Supremolecular Chemistry

SCHOOL
Faculty of Science

CAMPUS
Belle-Beille

LEVEL
2nd year Master's degree

OPEN TO EXCHANGE STUDENTS
Yes

SEMESTER
Fall (S1)

- **Degree course:** Light, Molecules, Matter
- **Teaching unit:** UE3
- **Course language:** English
- **Duration (hours):** 35
- **ECTS:** 3
- **Teacher(s):** David CANEVET

- **Assessment:**
  - [x] Continuous assessment
  - [ ] Final exam
- **Teaching methods:**
  - [x] Lecture course 25 hours
  - [ ] Tutorial course hours
  - [x] Practical work 10 hours
  - [ ] Case study
  - [ ] Project

COURSE DESCRIPTION

Supramolecular Chemistry: basics (9 hours)
- From molecular to supramolecular chemistry.
- Supramolecular interactions.
- Characterization of supramolecular structures.
- Host molecules for the recognition of cations, anions and neutral molecules.
- Chemosensors.
- Molecular flasks.
- Supramolecular catalysis.

Supramolecular polymerization (4 hours)
- Physical and chemical gels.
- Application fields (conducting materials, mesophases, self-healing systems,?).
- Description of supramolecular polymerization processes (isodesmic, cooperative, chain-growth).
- Chirality and supramolecular polymers (?sergeant and soldiers? and ?majority rules? experiments).
- H and J aggregates.

Supramolecular Chemistry based on metal (12 hours)
- Basics and tools
- Self-assembling: helicates.
- Self-assembling: grids, ladders and racks.
- Self-assembling: molecular polygons and polyhedra.
- Catenanes, rotaxanes and molecular knots.
- Molecular machines.
- Supramolecular polymers.

This teaching unit provides the conceptual bases of supramolecular chemistry, a modern axis of chemistry centered on non-covalent interactions that are playing a key role in materials science and in particular in designing organized structures for complex functions, including at the macroscopic scale (molecular receptors, sensors, molecular machines, etc.).

OBJECTIVES

The aim is to show students how this transverse new field of chemistry, often inspired by biological processes, can allow through a well-balanced use of various tools of chemistry (organic synthesis, coordination chemistry, spectroscopies, physical chemistry, analytical chemistry), to control the structuring and the properties of different classes of materials, on scales ranging from nano to micrometric sizes. In particular, mastering these tools allows students to design sophisticated supramolecular objects whose complexity could not be reached through traditional covalent synthesis.
The first part will examine the foundations on which is built this transverse field of chemistry (nature and characterization of non-covalent interactions, self-assembly and molecular recognition processes towards discrete structures, designing molecular receptors). The course continues with an extension of these concepts to the case of supramolecular polymerization (gels), and then to the rational use of coordination bonds for the construction of various supramolecular architectures and beyond, till the design of dynamic structures (molecular machines).
The complexity of the resulting systems is illustrated with the help of various recent examples from the literature. Also, practical work sessions allow to tackle several of these aspects. Finally, this course will stimulate student creativity by integrating the corresponding concepts into the different application areas which are considered in the other modules of the Master LUMOMAT.