Liverpool John Moores University

Title:	ADVANCED ORGANIC SYNTHESIS
Status:	Definitive
Code:	**7004APCHEM** (121145)
Version Start Date:	01-08-2021
Owning School/Faculty:	Pharmacy & Biomolecular Sciences
Teaching School/Faculty:	Pharmacy & Biomolecular Sciences

Team	Leader
Christopher Coxon	Y
Francesca Giuntini	
Mark Wainwright	

Academic Level:	FHEQ7	**Credit Value:**	20	**Total Delivered Hours:**	40
Total Learning Hours:	200	**Private Study:**	160		

Delivery Options
Course typically offered: Semester 1

Component	Contact Hours
Lecture	23
Tutorial	2
Workshop	12

Grading Basis: 50 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	Exam	Exam	70	3
Report	Report	Report	30	

Aims

The theme of the module will be the application of synthetic strategies to small, highly-functionalised molecules and larger biopolymers, which are of contemporary interest in pharmaceutical, agrichemical and materials science industries. A major element of focus will be chiral control and strategy in multistep organic synthesis.

Learning Outcomes

After completing the module the student should be able to:

1	Critically discuss the use of main group elements for modern synthesis.
2	Critically appraise chirality and chiral control in modern organic synthesis.
3	Apply correctly strategies involved in the solid phase synthesis of peptides and small molecules, allowing compound library generation,
4	Assess and plan strategies towards the synthesis of complex molecules using multiple steps.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Examination	1	2	4
Report	3		

Outline Syllabus

Part 1. Strategy & asymmetric methods: Application of complex strategies involving the use of B, S, Se, Si based reagents. Review of selectivity in organic synthesis, the effect of temperature on selectivity. Utilising the 'chiral pool'. Overview of stereoelectronic and conformational factors contributing to diastereoselectivity in synthesis through the analysis of diastereoselection in nucleophilic additions to carbonyl groups, electrophilic additions to alkenes, enolate generation, the aldol reaction, enolate alkylation and cyclisation processes including cycloadditions and sigmatropic rearrangements. Synthesis of enantiopure compounds including resolution, the chiron approach, chiral auxiliaries, reagents and catalysts. Reactions involving more than one chiral species - double asymmetric synthesis, kinetic resolutions and non-linear effects. The student will gain an understanding of strategy in designing routes to complex molecules via multistep organic synthesis.
Part 2. Synthesis of chiral molecules & solid-phase synthesis: methods to prepare unnatural amino acids and comtemporary amide bond forming reagents. Peptide synthesis using Fmoc and Boc methodology. Types of linkers and resins. Synthesis of peptides, coupling reactions, amino and side chain protecting groups, orthogonal protection. Problems encountered in solid-phase peptide synthesis. Examples of syntheses of linear, stapled and cyclic peptides. Protein synthesis via native chemical ligation and synthesis of post-translationally modified peptides.

Learning Activities

Lectures, workshops and tutorials

Notes

The module learning outcomes will be supported by workshops, following a problem-solving based exercise with peer-learning opportunity. This will include, the design of tractable synthetic routes to complex molecules (small molecules and peptides), as well as problems involving the correct assignment of reagents, reaction conditions and mechanistic details.