UCLouvain

lchm2247

2021

Supramolecular chemistry

3.00 credits	22.5 h + 7.5 h	Q2

Teacher(s)	Fustin Charles-André ;Singleton Michael ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	BAC or equivalent; basic knowledge of non-covalent interactions, thermodynamics, kinetics, and spectroscopic methods (Bachelor of Chemistry).
Main themes	This course details the basic principles of supramolecular chemistry, extending the basic concepts of non-covalent interactions seen in previous courses and exploring the essential role they play in all areas of modern chemistry. **The main themes are** : non-covalent interactions (inter/intramolecular); modern spectroscopic and analytical methods for studying supramolecular systems; molecular recognition/Host-guest chemistry; Self-assembly/self-organization; mechanically linked molecules; molecular machines, functional supramolecular systems and supramolecular catalysis; the role of supramolecular chemistry in materials, biology/medicine, or other areas depending on the topics of research/interests of the students enrolled.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 This course will serve to introduce important notions and concepts in the field of supramolecular chemistry. **The goals of this course are** : 1/ to familiarize students to the different methods and types of chemical systems used for the assembly of complicated molecular architectures and functional molecules; 2/ to help students obtain the essential knowledge needed to critically examine modern scientific literature related to supramolecular chemistry; and 3/ show how the notions and tools of supramolecular chemistry are applied in other areas of chemistry and biology.
Evaluation methods	The students will be evaluated on the basis of : 1. A written report on the role of supramolecular chemistry in an area of their choice (80 %) 2. Their participation during the quadrimester (20%) - A concise report (8-10 pages in total) on how supramolecular chemistry plays a role in an area of chemistry of their choice. For students involved in research, it is preferred that this relate to their subject of research. This report should provide a critical analysis of chemical approaches used in the subject and offer insights into how supramolecular chemistry was essential/could improve the research. As a part of the final evaluation of the report, the students will meet (15-20 minutes) with the professor to discuss the topic and content of the report. -The evaluation of the participation during the quadrimester is based on the in class discussions concerning the assigned scientific articles relevant for each topic and on the completion of problem sets.
Teaching methods	The course is primarily lecture based. The content important for each lecture will be presented primarily via the blackboard with powerpoint slides being used to supplement some concepts. For each lecture, students will have assigned reading, to be completed prior to the course, and will be expected to participate in a general discussion on the topics related to the subjects covered in the lecture. Additionally, independent (or loosely guided) study of scientific literature and the analysis of supramolecular chemistry aspects within is required for the redaction of their reports.
Content	Seminars and discussions on the main themes. 1. Introduction/definition of Supramolecular chemistry (interactions beyond the molecule, modern description of non-covalent interactions : energy/thermodynamic considerations, media dependence, cooperativity).

	2. Tools of supramolecular chemistry/Quantifying inter/intramolecular interactions (Spectroscopic and analytical methods used in supramolecular chemistry including modern/advanced NMR techniques; titration studies and determination of stoichiometry/binding constants in 1:1, 2:1, 1:2 systems ; more complicated equilibria ; kinetic versus thermodynamic stability, kinetics/affinity regimes and choice of methods). 3. Molecules interacting with each other - defining molecular recognition and host-guest chemistry; recognition of cationic/anionic/neutral molecules, including ion pairs; molecular design aspects for selectivity; role in biology and enzymes). 4. Self-assembly/self-organization : classifications and examples, strategies for molecular assemblies, metal/ligand/template directed synthesis, self-replication, dynamic combinatorial chemistry, higher order structures including foldamers and helicates, factors related to structural stability, folding/unfolding, and fluxionality; mechanically linked/interlocked systems). 5. Molecular machines and functional supramolecular assemblies. 6. Supramolecular chemistry and catalysis (enzymes, biomimetics, structural cooperativity).
Bibliography	Chapitres de livres, articles de revue, articles scientifiques, canevas pour le rapport seront disponibles sur Moodle. Texte de référence: Jonathan W. Steed, Jerry L. Atwood, 'Supramolecular Chemistry', 2nd Edition; ISBN: 978-1-118-68150-3 --------- Book chapters, journal articles, scientific papers, report outline will be available on Moodle. Reference text: Jonathan W. Steed, Jerry L. Atwood, 'Supramolecular Chemistry', 2nd Edition; ISBN: 978-1-118-68150-3
Faculty or entity in charge	SC

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Chemistry	CHIM2M	3		🔍