



## Visiting Professor Program Academic Year 2024/2025

**TEACHING COMMITMENT:** 12 hours

**COURSE TITLE**

**Syntheses and Mechanisms in Organic Chemistry**

**TEACHING PERIOD**

1st term

**SCIENTIFIC AREA**

Organic Chemistry

**LANGUAGE USED TO TEACH**

English

**COURSE SUMMARY**

The course treats advanced synthetic methods based especially on the organometallic chemistry, enantioselective synthesis and the chemistry related to heterocycles.

Organometallic chemistry. Allylic electrophiles are activated by palladium(0). Vinyl epoxides provide their own alkoxide base. Intramolecular alkylations make rings. Palladium can catalyse cycloaddition reactions. Palladium-catalysed amination of aromatic rings. Nucleophilic aromatic substitution and palladium catalysis compared. Heteroatom coupling for new C-S and C-P bonds. Alkenes coordinated to palladium(II) are attacked by nucleophiles. Oxypalladation and the Wacker oxidation. Alcohols and amines as intramolecular nucleophiles. Palladium catalysis in the total synthesis of a natural alkaloid. An overview of some other transition metals: Cobalt, Gold, Ruthenium. Asymmetric synthesis: Nature is asymmetric. The chiral pool: Nature's chiral centres 'off the shelf'. Resolution can be used to separate enantiomers. Chiral auxiliaries. Alkylation of enolates. Enantiomeric excess. Chiral reagents. Asymmetric catalysis. Catalytic asymmetric reduction of ketones. Catalytic

asymmetric hydrogenation of alkenes. Asymmetric epoxidation. Asymmetric dihydroxylation. Ligandaccelerated catalysis. Asymmetric formation of carbon–carbon bonds. Asymmetric conjugate addition. Organocatalysis. Asymmetric aldol reactions. Chiral auxiliary-controlled Main strategies to synthesize heterocycles. Reactivity of heterocycles.

### **LEARNING OBJECTIVES**

The course aims to broaden and deepen the knowledge in the field of synthesis and reactivity of organic molecular structures by learning concepts and methods that characterize the modern organic synthesis. The pupil must be able to deal with a critical sequence of steps proposed for an organic synthesis, as well as providing personal suggestions in order to optimize the desired results; to evaluate the aspects chemo-, regio- and stereoselective of some important reactions.

Acquisition of the techniques and procedures usually employed in an organic synthesis lab. Students must be able to synthesize, purify and adequately characterize organic molecules.

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### **VISITING PROFESSOR PROFILE**

Expertise in organic chemistry especially devoted to synthetic aspects. In particular: transition-metal catalyzed new synthetic reactions, methodologies for the preparation of biologically active compounds, and relevant structures present in drugs or diagnostic tools.

### **CONTACT REFERENT**

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