Stereochemical Models for Carbonyl Addition

**SYLLABUS**

# Lecturer information

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# Title of the course: Stereochemical Models for Carbonyl Addition

# Course program

The course will cover diverse aspects related the stereochemical outcome of addition of nucleophiles to carbonyl compounds which bear a stereogenic center nearby the C=O group. The course is structured as to develop an historical context, background revision and discuss the most useful stereochemical models that have been developed over the years to explain experimental results. We will focus more heavily on the 1,2-induction models, which are the most useful and important: Cram and earlier models; Felkin-Anh model; Cram-chelate model; Cornforth-Evans Model.

In addition, we will also discuss the potential flaws in these models and possible “new” solutions: Cieplak and electrostactic models.

Finally, the stereochemistry control in 1,3-induction systems will also be covered.

# Course content detailed per lesson of two hours (possibly with dates and room real and virtual)

Lesson 1 – Introduction, historical context, background revision. Cram and earlier models; Felkin-Anh model.

Lesson 2 – Cram-chelate model. Comparison between Felkin-Anh and Cram-Chelate model. Cornforth-Evans Model. Comparison between polar Felkin-Anh and Cornforth-Evans models.

Lesson 3 – Challenging cases for traditional models and possible “new” solutions: Cieplak and electrostactic models.

Lesson 4 – Stereochemistry controls in 1,3-induction systems. Examination

# Suggested reading

* J. Clayden, N. Greeves, S. Warren. Organic Chemistry, 2nd Ed. **2012**.
* A. Mengel, O. Reiser. Around and beyond Cram’s Rule. *Chem. Rev.* **1999**, *99*, 1191.
* Additional references from the primary literature will be given during the course.

# Learning Objectives

* To understand the underlying factors that influence the stereochemical outcome of addition reactions to carbonyl compounds.
* To develop the necessary knowledge to apply the stereochemical models for carbonyl addition to interpretate and explain results observed experimentally, both in published literature and (in the future) in their own results.
* To be able to use this tools to predict reaction outcomes in advance and use this information as a planning element to his/hers own research projects.

# Knowledge and Skills to be acquired

By the end of the course the student should be able to understand the origin of the stereoselectivity in carbonyl addition reaction in which a new stereogenic center is generated. By studying the stereochemical models for carbonyl addition, beyond comprehension of the reasons by which a given product is formed, the ultimate goal is that the student should be able to predict selectivity in systems that have not been studied yet and, therefore, should contribute to their own research endeavour.

# Prerequisites

Graduate degree in Chemistry or completion of basic undergraduate organic chemistry courses.

# Teaching Methods

MODE 1 - Pre-recorded lessons uploaded on the moodle platform (a meeting must be organized with PhD students in order to clarify eventual doubts)

**X** MODE 2 (preferred) - Lessons delivered in-person and in remote with simultaneous recording by the WEBEX platform

(The lessons must be recorded and available to all the students that cannot take part to the lessons in streaming. The Webex platform must be used. All course content should be uploaded to the Moodle platform on the Chemical Sciences PhD page “Courses and Seminars of the PhD in Chemical Sciences 2022-2023”)

# Further information

# Type of Assessment

Written evaluation.

The final evaluations will have to be validated maximum 1 month after the end of the course

# Period

Short course, from 13/12/2024 to 17/12/2024.