



Introduction to Organic Synthesis – 2025-26

1. Introduction to retrosynthetic analysis: general concepts (disconnection, functional group interconversion, synthon, synthetic equivalent). Parameters of retrosynthetic analysis: carbon backbone and degree of structural complexity. Functional groups and molecular symmetry. Topological relationships between functional groups. Spatial correlations and control systems.

2. One-group C-X and C-C disconnections:

- Alcohols

- Olefins Full disconnection of the double bond, Wittig, Julia, Peterson and Horner – Wardsworth – Emmons olefinations. Metathesis with ruthenium and molybdenum carbenoid catalysts.

- Carbonyl compounds. α , β and γ -disconnections. Control in β disconnection: selective activation, enamines. Oxidation of alcohols. Alkyne hydration. α -disconnections of carboxylic acids and related compounds.

3. C-C bond formation by Pd(0) catalysts: Suzuki, Heck, Stille, Sonogashira, Hiyama and Kumada coupling reactions.

4. Two-groups disconnections: 1,1-difunctional compounds. 1,3-difunctional compounds (aldol addition and related reactions; 1,3-dicarbonyl derivatives – Claisen, Mannich, crotonic and Dieckmann reactions). 1,5-difunctional compounds (Michael and Knoevenagel additions). 1,2-difunctional compounds (olefin oxidation, pinacol reaction; α -hydroxyacids, α -aminoacids and α -hydroxyketones – illogical disconnections, reactivity inversion and synthetic equivalents of illogical intermediates; α -halogenocarbonyl compounds). 1,4-difunctional compounds (1,4-diketones and γ -hydroxyketones). 1,6-difunctional compounds.

5. Cycles: Robinson annelation to six-membered rings, asymmetric and organocatalyzed Robinson reactions: the Wieland – Misher ketone, its use in total synthesis (Danishefsky taxol synthesis: rings C and D). Nazarov cyclization to five-membered rings; Diels – Alder reaction to six-membered rings. Three-membered rings by intramolecular cyclization and insertion reactions. Four-membered rings by [2+2] cycloadditions. Polycyclic compounds.

6. Resources for online retrosynthetic analysis.

7. Starting materials and sustainable sources of reagents in organic synthesis.

Introductory textbook:

S. Warren P. Wyatt - **Organic Synthesis – the disconnection approach**, 2nd edition 2008, Wiley NY ISBN 978-0-470-71237-5; EAN 9780470712368.

Reference textbook:

F.A. Carey – R.J. Sundberg – **Advanced Organic Chemistry Part B: Reactions and Synthesis**, 5th edition 2010, Springer NY. ISBN-3: 978-0-387-68350-8; EAN 9780387683546.

Further readings:

E.J. Corey – **The Logic of Chemical Synthesis, multistep synthesis of carbogenic compounds** – Nobel Lecture 8 dic 1990. www.nobel.se

L. Cerruti – **Bella e potente – la chimica del '900 fra scienza e società**. Seconda edizione, Editori riuniti, Roma, 2016.
EAN 9788864731667.