Orbitals in Organic Chemistry - Stereoelectronics

Overview

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Aims
To demonstrate the role of orbital interactions and the importance of stereoelectronic effects in controlling the conformation of molecules and in influencing the reactivity of molecules and the outcome of reactions. Familiar reactions as well as new reactions will be used to illustrate the ideas.

Summary
This course explains how orbital interactions influence molecular shape and conformation in the 'ground state' (i.e. structure) and explores 'transition state' stereoelectronic effects which influence reactivity. The course will concentrate on 'ionic' reactions (i.e. those involving electrophiles/nucleophiles, carbanions/carbocations etc.) since these constitute the majority of synthetically useful transformations.

Objectives:
On completion of this course you will be able to:

- Recognise anti-periplanar relationships between reacting bonds in synthetic transformations
- Draw orbital representations and energy diagrams for several stereoelectronic interactions
- Discuss the factors that affect orbital overlap and lead to important (stabilising) interactions
- Explain the role of stereoelectronic interactions in determining the conformations of functional groups
- Appreciate the influence of orbital control in ionic reactions, particularly in carbonyl chemistry, substitution reactions and ring opening/closure reactions
- Rationalise the stereochemical outcome of synthetically important rearrangements and fragmentations

Course delivery (4 lectures)

Lecture 1: Recap on key stereoelectronic principles.
Lecture 2: Conformational analysis of selected functional groups. The anomeric effect.

Reference material
The following texts all contain information pertinent to the course content.