LF208-15 Enzymology

26/27

Department
Life Sciences
Level
Undergraduate Level 2
Module leader
Corinne Smith
Credit value
15
Module duration
5 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Living organisms are continually degrading and synthesising organic compounds. To effect the conversion of simple organic substrates into the complex polymers of the cell (and vice versa) requires the concerted use of a wide range of enzymes with many different functions. Students will become familiar with the basic methods of studying enzymes in order to understand the mechanisms whereby enzymes are able to catalyse reactions, and how individual reactions are controlled and integrated into the metabolic pathways of the cell.

Module aims

This module provides essential core material for biochemists, extending introductory enzymology covered in Year 1, and providing a foundation for understanding cellular processes driven by enzymes discussed in Year 3 modules. Content in this module will also support both second and final year laboratory work. The module aims to extend understanding of how enzymes are studied, show how enzyme mechanisms can be determined experimentally, introduce the student to a range of enzyme mechanisms and give insight into how enzymes are regulated in different biological contexts.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Introduction to enzyme catalysis and the concept of the enzyme active site.
Substrate binding via non-covalent interactions.
Energetics and kinetics of enzyme catalysis.
Michaelis-Menten kinetics for enzyme-catalysed reactions.
Importance of transition state stabilisation.
Proximity effects in intramolecular and enzyme-catalysed reactions.
Types of catalysis observed in enzyme-catalysed reactions.
Acid-base catalysis (triose phosphate isomerase, ketosteroid isomerase).
Covalent catalysis (haloalkane dehalogenase, acetoacetate decarboxylase).
Strain in enzyme catalysis (carboxypeptidase A, lysozyme).
Stereospecificity – prochiral selectivity.
Mechanisms of Serine proteases, Cysteine proteases, Metalloproteases and Aspartyl proteases
Phosphoryl transfer and NAD-dependent dehydrogenases
General principles, examples and design of enzyme assays and methods for purification of enzymes.
Identification of key residues in enzymes
Rapid reaction methods and the determination of enzyme reaction rate parameters.
Regulation of enzyme activity in a wider biological context, including discussion of enzymes in membranes

Learning outcomes

By the end of the module, students should be able to:

- Understand how conversion of simple organic substrates into the complex polymers of the cell (and vice versa) requires the concerted use of a wide range of enzymes with many different functions
- Understand research tools and techniques used to measure enzyme kinetics and investigate enzyme mechanisms
- Understand how enzymes catalyse reactions
- Understand how individual reactions are controlled and integrated into the metabolic pathways of the cell

Indicative reading list

Reading lists can be found in Talis

Subject specific skills

Understand how to assay enzymes and the features of enzyme catalysis.
Understand the mechanism of action of proteases and their role in the body.
Understand the mechanism of phosphoryl transfer
Understand the functioning of dehydrogenases
Understand the role of key residues involved in protein function and how this information can

inform protein engineering.

Transferable skills

Adult learning, self directed learning, team based learning and quantitative skills.

Study

Study time

Type	Required
Lectures	15 sessions of 1 hour (10%)
Supervised practical classes	3 sessions of 6 hours (12%)
Private study	85 hours 30 minutes (57%)
Assessment	31 hours 30 minutes (21%)
Total	150 hours

Private study description

Self-directed learning and revision

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D3

	Weighting	Study time	Eligible for self-certification
In-class assignment 1	15%	15 hours	No
Comparison and evaluation of assays for clinical biochemistry use with a focus on writing skills and data presentation			
In-class assignment 2	15%	15 hours	No
Comparison of assays and understanding the use of enzyme kinetics in elucidating mechanism of enzymes with a focus on the mathematical handling skills required			

	Weighting	Study time	Eligible for self-certification
Closed-book end-of-year examination	70%	1 hour 30 minutes	No

In-person locally-timetabled closed-book end-of-year examination

Assessment group R3

	Weighting	Study time	Eligible for self-certification
Closed-book examination	100%		No

In-person locally-timetabled closed-book examination

Feedback on assessment

Pastoral meetings with personal tutors

Past exam papers for LF208

Availability

Courses

This module is Core for:

- UBSA-C700 Undergraduate Biochemistry
  - Year 2 of C700 Biochemistry
  - Year 2 of C700 Biochemistry
- ULFA-C1A2 Undergraduate Biochemistry (MBio)
  - Year 2 of C1A2 Biochemistry
  - Year 2 of C700 Biochemistry
- Year 2 of ULFA-C702 Undergraduate Biochemistry (with Placement Year)
- Year 2 of ULFA-C1A6 Undergraduate Biochemistry with Industrial Placement (MBio)

This module is Optional for:

- Year 2 of UMDA-CF11 Undergraduate Integrated Natural Sciences (BSc)
- Year 2 of UMDA-CF10 Undergraduate Integrated Natural Sciences (MSci)