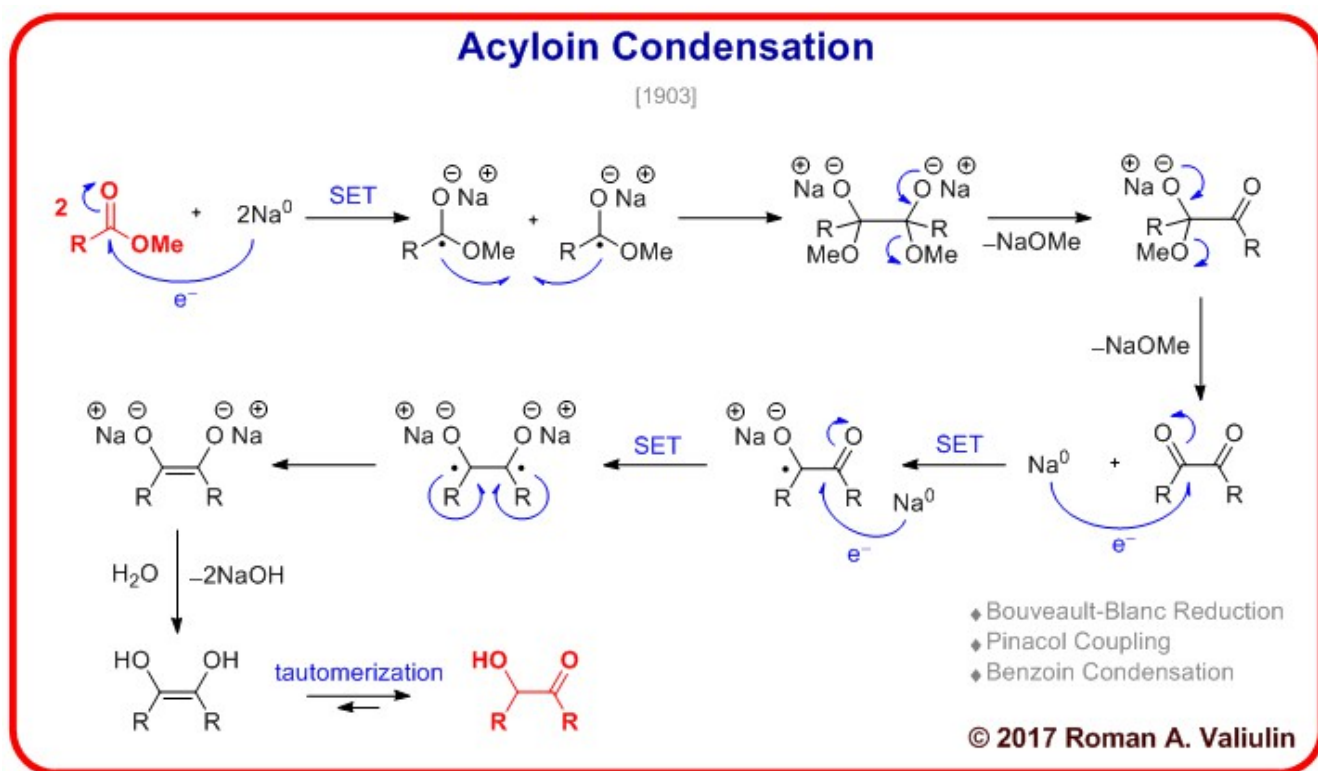
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I. 100 Must Know Mechanisms

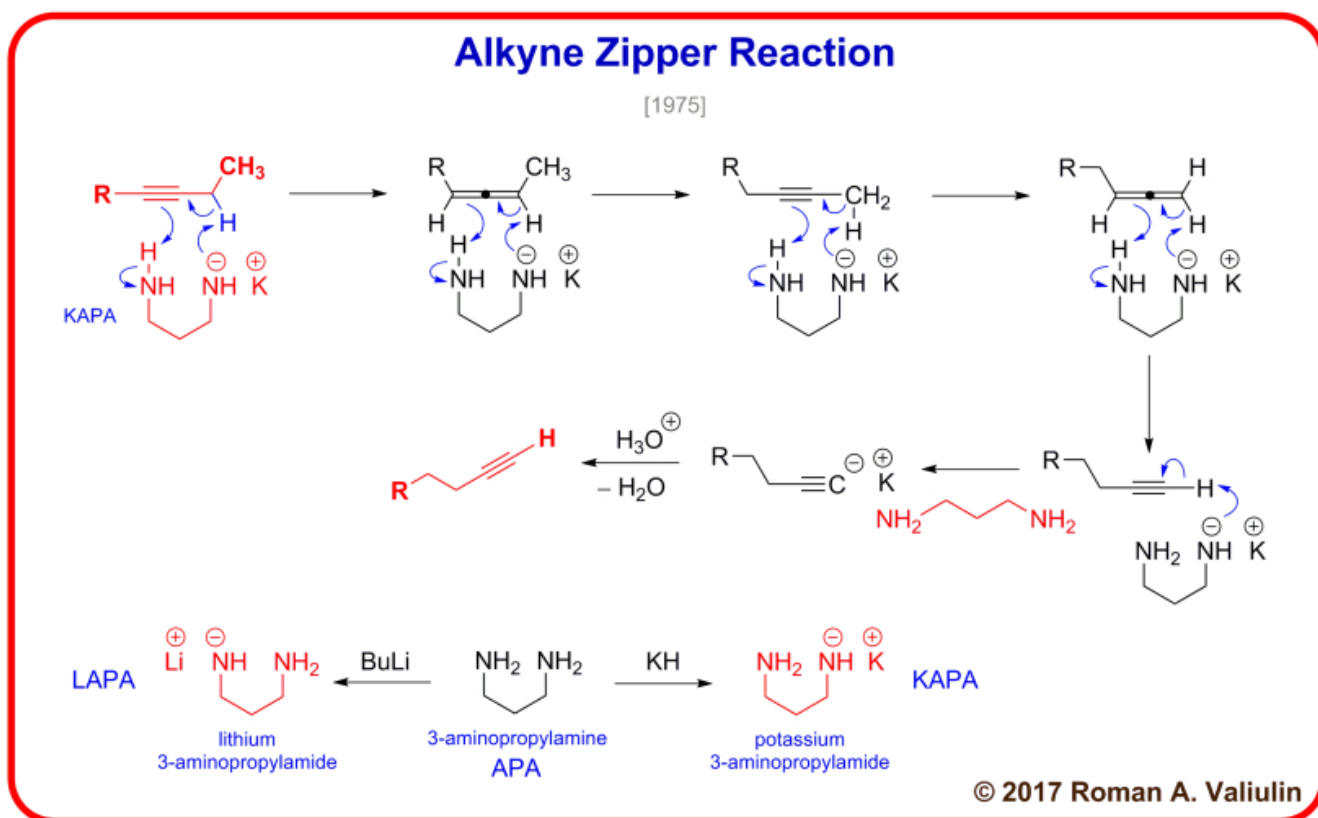
1. Arbuzov Reaction (1898–1906)



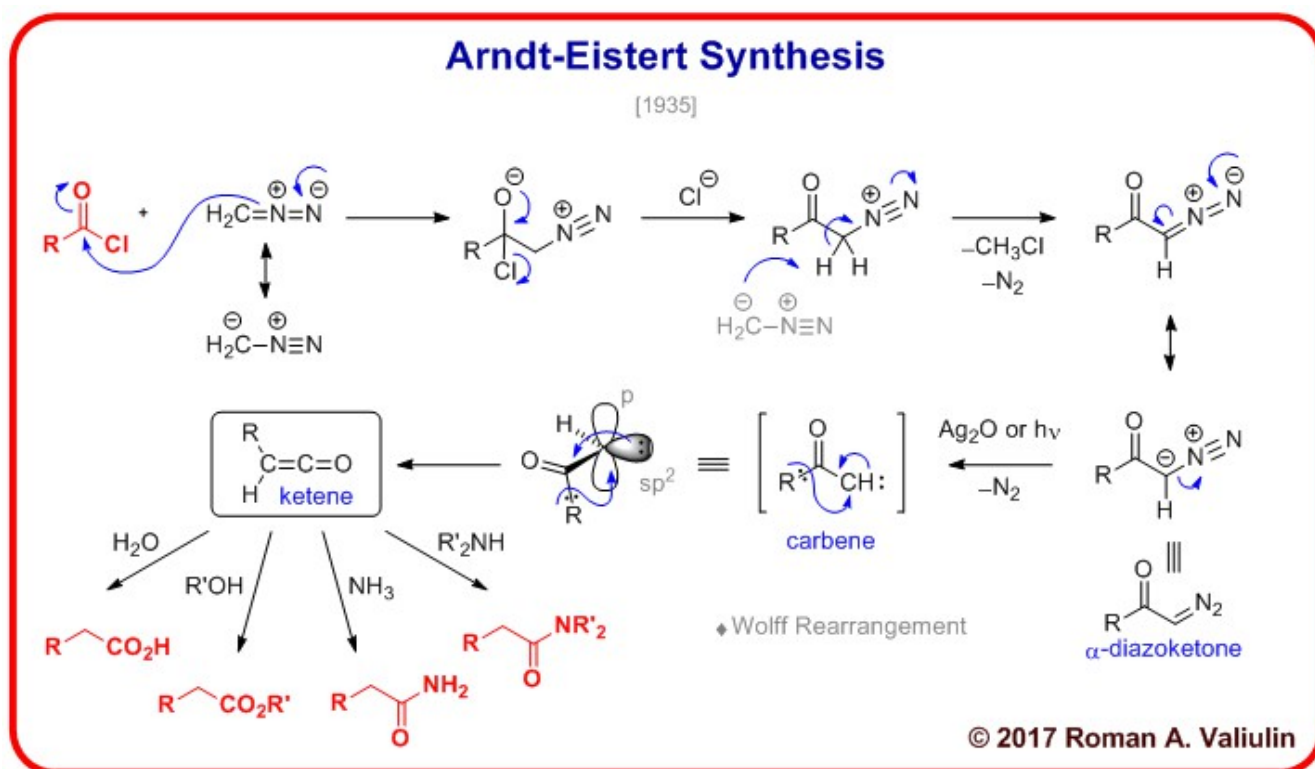
2. Acyloin Condensation 1903



3. Alkyne (acetylene) Zipper 1975



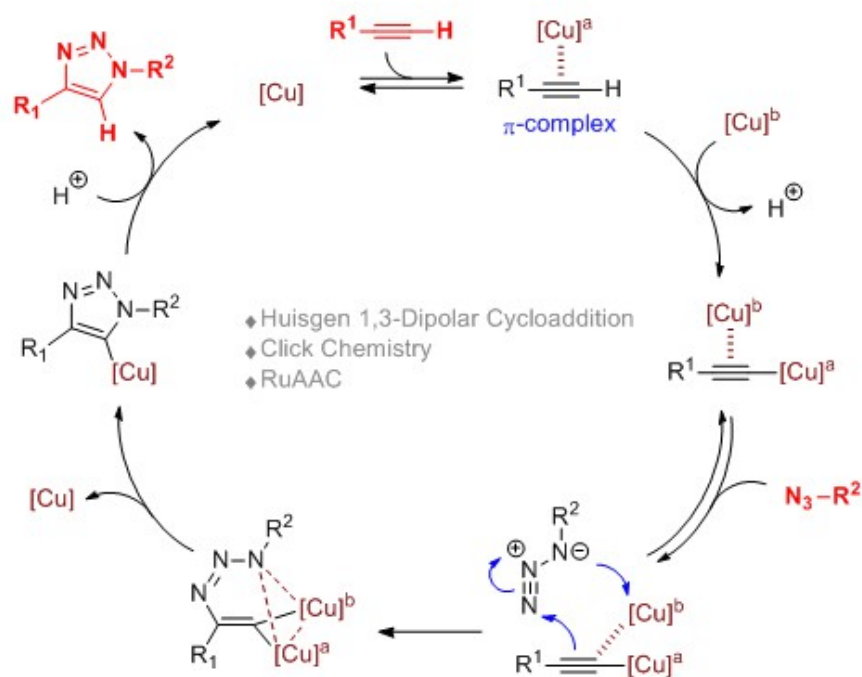
4. Arndt-Eistert Synthesis 1935



5. Copper-Catalyzed Alkyne Azide Cycloaddition

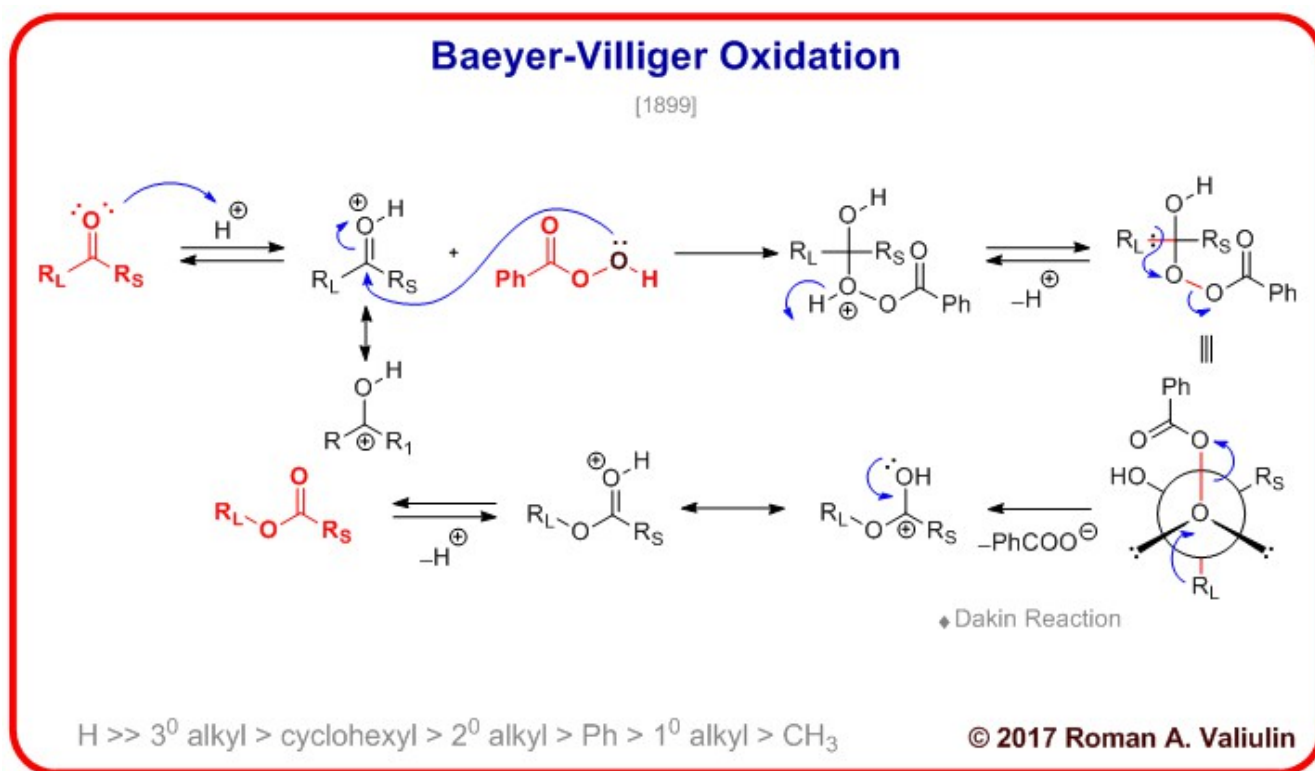
Cu Catalyzed Alkyne Azide Cycloaddition

CuAAC [2002]

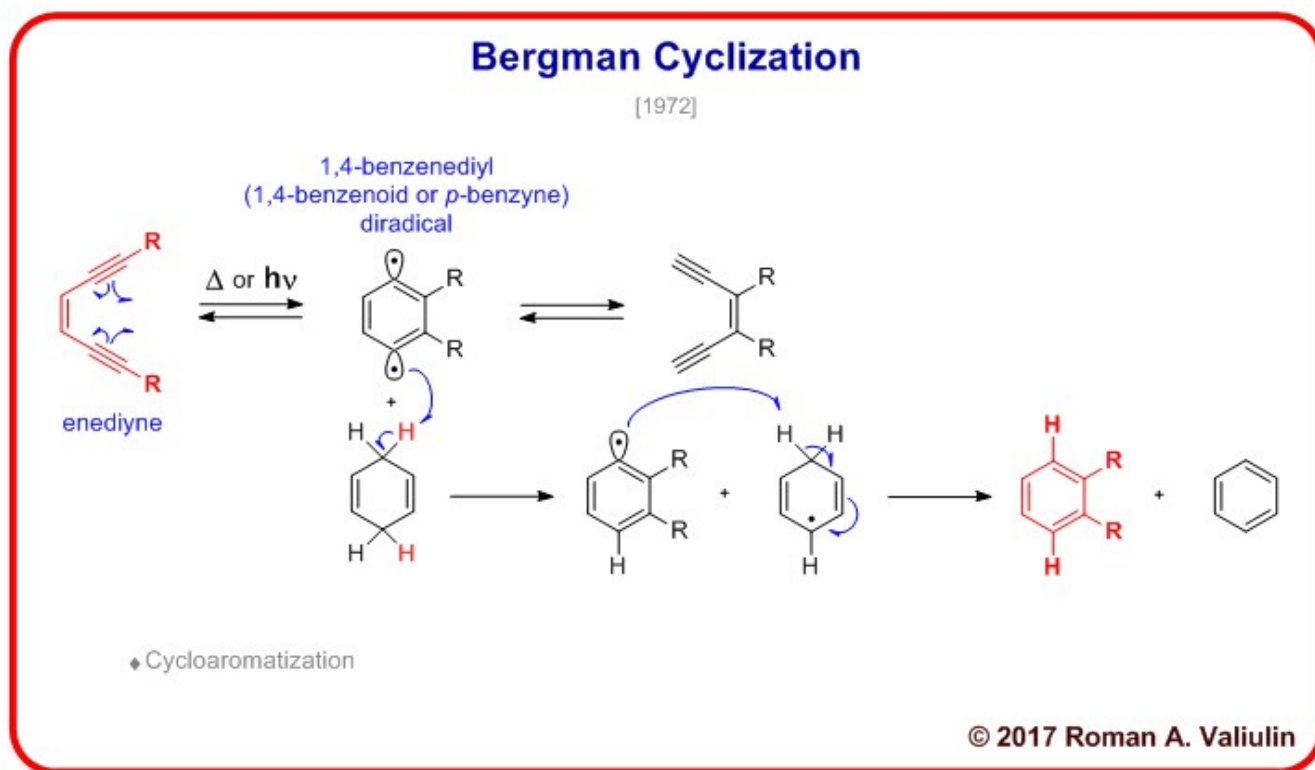


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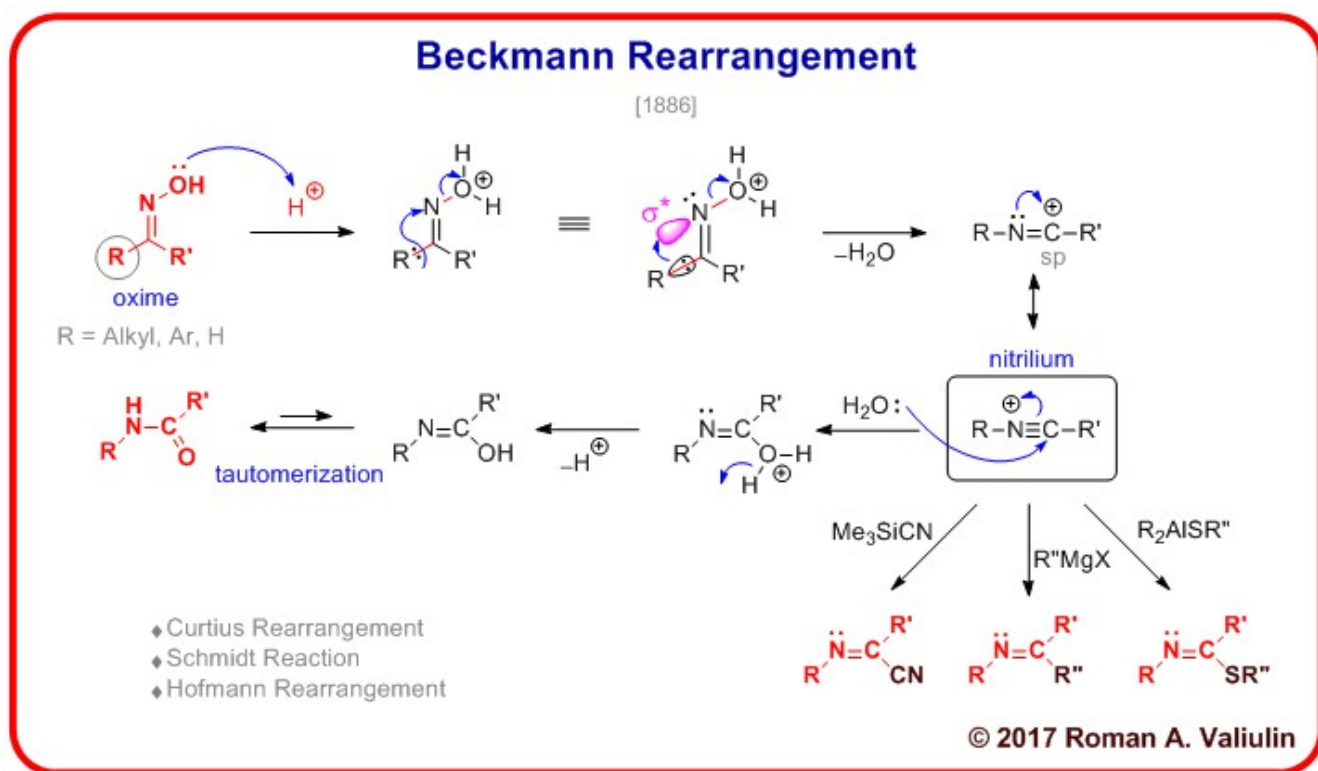
6. Baeyer-Villiger Oxidation 1899



7. Bergman Cyclization 1972



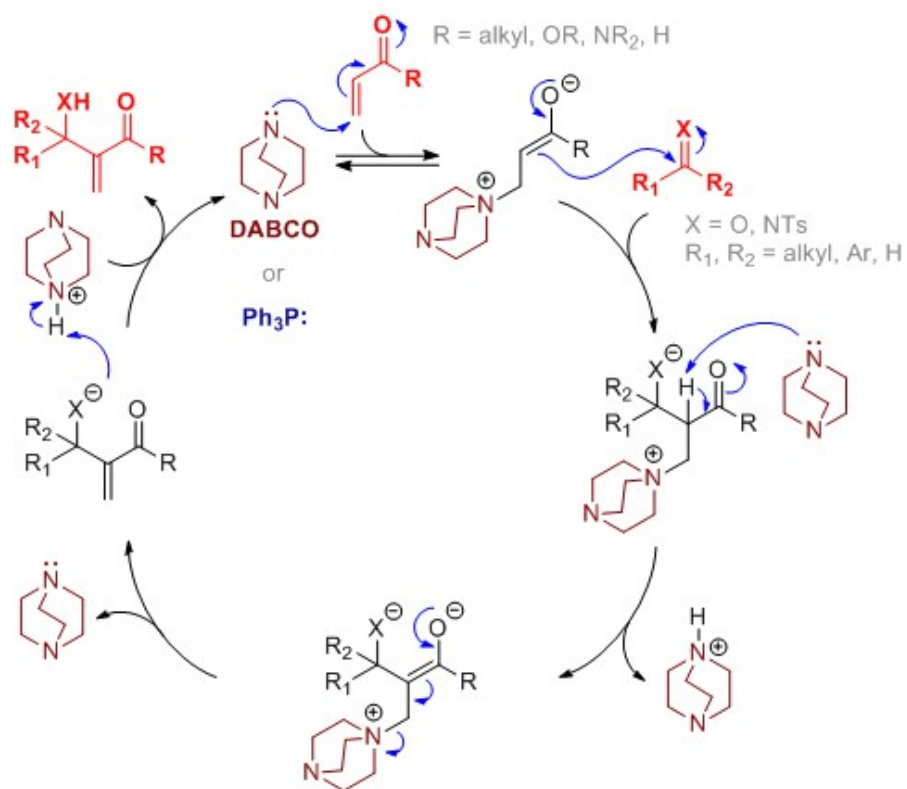
8. Beckmann Rearrangement 1886



9. Baylis-Hillman Reaction 1972

Baylis-Hillman Reaction

[1972]

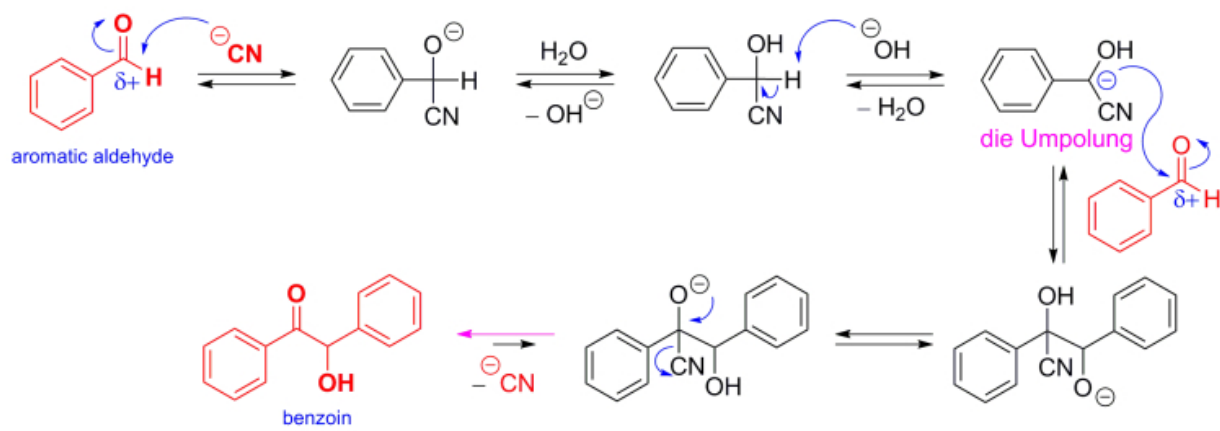


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10. Benzoin Condensation 1832

Benzoin Condensation

[1832]

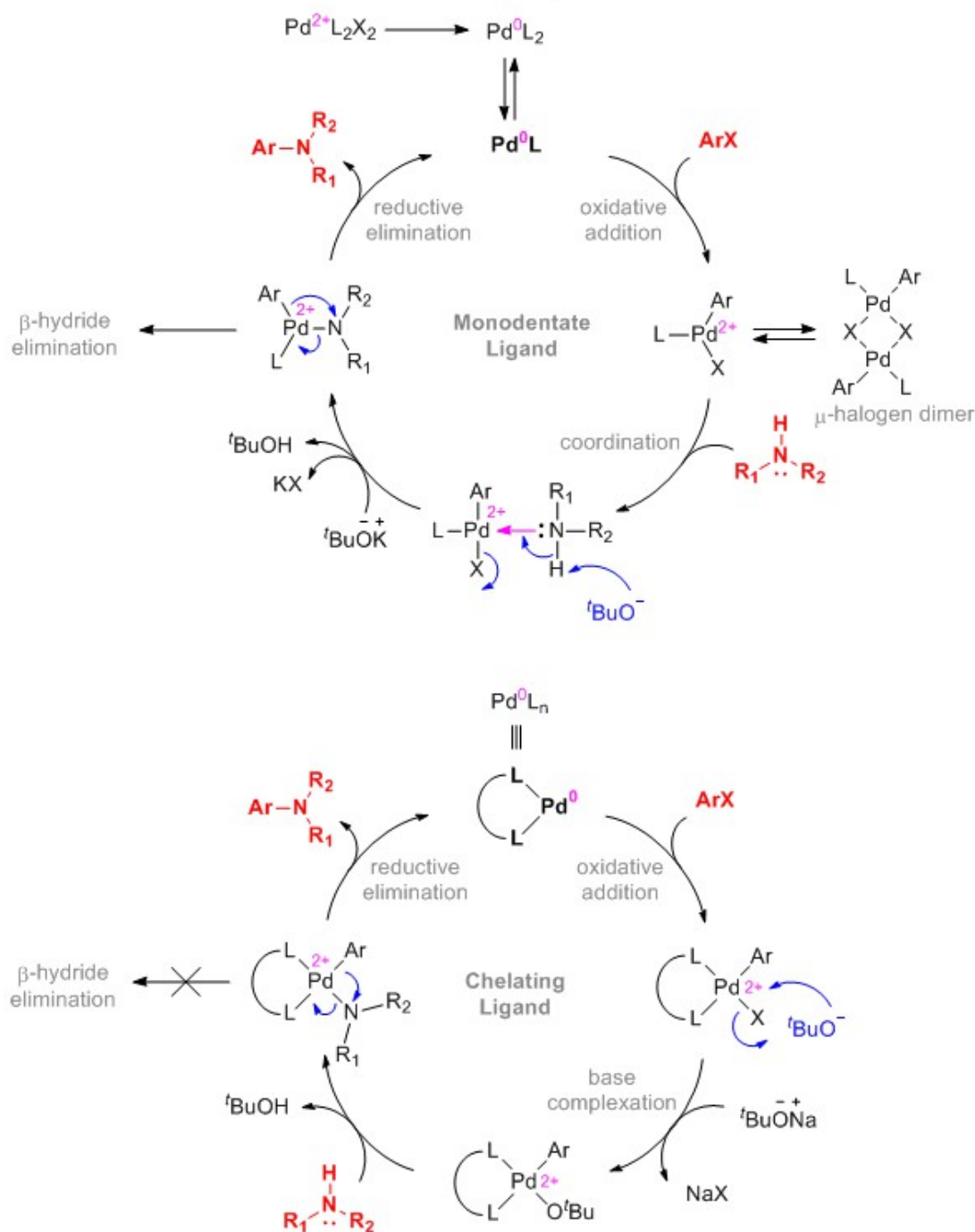


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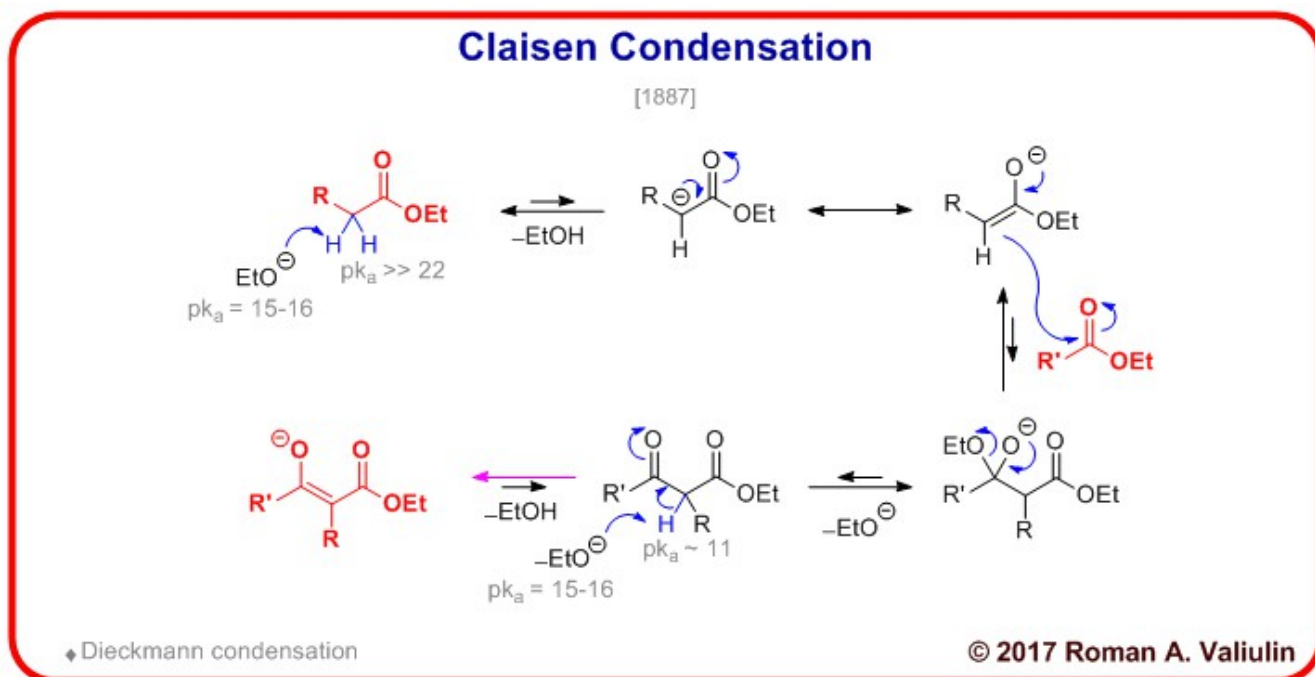
11. Buchwald-Hartwig Cross Coupling 1994

Buchwald-Hartwig Cross Coupling

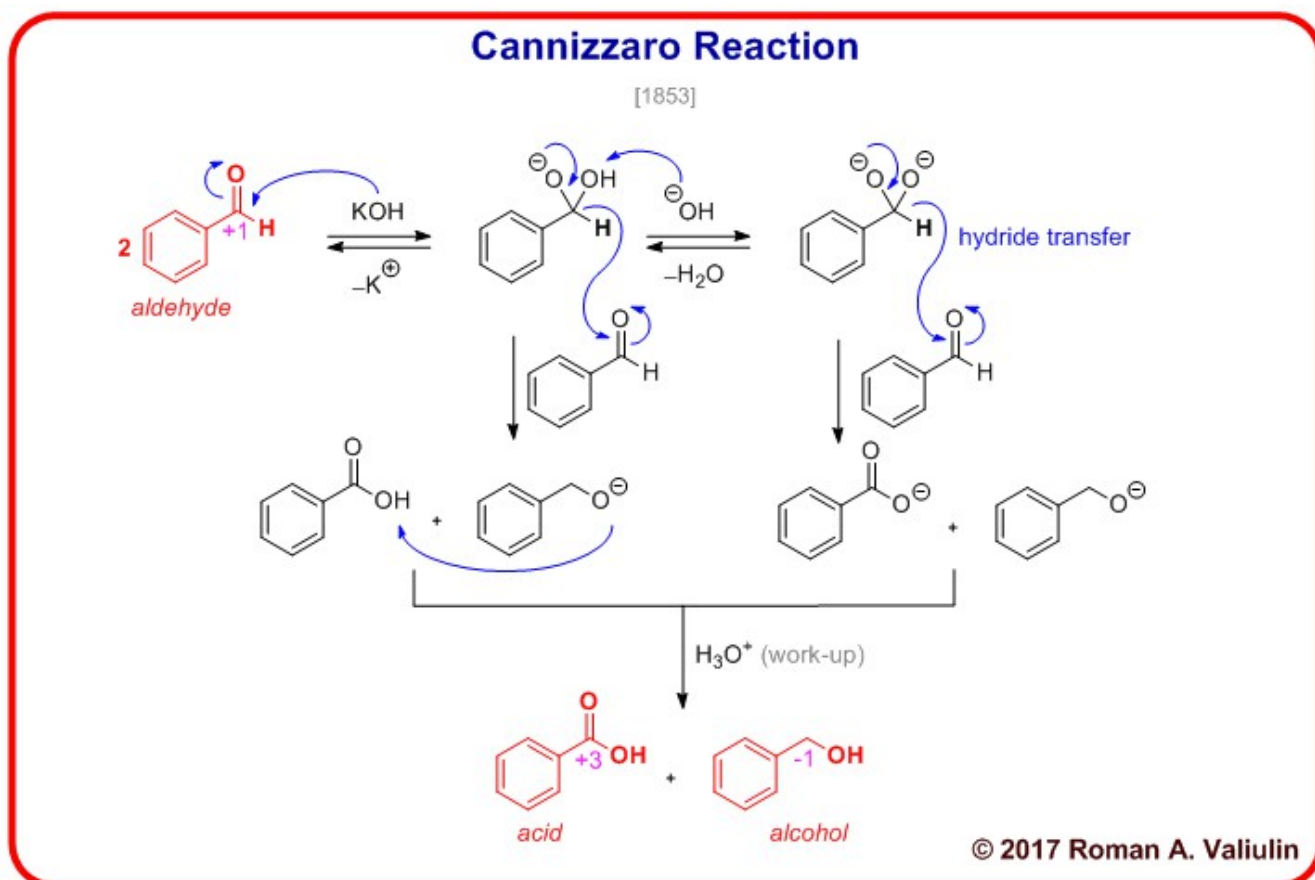
[1994]



12. Claisen Condensation 1887



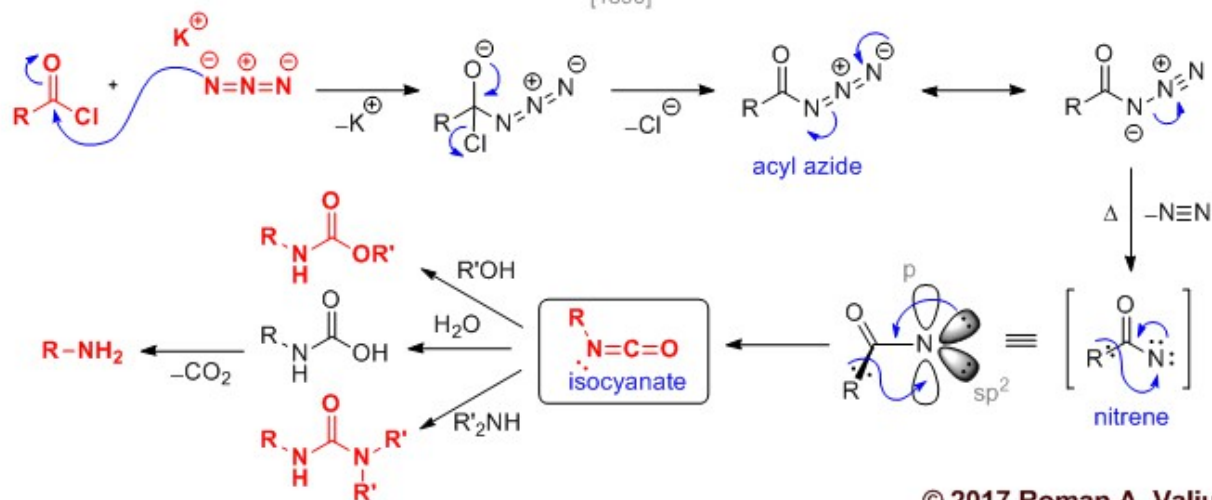
13. Cannizzaro Reaction 1853



14. Curtius Rearrangement 1890

Curtius Rearrangement

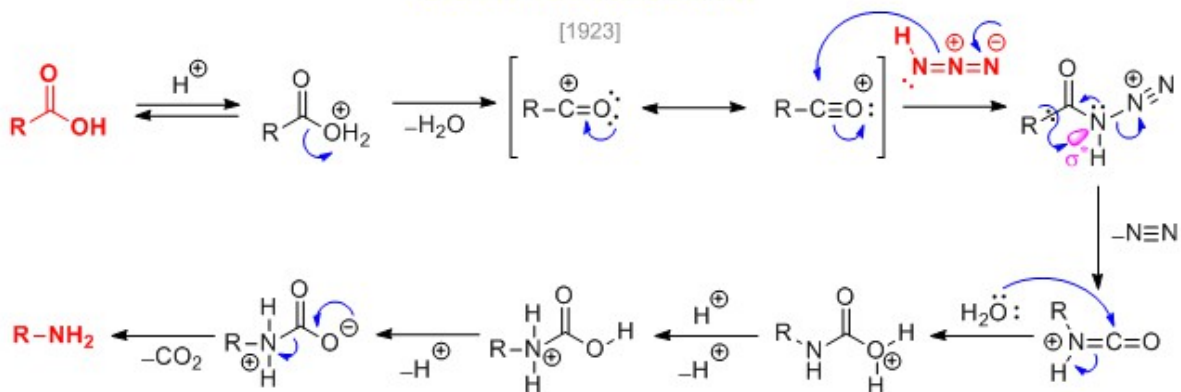
[1890]



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Schmidt Reaction

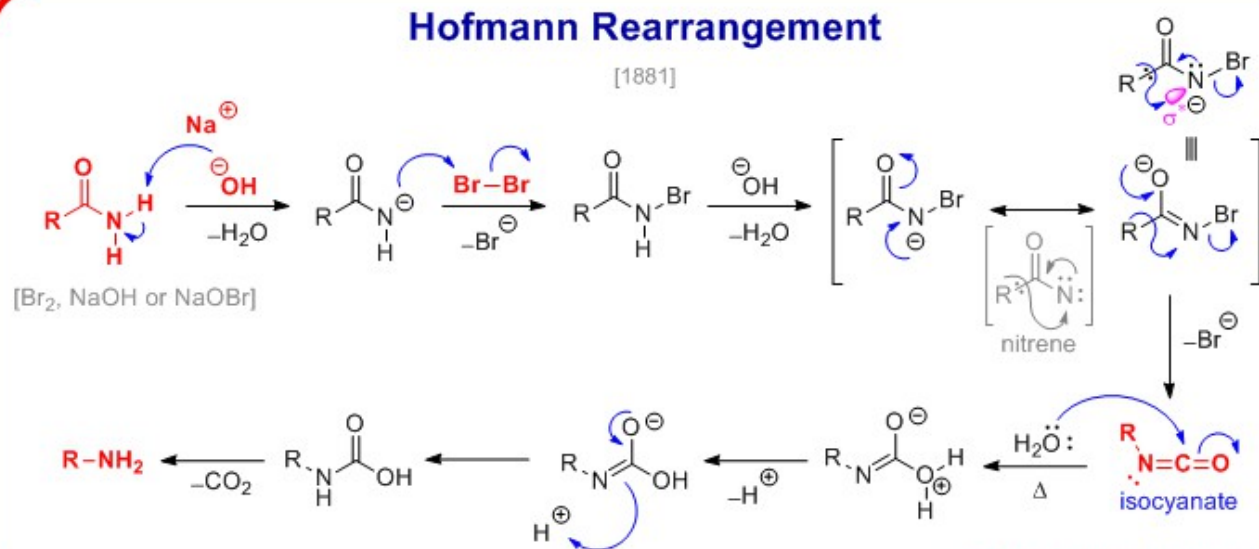
[1923]



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Hofmann Rearrangement

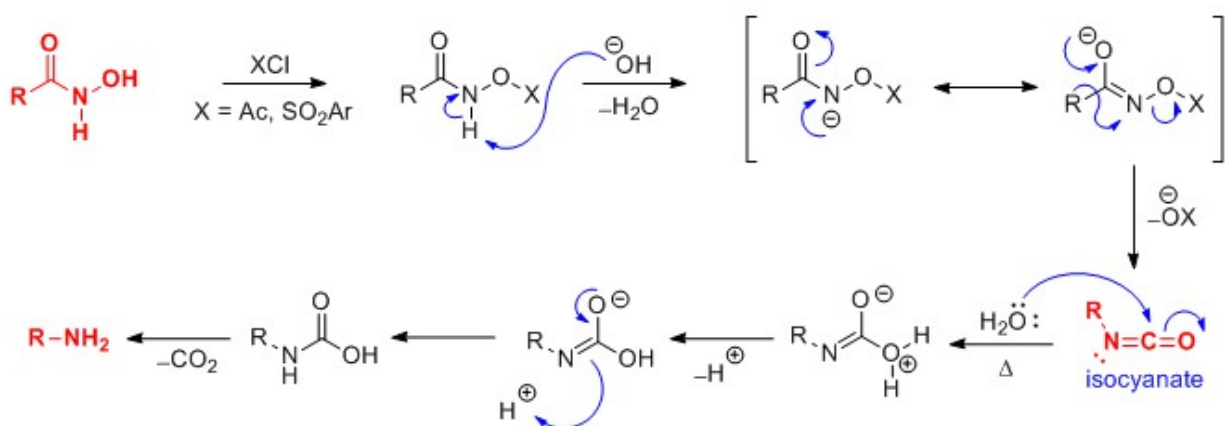
[1881]



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Lossen Rearrangement

[1872]



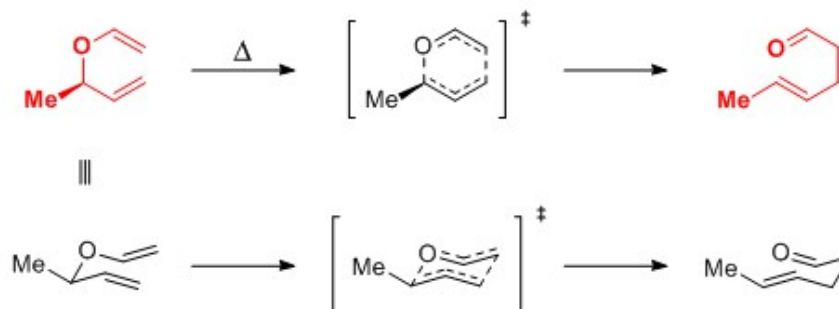
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15. Claisen Rearrangement 1912

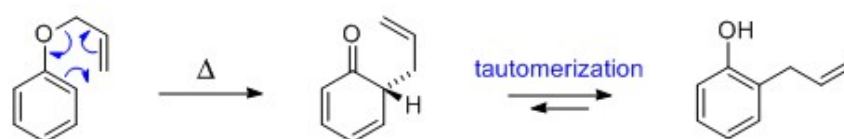
Claisen Rearrangement

[1912]

♦ Allylphatic [3,3]-sigmatropic shift



♦ Aromatic [3,3]-sigmatropic shift



♦ Overman Rearrangement

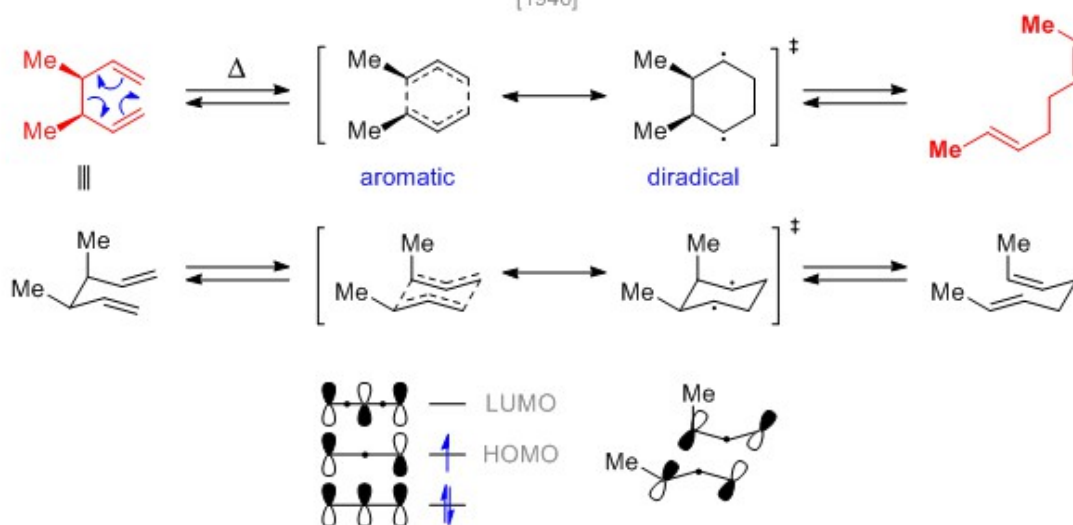
♦ Ireland-Claisen Rearrangement

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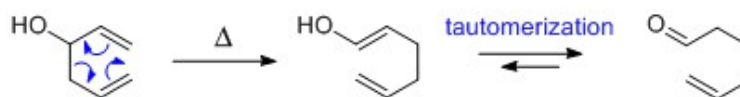
16. Cope Rearrangement 1940

Cope Rearrangement

[1940]



Oxy-Cope Rearrangement



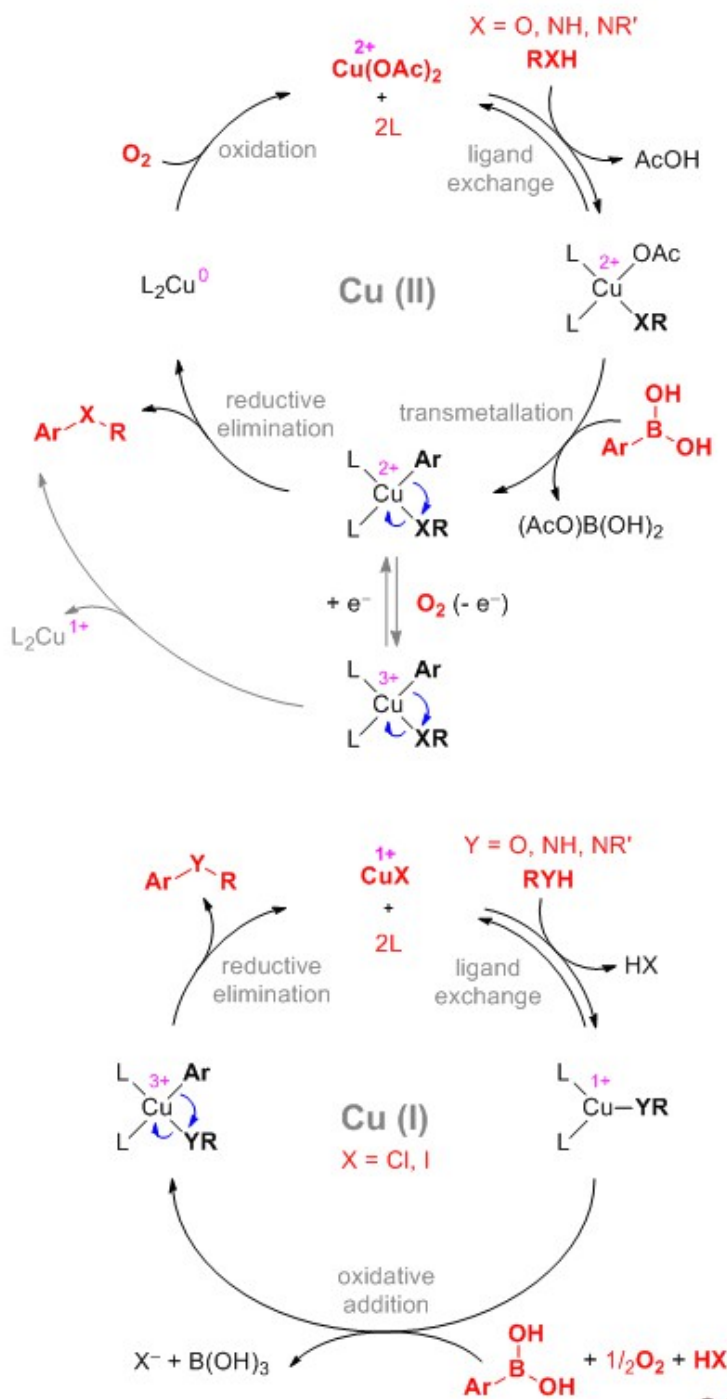
- ♦ Anionic Oxy-Cope Rearrangement
- ♦ Aza-Cope Rearrangement
- ♦ Claisen Rearrangement

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17. Chan-Evans-Lam Cross Coupling 1998

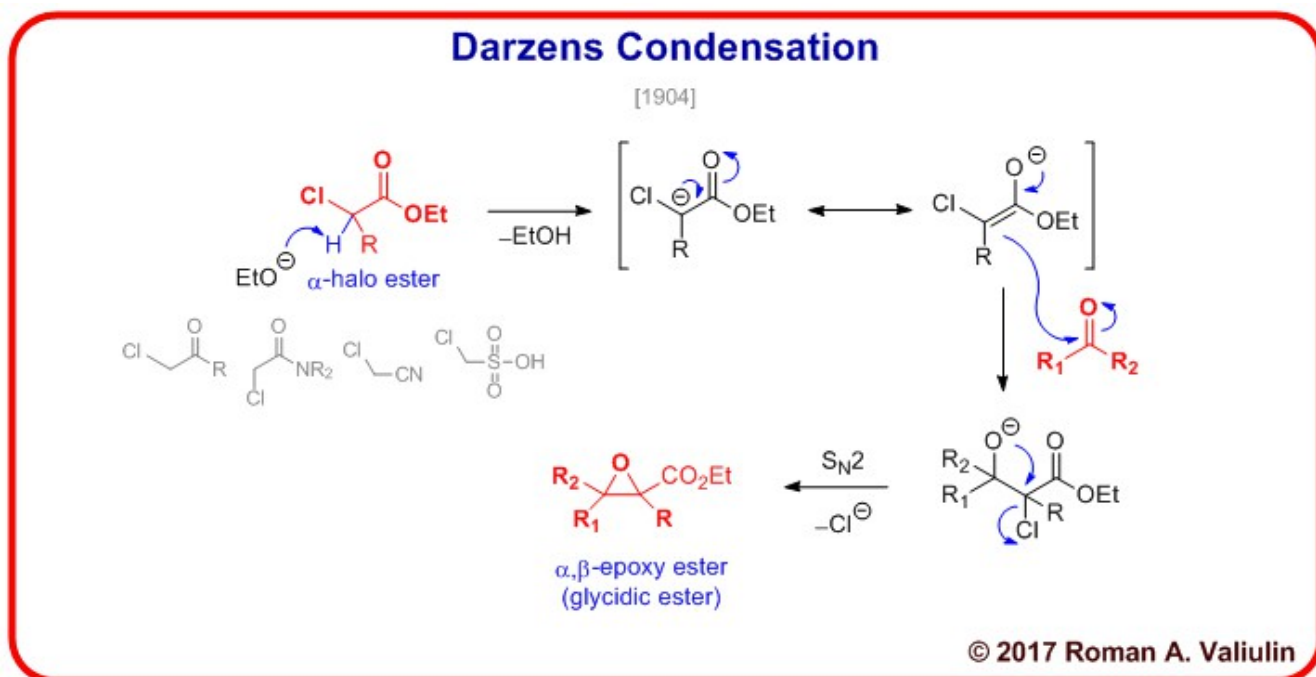
Chan-Evans-Lam Cross Coupling

[1998]

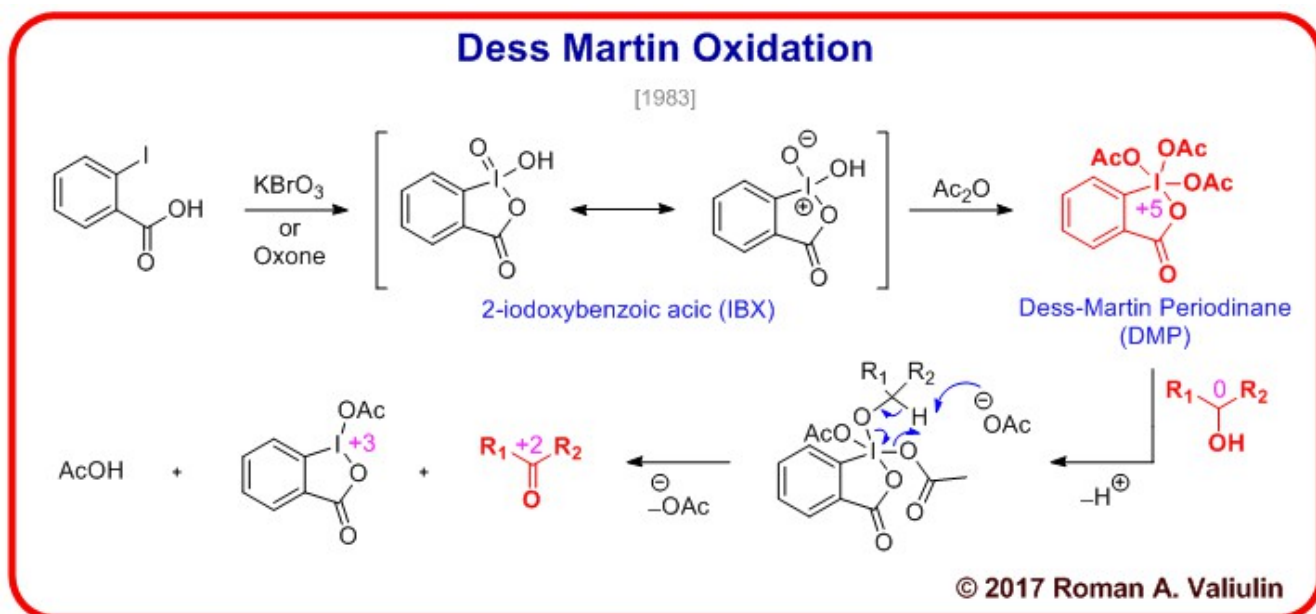


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18. Darzens Condensation 1904



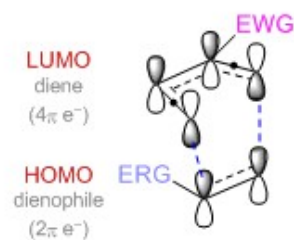
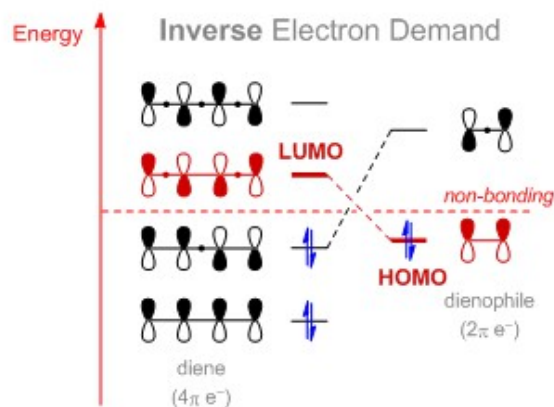
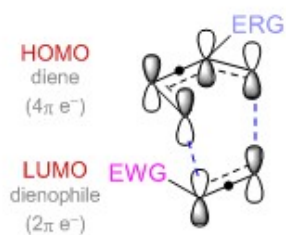
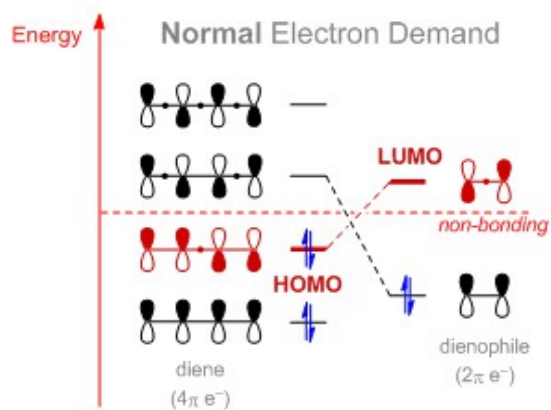
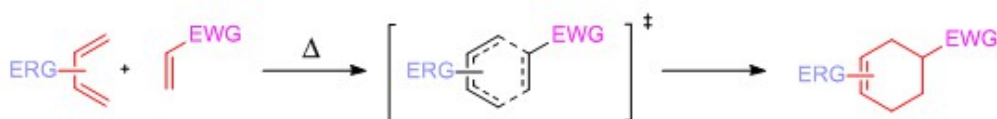
19. Dess-Martin Oxidation 1983



20. Diels-Alder Cycloaddition 1928

Diels-Alder Cycloaddition

[1928]



♦ Ene Reaction
♦ [4+2] Cycloaddition

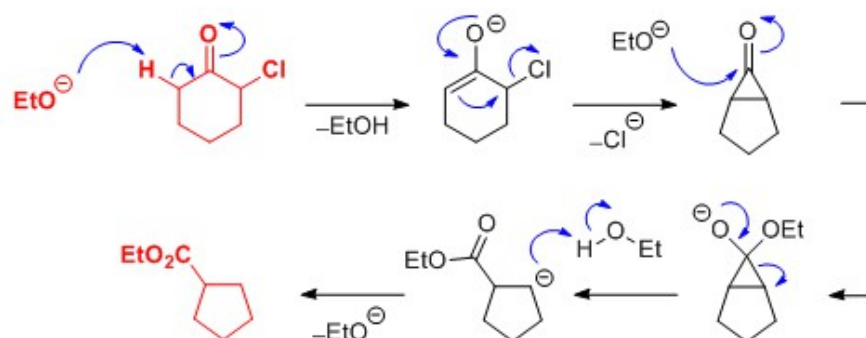
ERG = EDG = Electron Releasing/Donating Group
EWG = Electron Withdrawing Group

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21. Favorskii Rearrangement 1894

Favorskii Rearrangement

[1894]

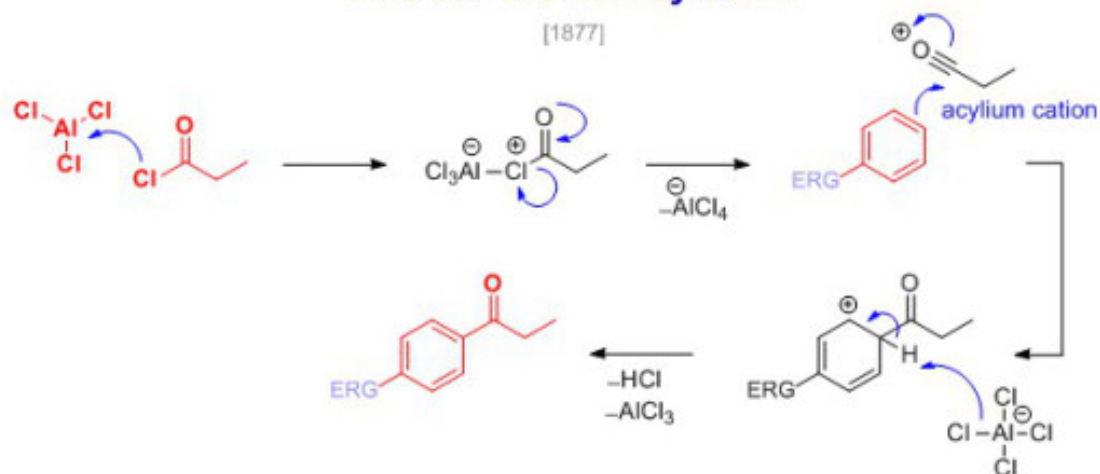


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22. Friedel-Crafts Acylation & Alkylation 1877

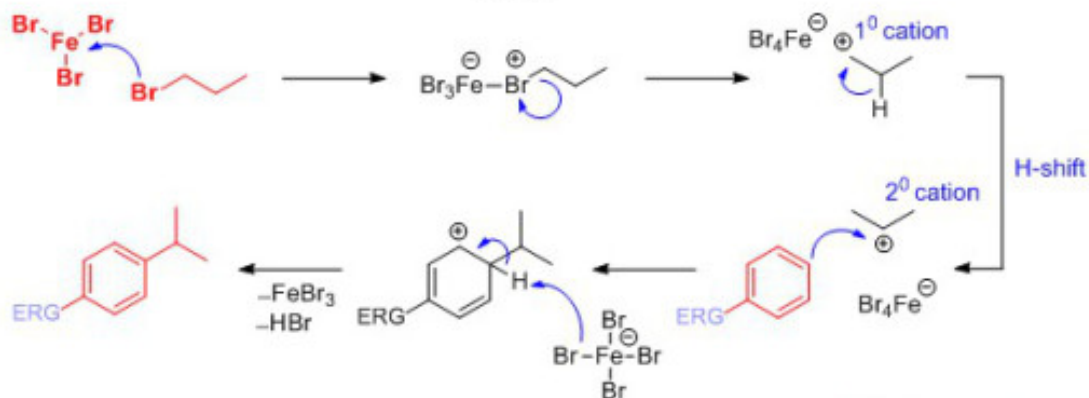
Friedel-Crafts Acylation

[1877]



Friedel-Crafts Alkylation

[1877]

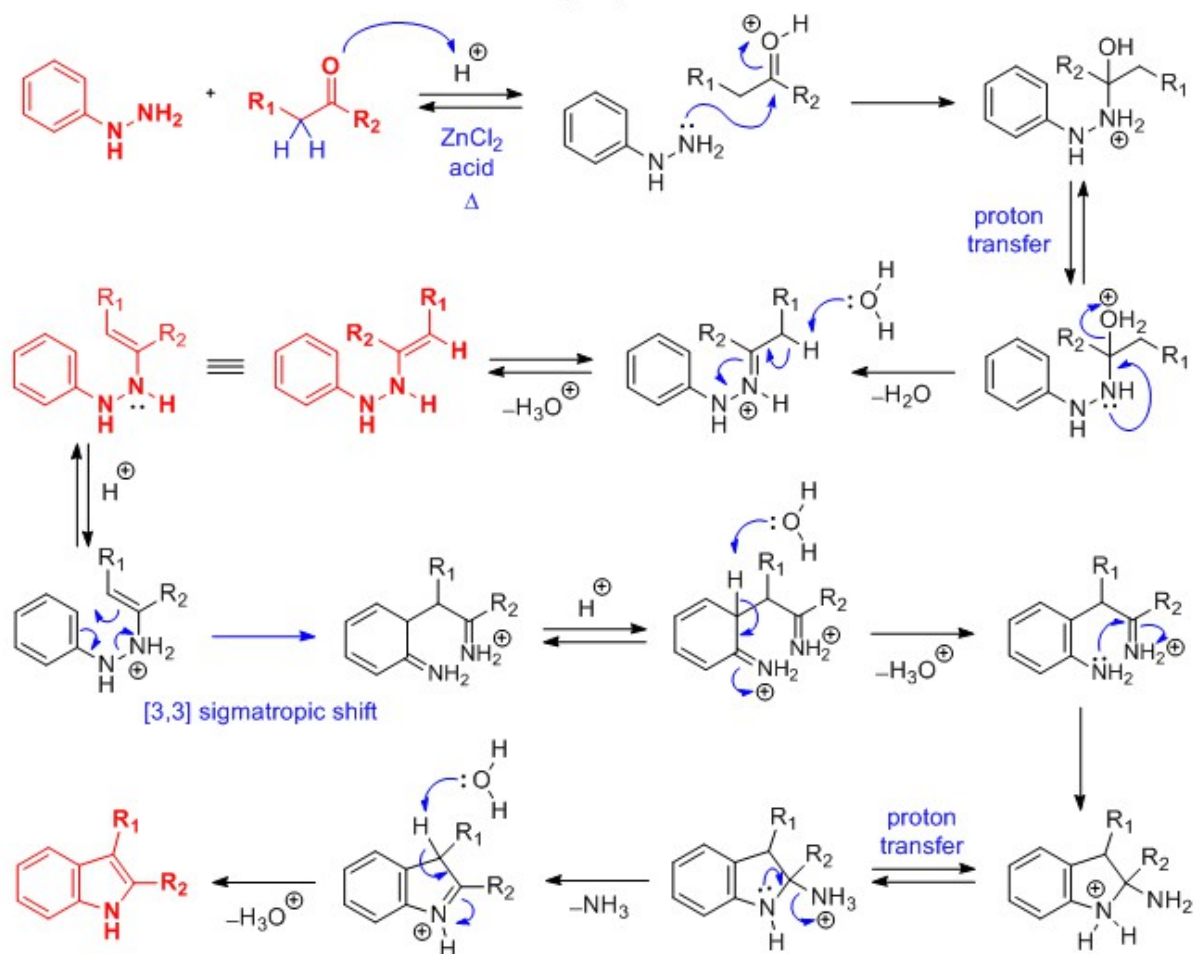


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23. Fischer Indole Synthesis 1883

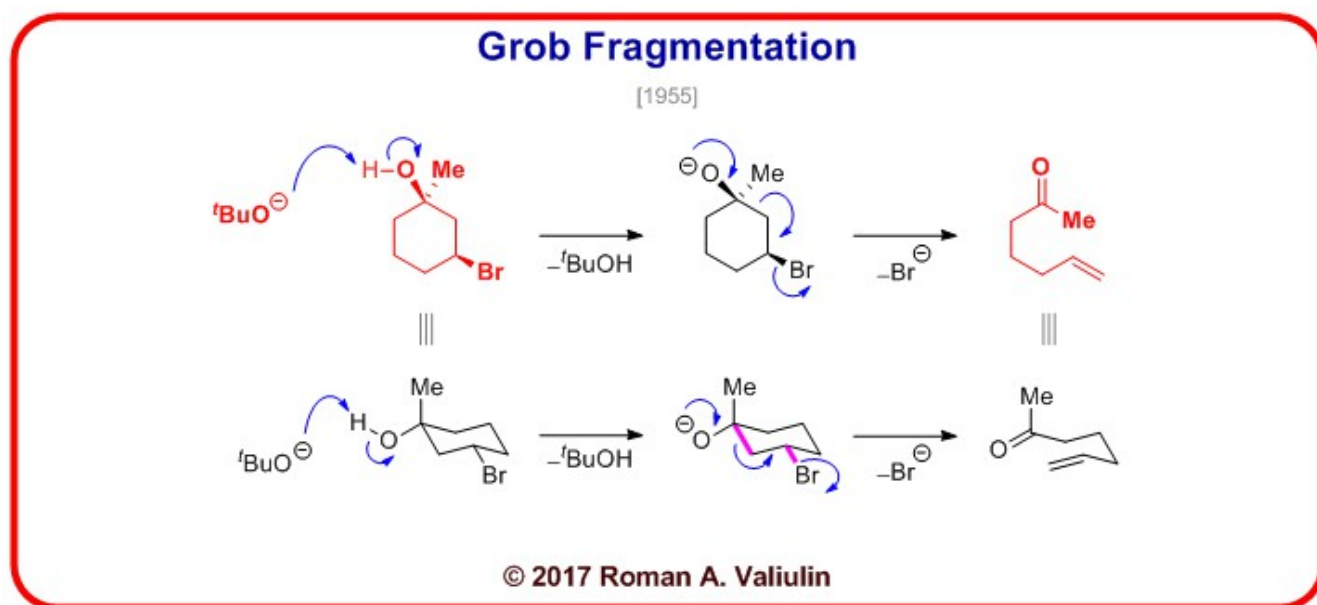
Fischer Indole Synthesis

[1883]

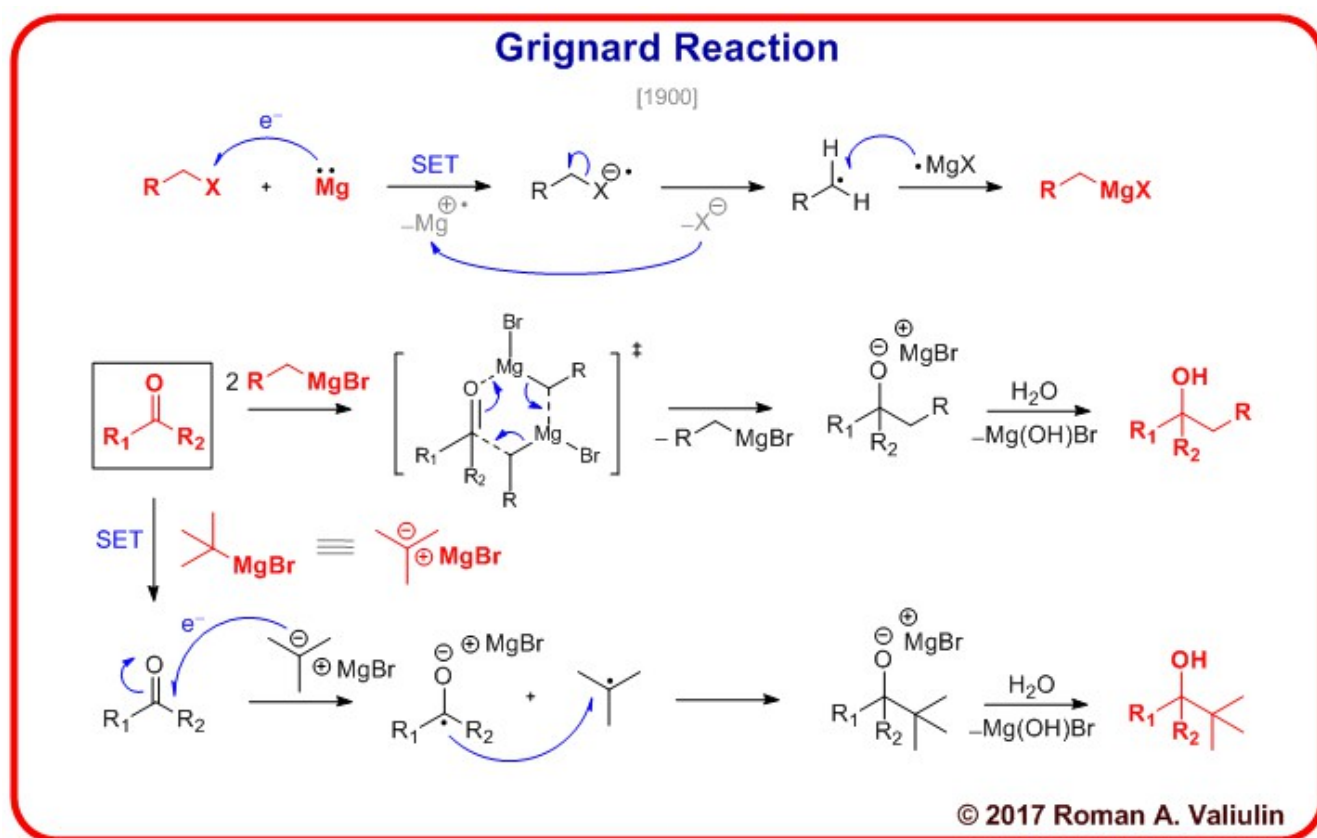


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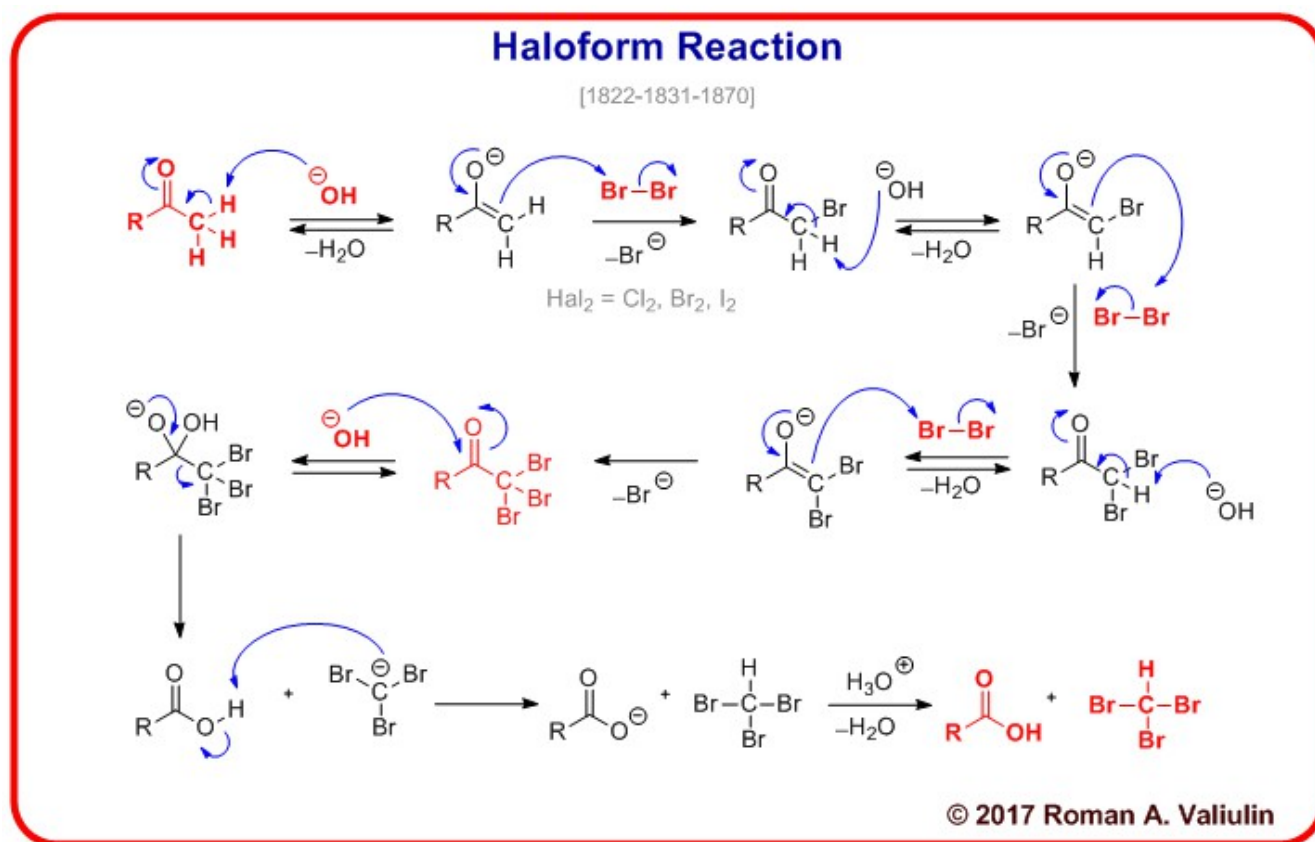
24. Grob Fragmentation 1955



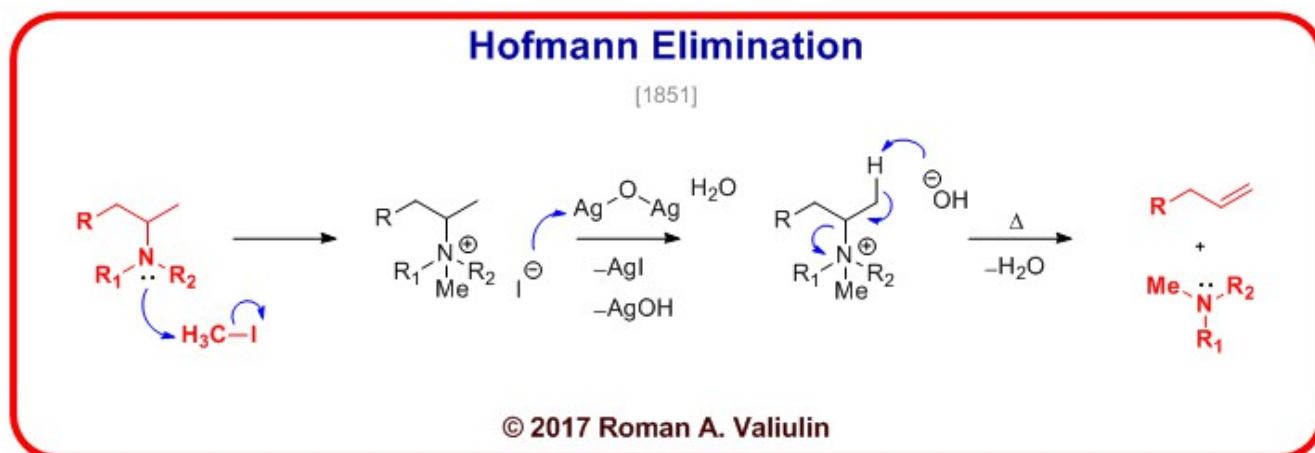
25. Grignard Reaction 1900



26. Haloform Reaction 1822



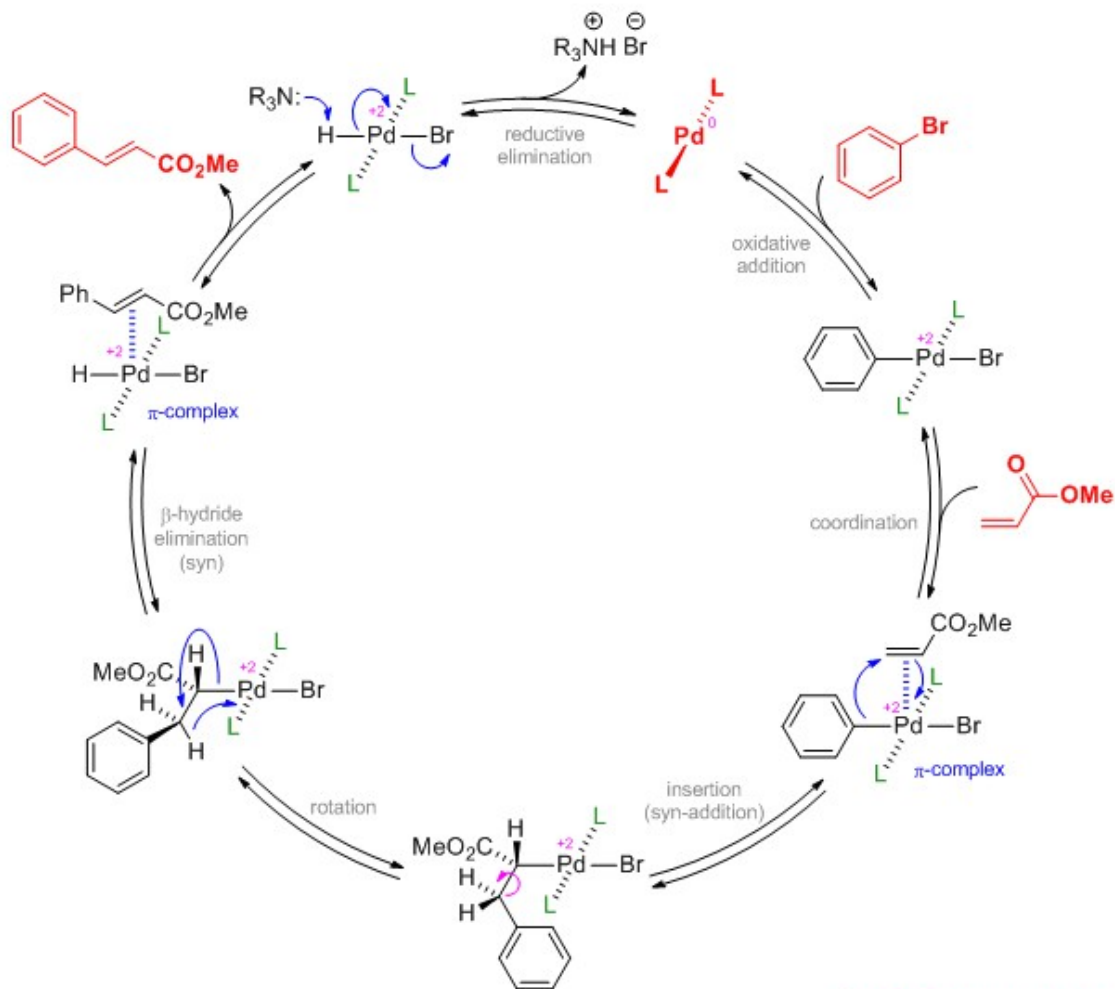
27. Hofmann Elimination 1851



28. Heck Cross Coupling 1968

Heck Coupling

[1968]

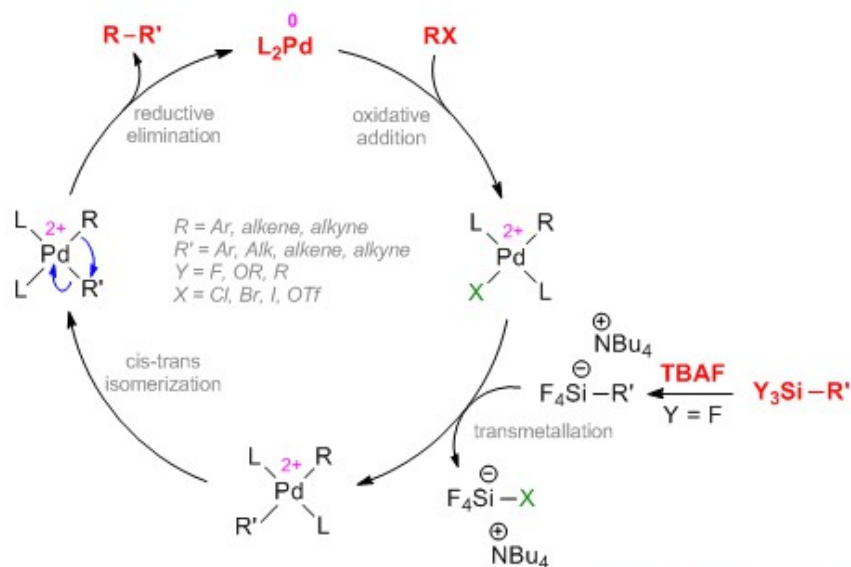


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29. Hiyama Cross Coupling 1988

Hiyama Cross Coupling

[1988]

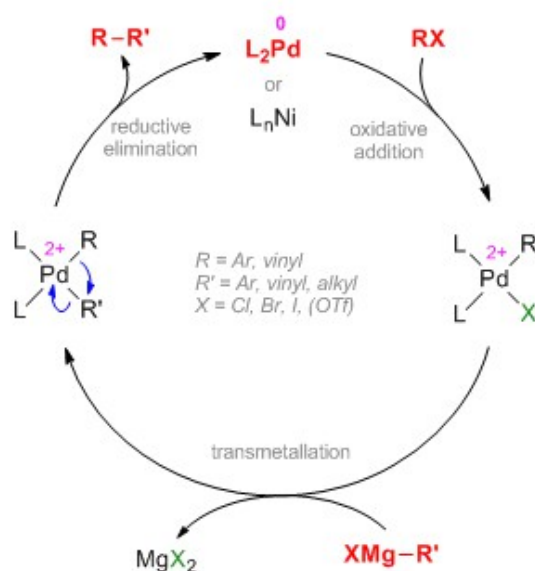


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30. Kumada Cross Coupling 1972

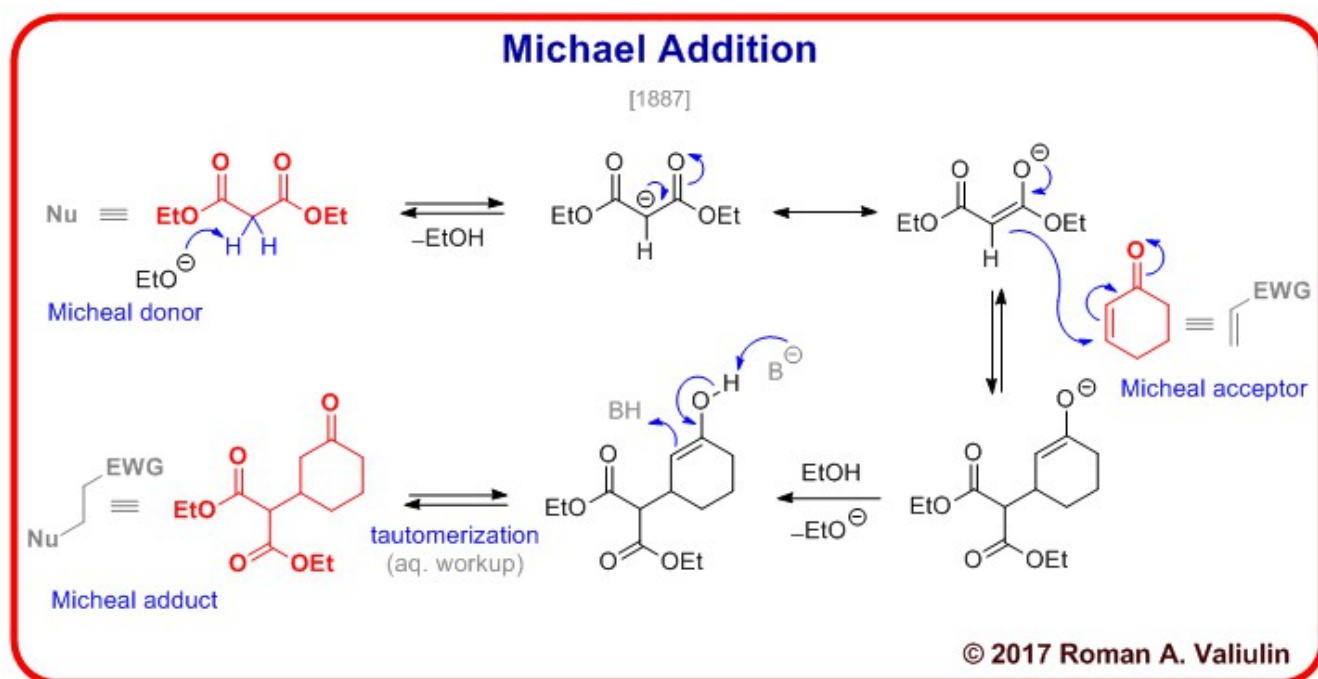
Kumada Cross Coupling

[1972]



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31. Michael Addition 1887

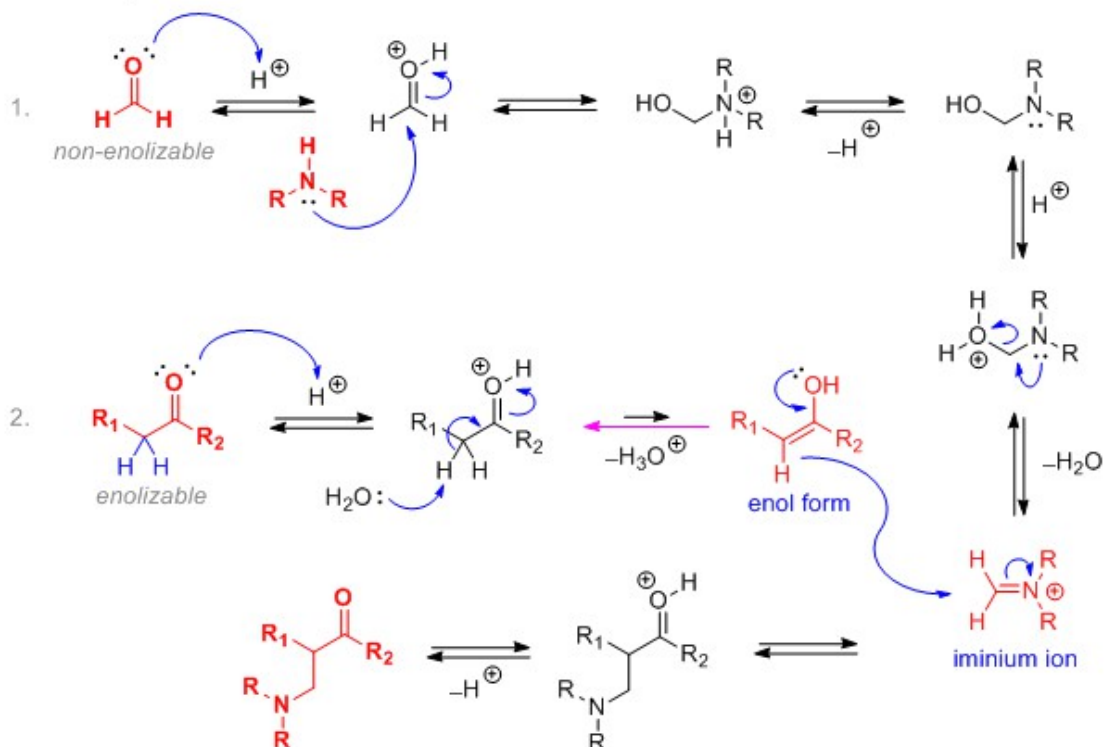


32. Mannich Reaction 1912

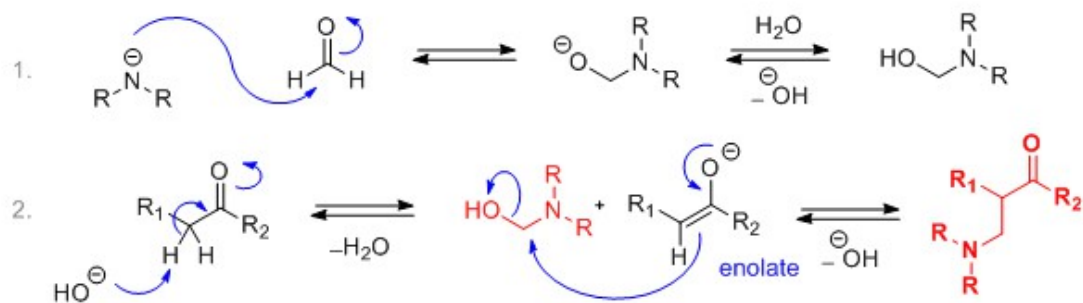
Mannich Reaction

[1912]

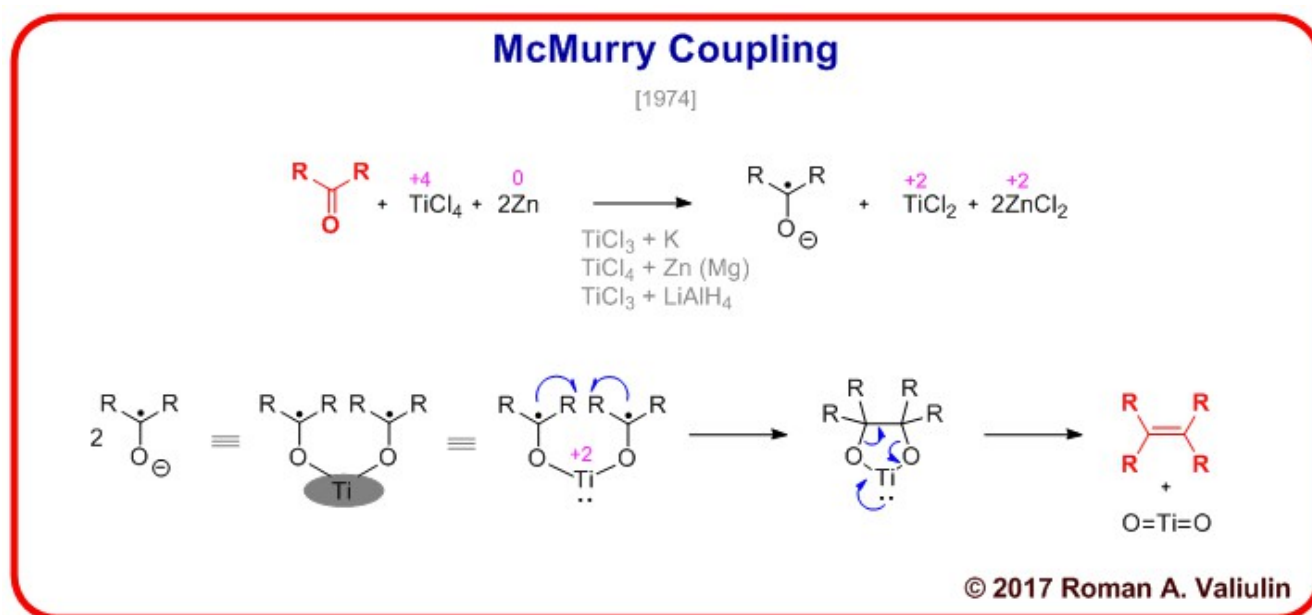
Acid Catalyzed:



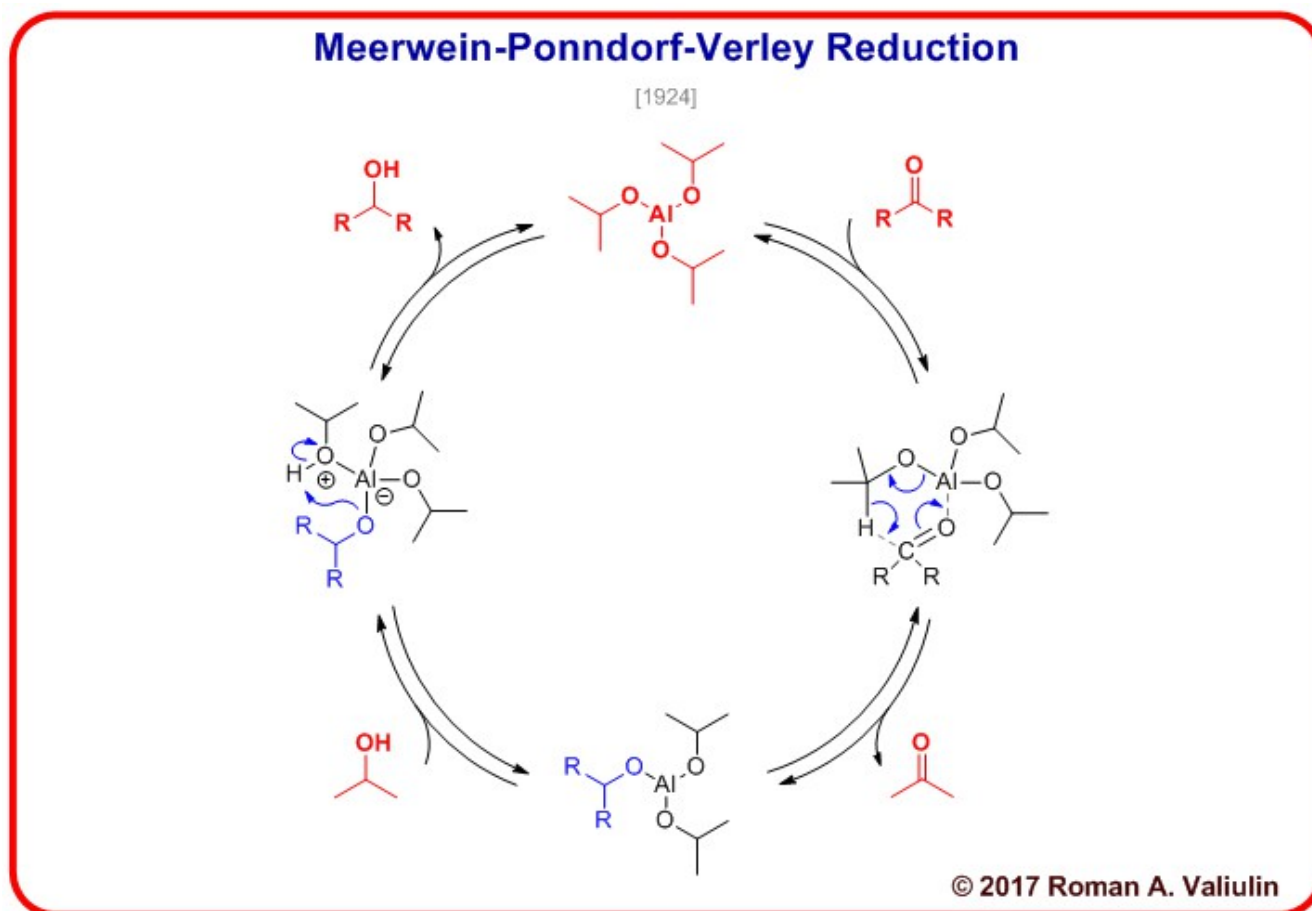
Base Catalyzed:



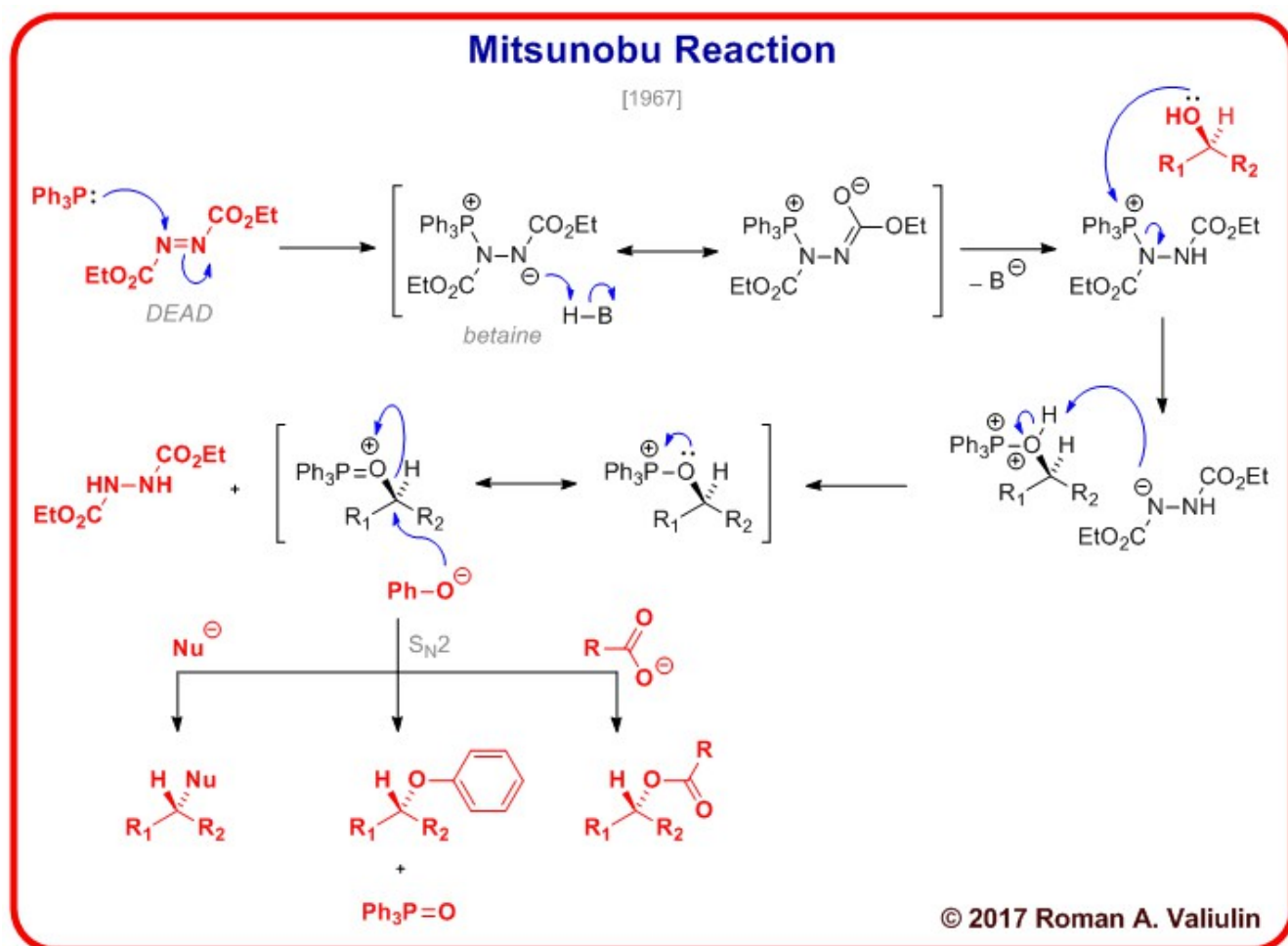
33. McMurry Coupling 1974



34. Meerwein-Ponndorf-Verley Reduction 1924

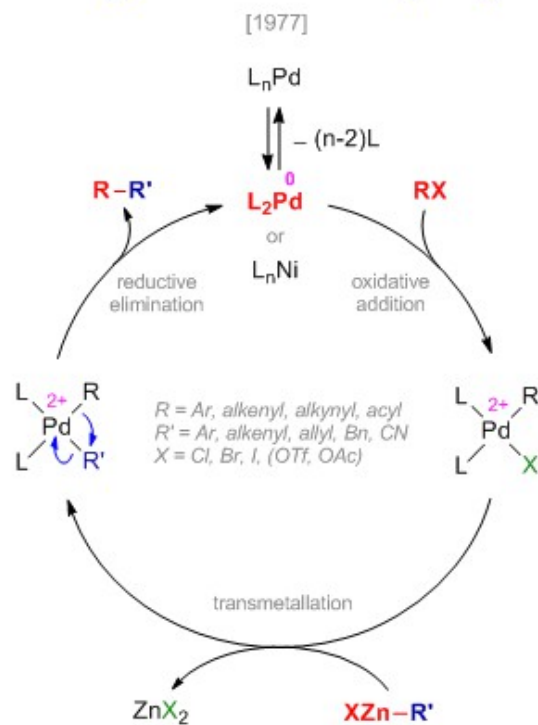


35. Mitsunobu Reaction 1967



36. Negishi Cross Coupling 1977

Negishi Cross Coupling



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Nef Reaction

[1894]

The diagram illustrates the Nef reaction mechanism, which converts an aldehyde into a carboxylic acid. The reaction proceeds through several key intermediates:

- Deprotonation:** The aldehyde ($R-CHO$) is deprotonated by a base (B^-) to form an alkoxide ($R-CH_2O^-$).
- Protonation:** The alkoxide is protonated by water (H_3O^+) to form an alcohol ($R-CH_2OH$).
- Hydration:** The alcohol is protonated and then reacts with water to form a geminal diol ($R-C(OH)_2H$).
- Elimination:** The geminal diol is protonated and then loses water to form a carbocation ($R-C^+H_2$).
- Resonance:** The carbocation is in resonance with a diazo intermediate ($R-C(=O)N_2$).
- Final Step:** The diazo intermediate is protonated and then loses nitrogen gas (N_2) to form a carboxylic acid ($R-COOH$).

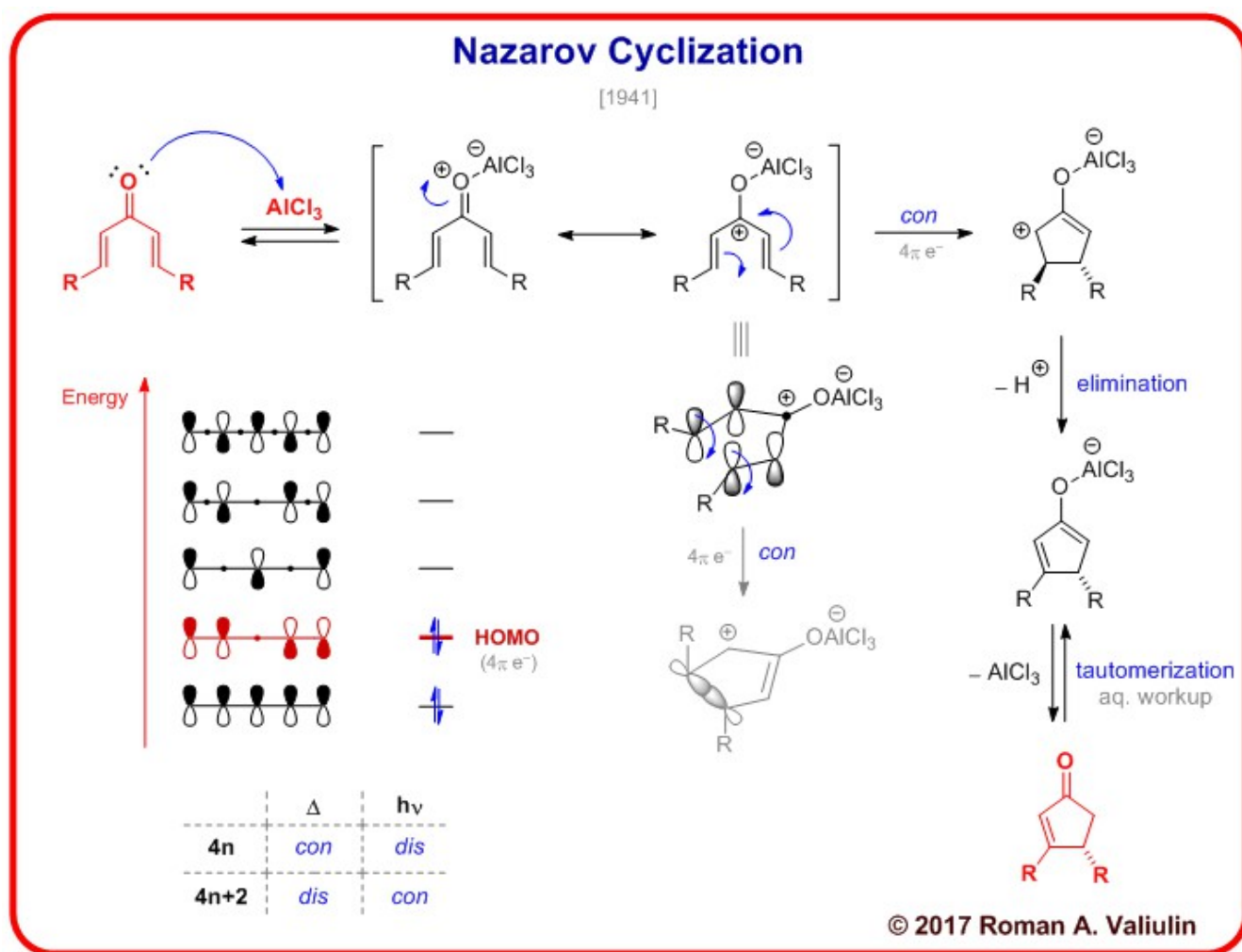
The overall reaction is summarized as:

$$R-CHO \xrightarrow{1. \text{ base } -BH} R-CH_2O^- \xrightarrow{2. H_3O^+ -H_2O} R-CH_2OH \xrightarrow{H_3O^+ -H_2O} R-C(OH)_2H \xrightarrow{H_3O^+ -H_2O} R-C^+H_2 \rightleftharpoons R-C(=O)N_2 \xrightarrow{H_3O^+ -H_2O} R-COOH$$

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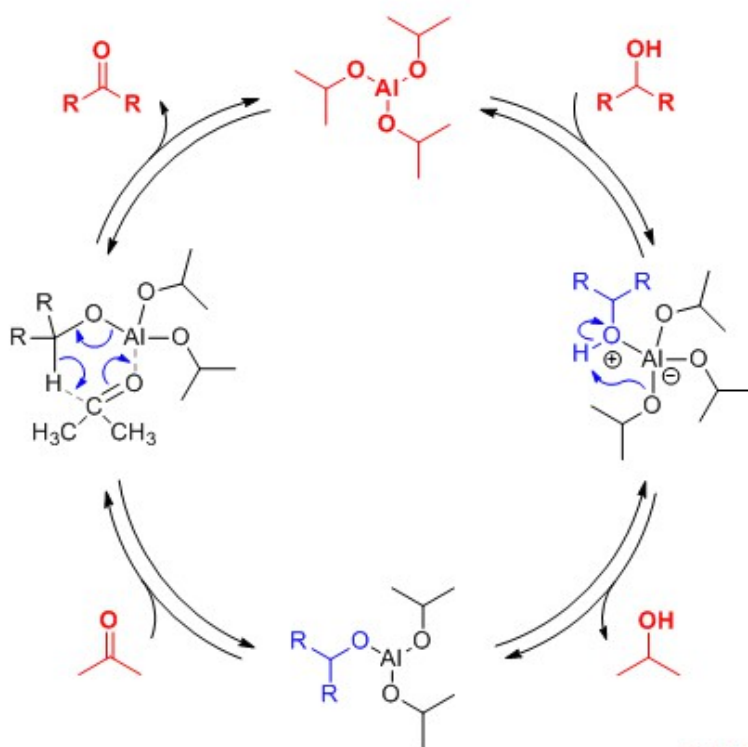
38. Nazarov Cyclization 1941



39. Oppenauer Oxidation 1937

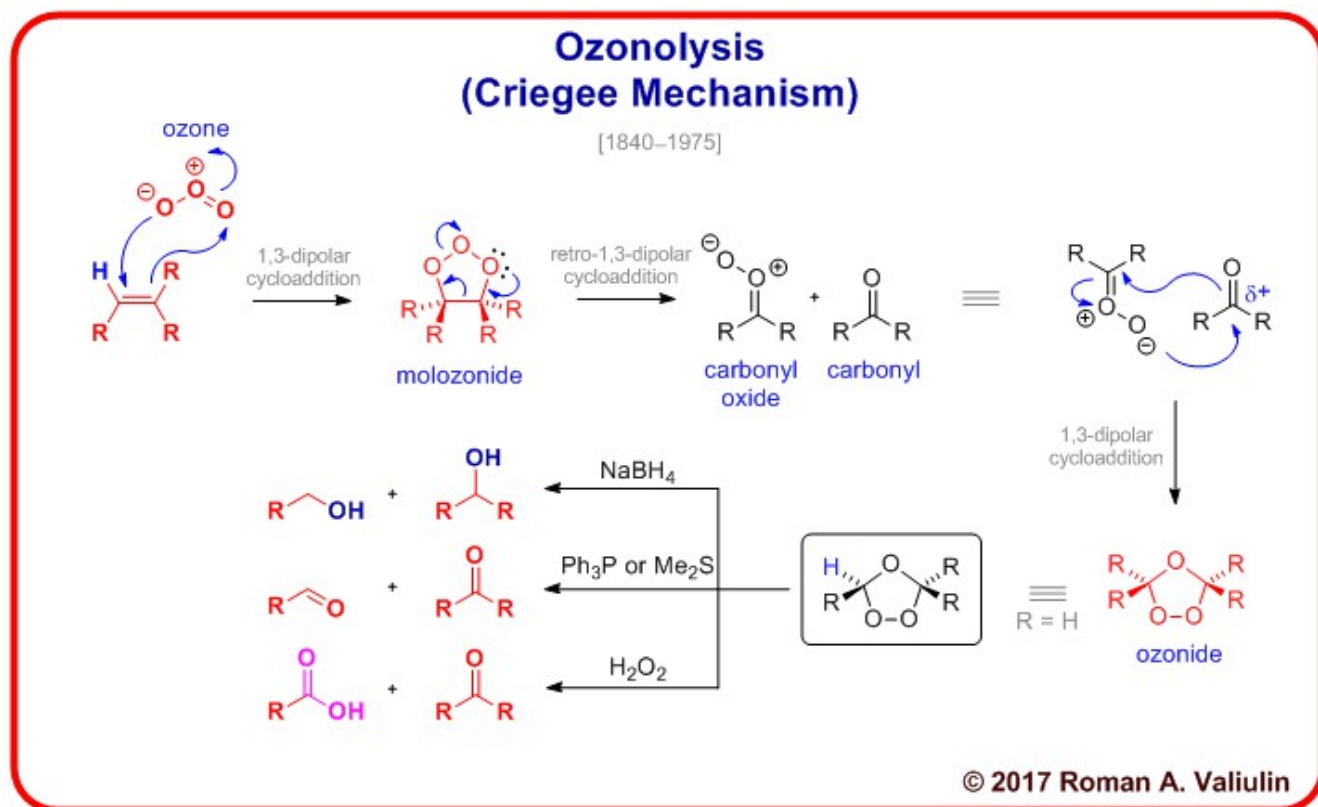
Oppenauer Oxidation

[1937]

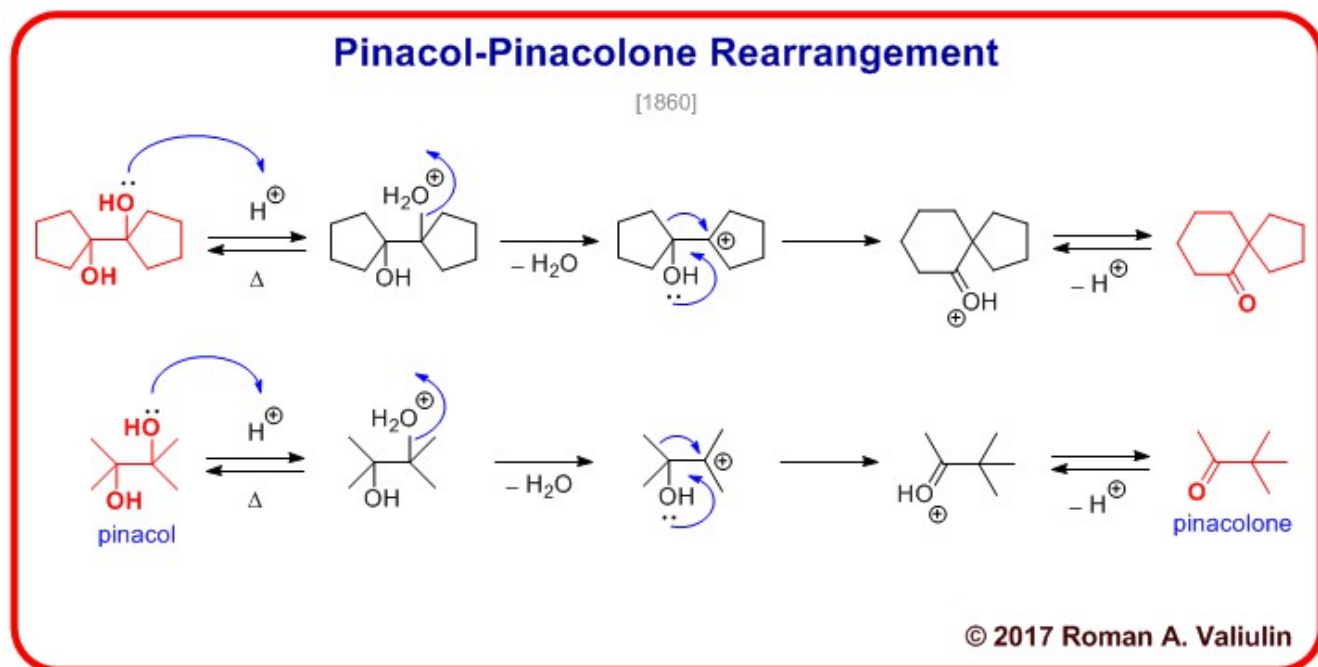


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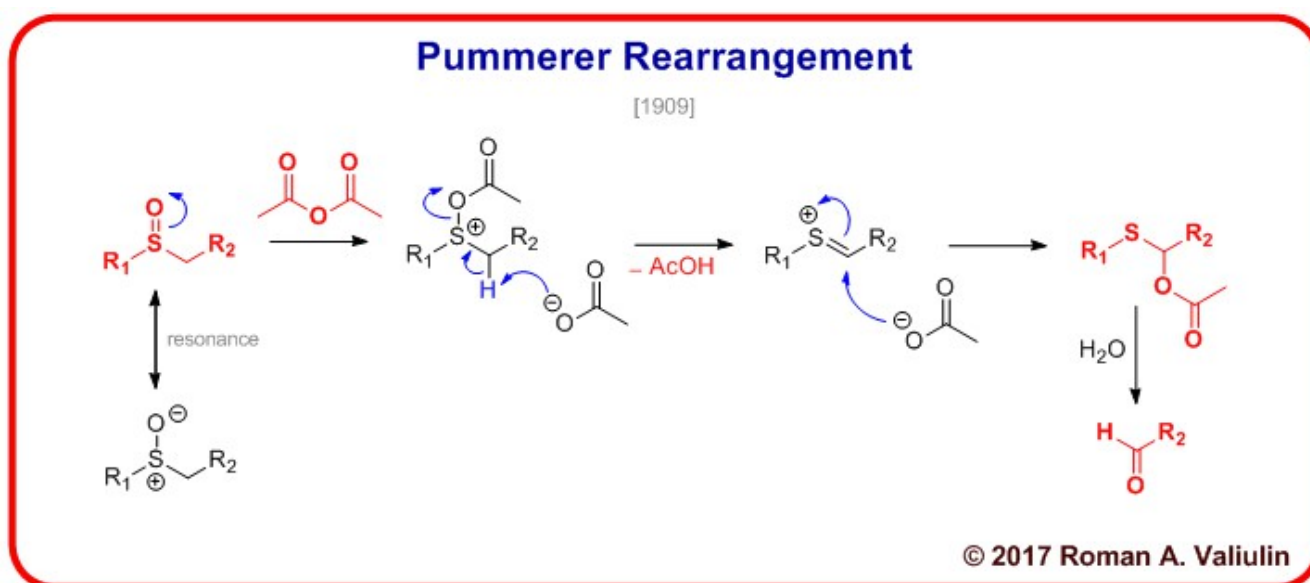
40. Ozonolysis 1840



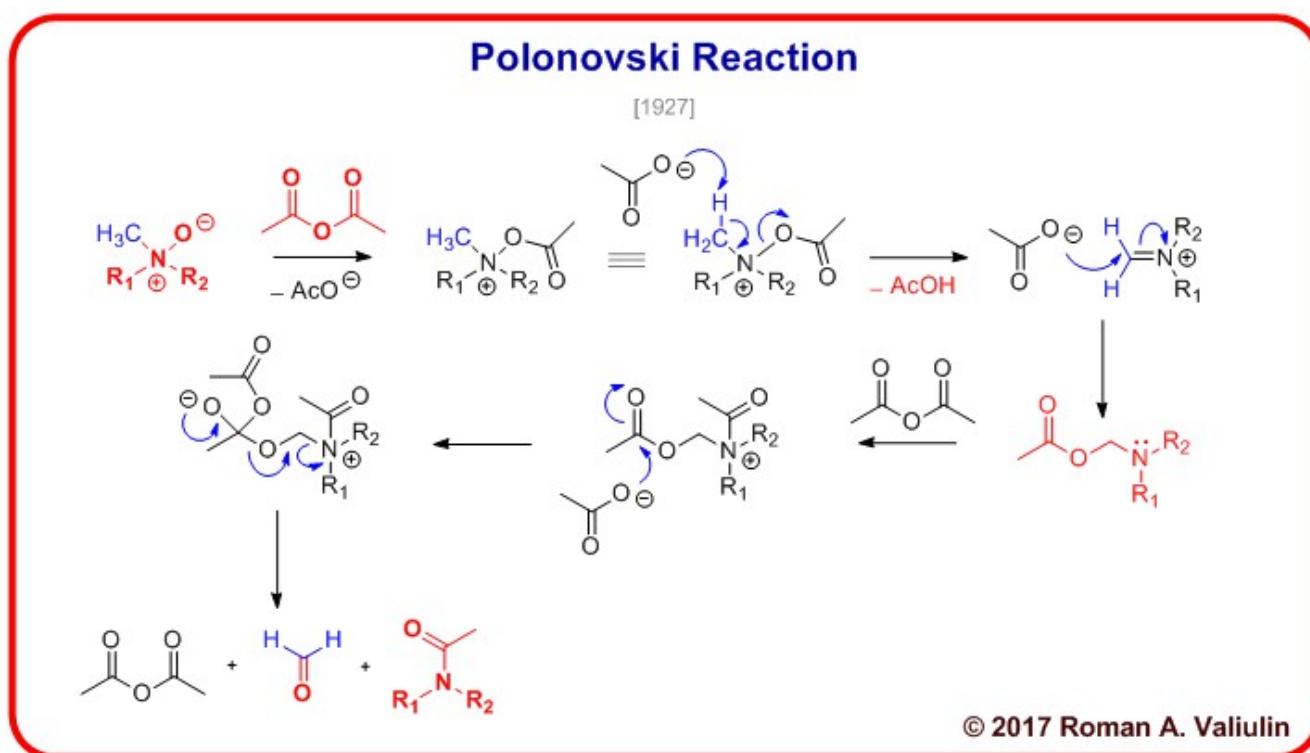
41. Pinacol Rearrangement 1860



42. Pummerer Rearrangement 1909



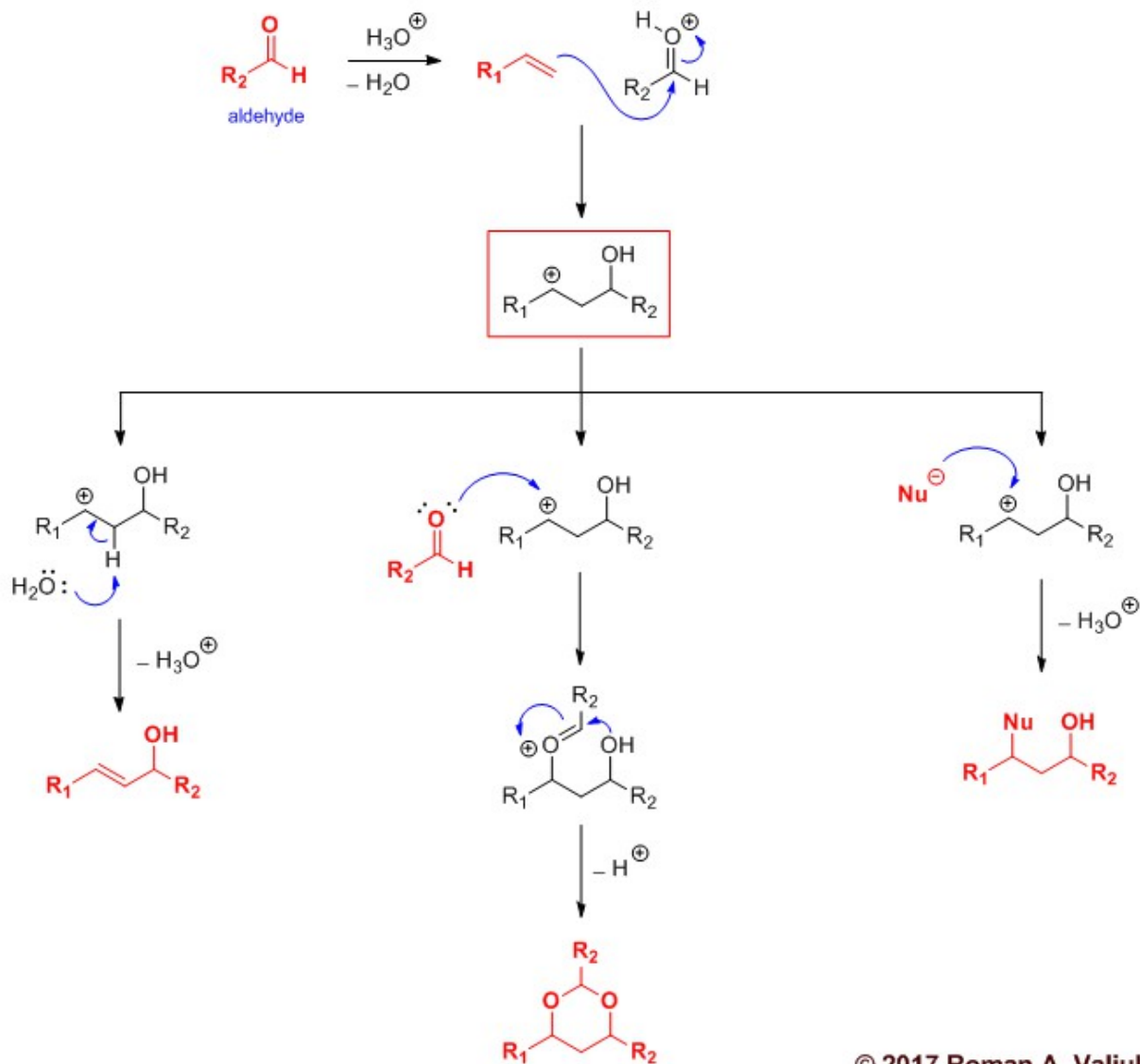
43. Polonovski Reaction 1927



44. Prins Reaction 1919

Prins Reaction

[1919]



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45. Paternò-Büchi Reaction (1909, 1954)

Paternò-Büchi Reaction

[1909+1954]

Mechanism:

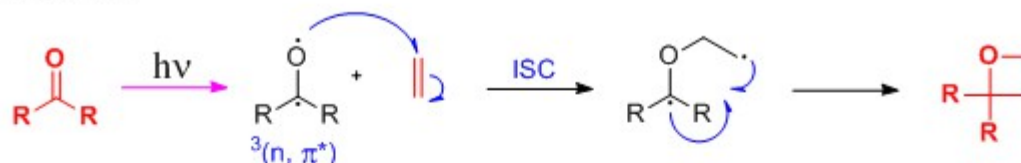
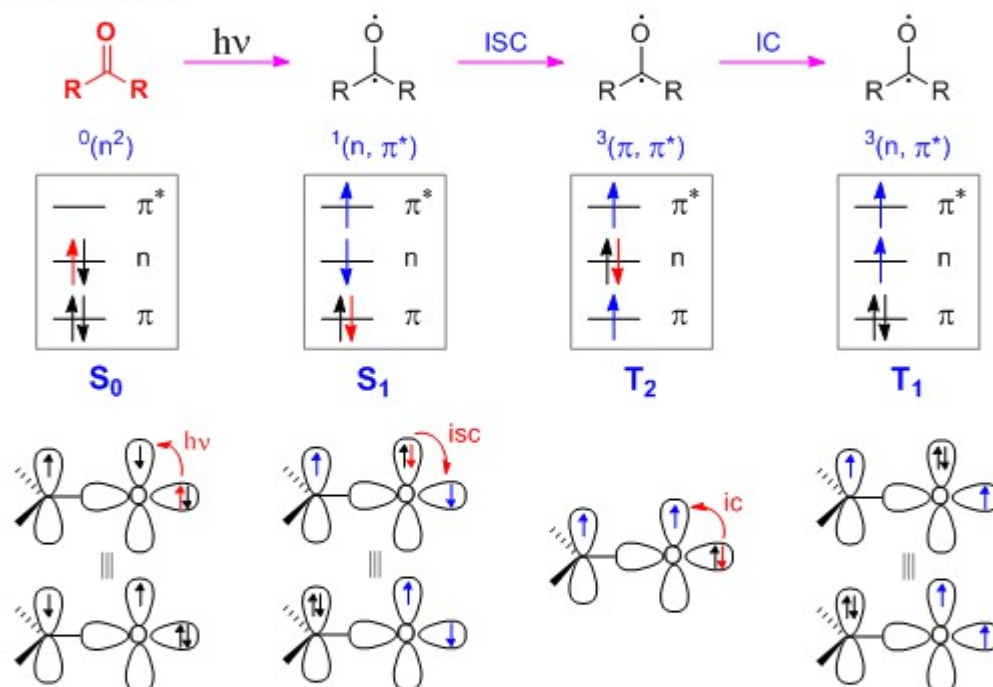
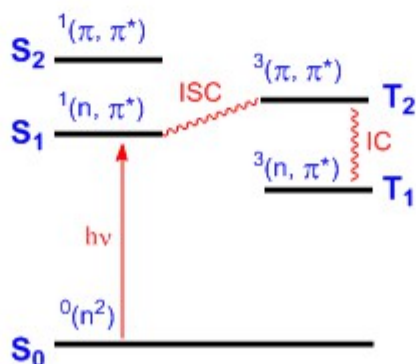


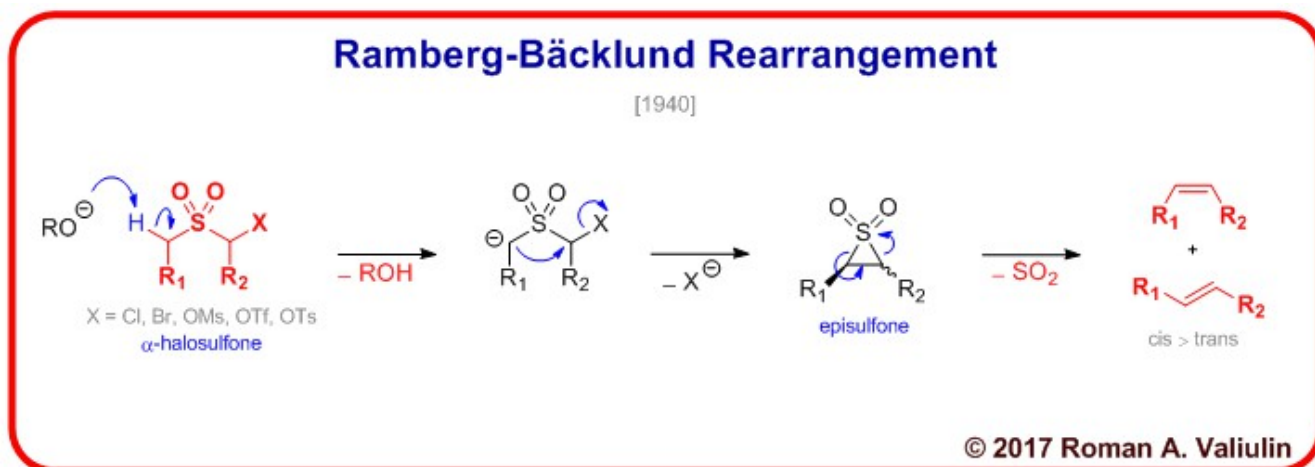
Photo-excitation:



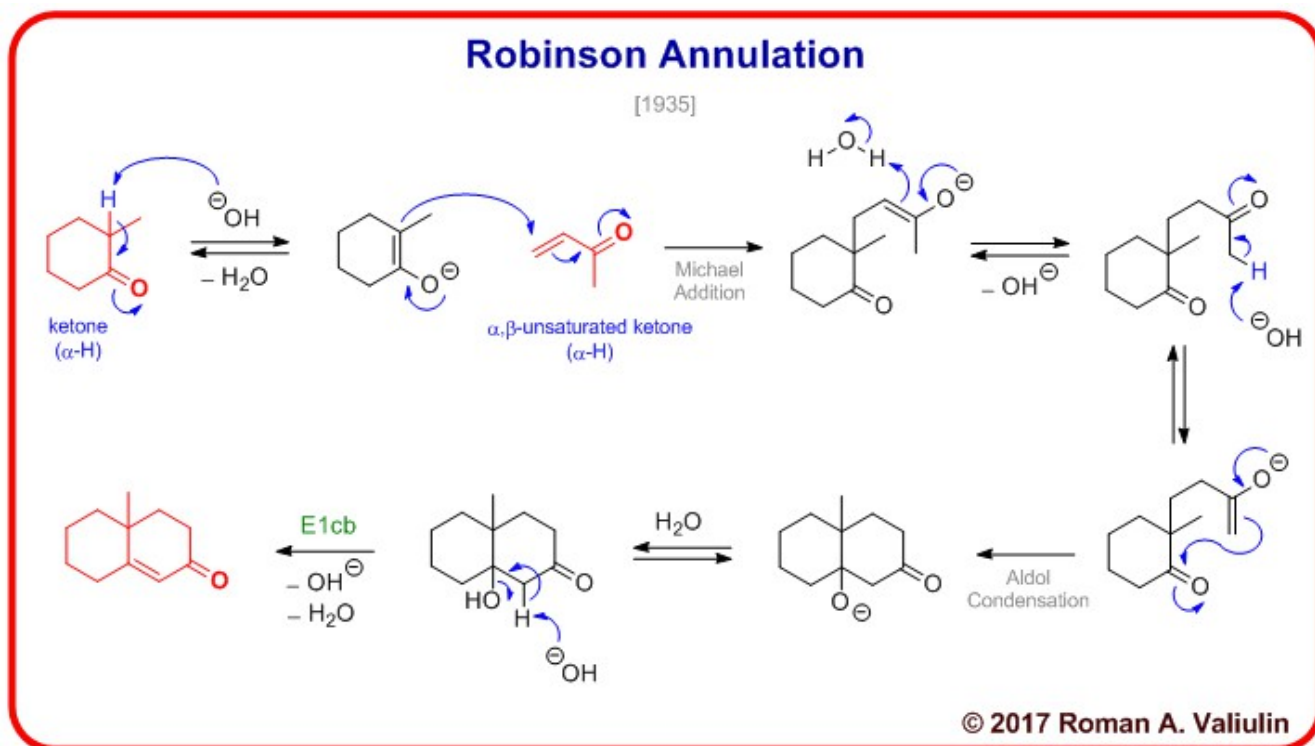
Energy Diagram:



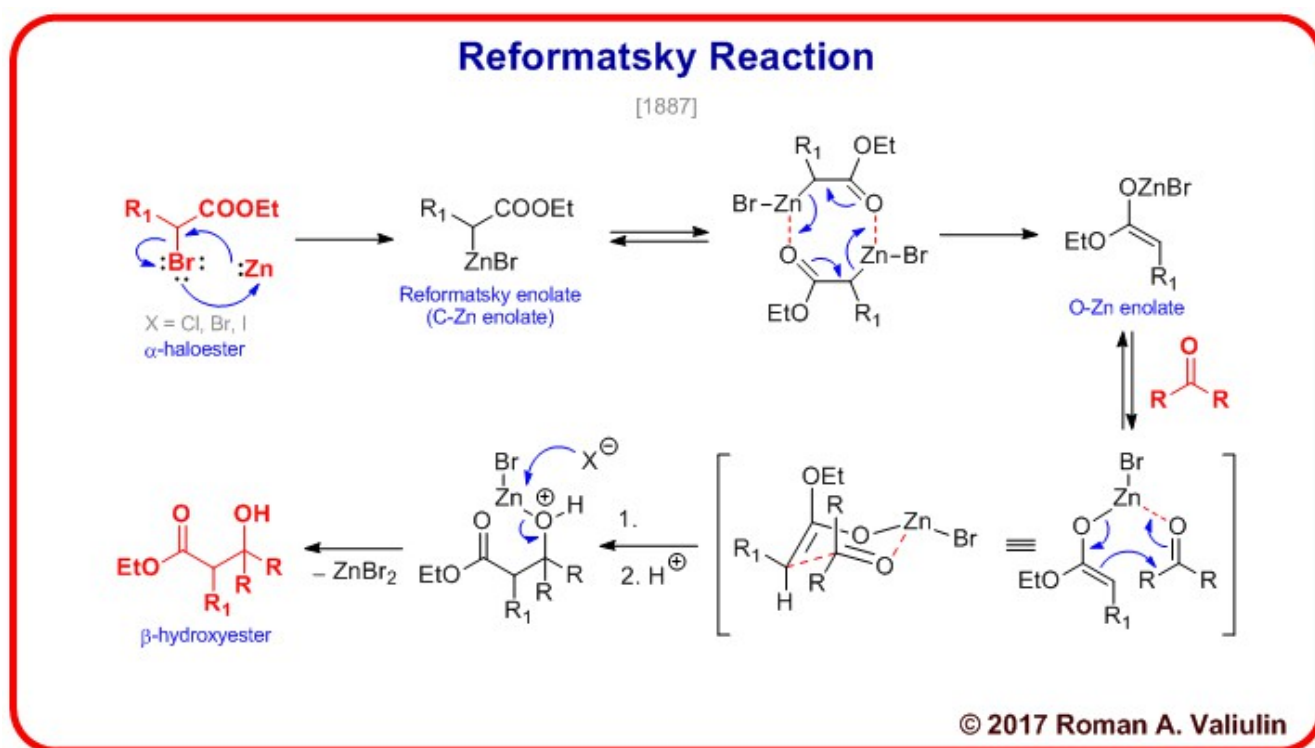
46. Ramberg-Bäcklund Rearrangement 1940



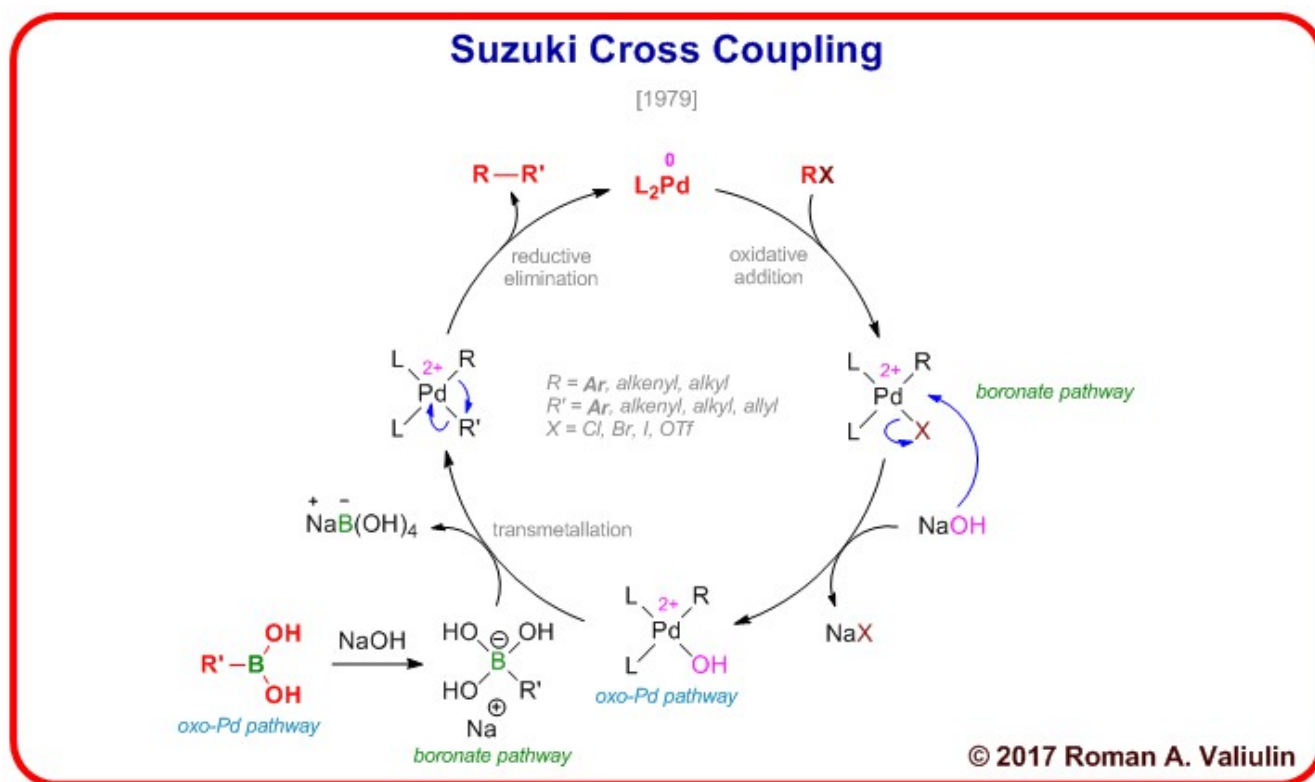
47. Robinson Annulation 1935



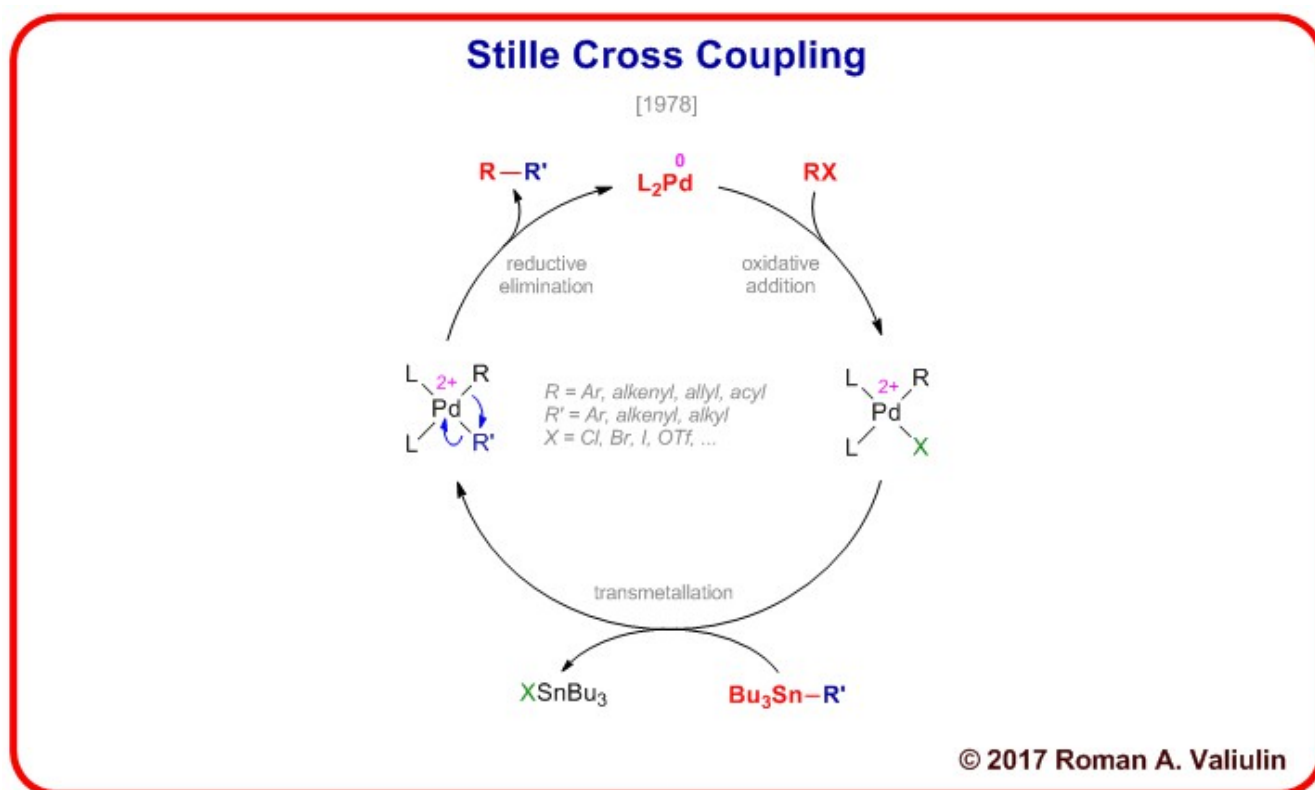
48. Reformatsky Reaction 1887



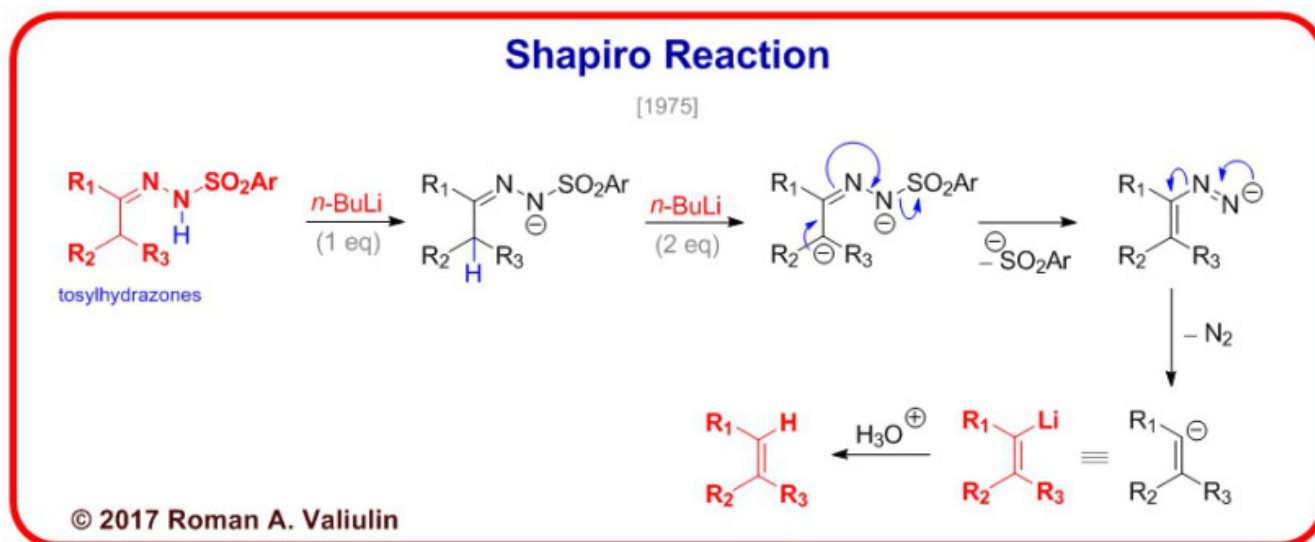
49. Suzuki Cross Coupling 1979



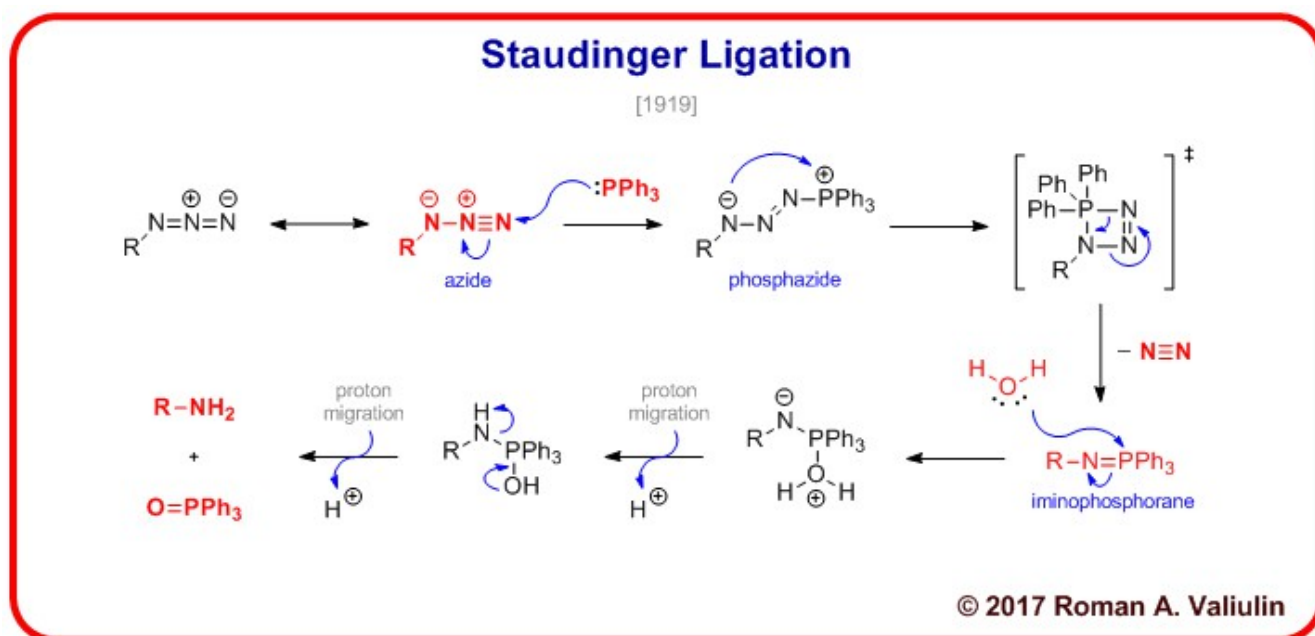
50. Stille Cross Coupling 1978



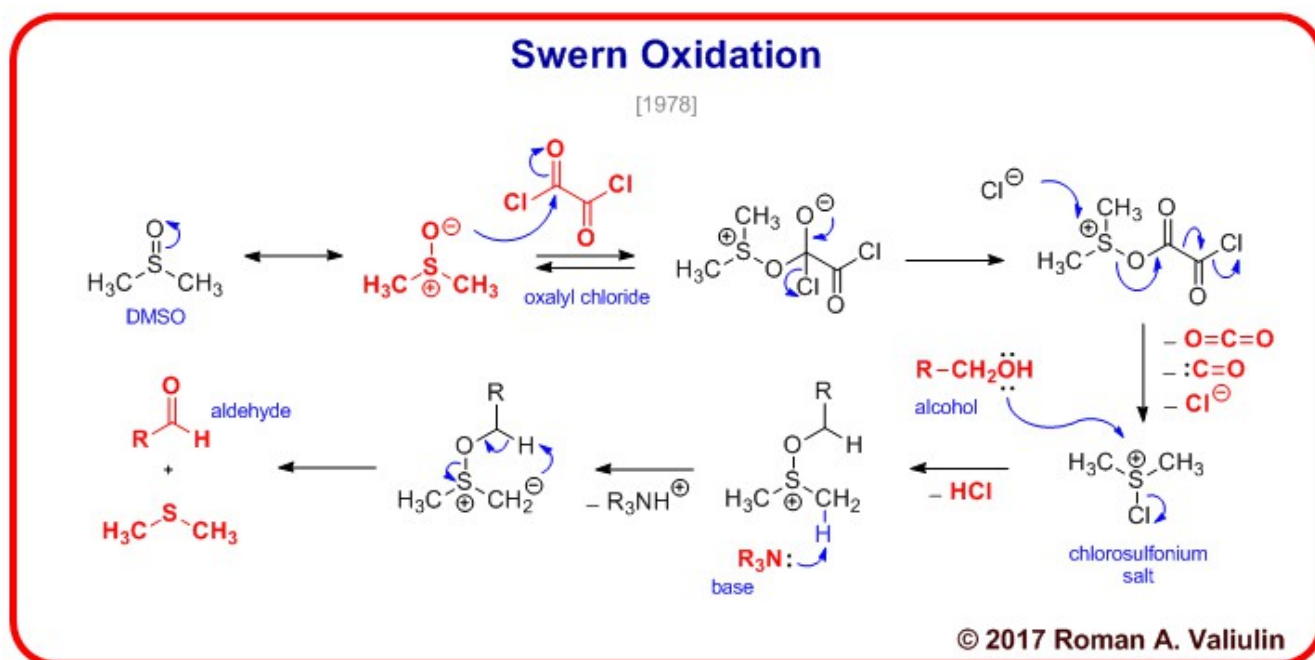
51. Shapiro Reaction 1975



52. Staudinger Ligation 1919



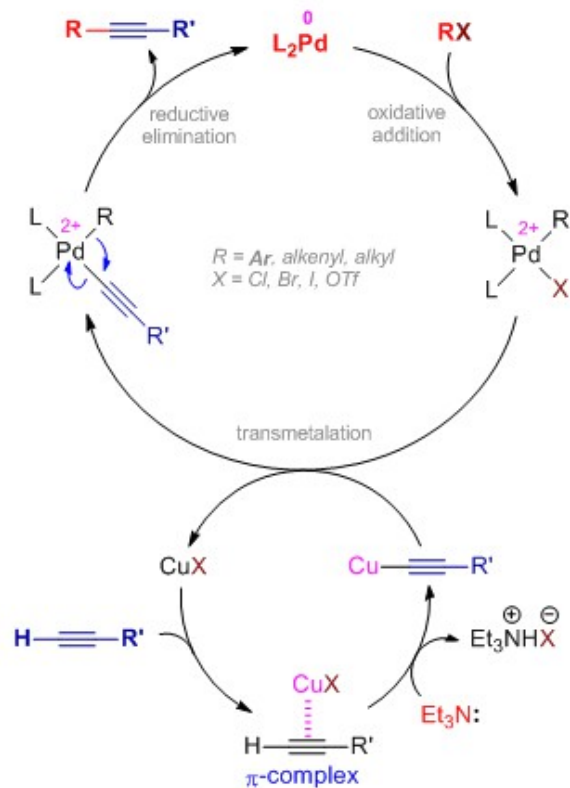
53. Swern Oxidation 1978



54. Sonogashira Cross Coupling 1975

Sonogashira Cross Coupling

[1975]

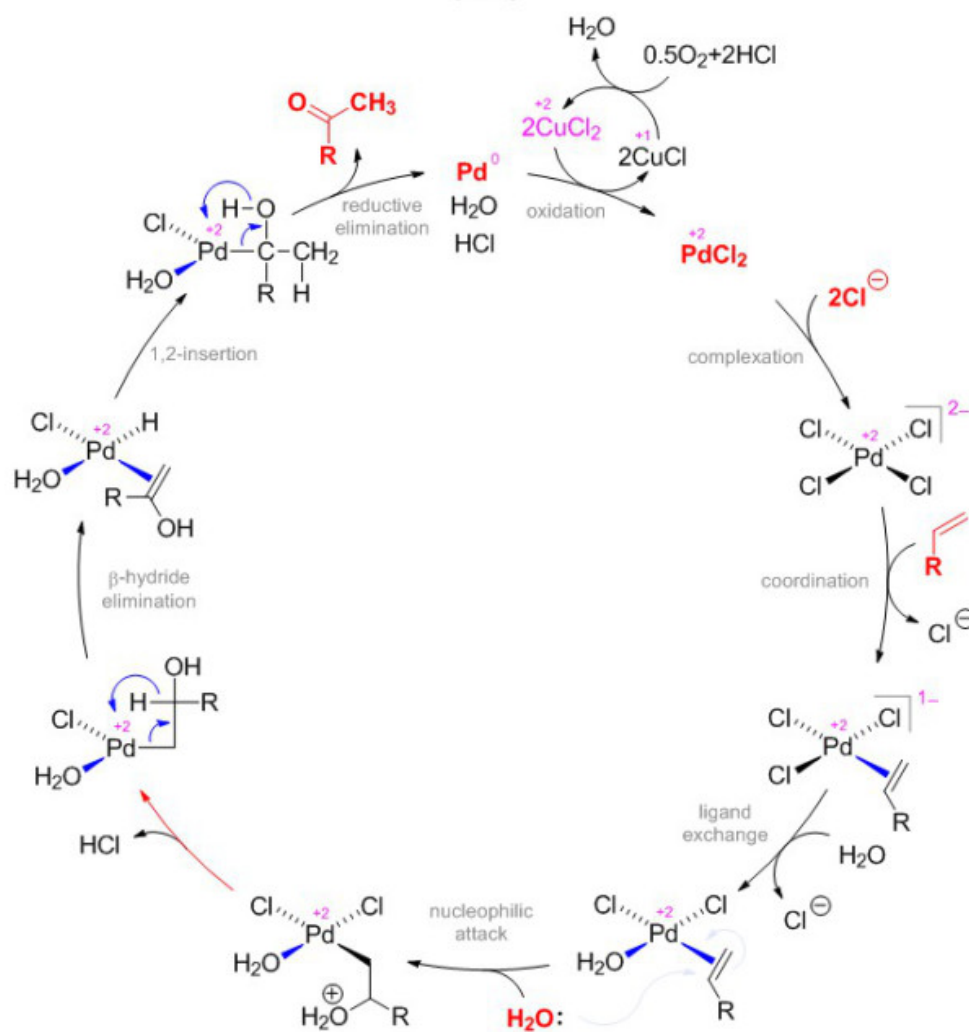


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55. Wacker Oxidation 1959

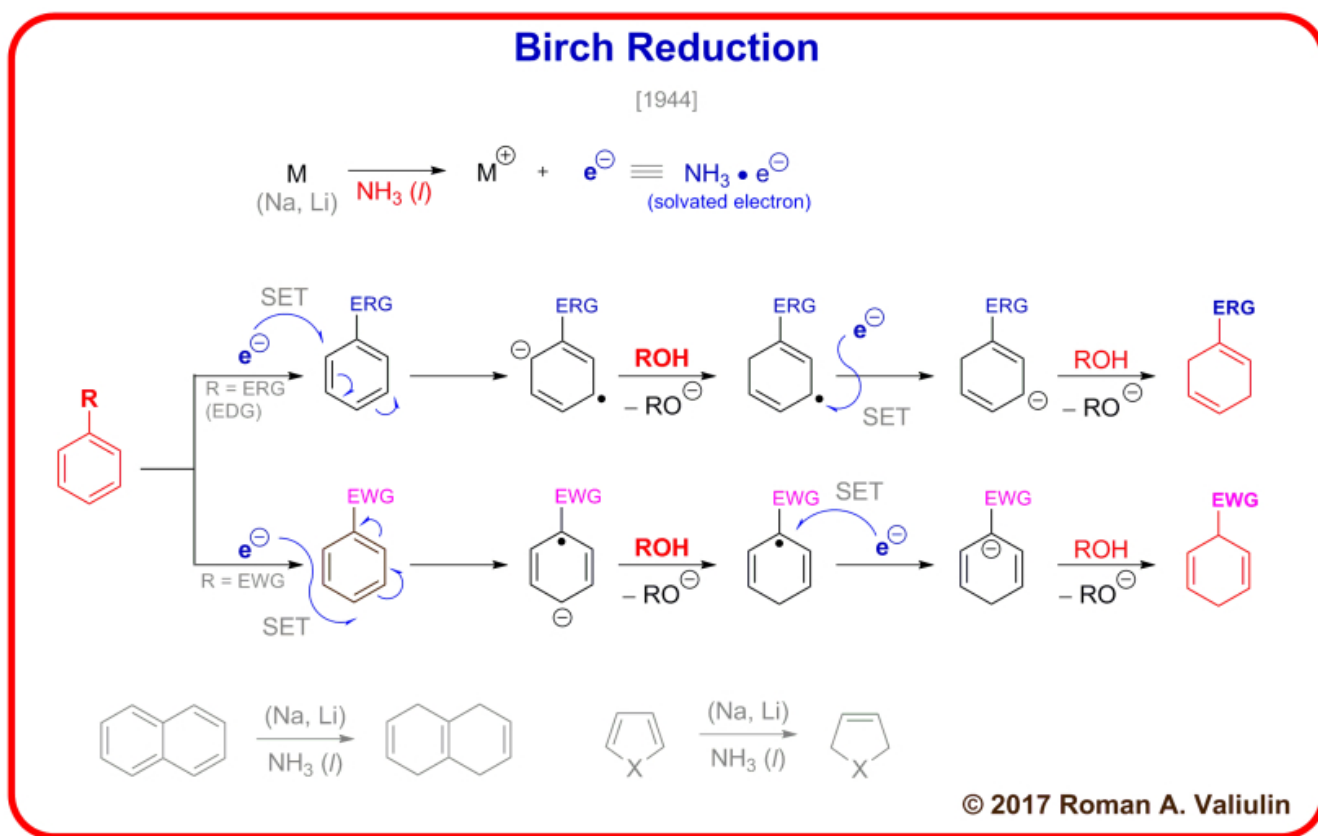
Wacker Oxidation

[1959]

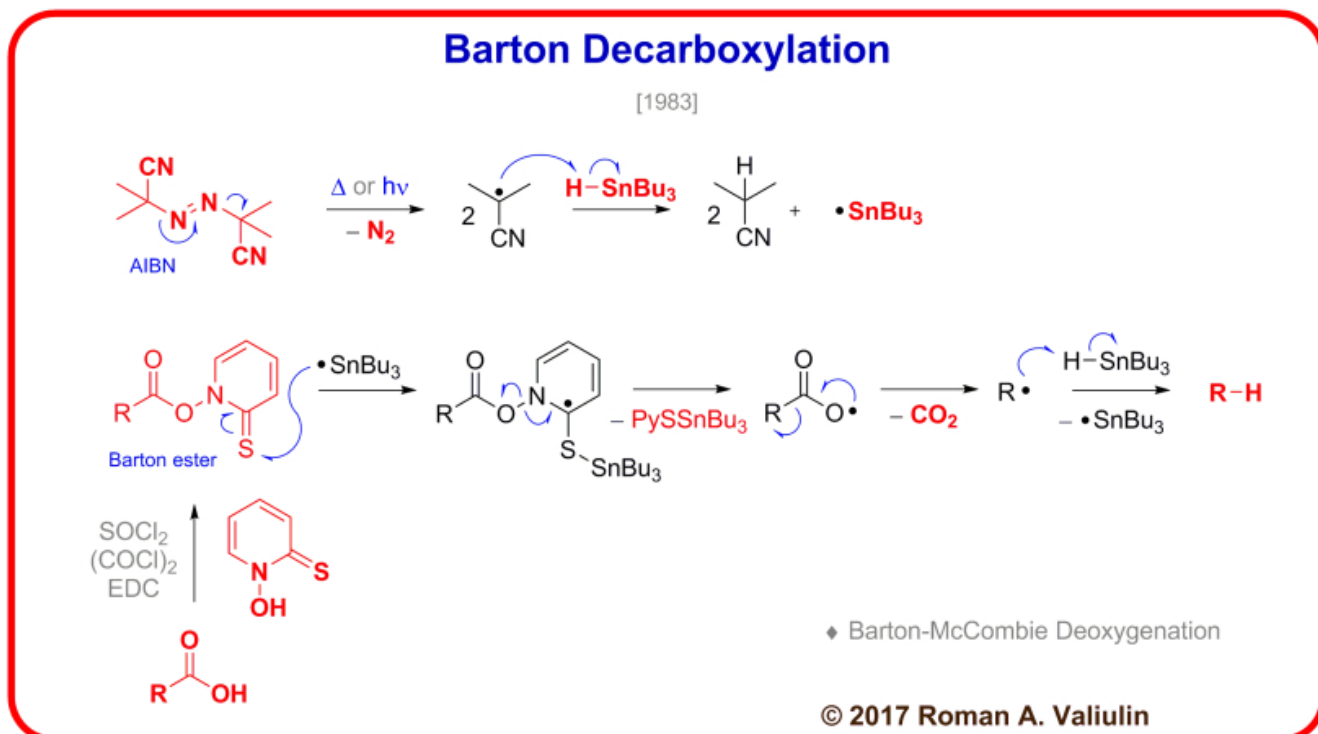


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56. Birch Reduction 1944



57. Barton Decarboxylation 1983



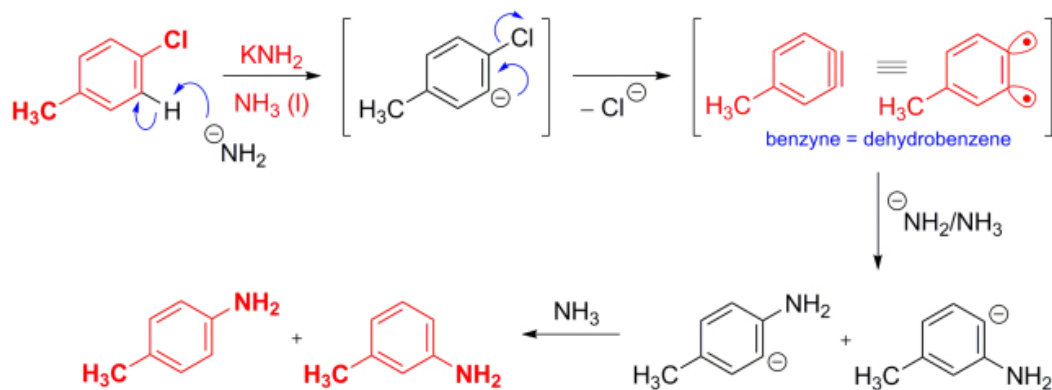
58. Benzyne Mechanism 1953

Benzyne Mechanism

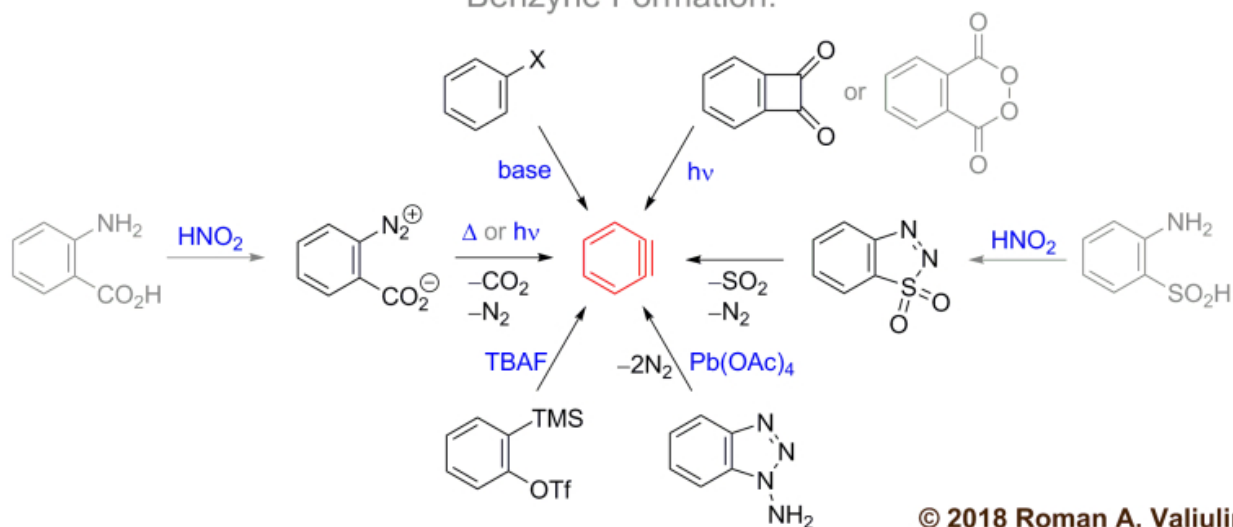
[1953]



Nucleophilic Aromatic Substitution:
Elimination-Addition



Benzyne Formation:

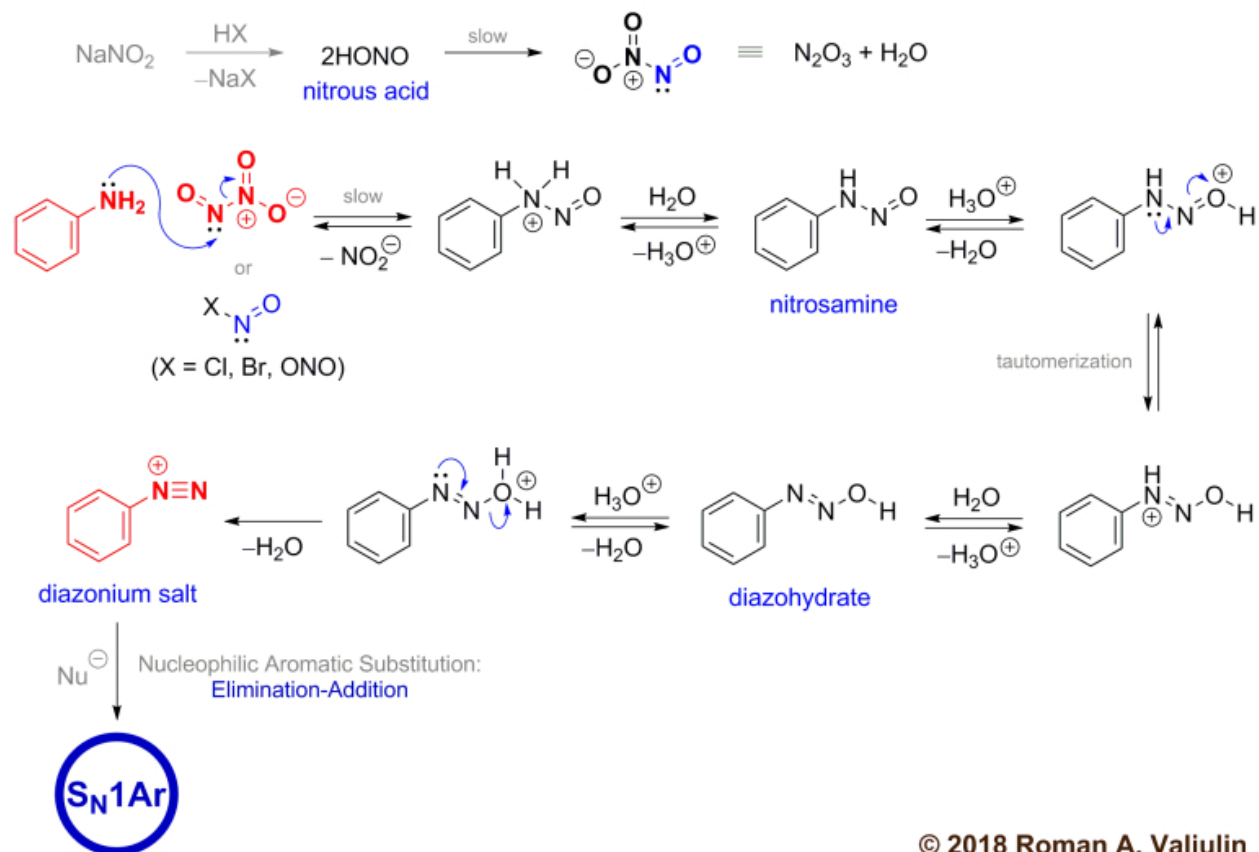


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59. Diazotisation 1900

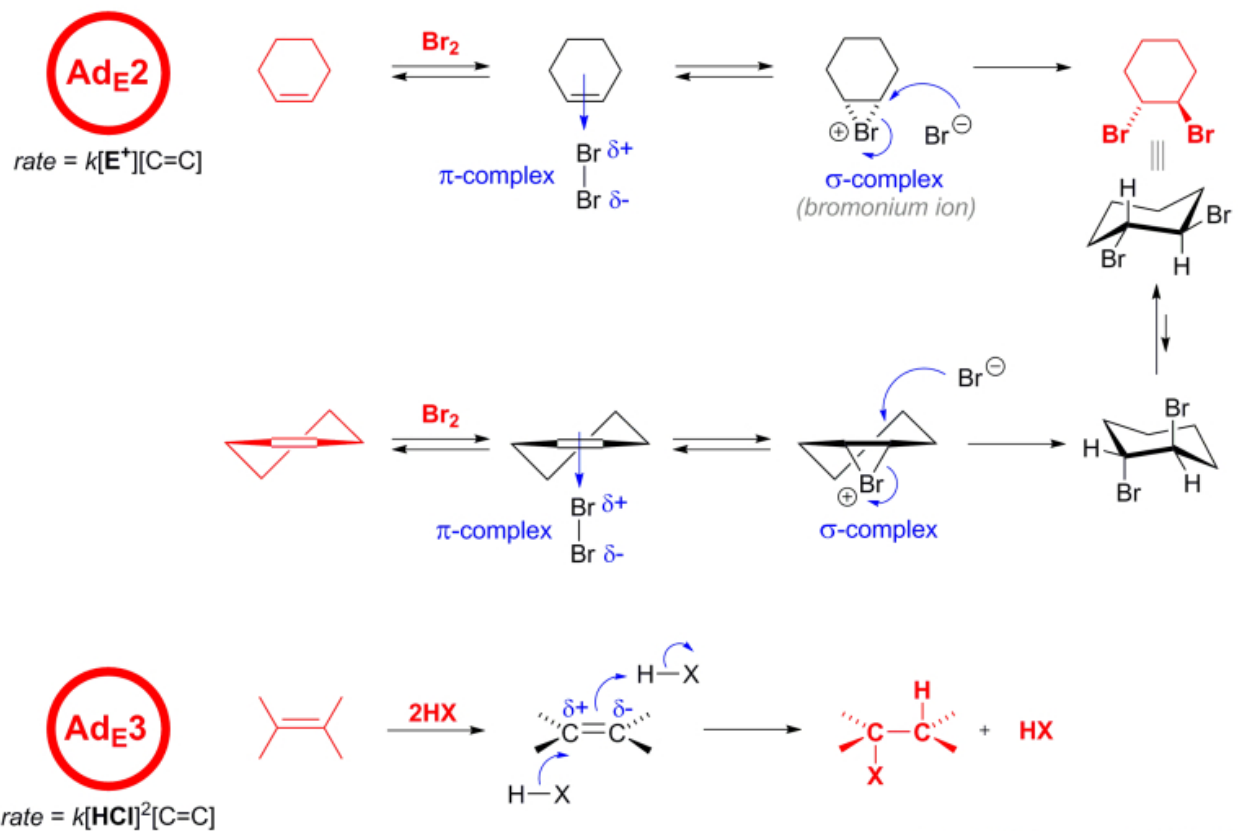
Diazotisation

[1900]



60. Electrophilic Addition

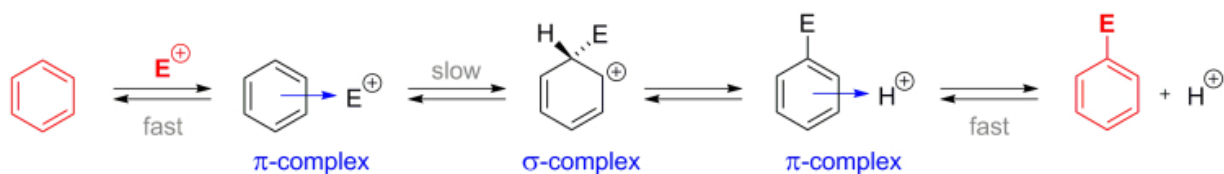
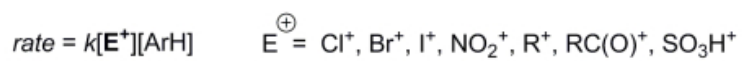
Electrophilic Addition



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61. Electrophilic Aromatic Substitution

Electrophilic Aromatic Substitution



Electron **R**eleasing (Donating) **G**roup

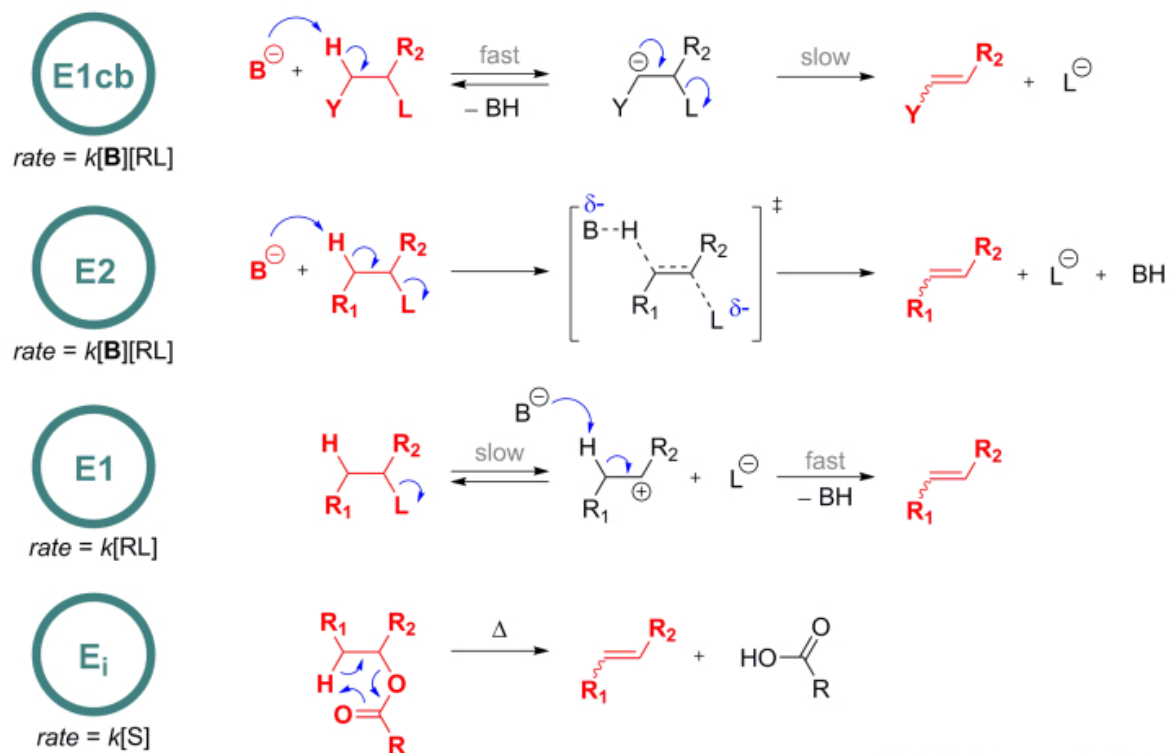
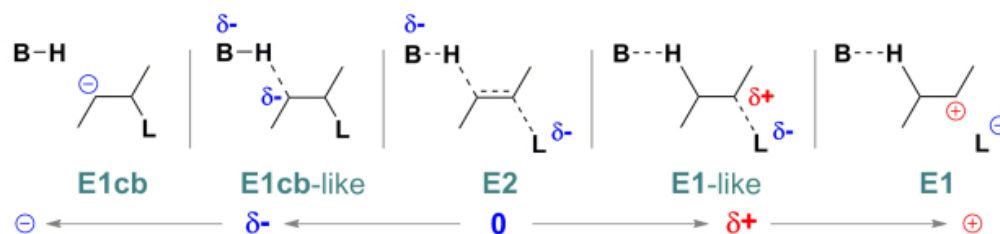


Electron **W**ithdrawing **G**roup

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62. Beta-Elimination

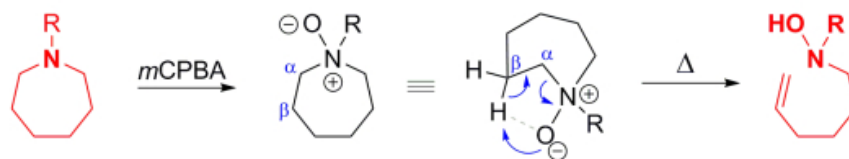
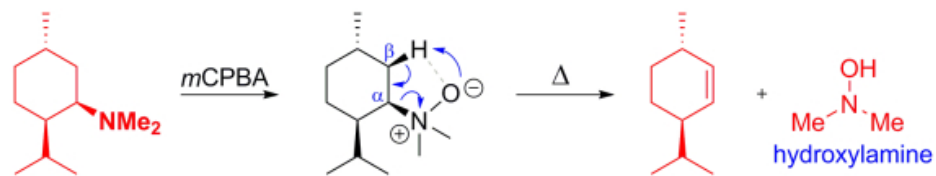
β -Elimination



63. Cope Elimination 1949

Cope Elimination

[1949]

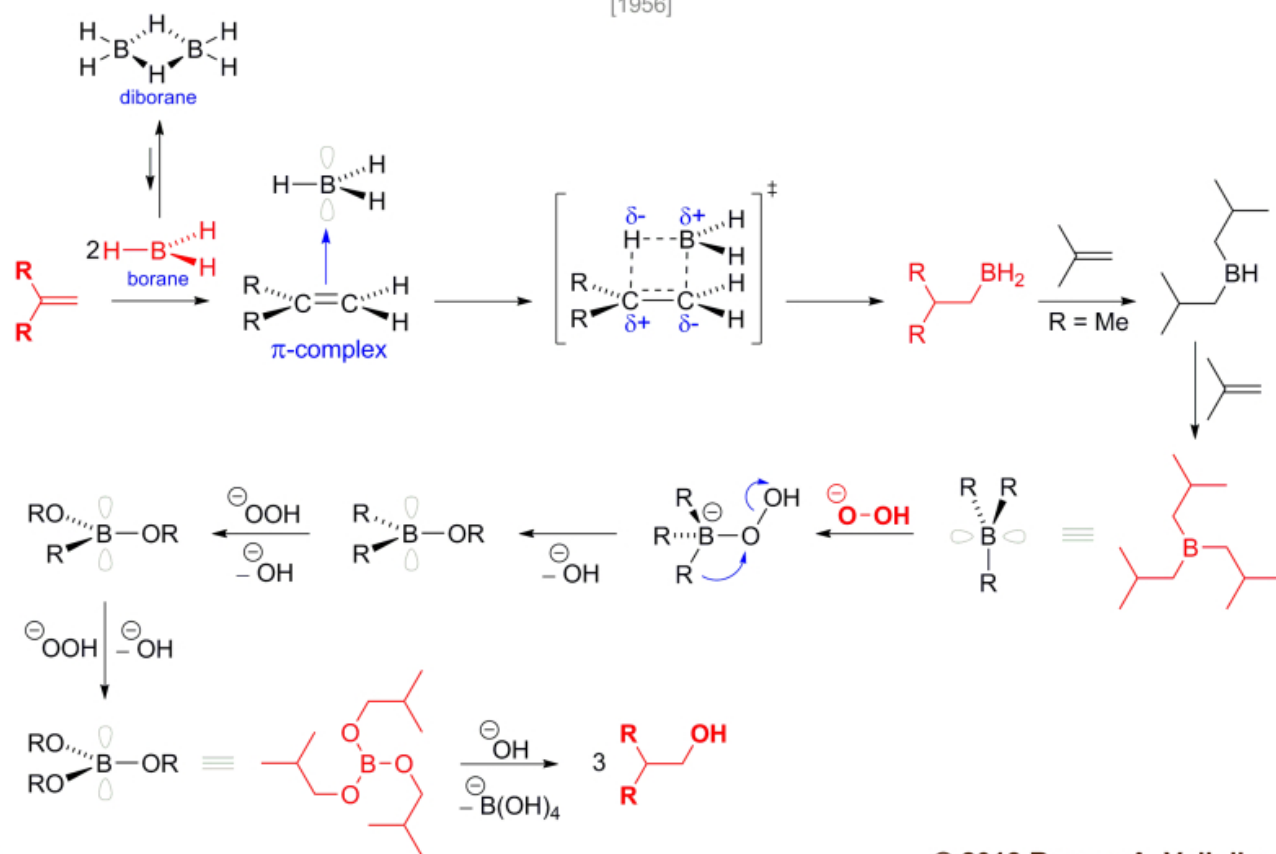


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64. Brown Hydroboration 1956

Brown Hydroboration

[1956]

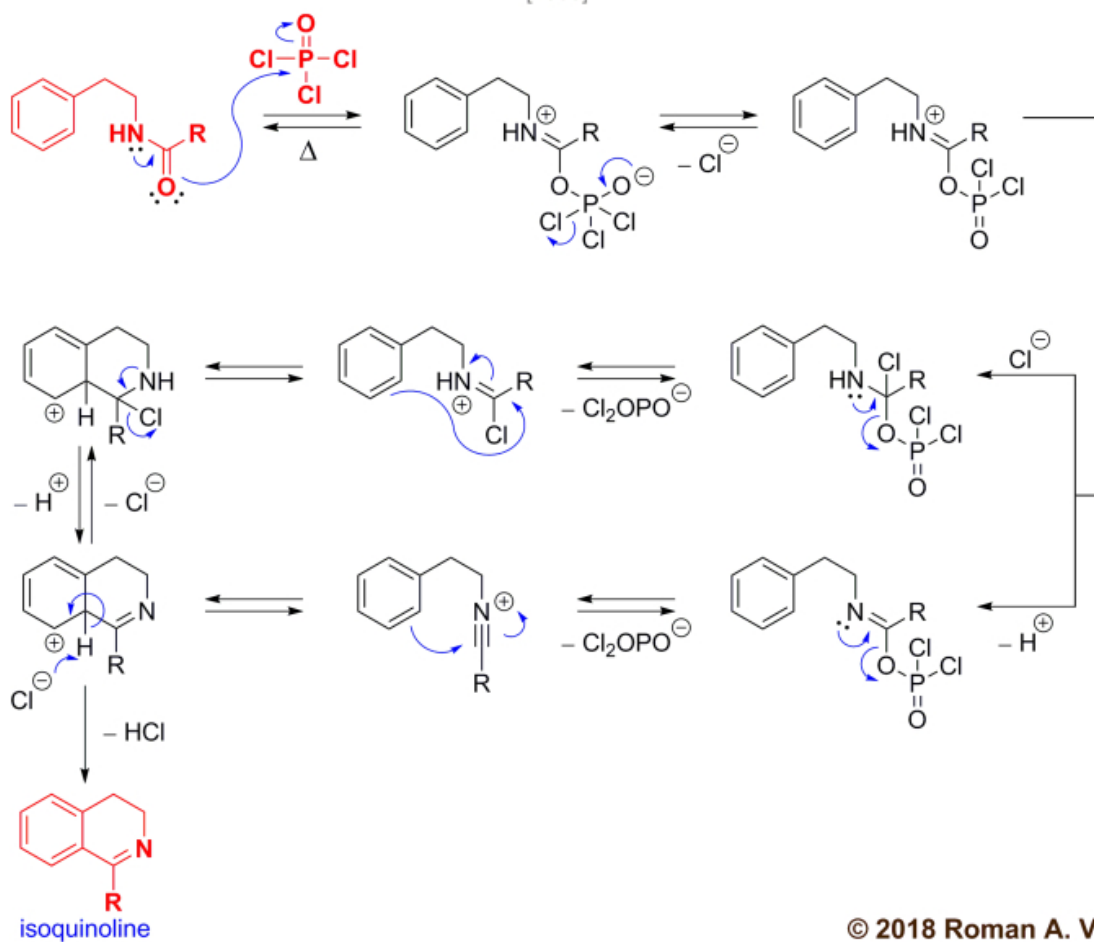


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65. Bischler-Napieralski Reaction 1903

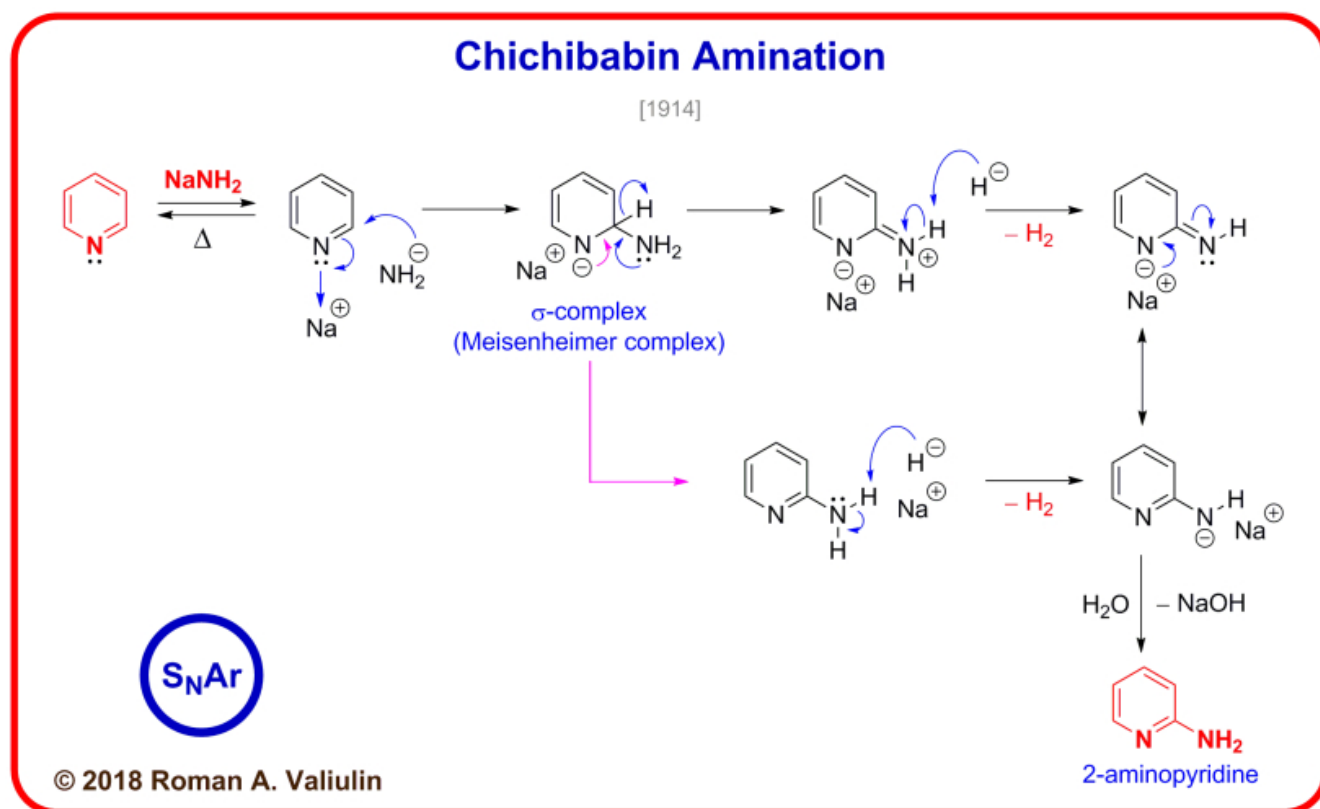
Bischler-Napieralski Cyclization

[1903]



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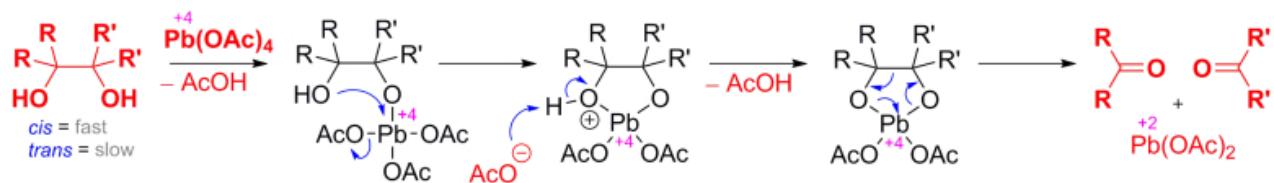
66. Chichibabin Amination 1914



67. Criegee Oxidation 1931 – Malaprade Oxidation 1934

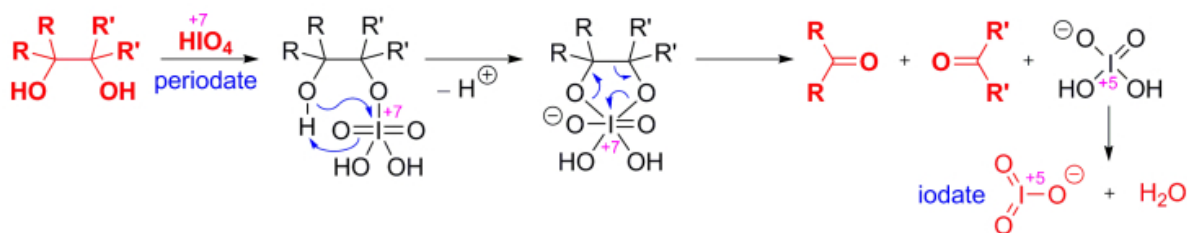
Criegee Oxidation

[1931]



Malaprade Oxidation

[1934]

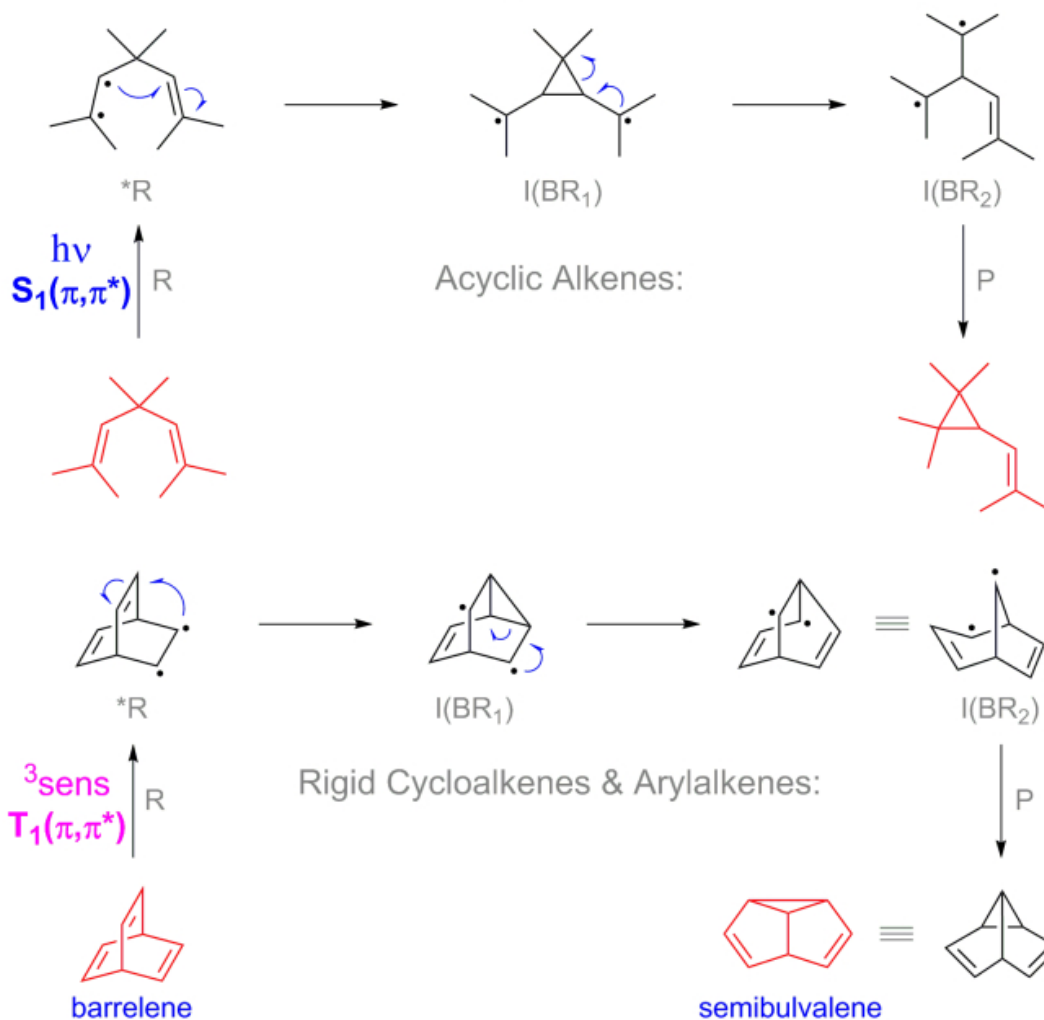


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68. Di- π -Methane (DPM) Rearrangement (Zimmerman Reaction) 1967

Di- π -Methane (DPM) Rearrangement (Zimmerman Reaction)

[1967]

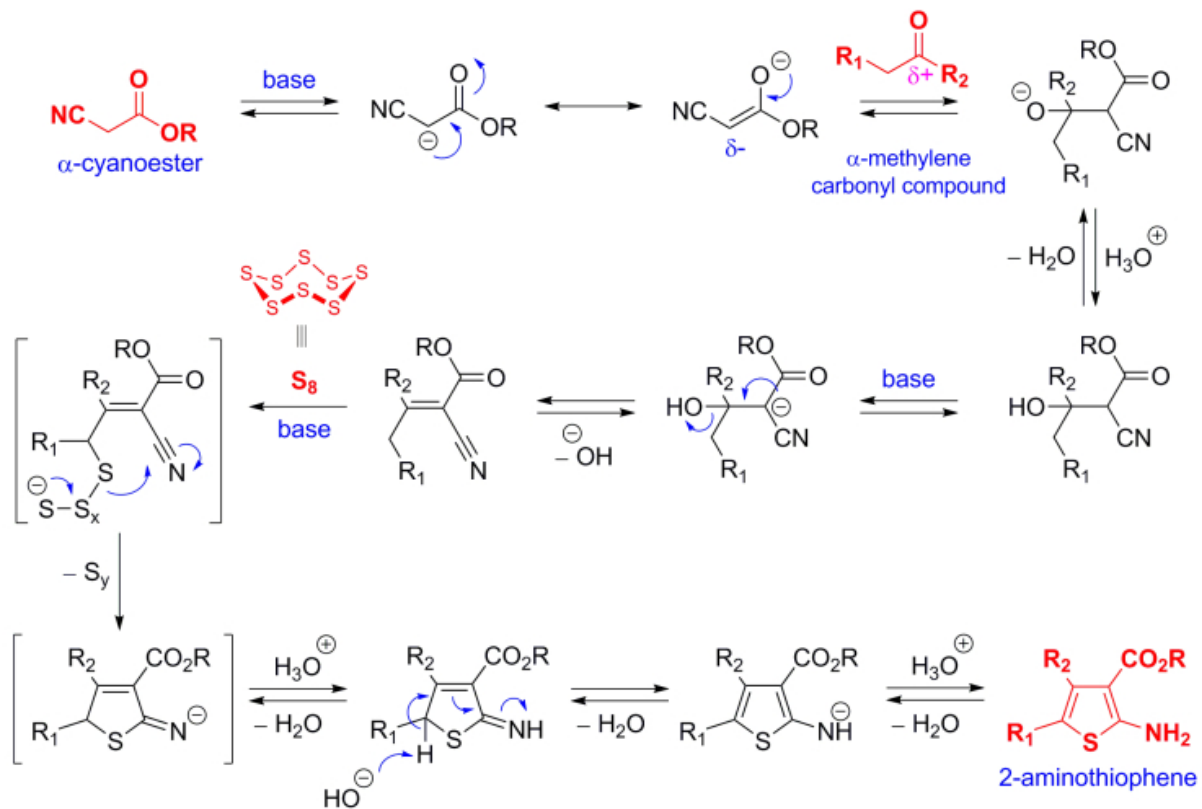


69. Gewald Reaction 1966

Gewald Reaction

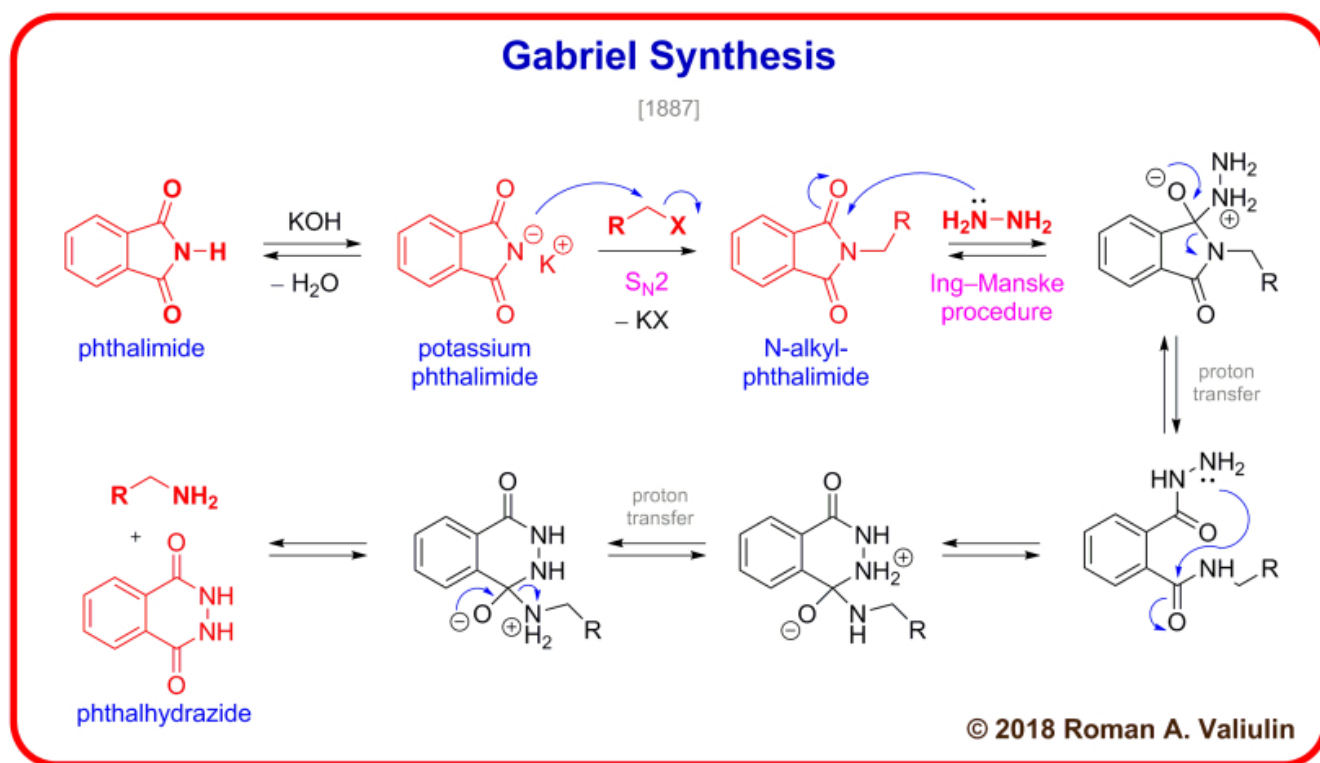
[1966]

Knoevenagel Condensation

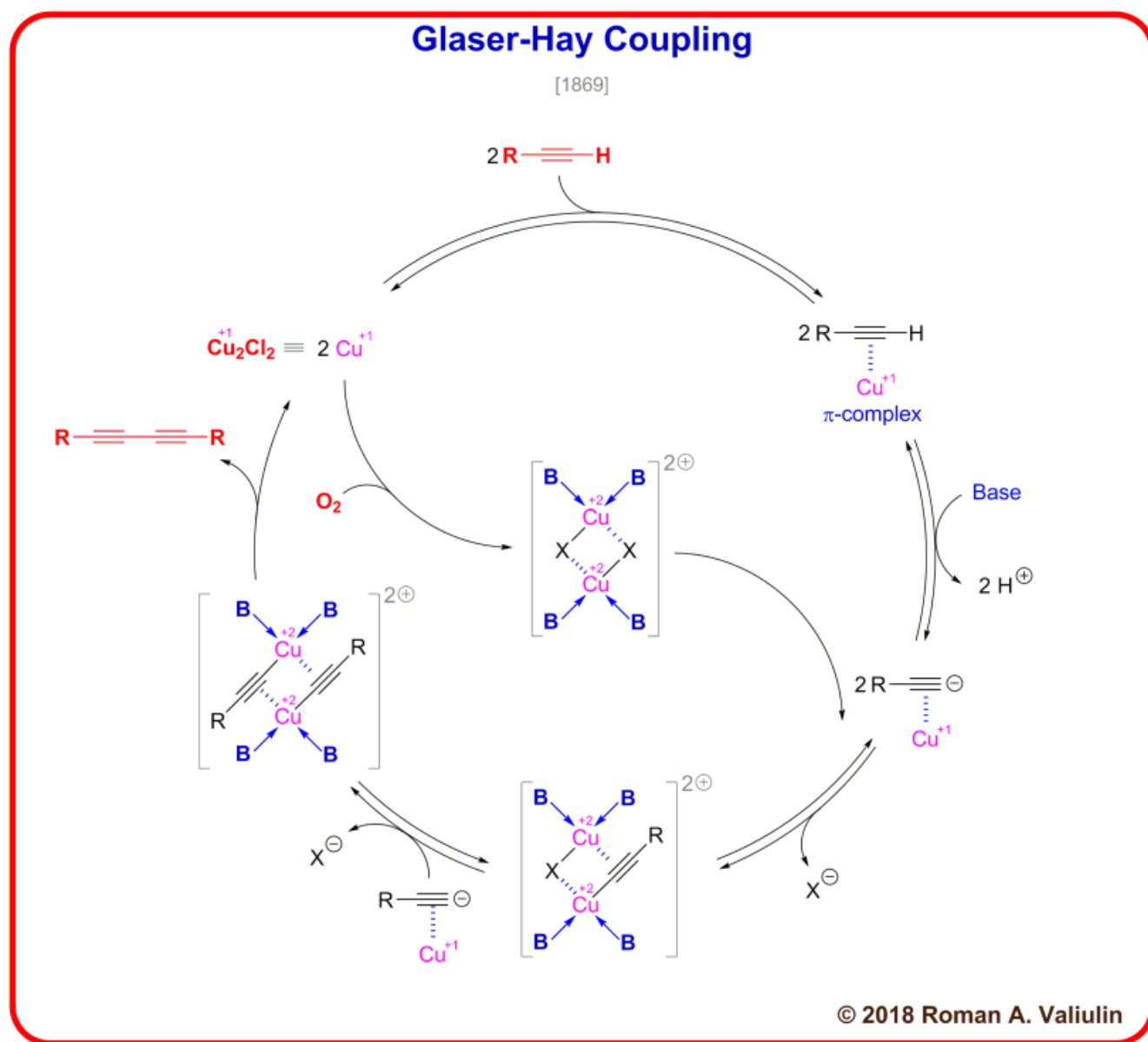


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70. Gabriel Synthesis 1887



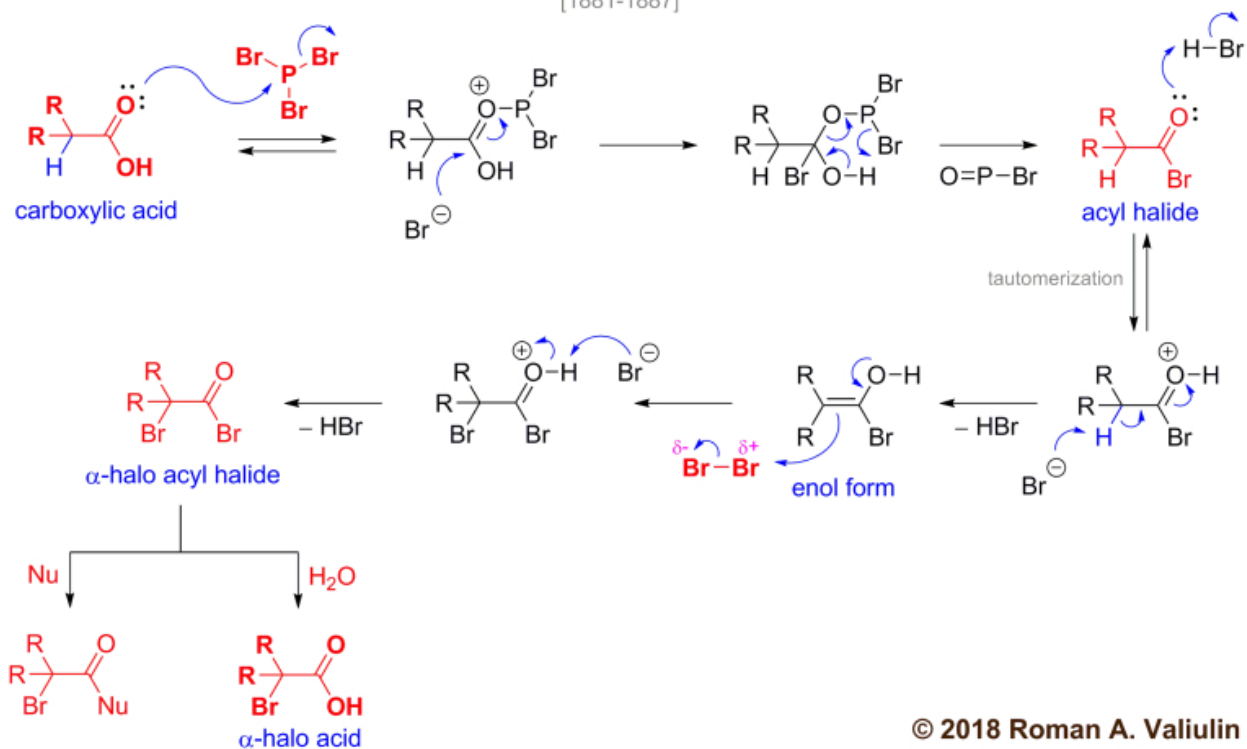
71. Glaser-Hay Coupling 1869



72. Hell-Volhard-Zelinsky Reaction 1881-1887

Hell-Volhard-Zelinsky Reaction

[1881-1887]

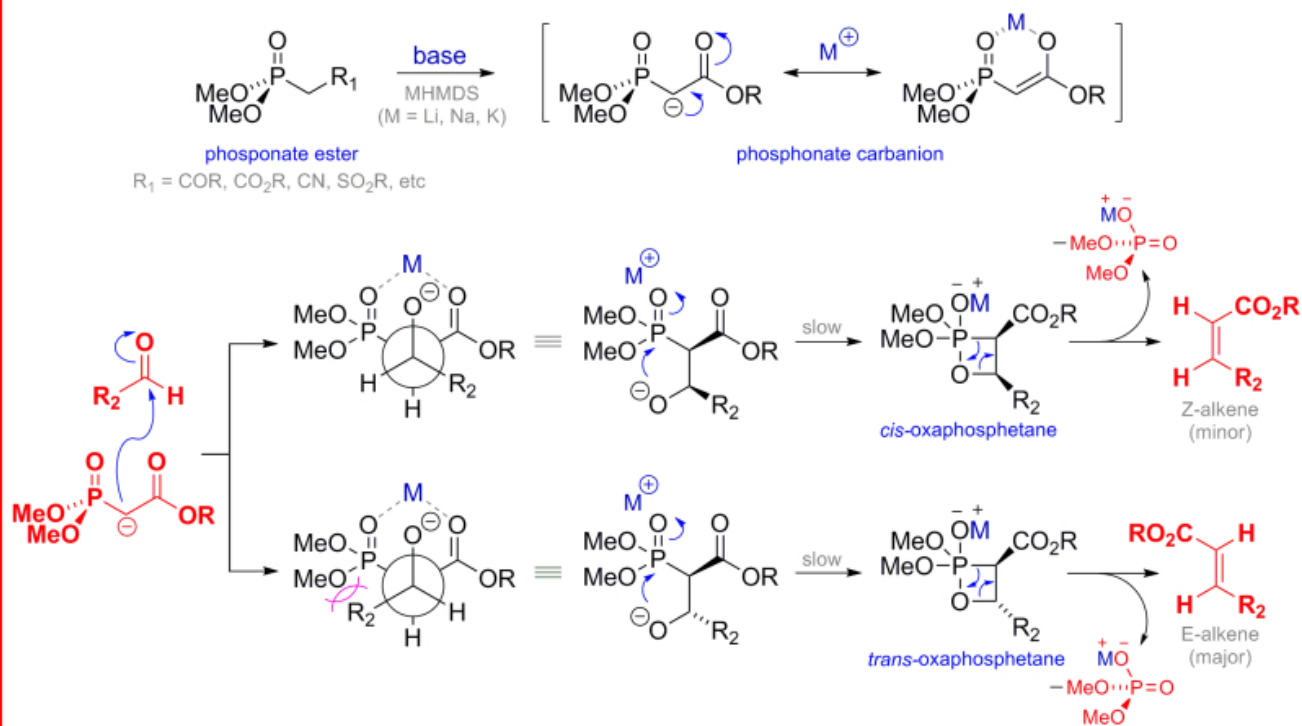


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73. Horner-Wadsworth-Emmons (HWE) Olefination 1958

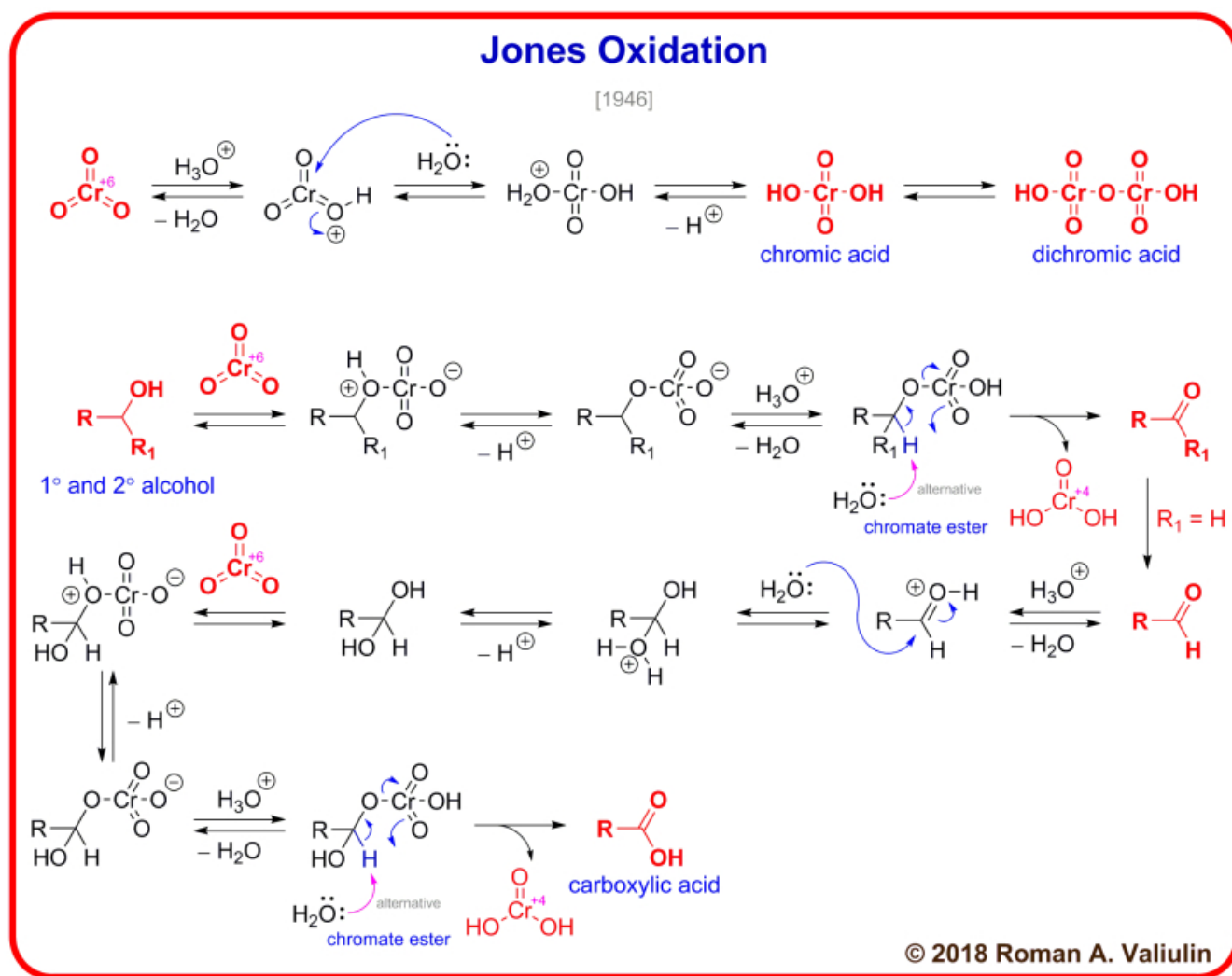
Horner-Wadsworth-Emmons (HWE) Olefination

[1958]



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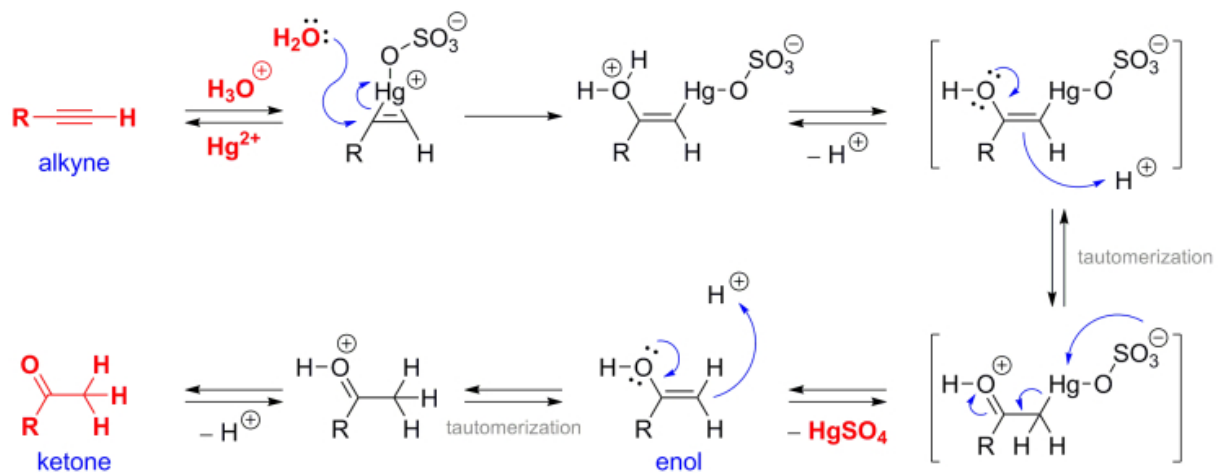
74. Jones Oxidation 1946



75. Kucherov Reaction 1881

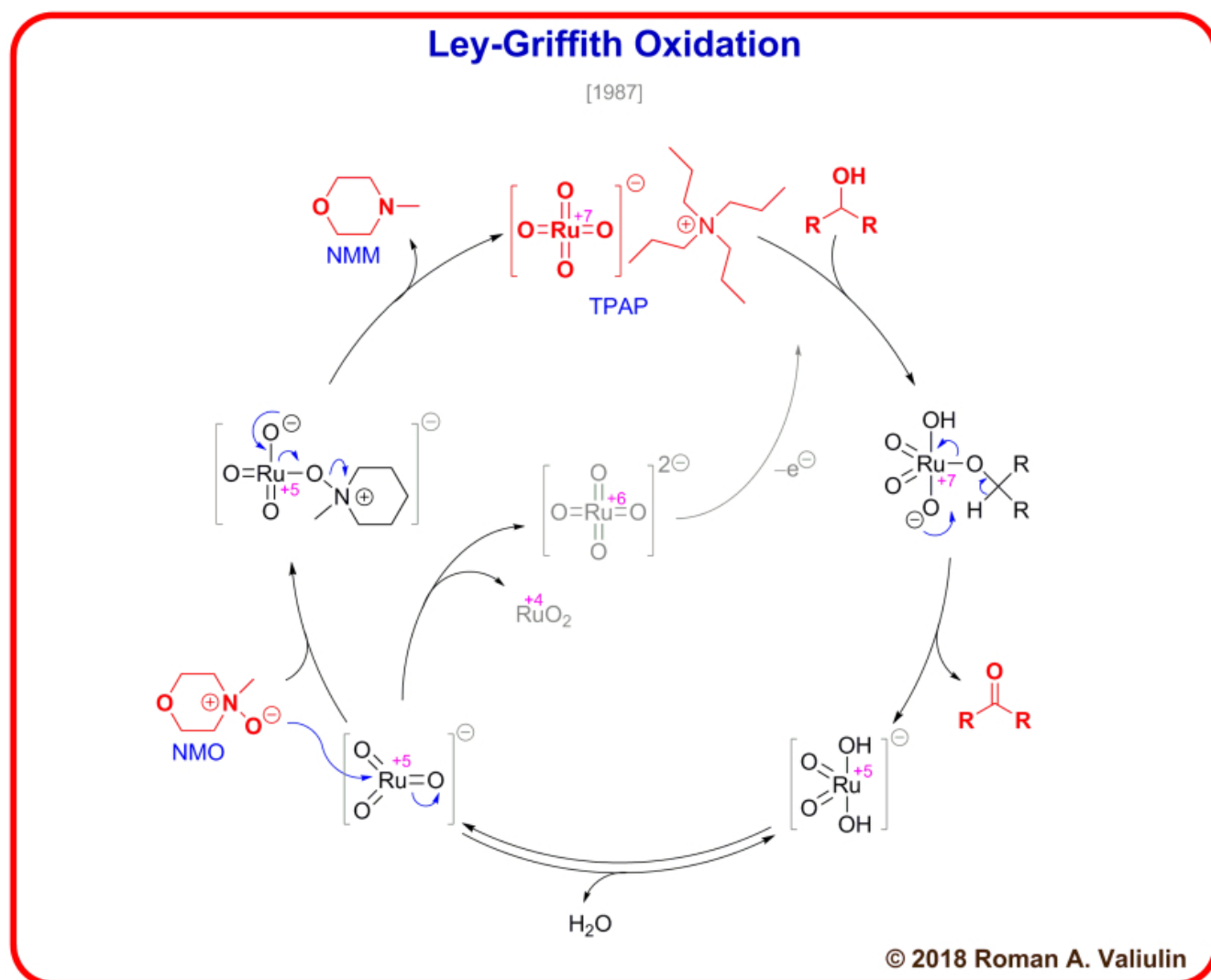
Kucherov Reaction

[1881]



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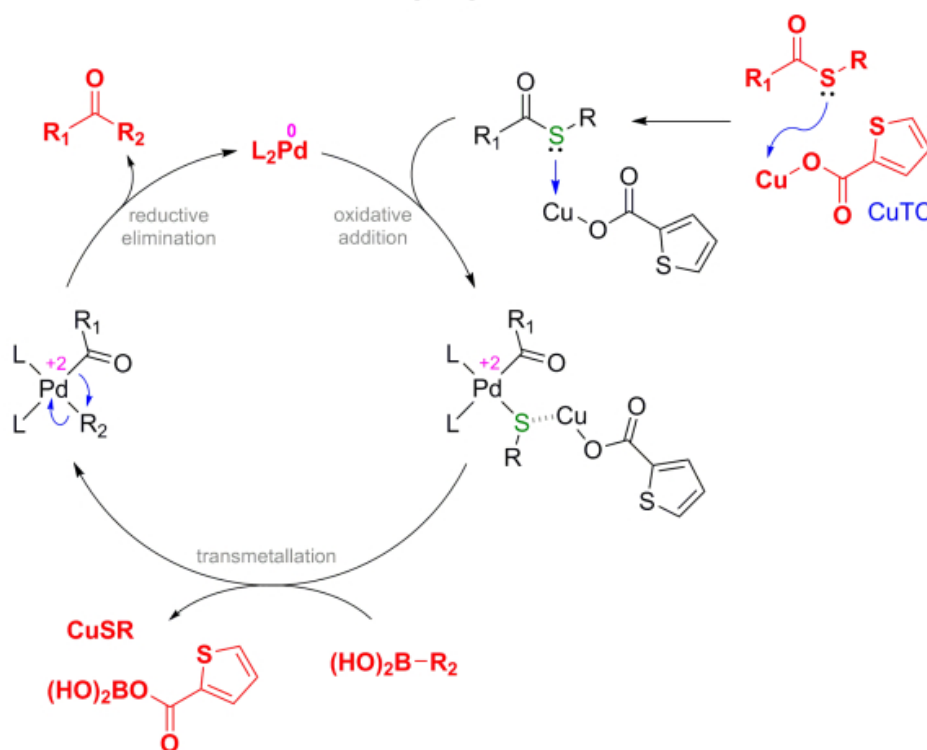
76. Ley-Griffith Oxidation 1987



77. Liebeskind-Srogl Coupling 2000

Liebeskind-Srogl Coupling

[2000]

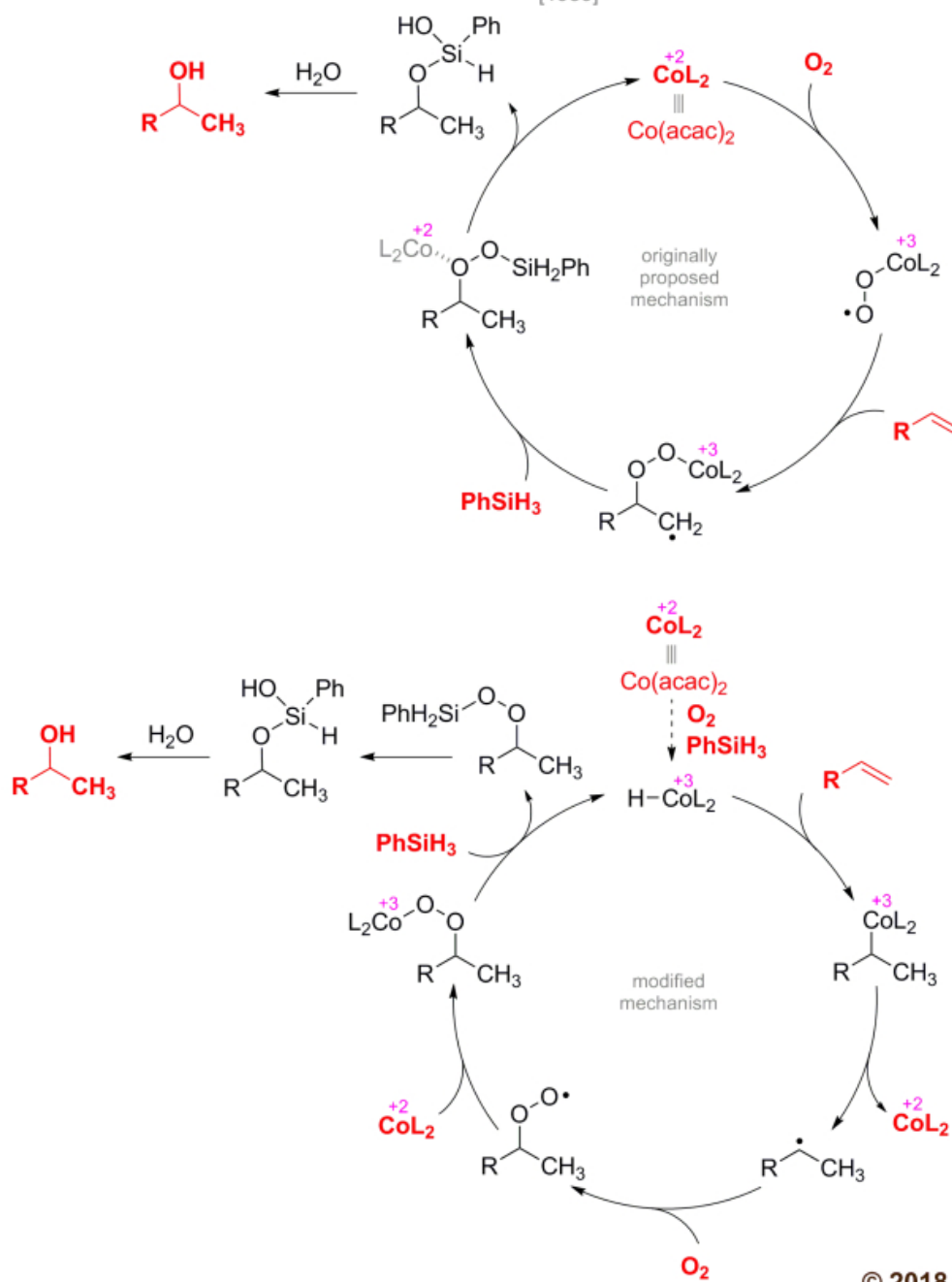


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78. Mukaiyama Hydration 1989

Mukaiyama Hydration

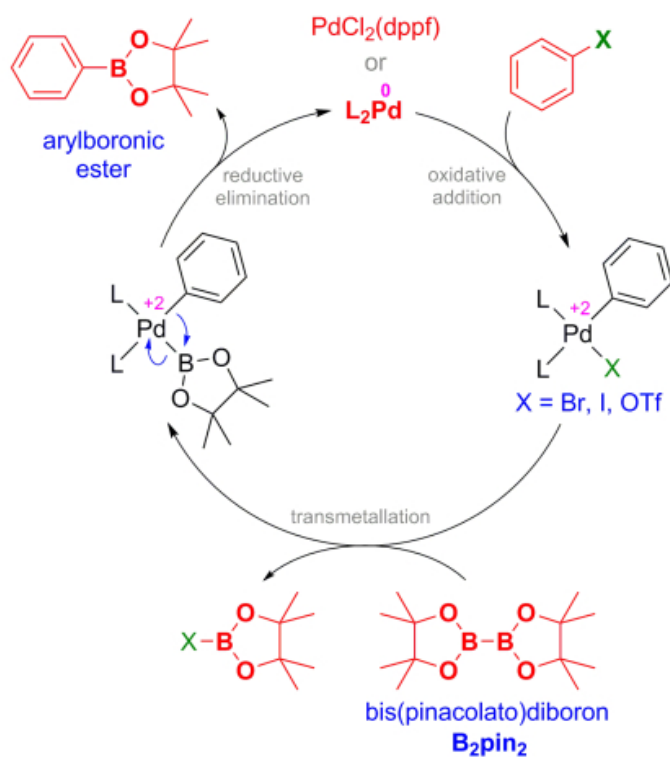
[1989]



79. Miyaura Borylation 1995

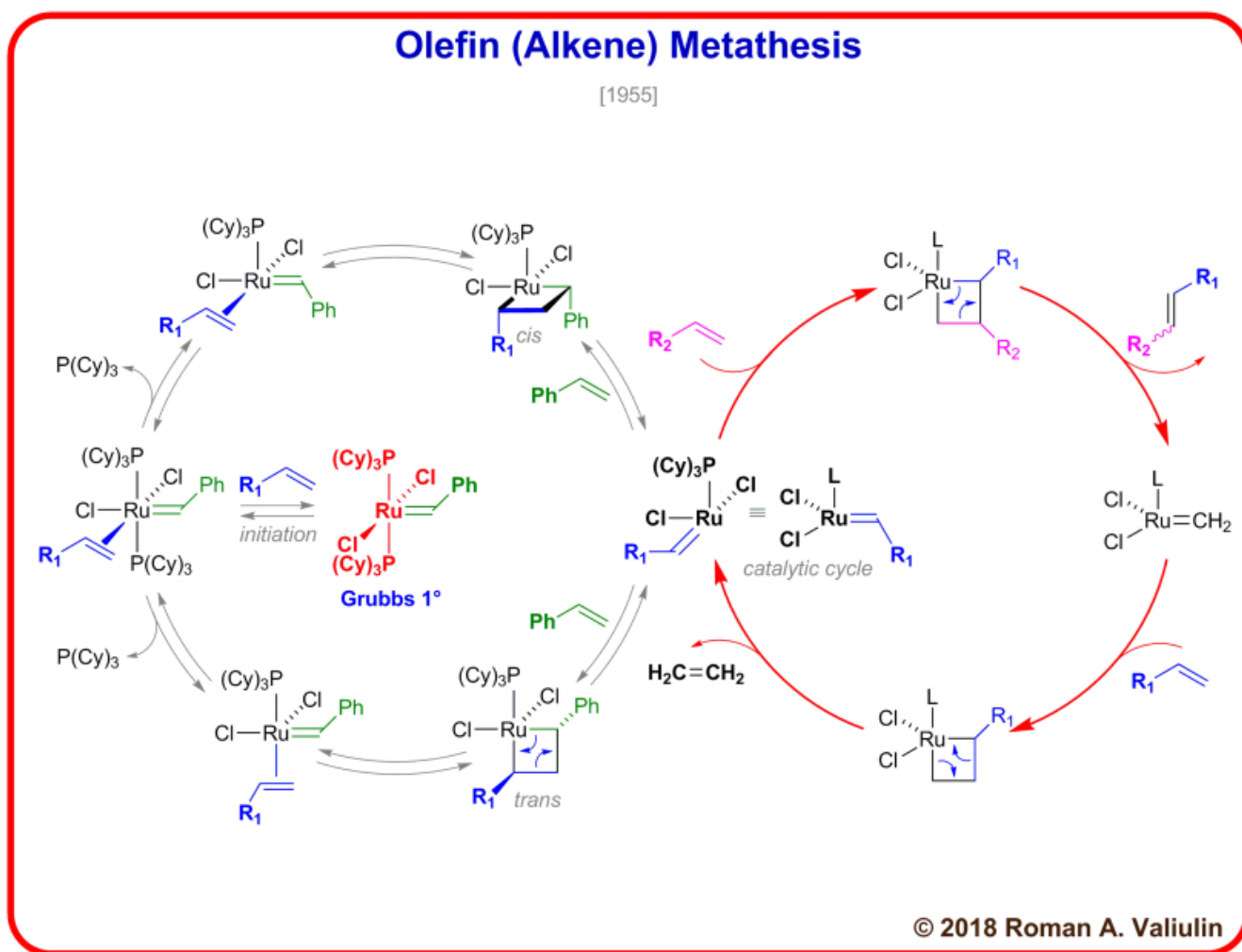
Miyaura Borylation

[1995]

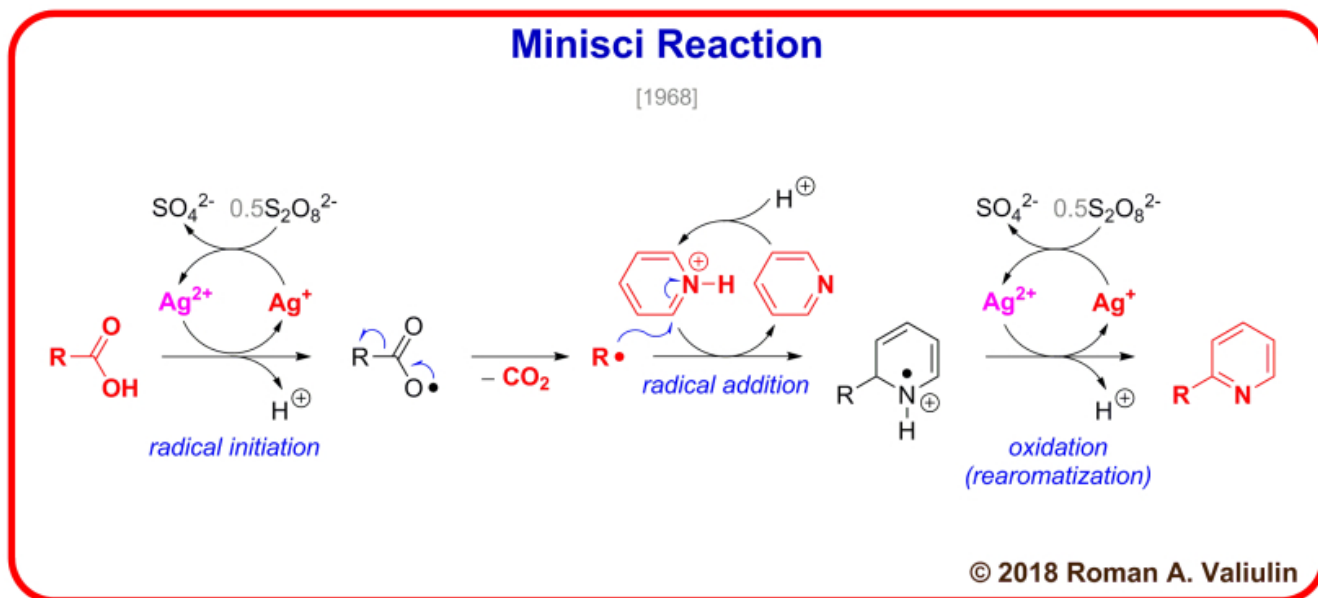


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80. Olefin (Alkene) Metathesis 1955

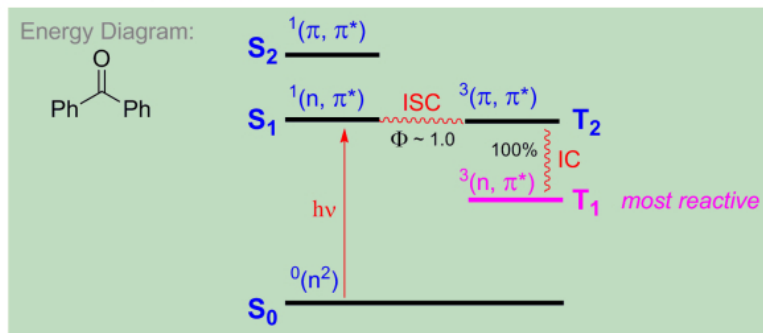
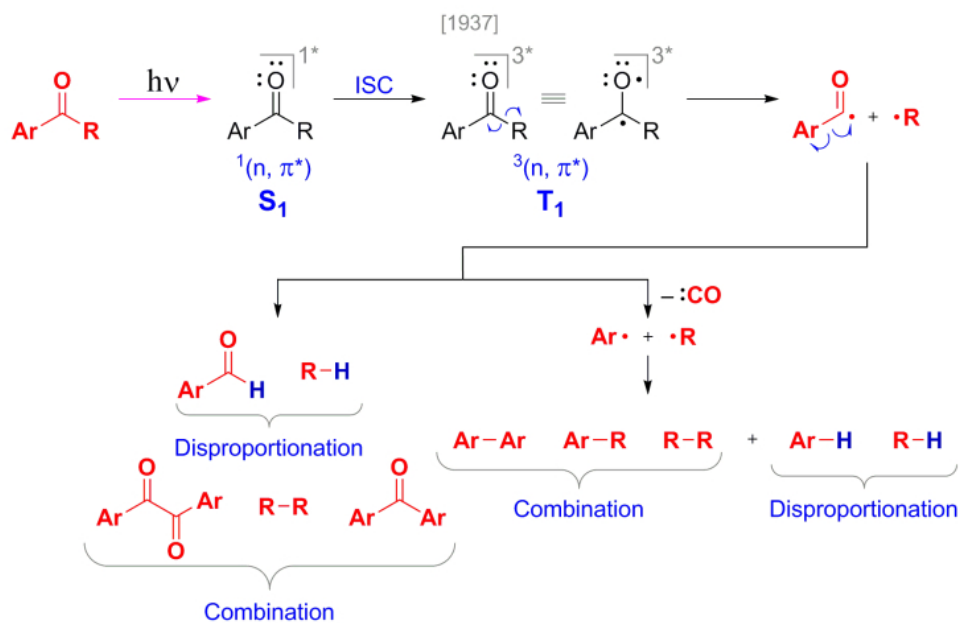


81. Minisci Reaction 1968

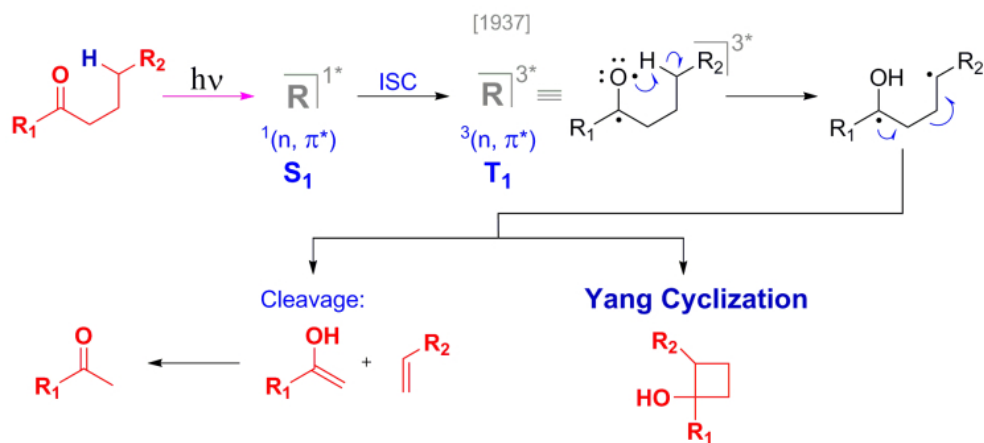


82. Norrish Type I and II Fragmentation 1937

Norrish Type I Fragmentation



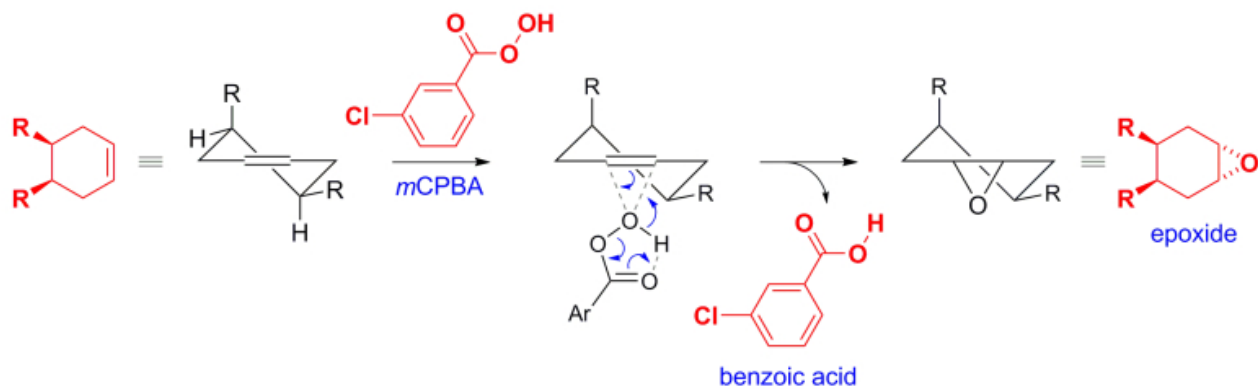
Norrish Type II Fragmentation



83. Prilezhaev Epoxidation 1909

Prilezhaev Epoxidation

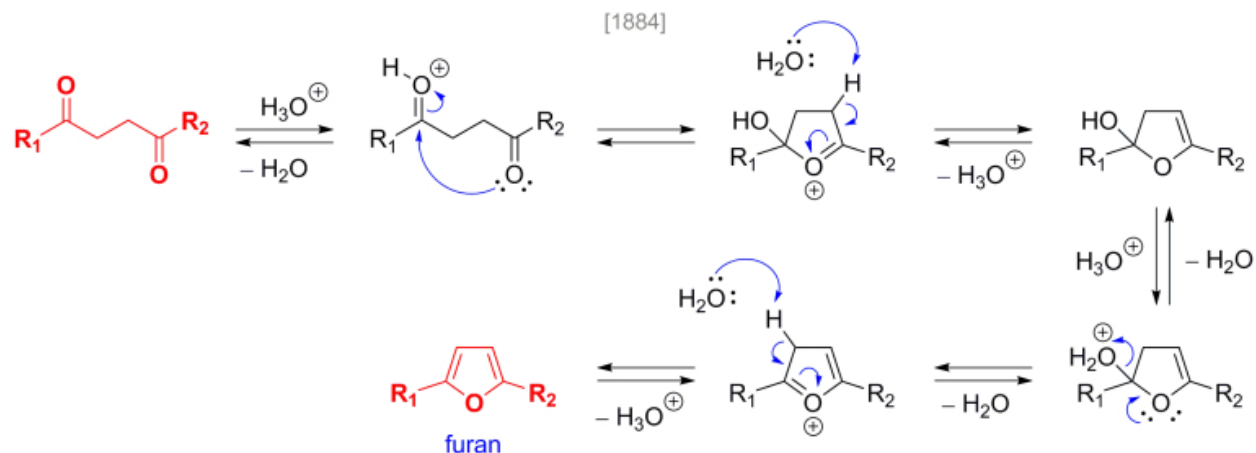
[1909]



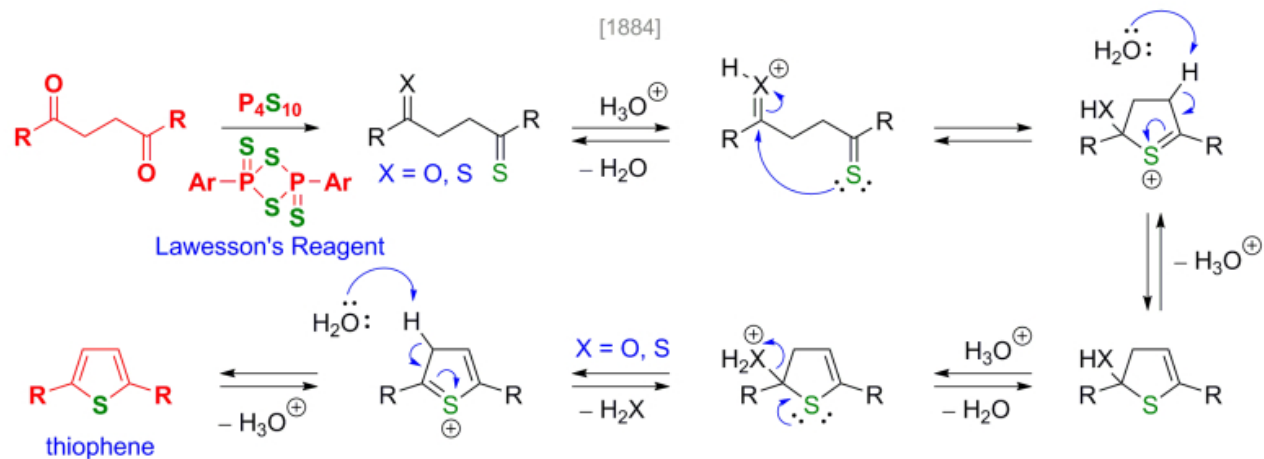
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84. Paal-Knorr Syntheses 1884

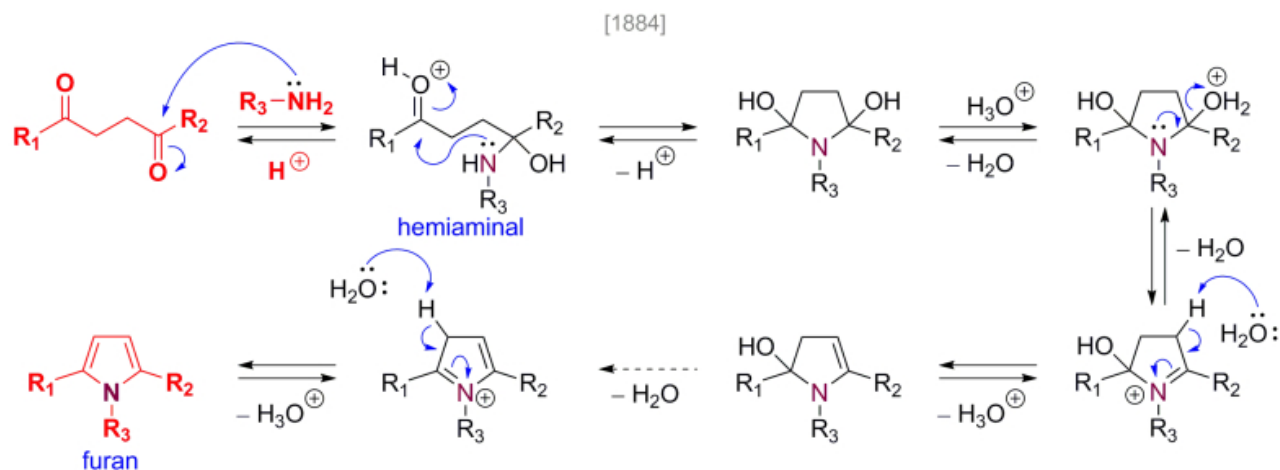
Paal-Knorr Furan Synthesis



Paal-Knorr Thiophene Synthesis



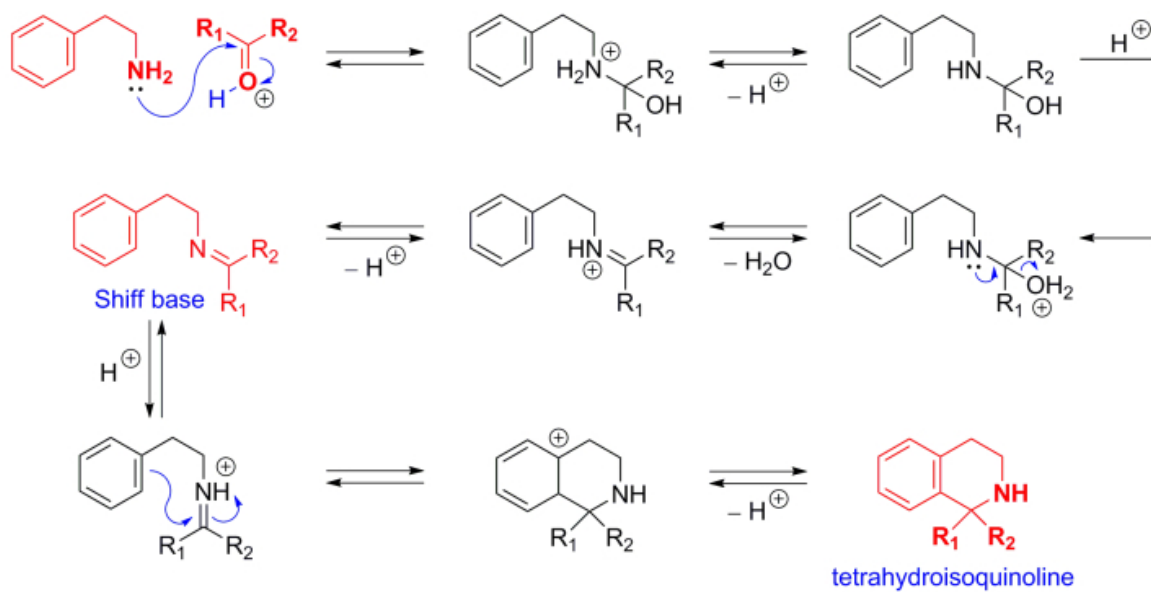
Paal-Knorr Pyrrole Synthesis



85. Pictet-Spengler Reaction 1911

Pictet-Spengler Reaction

[1911]



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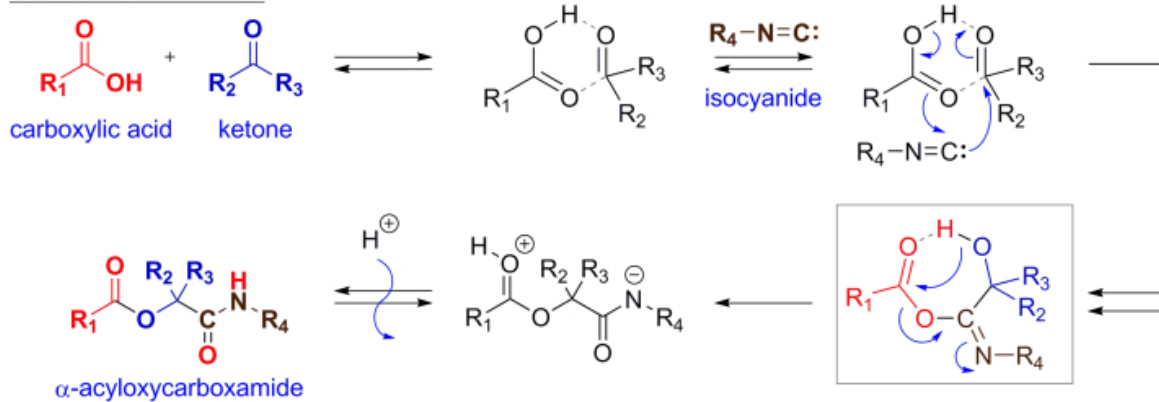
86. Passerini Three-Component Reaction 1921

Passerini Reaction

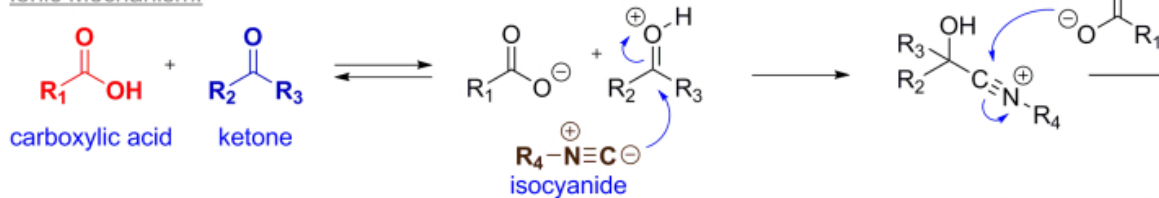
3-Component Reaction (3-CR)

[1921]

Concerted Mechanism:



Ionic Mechanism:

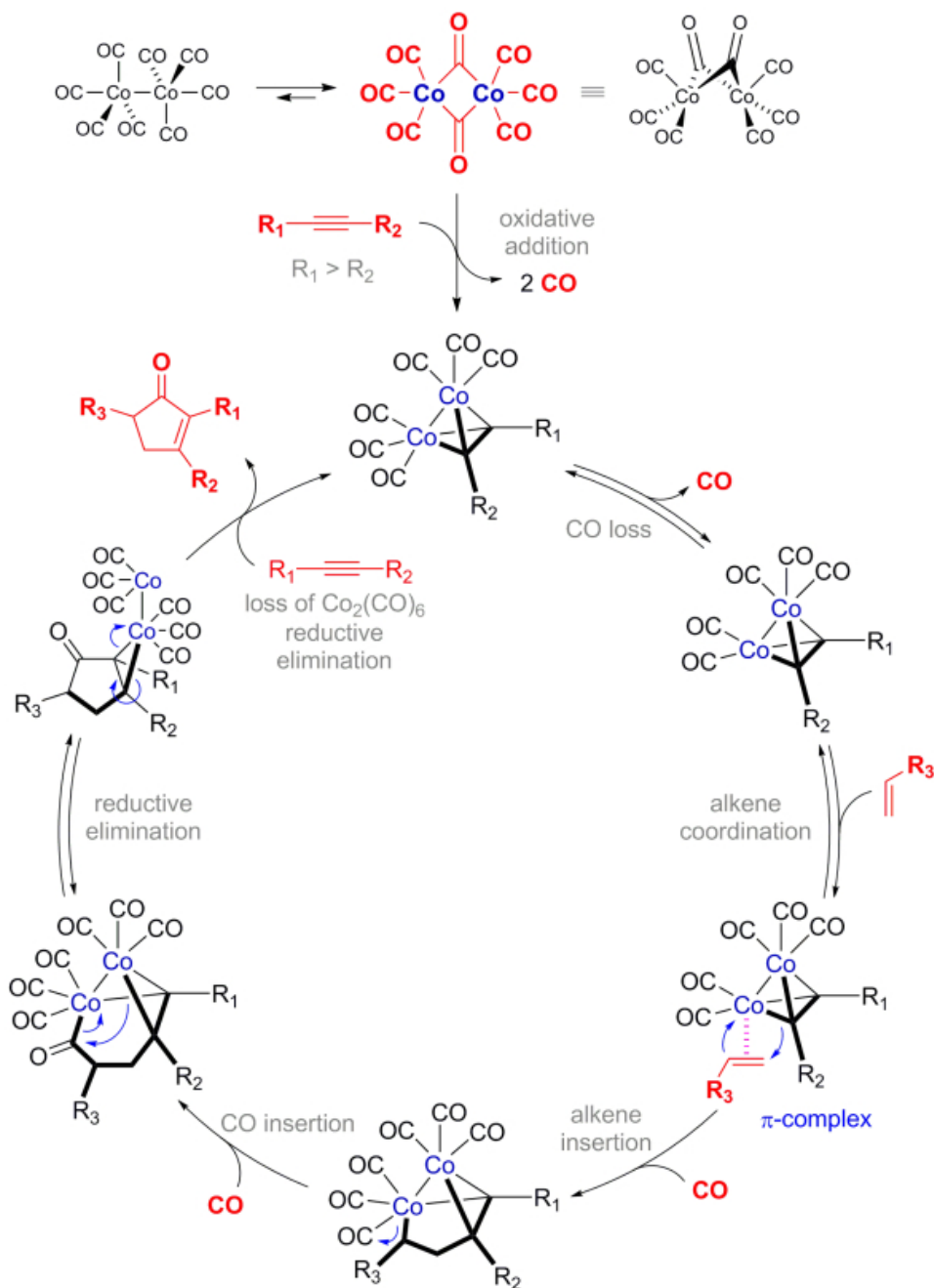


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87. Pauson-Khand Reaction 1977

Pauson-Khand Reaction

[1977]



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88. Nucleophilic Substitution

Nucleophilic Substitution

(see Finkelstein Reaction)

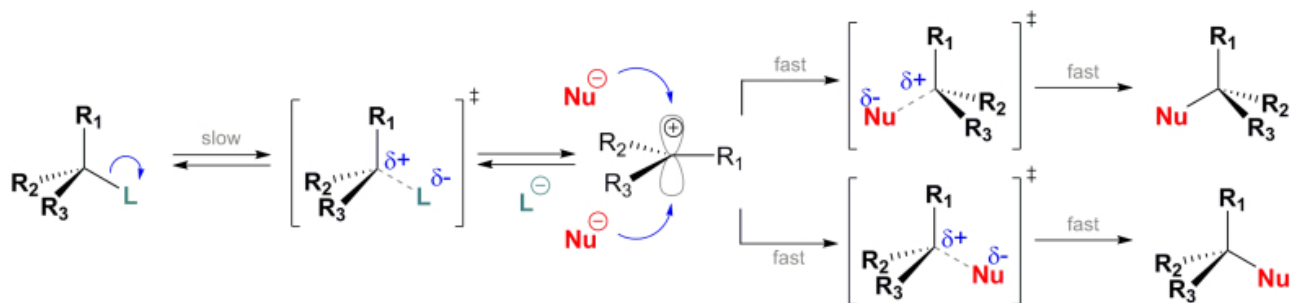
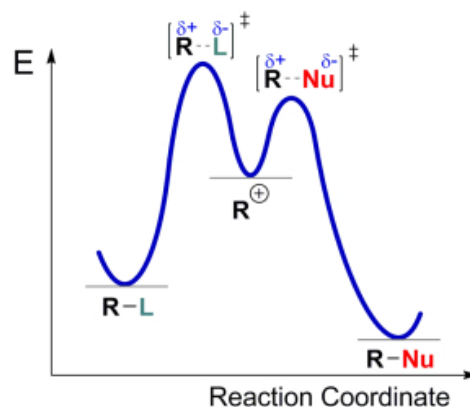


Unimolecular Nucleophilic Substitution

$$\text{rate} = k[\text{R-L}]$$

L = Cl, Br, I, OSO₂R', OTf, OMs, OTs, OBs, ONs

3° > 2° > 1°

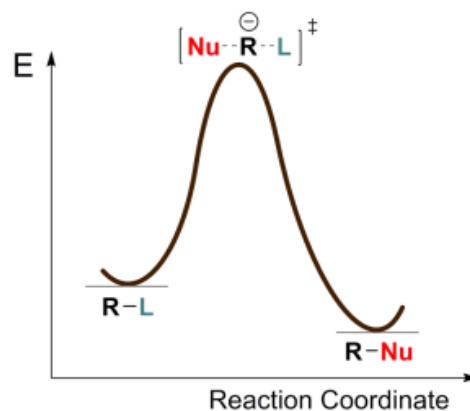


Bimolecular Nucleophilic Substitution

$$\text{rate} = k[\text{Nu}][\text{R-L}]$$

L = Cl, Br, I, OSO₂R', OTf, OMs, OTs, OBs, ONs

1° > 2° > 3°

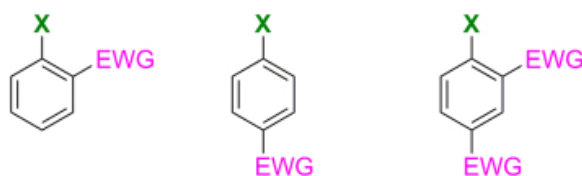
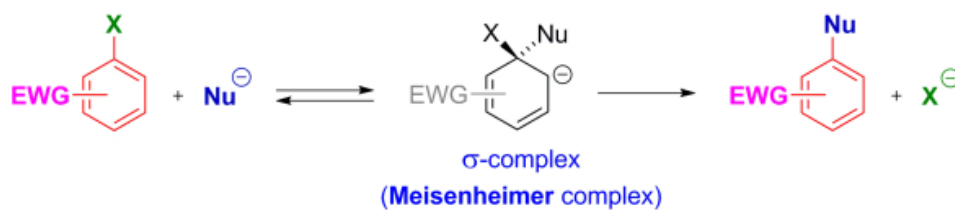


89. Nucleophilic Aromatic Substitution

Nucleophilic Aromatic Substitution

Bimolecular Nucleophilic Aromatic Substitution
(addition-elimination)

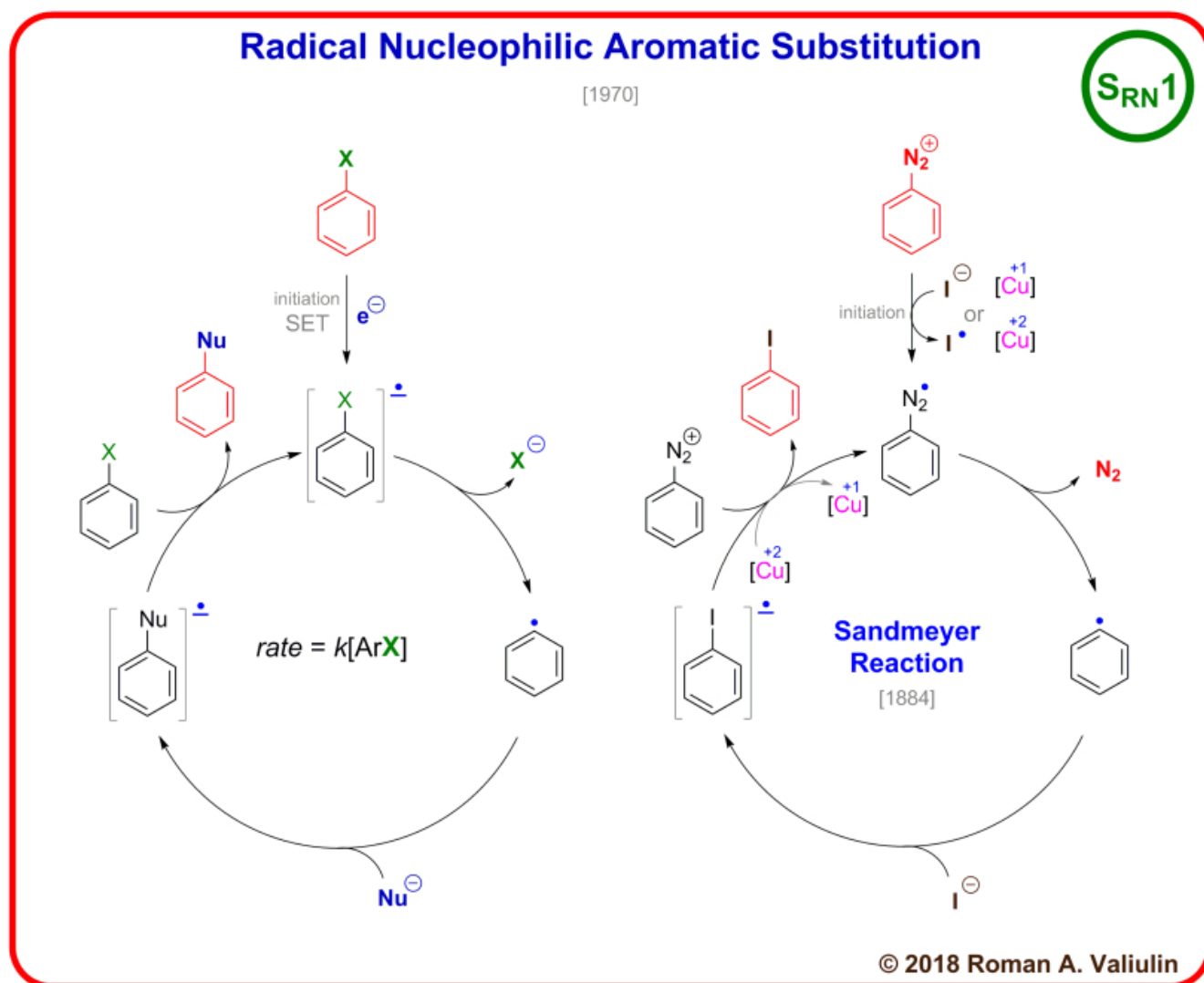
$$\text{rate} = k[\text{Nu}][\text{ArX}]$$



Electron **W**ithdrawing **G**roup
 $\text{NO}_2, \text{SO}_2\text{R}, \text{CN}, \text{N}_2^+$

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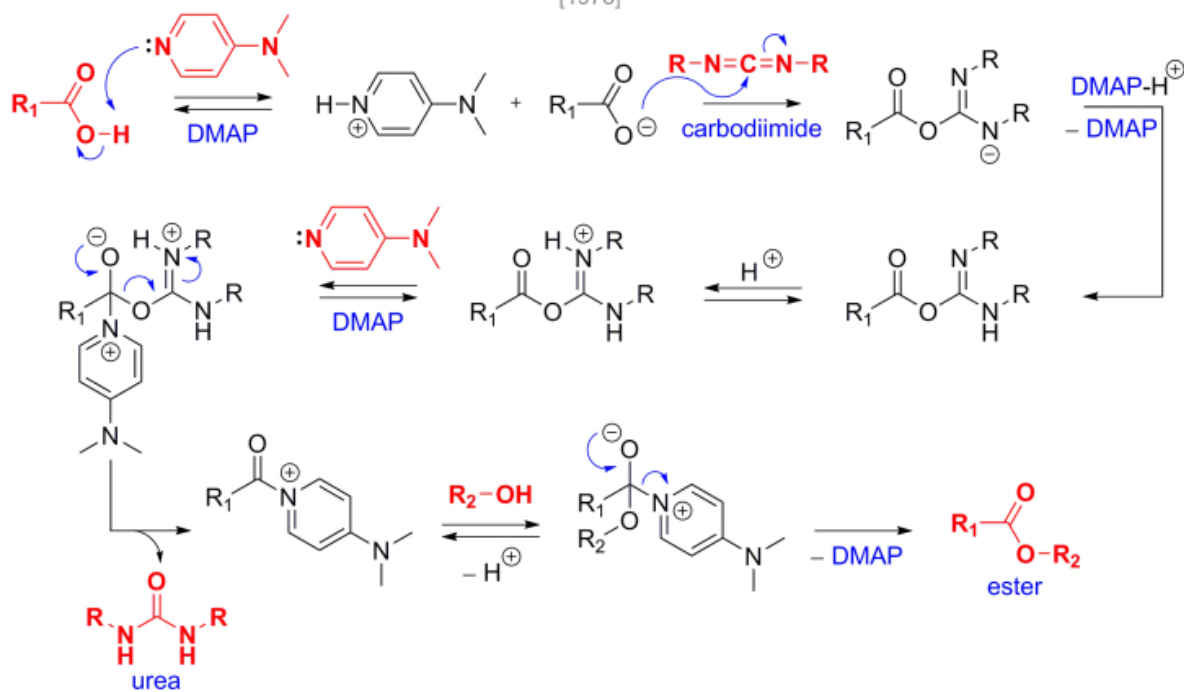
90. Radical Nucleophilic Aromatic Substitution 1970



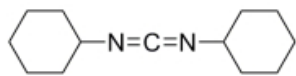
91. Steglich Esterification 1978

Steglich Esterification

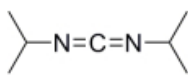
[1978]



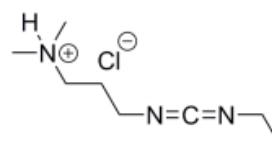
Carbodiimide reagent:



DCC



DIC



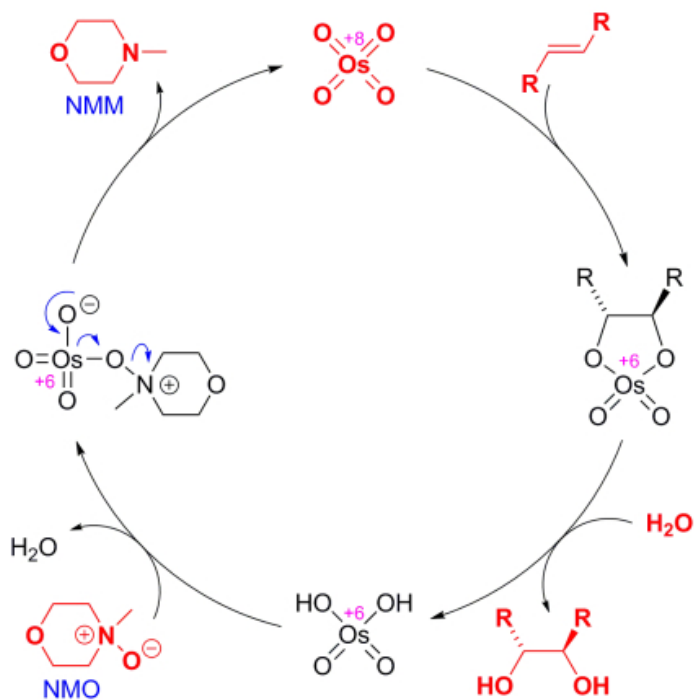
EDC

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92. Upjohn Dihydroxylation 1976

Upjohn Dihydroxylation

[1976]



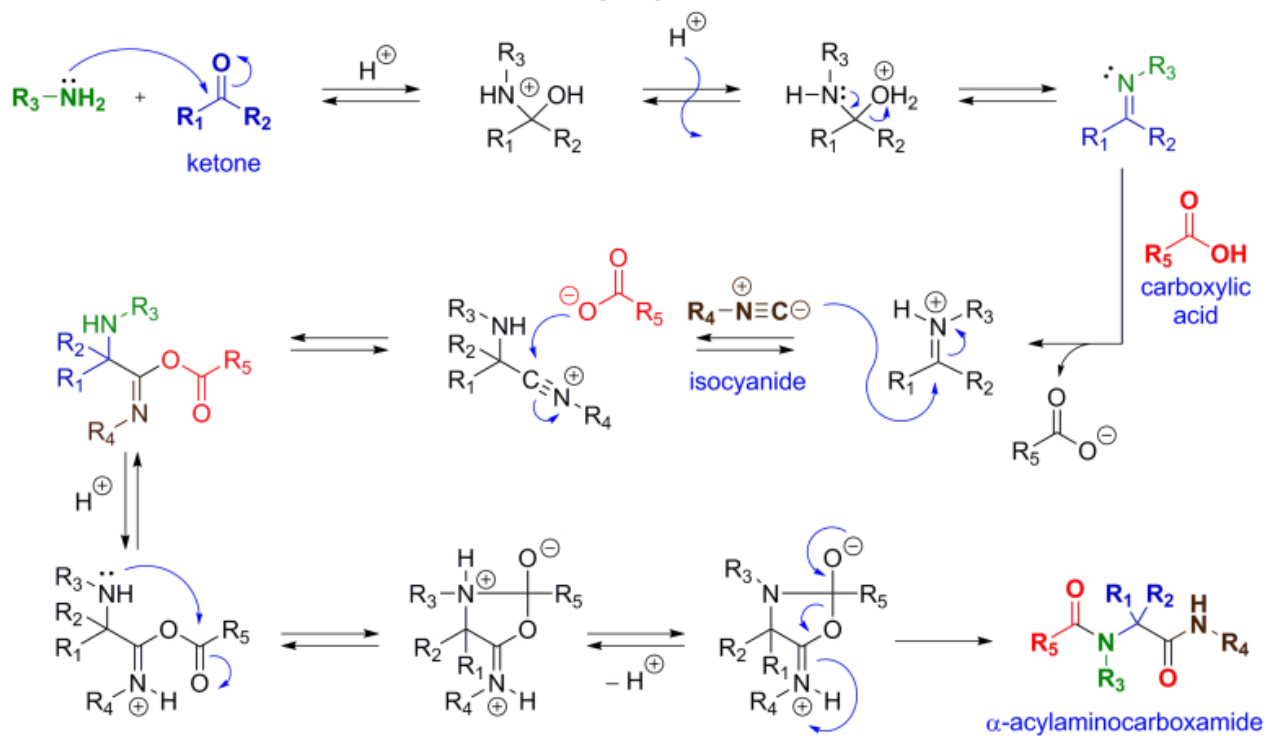
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93. Ugi Reaction 1959

Ugi Reaction

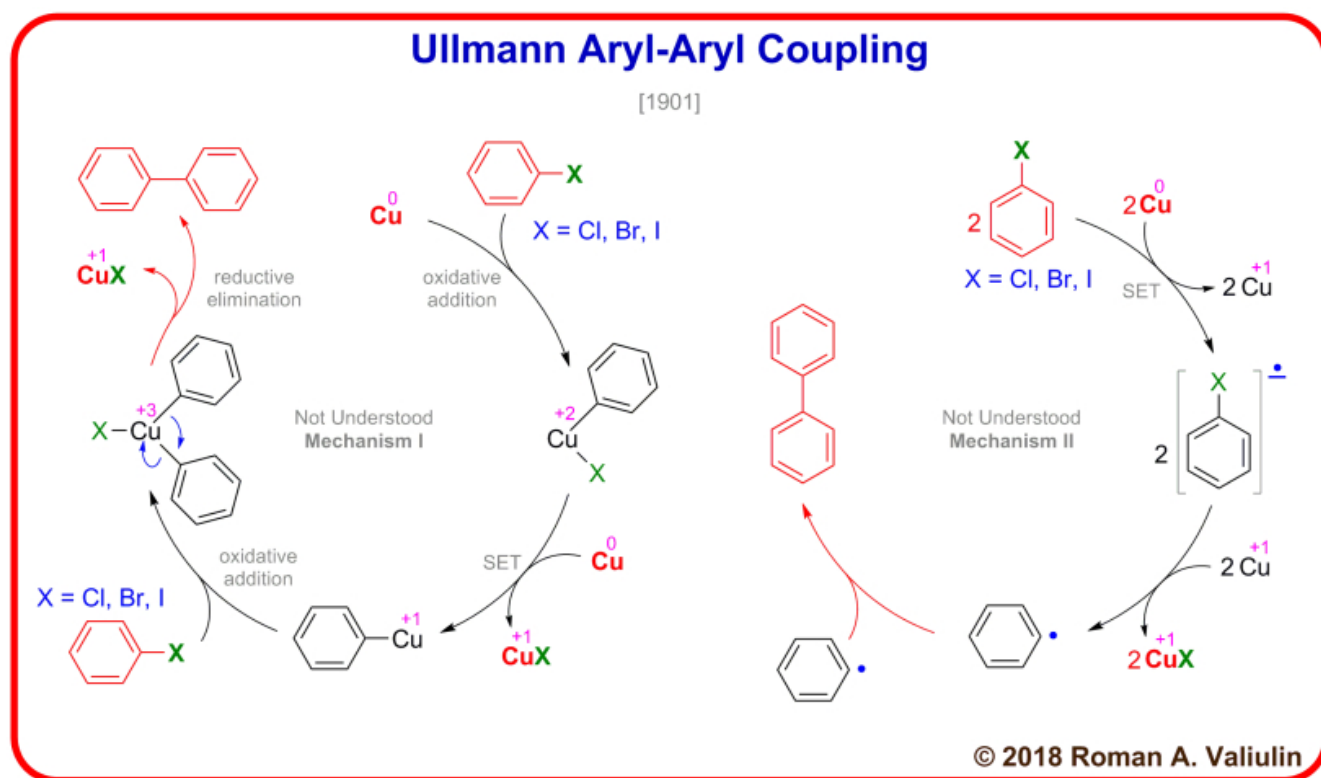
4-Component Reaction (4-CR)

[1959]



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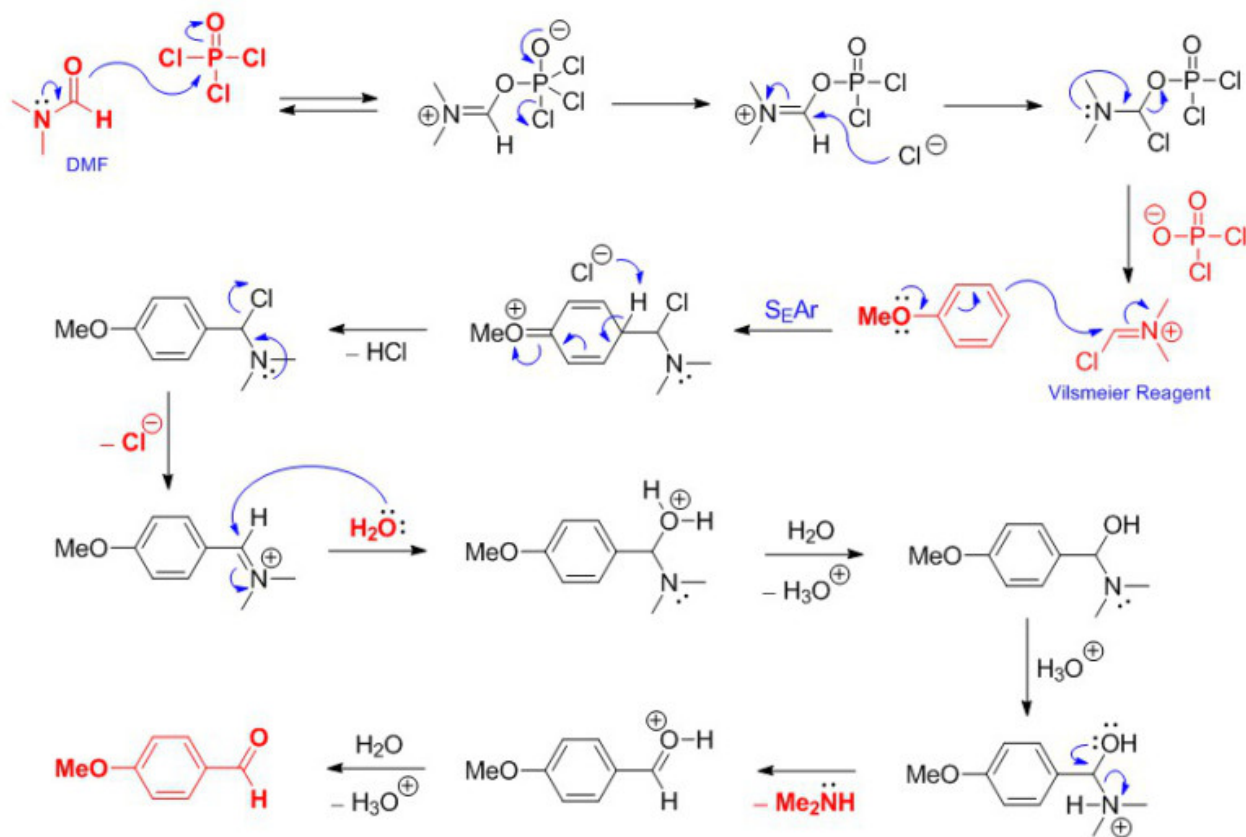
94. Ullmann Aryl-Aryl Coupling 1901



95. Vilsmeier-Haak Formylation 1927

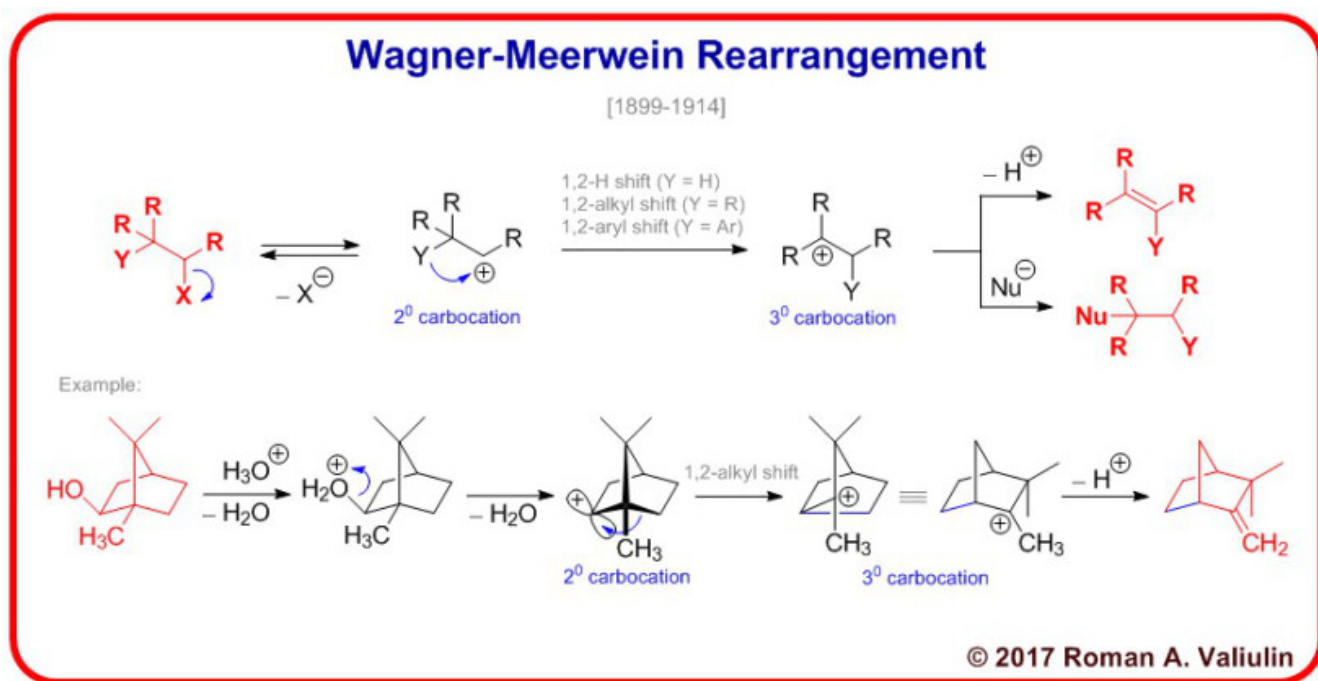
Vilsmeier-Haak Formylation

[1927]

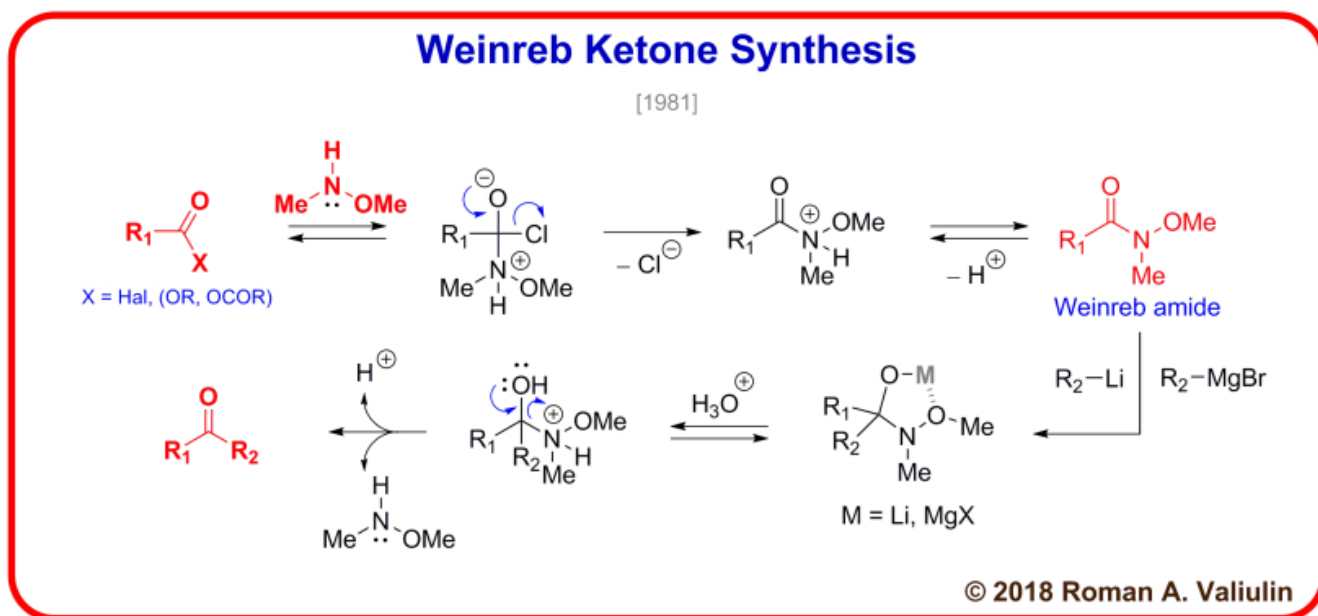


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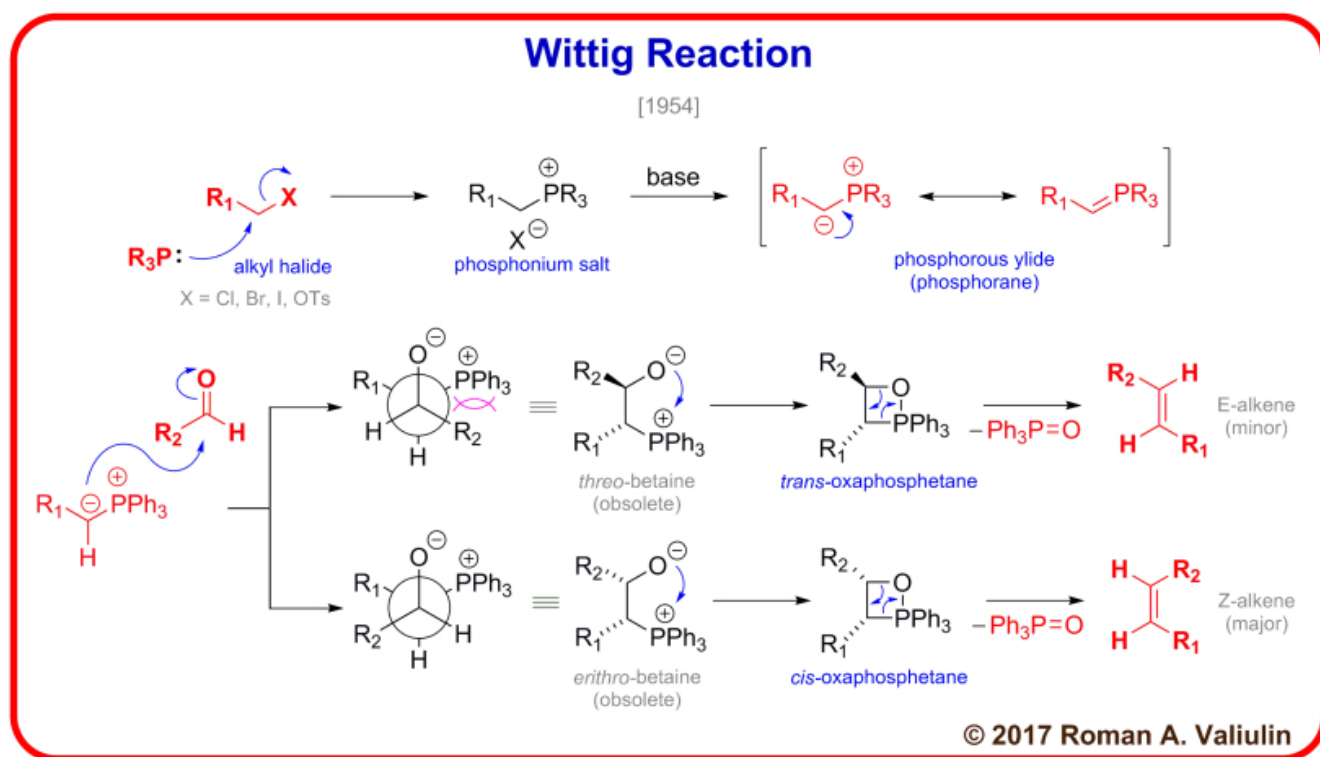
96. Wagner-Meerwein Rearrangement (1899–1914)



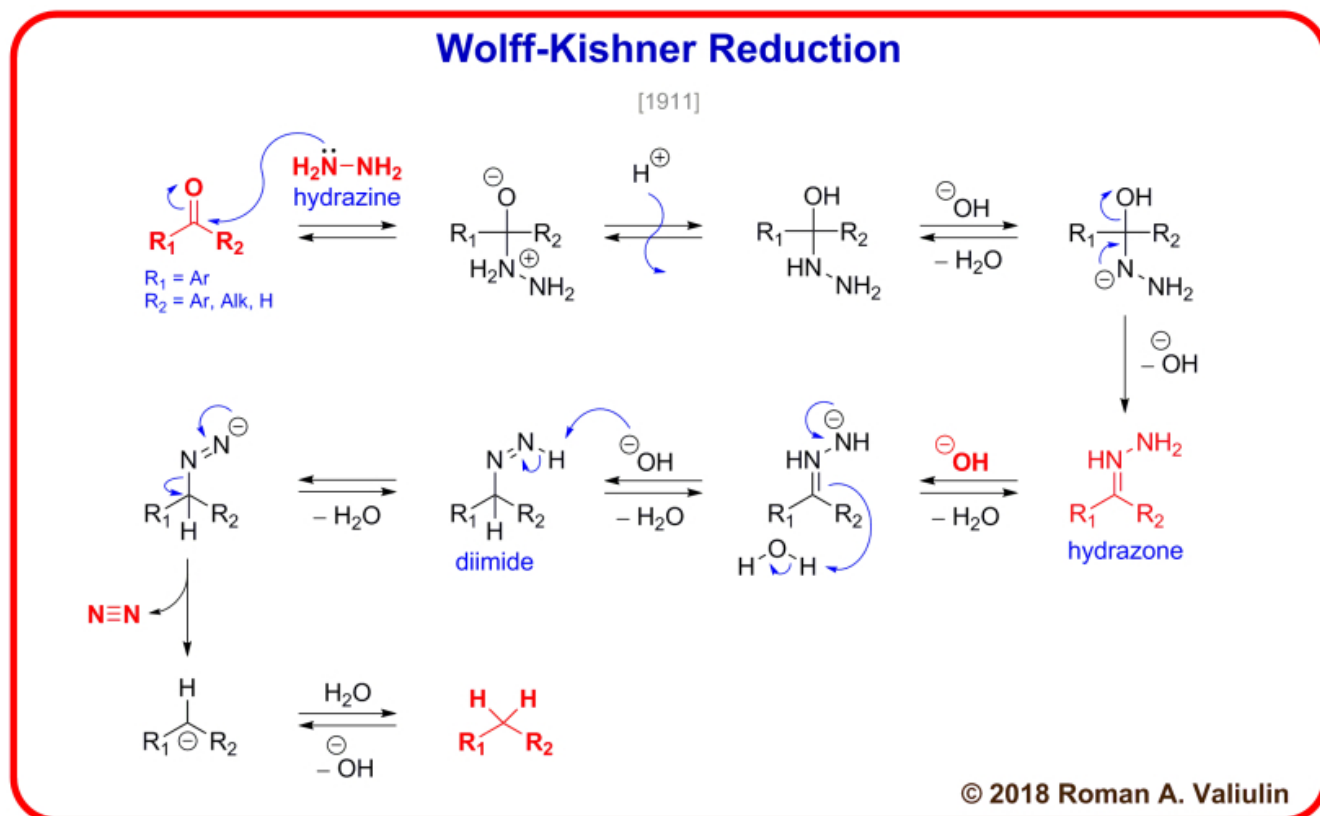
97. Weinreb Ketone Synthesis 1981



98. Wittig Reaction 1954



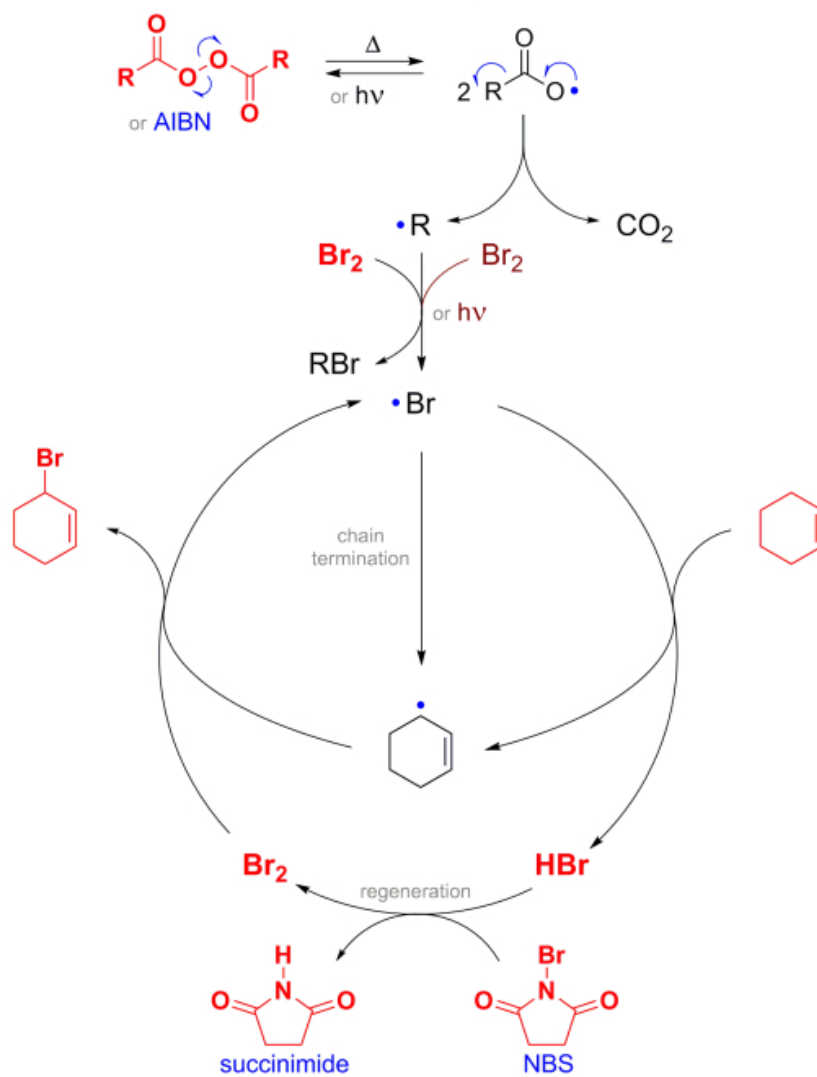
99. Wolff-Kishner Reduction 1911



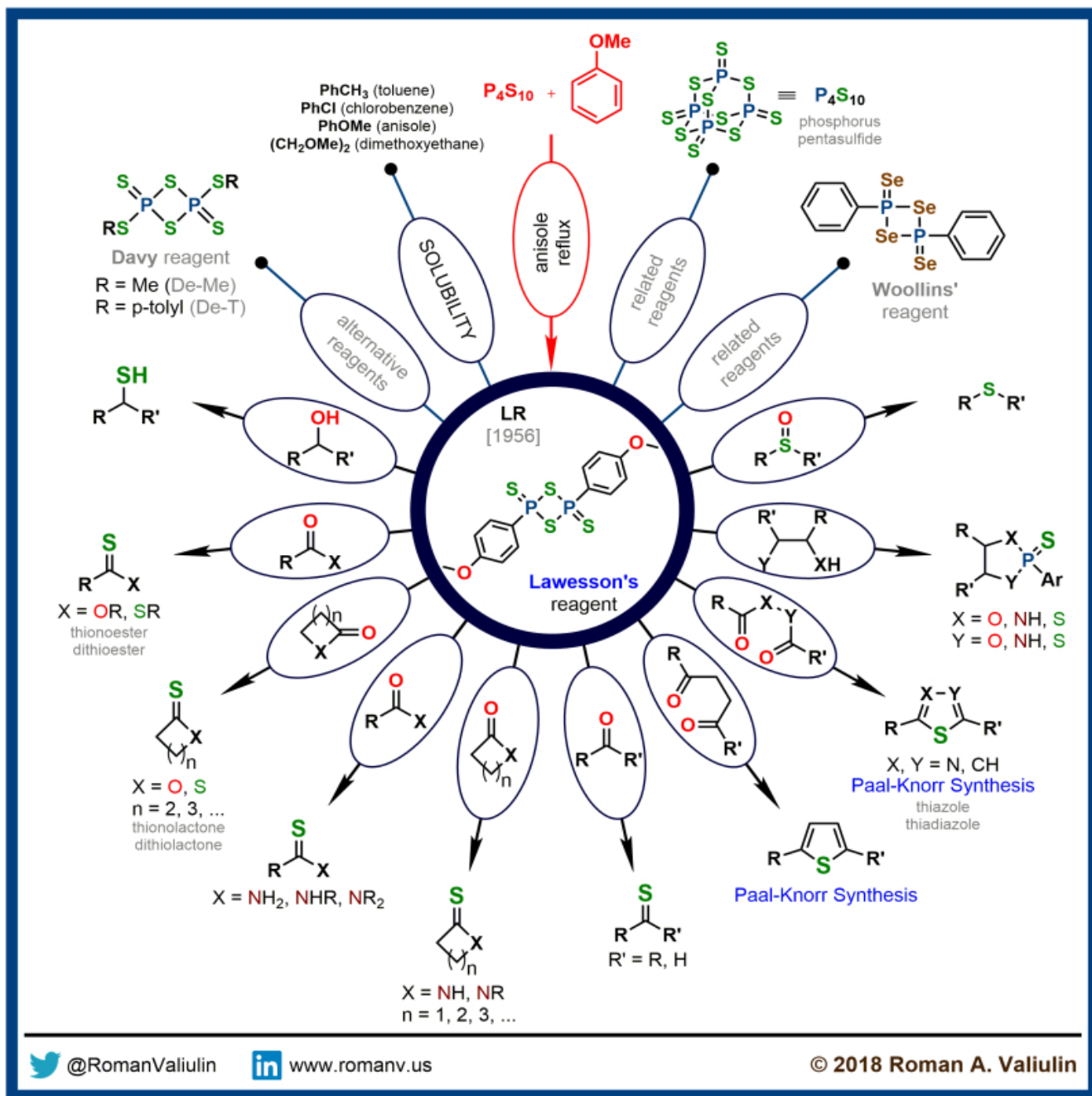
100. Wohl-Ziegler Reaction (1919–1942)

Wohl-Ziegler Reaction

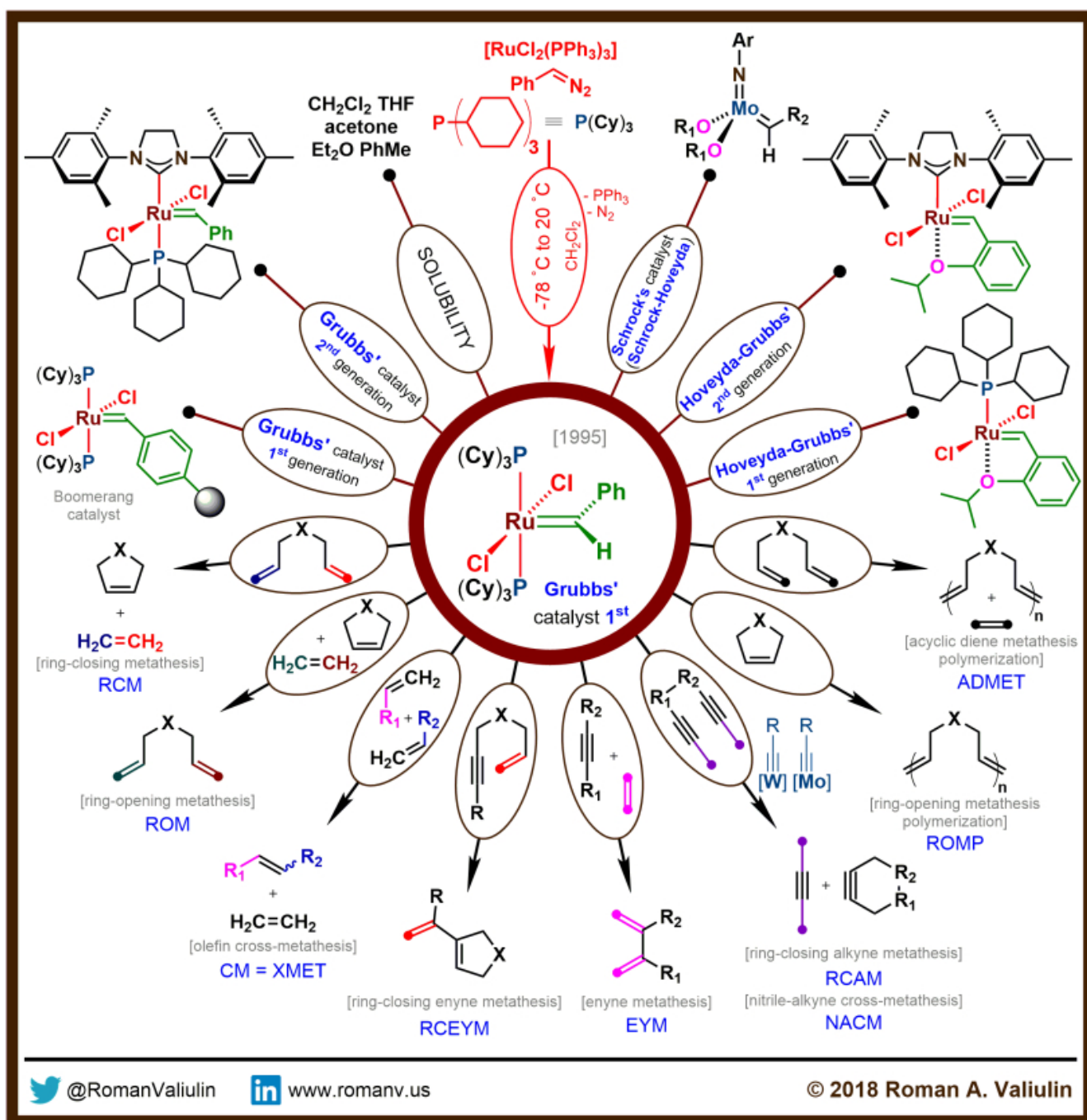
[1919-1942]



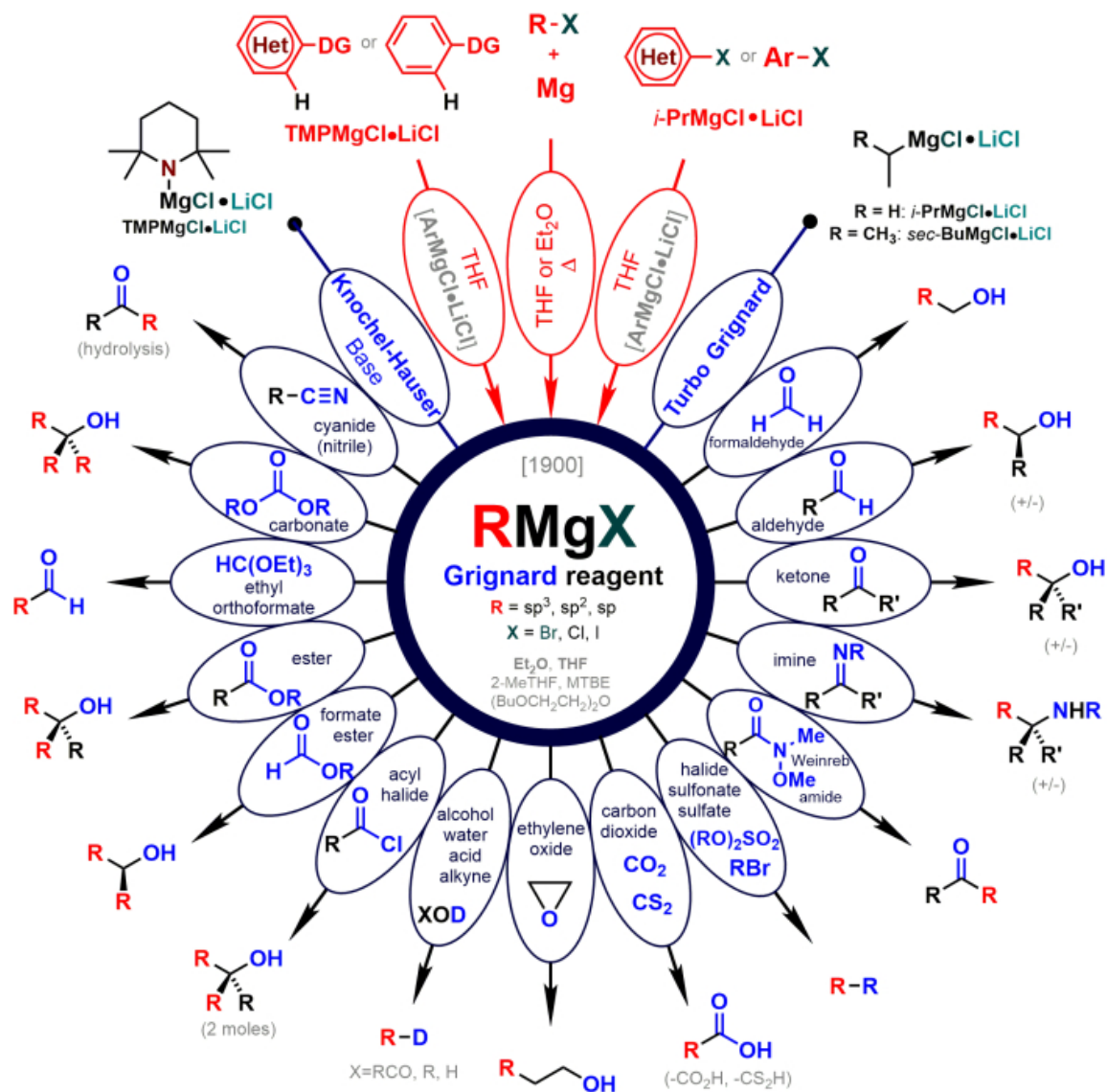
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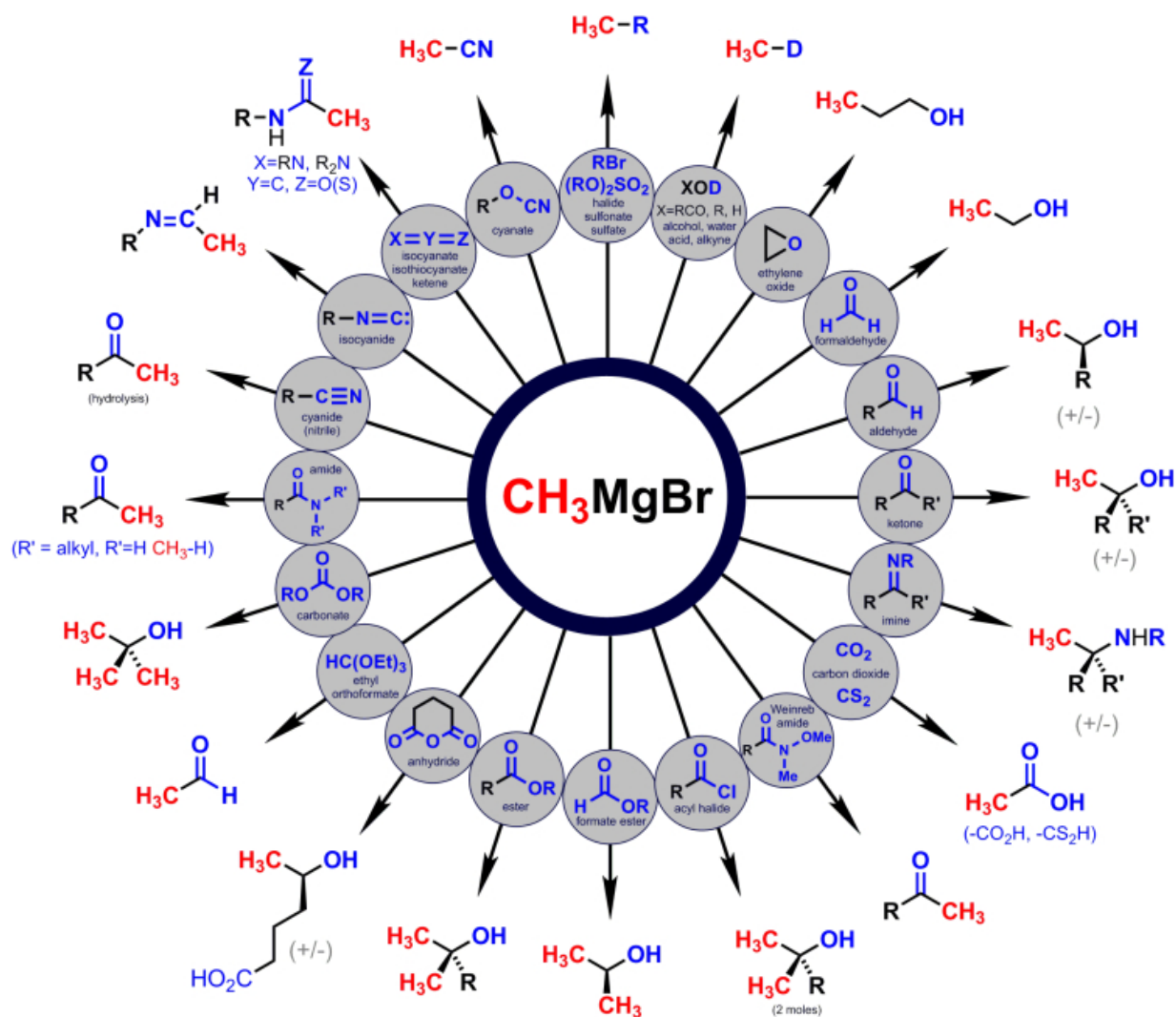
2. Grubbs' Catalyst First Generation 1995



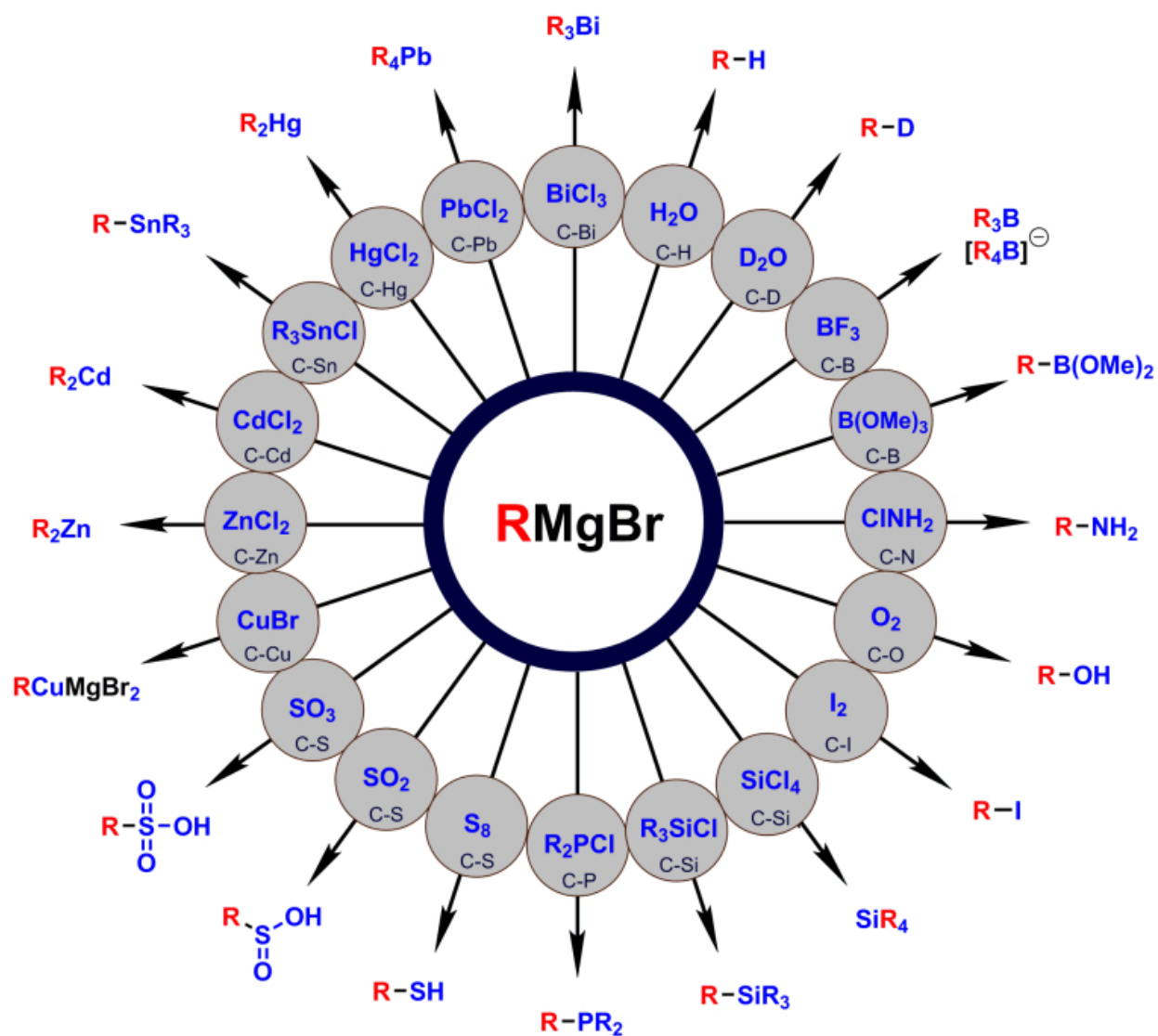
3. Grignard Reagent 1900



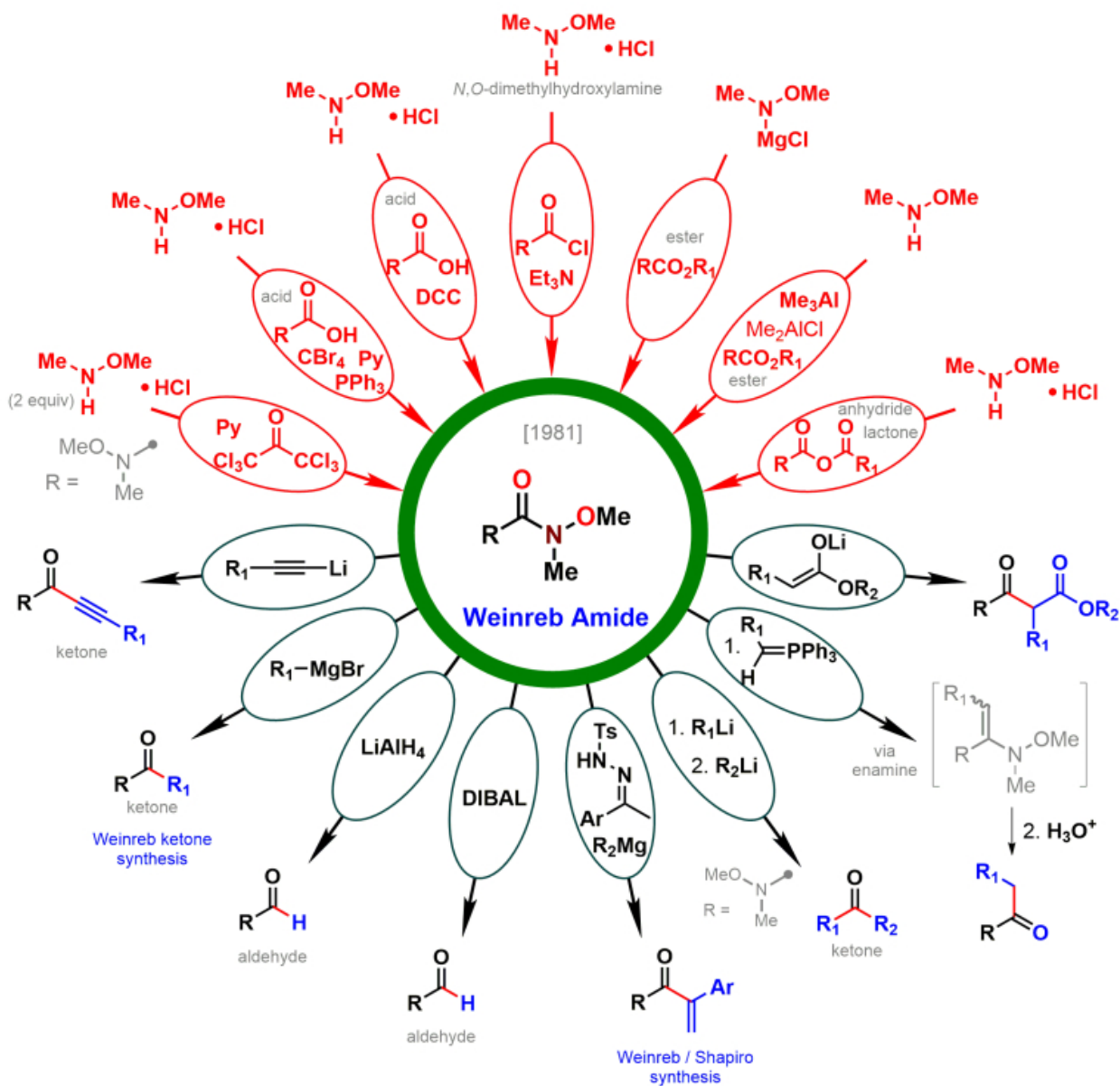
Grignard Reagent C-C Bond



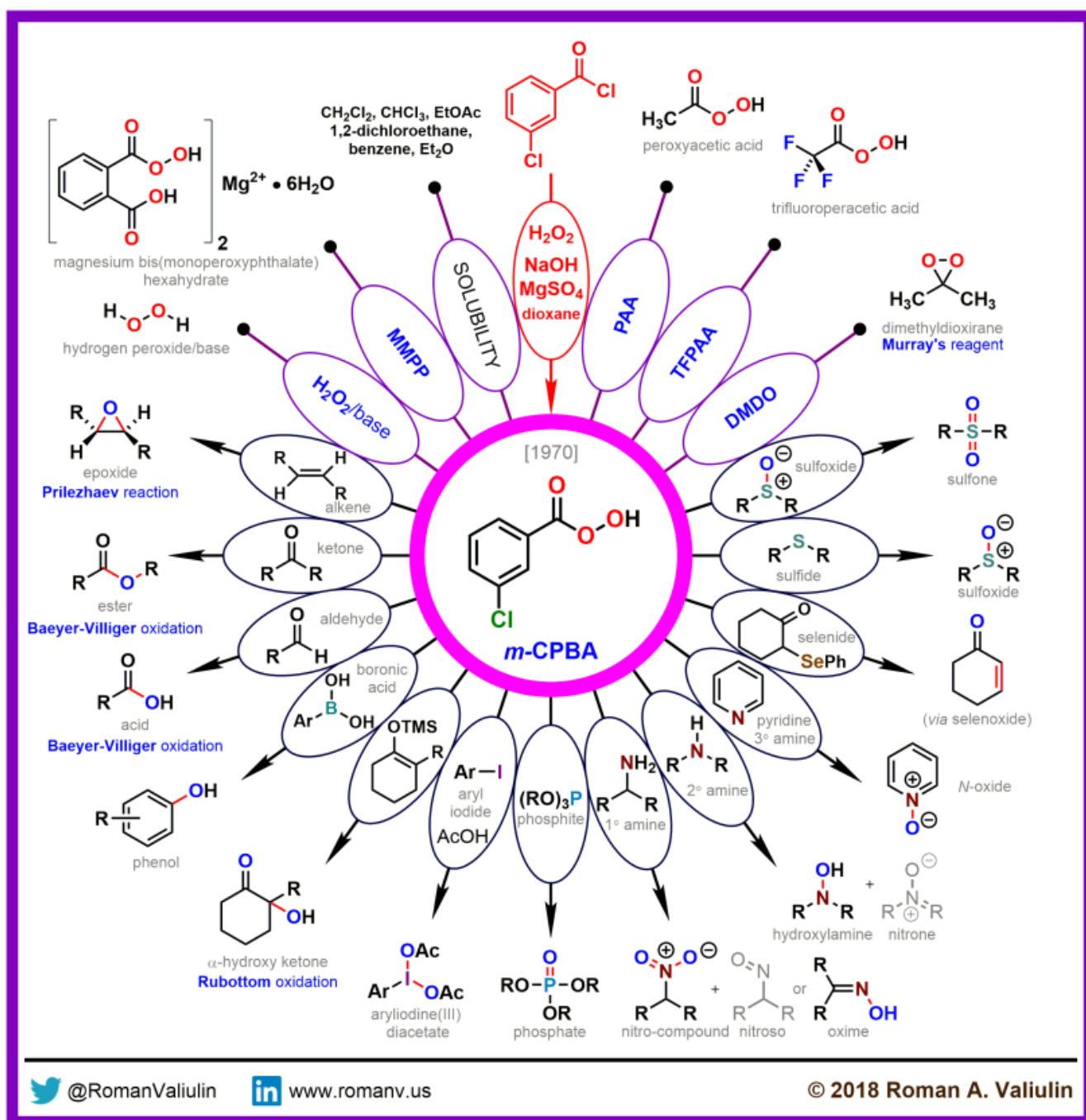
Grignard Reagent C-X Bond



4. Weinreb Amide 1981

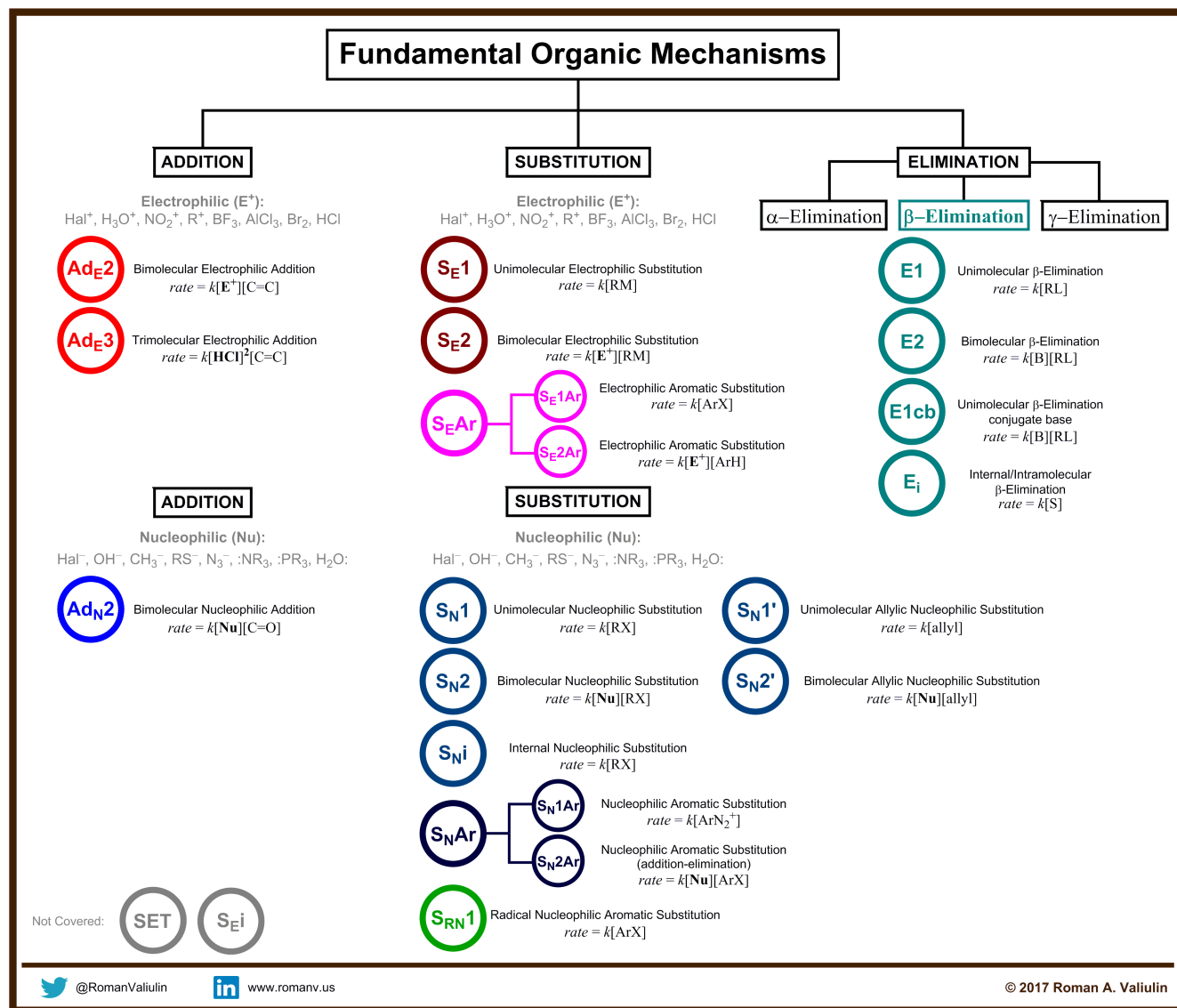


5. 3-Chloroperoxybenzoic Acid – mCPBA 1970

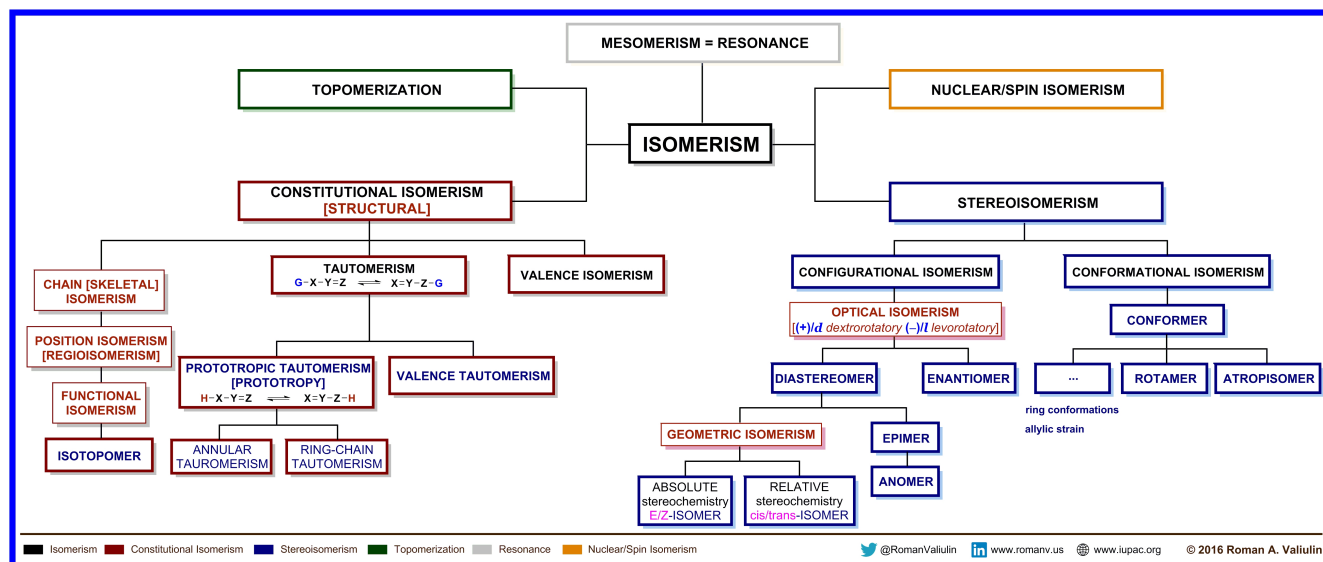


III. Misc

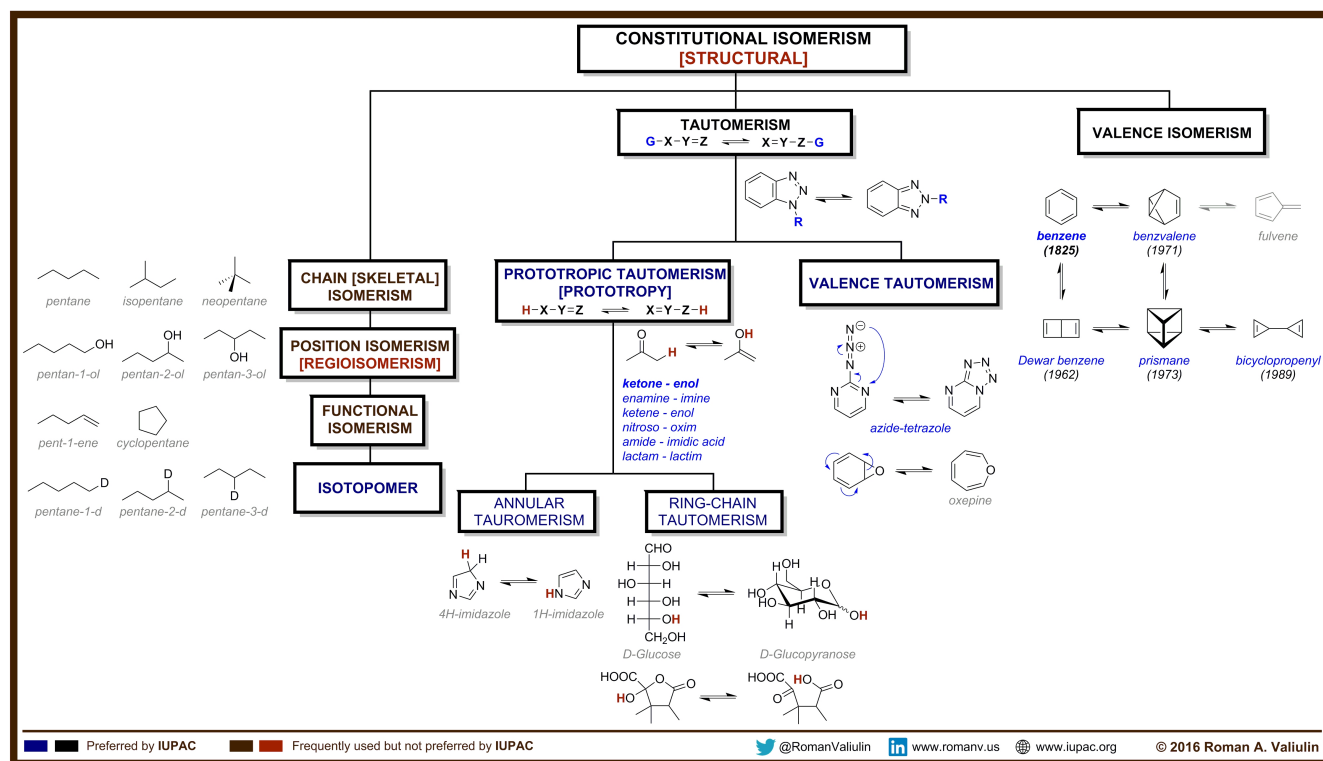
1. Fundamental Organic Mechanisms



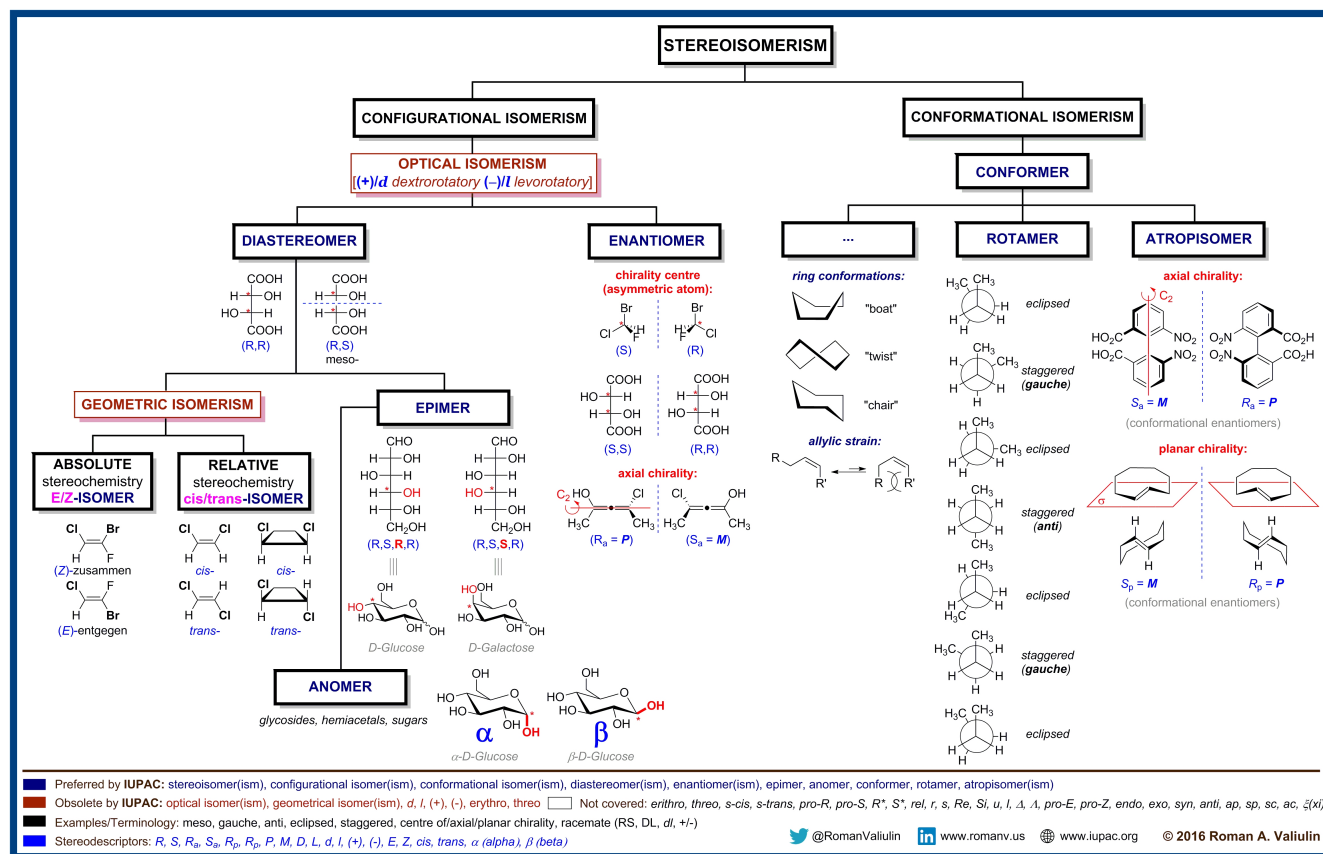
2. Isomerism



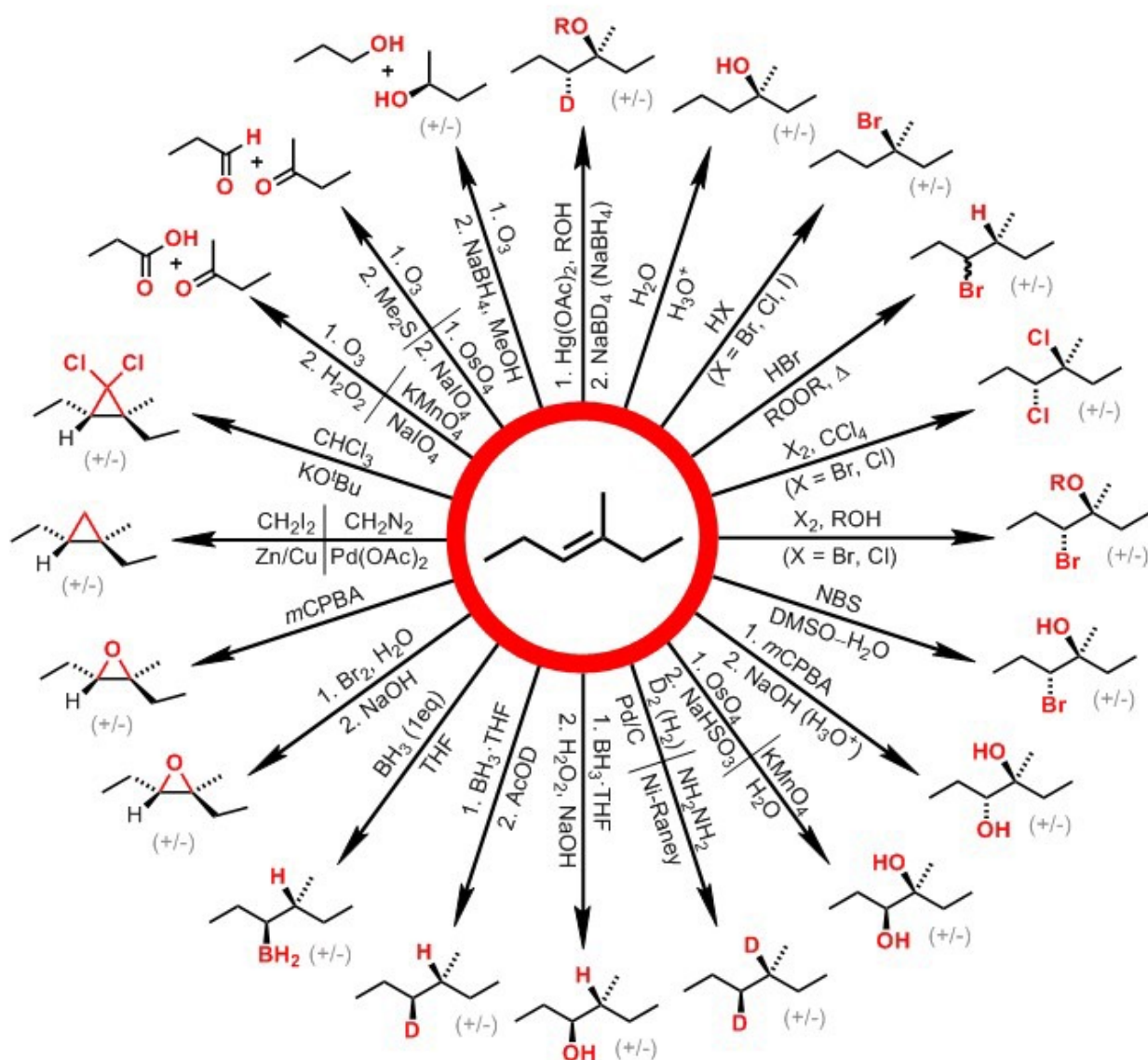
3. Constitutional Isomerism



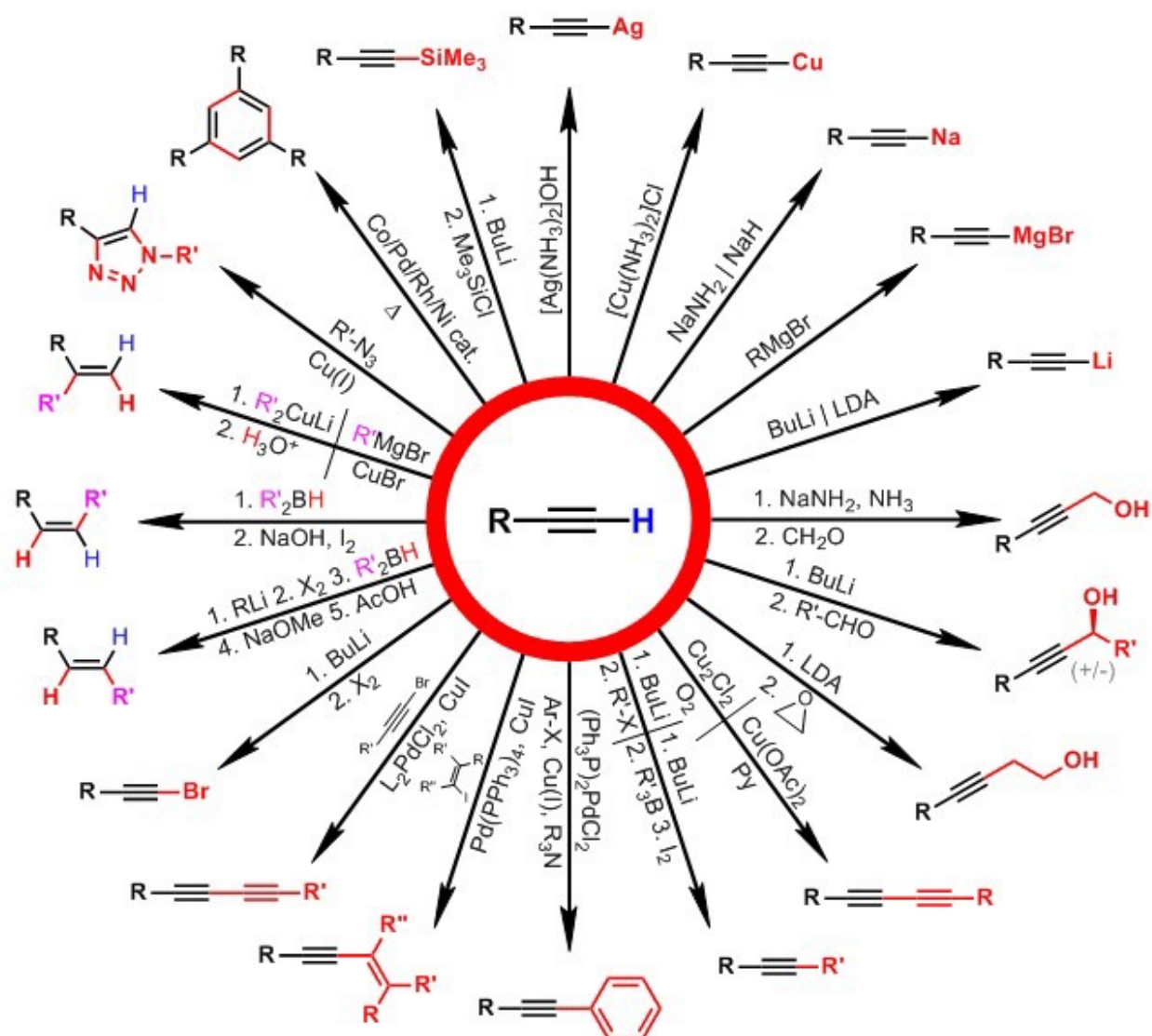
4. Stereoisomerism



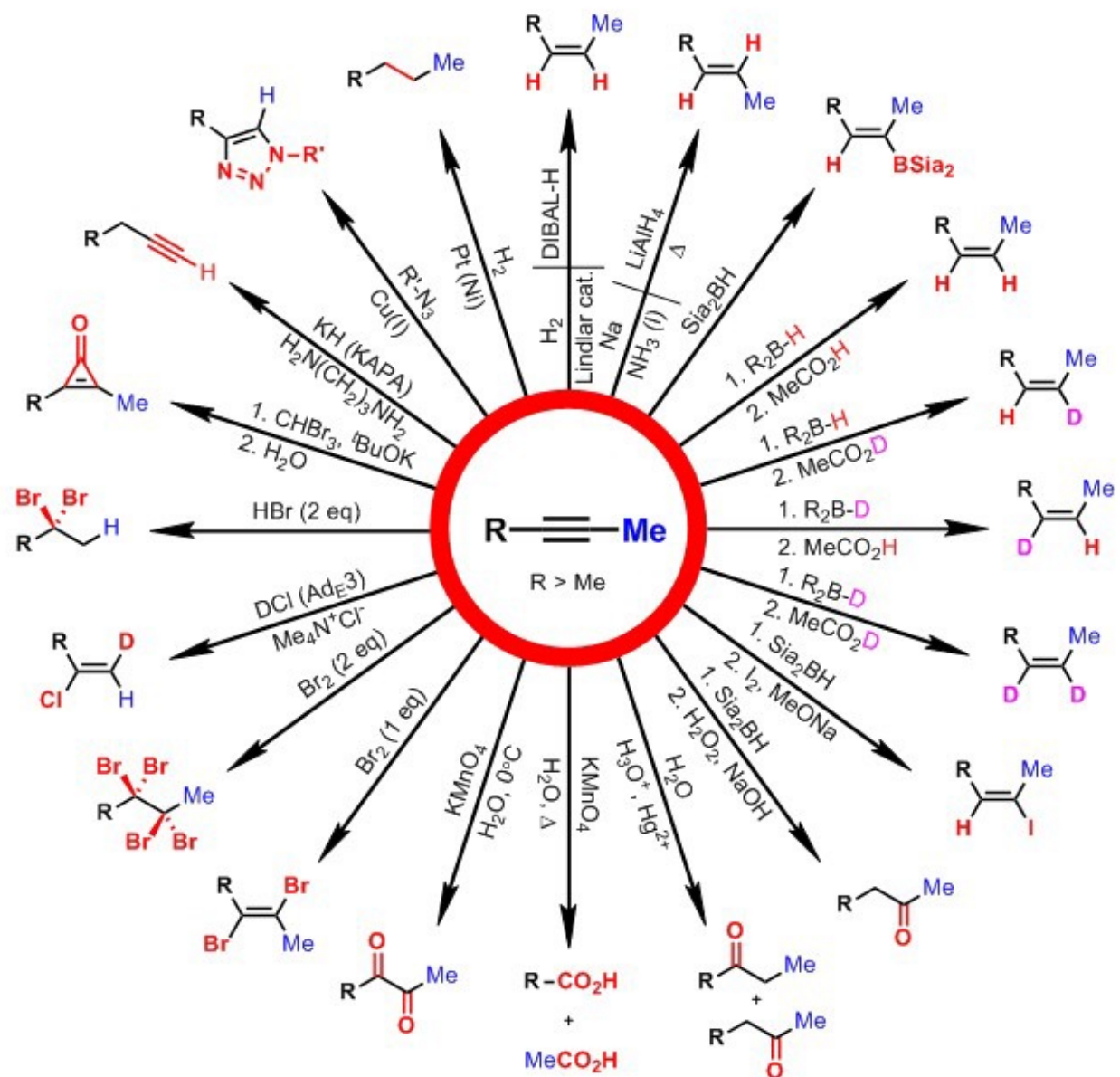
5. Alkenes



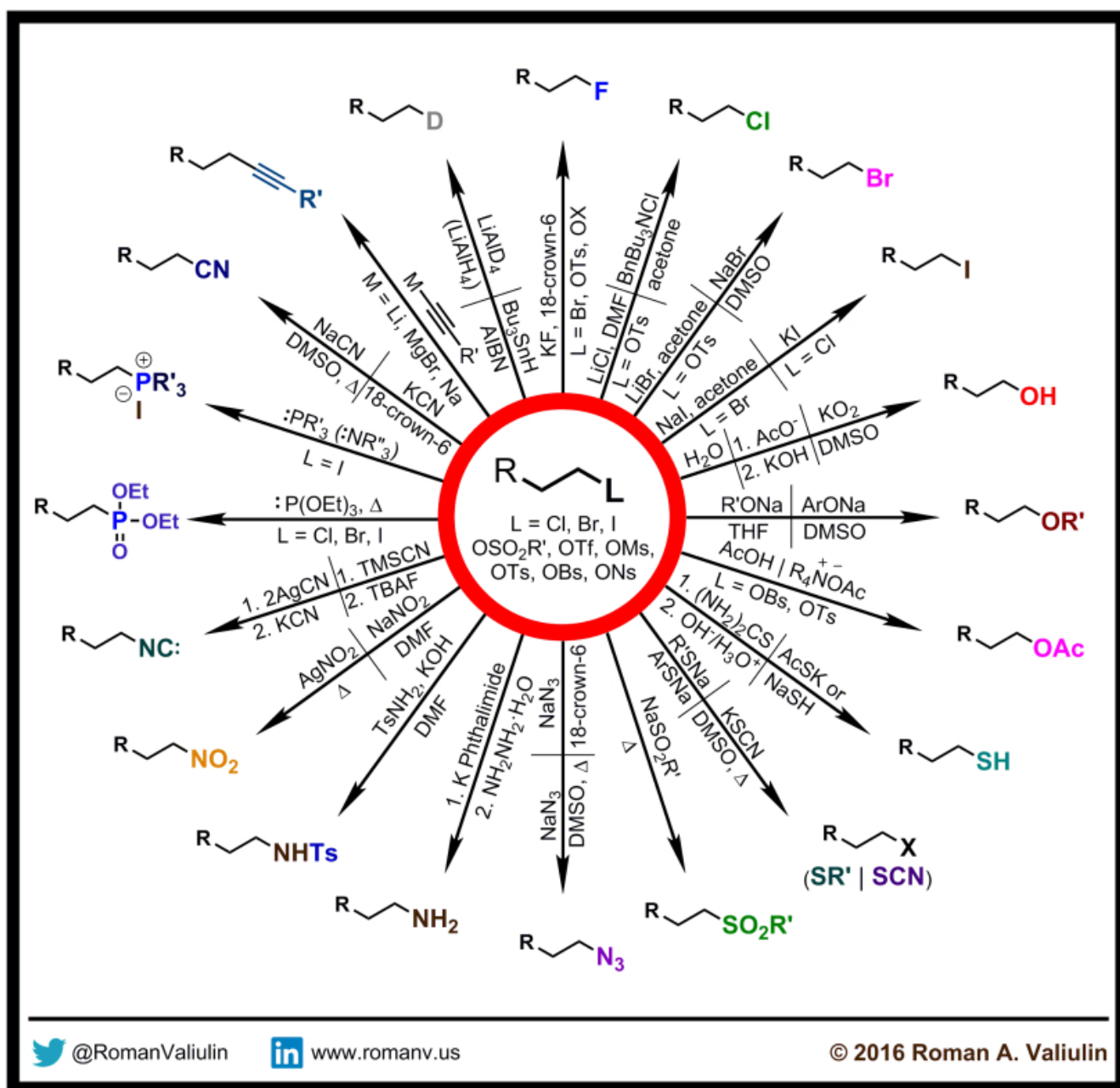
6. Terminal Alkynes



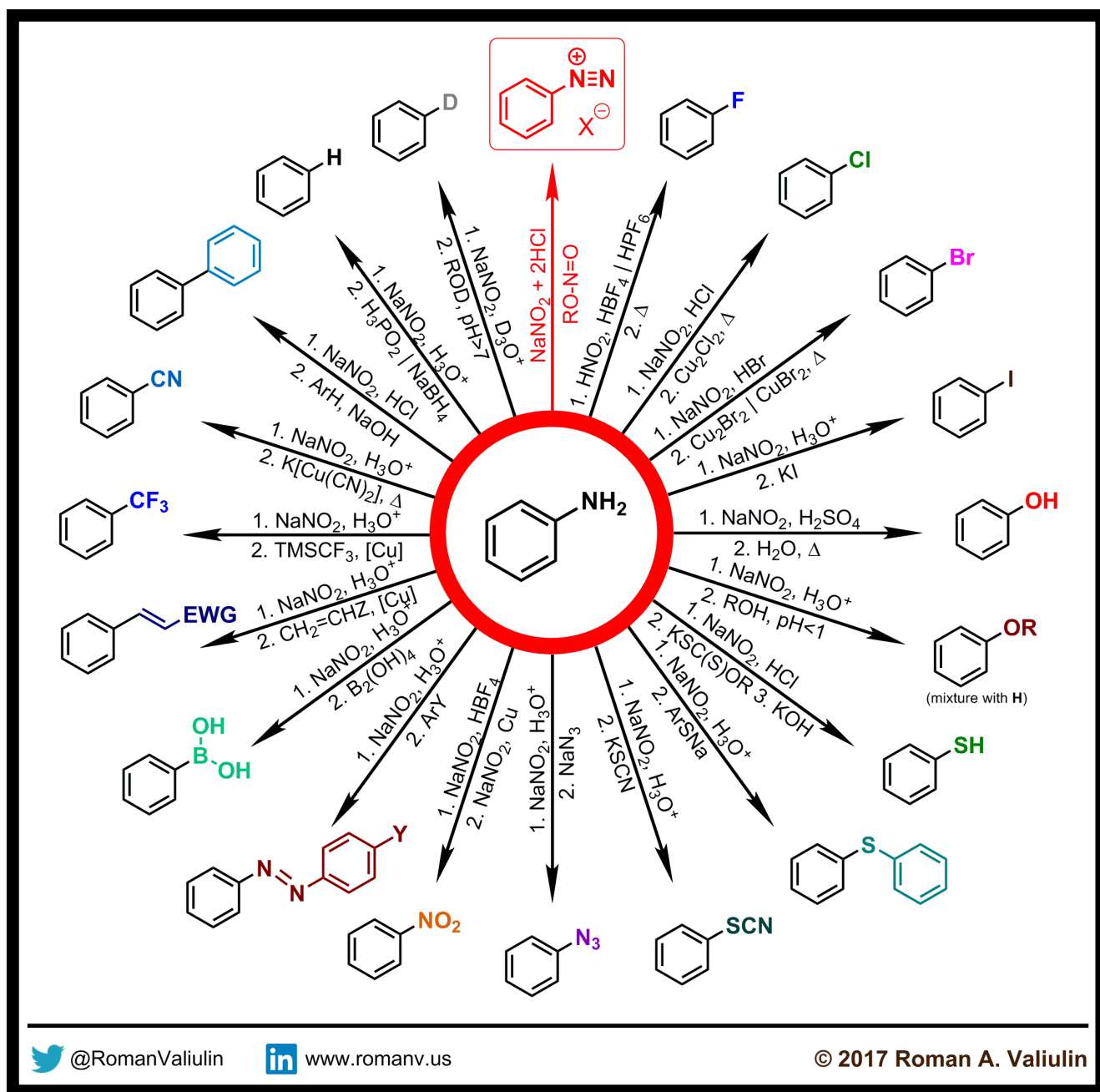
7. Internal Alkynes



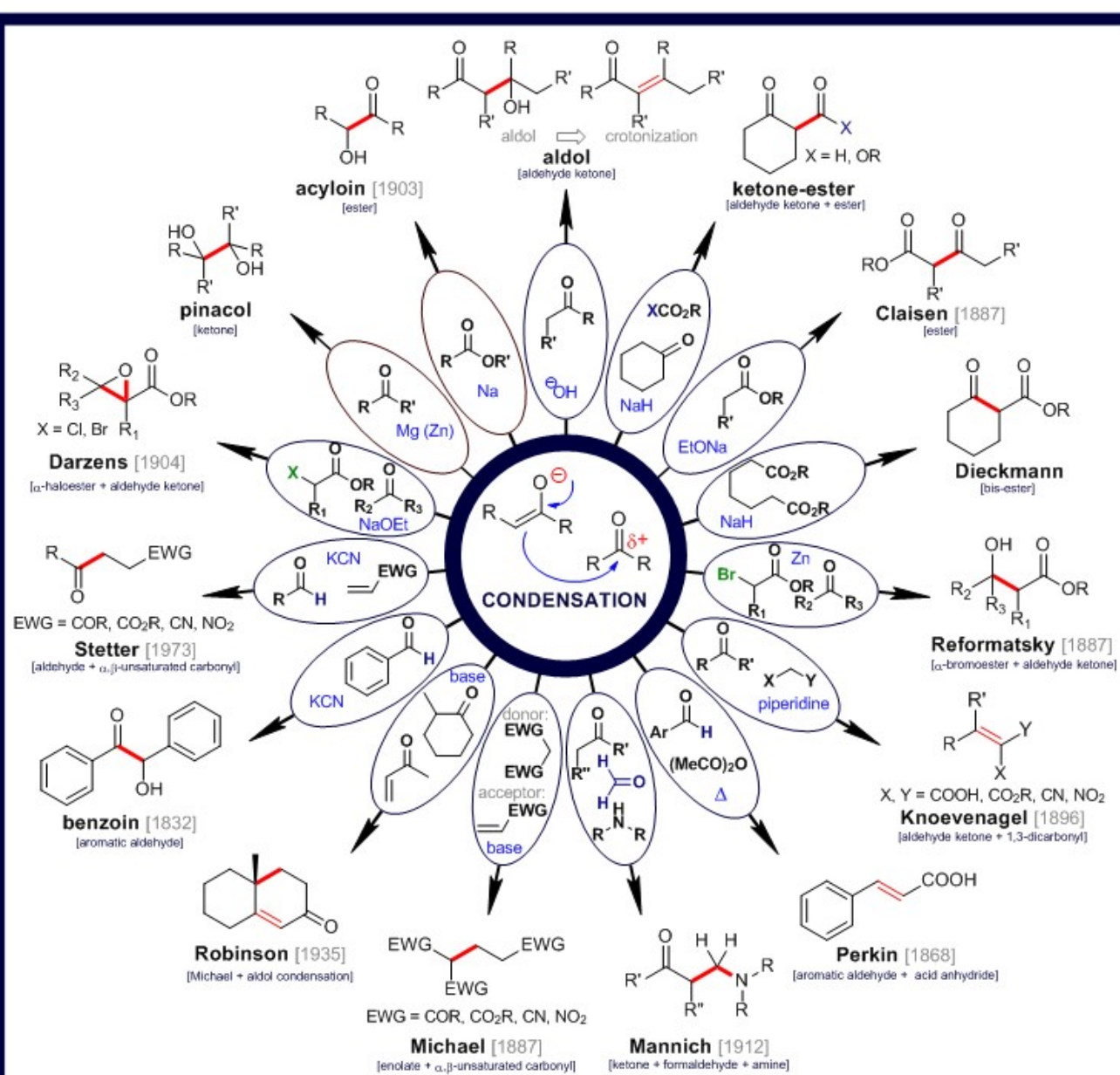
8. Nucleophilic Substitution



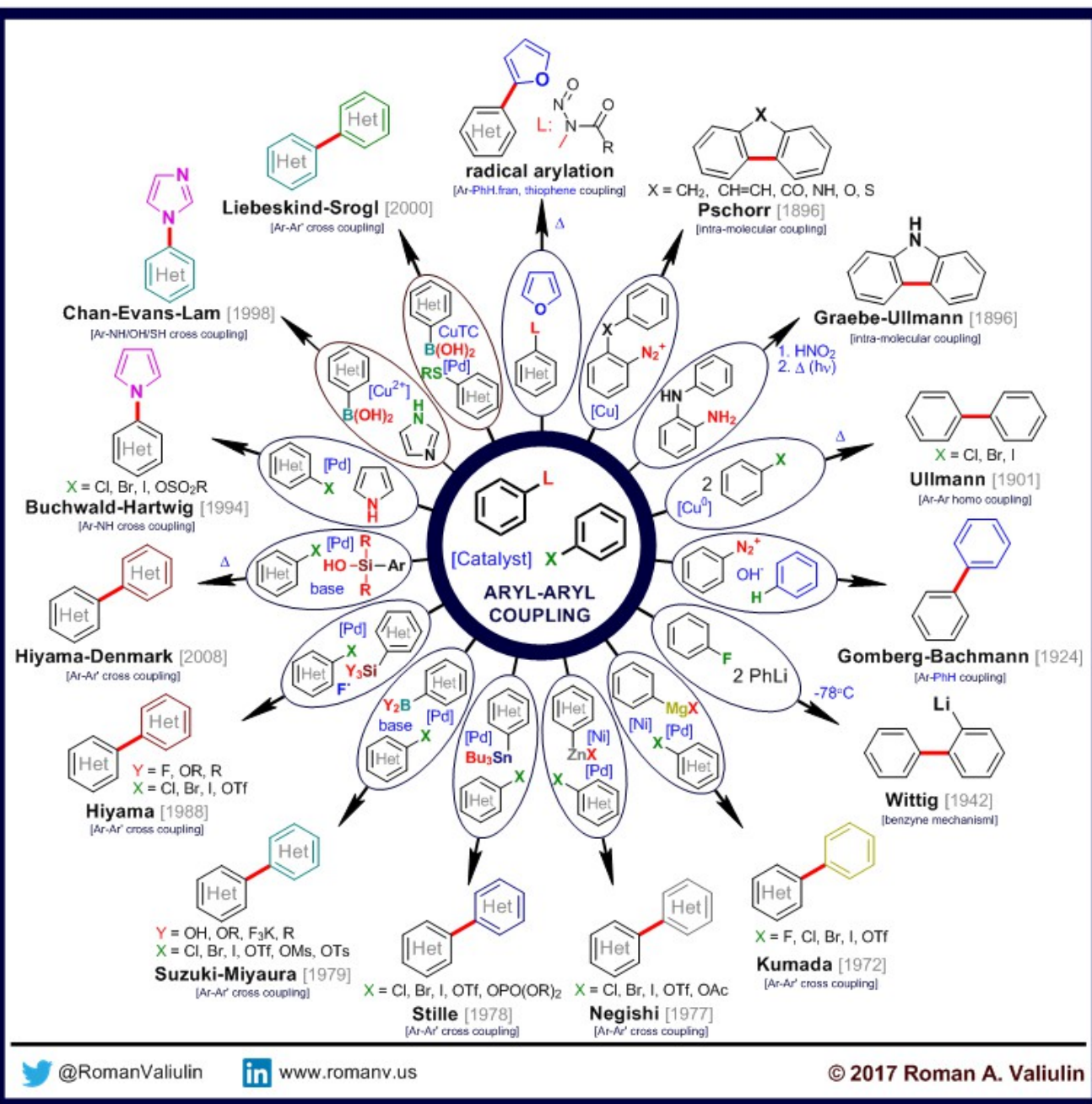
9. Diazonium Chemistry



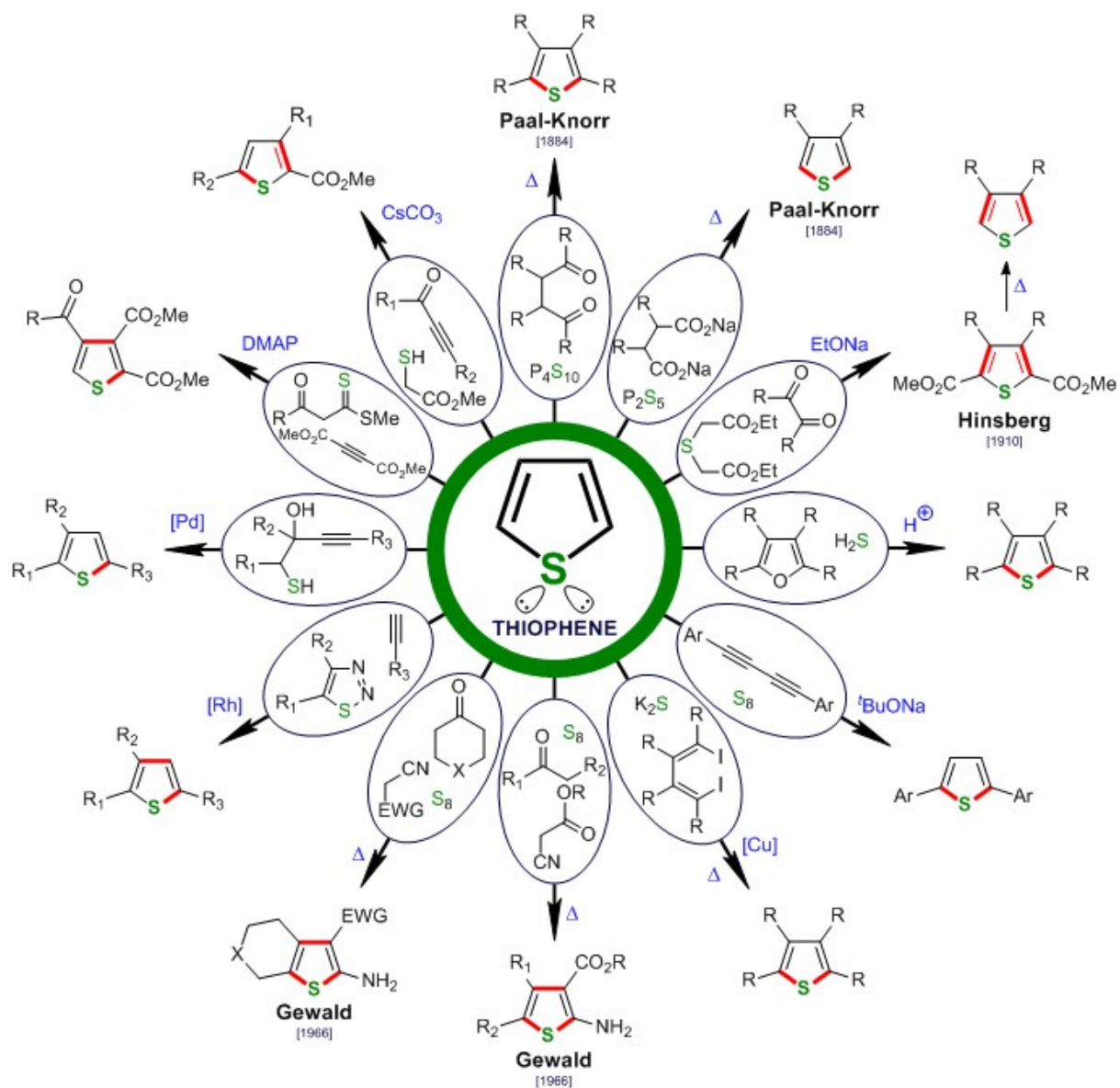
10. Condensation



11. Aryl-Aryl Coupling



12. Thiophene Synthesis A



13. Thiophene Synthesis B

