

COURSE SYLLABUS

1. Identification

Code and title: QUP 015 – Special Topics in Dynamic Stereochemistry

Professors: Aloir Antonio Merlo and Dennis Russowsky

Level: Master and Doctorate

Credit hours: 2

Revised: JUne_2020

2. Summary

Concepts and definitions of stereochemistry, chirality and pro-chirality relationships, stereoisomer and chiropractic properties. Use the conceptual definitions in the study of case reactions - enantio- and diastereoselective transition state models aiming at learning optically active compounds synthesis methods.

3. Objective

Study the fundamental concepts and definitions of stereochemistry, and analyze them in some types of reactions, cases with emphasis on the origin of enantioselectivity or diastereoselectivity, and Transition State models.

4. Contents

4.1 Part I - Basic Concepts in Static Stereochemistry in 2D and 3D Euclidean objects.

- Introduction: Constitution and chemical connectivity. Stereoisomers. Configuration and conformation. Chirality, optical activity, enantiomers and diastereoisomers
- Enantiomeric relations: Cahn-Ingold-Prelog Convention. Fischer Convention. Nomenclature of Sugars. Alpha-beta nomenclature. Erythro-threo nomenclature. Syn-anti nomenclature. Stereochemistry of cyclic systems with 4, 5 and 6 atoms and tensioned systems.
- Stereochemistry of alkenes and analogues: cis-trans and Z-E nomenclature.
- Chirality of origin in axes and planes: Atropoisomerism. Cycloalkanes, cycloalkylidenes. Spirocompounds. Sand-metal complexes.
- Pro-chirality Relations
- Optical Activity: History. Chiropractic properties.

4.2 Part II - Dynamic Stereochemistry. Concepts and Studies of Selected Stereoselective Reactions.

- Stereoselective Aldol Reactions and Applications: Control of Enolate Geometry and Diastereoselectivity. Chiral Enolates and Enantioselectivity Control. Transition State Models.
- Asymmetric Organocatalysis and Applications: Activation via the formation of Covalent Bonds - Iminocatalysis and Enaminocatalysis. Activation and Enantioselectivity via Chiral Thiourea and Chiral Squaramides.
- Stereoselectivity in Multicomponent Reactions and Applications: Stereoselective reactions of Mannich, Biginelli, Petasis, Passerini and Ugi.

5. Assessment



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Assessments will be based on a series of Directed Studies involving the contents presented in Parts I and II. Directed Studies will be forwarded to students and must be completed within one week. The student, who obtains a final grade of A, B or C, awarded as per the list below, will be considered approved:

- A: grade equal to or above 9.0
- B: grade equal to or above 7.5 and below 9.0
- C: grade equal to or above 5.0 and below 7.5
- D: grade below 5
- FF: lack of frequency

6. Methodology

Lectures, exercises lists, seminars and examinations.

7. Bibliography

Books on Stereochemistry, Asymmetric Organic Synthesis and selected articles from the literature to be indicated during the course. Eventually, part of the bibliography may be made available by the Professor.