Liverpool John Moores University

Title:	MOLECULES OF LIFE
Status:	Definitive
Code:	**5001CHACAP** (113170)
Version Start Date:	01-08-2011
Owning School/Faculty:	Pharmacy & Biomolecular Sciences
Teaching School/Faculty:	Pharmacy & Biomolecular Sciences

Team	Leader
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Academic Level:	FHEQ5	**Credit Value:**	12.00	**Total Delivered Hours:**	32.00
Total Learning Hours:	120	**Private Study:**	88		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	17.000
Practical	10.000
Tutorial	3.000

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS1	Examination	70.0	2.00
Report	AS2	Report of an extended practical	30.0	

Aims

To introduce the Organic Chemistry of Biomolecules which occur in nature.

Learning Outcomes

After completing the module the student should be able to:

1 Recognise the chemical structure of simple molecules of biological importance which occur in nature.
2 Explain the physical and chemical properties of biomolecules which occur in nature.
3 Outline the synthesis of simple biomolecules and show how they link together to form more complex molecules.
4 Effectively carry out experiments involving the isolation and synthesis of biomolecules.

Learning Outcomes of Assessments

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

EXAM	1	2	3
Report of practical work	4		

Outline Syllabus

The diversity of naturally occurring compounds. Methods of isolating natural products from plant and animal matter.
Isolation, extraction and purification of, for example, essential oils, alkaloids, quinones, lipids, amino acids and proteins. Obtaining natural products by techniques such as extraction into organic solvents or supercritical fluids, salting out, crystallisation and recrystallisation,
distillation and steam distillation, freeze-drying, size-exclusion chromatography and bio-affinity chromatography.

Primary versus secondary metabolism. Range and classes of natural products, their importance and applications. Production of pyruvic and acetic acids from glyceraldehyde. The role of enzymes, co-factors, acetate thioesters, co-enzyme A and acyl-carrier proteins. Enolisation of acetate thioesters. Malonate formation, regulation by CO2. The Claisen condensation. Polyketide formation. The Aldol condensations. Intramolecular condensation of polyketides. Formation of simple polyketide derived natural products. NADPH and NADP+. Reduction of polyketides. Use of radio-labelled acetate. Formation of mevalonic acid. Roles of phosphate(s) in biosynthesis. Phosphorylation of mevalonic acid, formation of isopentenyl pyrophosphate and dimethyl allyl pyrophosphate. Formation of terpenes; geraniol, linalool and nerol. Formation of cyclic and bicyclic monoterpenes; cation rearrangements, menthol, pinene and camphor. Sesqui and diterpenes. Squalene. Cascade cyclisations. Formation of the steroid nucleus.

Classification of carbohydrates, classification of monosaccharides, structure and stereochemistry of monosaccharides. Formation of cyclic hemiacetals by aldohexoses (D-glucose). Haworth and chair forms of monosaccharides.

Mutarotation of D-glucose. Reactions of monosaccharides; oxidation, reduction, phenylosazone formation, ester formation, glycoside formation. Disaccharides, general structure, structure and reactions of e.g. maltose, lactose and sucrose.

Amino acids - structure, stereochemistry and physical properties. Isoelectric point of amino acids, electrophoresis of amino acids. Synthesis of amino acids - Strecker synthesis, Gabriel synthesis and stereoselective synthesis. Resolution of racemic mixtures of amino acids. Chemical reaction of amino acids e.g. esterification, acylation, Ninhydrin reaction. Simple biochemical reactions of amino acids. Formation of peptide linkage.

The experiments for the practical sessions will be selected from the following:

1. Conversion of Camphene to Camphor.

2. Carbohydrates - reactions of mono- and disaccharides.

3. Isolation and TLC of piperine from black pepper

Learning Activities

Lectures, Practicals, whole class Tutorials; dedicated computer-assisted-learning software.

References

Course Material	Book
Author	Vollhardt, KPC and Schore, NE
Publishing Year	2005
Title	Organic Chemistry
Subtitle	Structure and Function
Edition	5th
Publisher	WH Freeman
ISBN	0176799499

Course Material	Book
Author	Solomons, TWG and Fryhle, CB
Publishing Year	2008
Title	Organic Chemistry

Subtitle	
Edition	9th
Publisher	Wiley
ISBN	0471684961

Course Material	Book
Author	Dewick, PM
Publishing Year	2002
Title	Medicinal Natural Products
Subtitle	a Biosythetic Approach
Edition	
Publisher	Wiley
ISBN	0471496413

Course Material	Book
Author	Mann, J
Publishing Year	1994
Title	Natural Products
Subtitle	Their Chemistry and Biological Significance
Edition	
Publisher	Longman
ISBN	0582060092

Notes

This module will make students familiar with the structure and organic chemistry of simple biomolecules which occur naturally in the environment. Dedicated computer-assisted-learning courseware underpins this module.