UCLouvain

lchm2241

2023

Organic synthesis

6.00 credits	45.0 h + 15.0 h	Q2

Teacher(s)	Elias Benjamin ;Riant Olivier ;Singleton Michael ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	The content of the first part of this lecture course can vary, based upon novelties in the literature. The general themes will encompass : the basics of organometallic chemistry - examples of organometallic catalysis in industrial processes - the main classes of organometallic catalysts - application in enantioselective catalysis - application to the synthesis of organic compounds of interest for the agrochemical and pharmaceutical industries - application to the synthesis of natural products. The second part will focus on the study of the most important classes of natural products (terpenes, steroids, alkaloids, macrolides, prostaglandins,..). Their biosynthesis and their total synthesis will be presented. Representative total synthesis will illustrate the power of organic chemistry. In parallel, the notions of strategies in total synthesis and of retrosynthetic analysis will be implemented and developed. New methods, reagents and concepts will be discussed and their use in total synthesis exemplified. Methods for asymmetric induction will be studied and multi steps total synthesis will be practised on paper.
Learning outcomes	**At the end of this learning unit, the student is able to :** Specialised course on the construction of complex molecules by multi steps synthesis. The first part of this course will focus on modern methods for multi steps organic synthesis and more specifically on organometallic catalysis, a synthetic tool widespread in academic and in industrial laboratories. The special case of enantioselective catalysis will also be studied in detail. Several examples of multi steps total syntheses, employing one or more organometallic reagents, will highlight the usefulness of these catalysts in applied fields. The second part of the course will focus on deepening the knowledge of synthetic organic chemistry, including the mastering of notions of strategies in total synthesis. It will be followed by the study of the most important classes of natural products and by the use of retrosynthetic analysis. The content of the first part of the course is variable, taking into account the novelties of the literature. Basics of organometallic chemistry 1 - Examples of the use of organometallic catalysis in industrial processes - The main classes of organometallic catalysts - Applications to enantioselective catalysis - Applications to the organic synthesis of products of interest in the food and pharmaceutical industries, and natural products. The second part focuses on the study of the major classes of natural products (terpenes, steroids, alkaloids, macrolides, prostaglandins,) from the point of view of both their biosynthesis and their total synthesis. Illustration by selected examples of total synthesis. Development and refinement of the notions of synthesis strategy and retrosynthetic analysis. Introduction of new methodologies, reagents and concepts. In-depth use of chiral synthesis. Study of asymmetric induction. Learning of multi-step synthesis.
Evaluation methods	written and oral exam
Teaching methods	Ex-cathedra courses + monitors + home exercises
Content	**First part** : • Reminder of the basic mechanisms of organometallic chemistry.

	• Chemistry of Nickel (hydrocyanation of alkenes) • chemistry of Rhodium and Ruthenium (catalytic hydrogenation of alkenes, asymmetric hydrogenation, synthesis of menthol) • chemistry of Palladium (activation of double bonds by palladium (II) salts, coupling processes, pi-allyl palladium chemistry, new concepts in the chemistry of palladium, creation of new carbon-heteroatom bonds) • olefin metathesis reactions (Schrock and Grubbs catalysts, ring opening polymerisation, ring closing metathesis) • Cyclotrimerisation of alkynes • Pauson-Khand reaction • stoichiometric reagents and their use in organic synthesis: low valence titanium and zirconium complexes • Schwartz reagent • Sato and Negishi reagents • Hydrozirconation of alkynes. **Second part :** This course capitalises upon the knowledge built up during the previous years and offers a larger and deeper vision of the total synthesis of complex natural products. The biosynthesis of the most representative families of natural products and some of their total syntheses will be presented. Retrosynthetic analysis and the notions of strategies and tactics in organic synthesis will be highlighted. New methodologies and novel reagents will be introduced and particular care will be devoted to the control of relative and absolute stereochemistry, asymmetric induction and multi step logic.
Bibliography	• Classics in Total Synthesis (K.C. Nicolaou); • the Logic of Chemical Synthesis (E.J. Corey); • Retrosynthetic Analysis (S. Warren).
Other infos	**Background** : knowledge of organic chemistry from the previous years, CHM2140 and CHM2181. Notions of biochemistry.
Faculty or entity in charge	CHIM

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Chemistry	CHIM2M	6		🔍