APPROVED

CHEM S8Z01: Biochemistry

Module Details

Module Code:	CHEM S8Z01
Full Title:	Biochemistry APPROVED
Valid From::	Semester 1 - 2018/19 (September 2018)
Language of Instruction:	English
Duration:	1 Semester
Credits::	7.5
Module Owner::	Ronan Bree
Departments:	Unknown
Module Description:	•To introduce students to the nature, properties and biological roles of the main groups of biochemicals •To examine the levels of protein structure and their importance. •To review enzymes and their reaction kinetics. •To explain the overall organisation of metabolism as a series of interlinked pathways •To describe in some detail the driving forces and regulators behind metabolism (energy flows, enzyme catalysts and reaction equilibria) •To survey briefly the ways in which biochemicals and metabolism are studied.

Module Learning Outcome	
On successful completion of this module the learner will be able to:	
#	**Module Learning Outcome Description**
MLO1	Discuss the basic structures, and properties of biological relevance, of the common groups of biomolecules.
MLO2	Distinguish the areas of primary, secondary, tertiary and quaternary structures in protein folding.
MLO3	Explain the principles of enzyme catalysis, inhibition and regulation.
MLO4	Analyse the cell's metabolic pathways, their inter-relationships and regulation.
MLO5	Communicate the biochemical procedures detailed/performed in the module using professional scientific reports or portfolios.
MLO6	Apply practical competence in selected biochemical techniques.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named DkIT module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).*
No recommendations listed

Module Indicative Content

CONTENT
n/a

Introduction
Cell structure and the cell cycle. Biomolecules introduction. Overview roles of the elements (with a focus on Carbon) and water in the cell. Overview of amino acids as 'building blocks'. Thermodynamics and chemical reactions in the cell. Evolution and conservation. Minerals and vitamins in the body and their function.

Protein structure
Amino acids and their functional groups. Linking them together through peptide bonds. Structure/Function relationships. Primary, secondary, tertiary and quaternary protein structure in detail. Post-translational modifications, e.g. glycosylation.

Enzymes in action
Enzyme catalysis, role of energy of activation. Chemical reactions in the cell, control through negative/positive feedback. Active site features and characteristics. Enzyme kinetics and enzyme inhibition principles (Michaelis-Menten and Lineweaver-Burk analysis). Competitive and non-competitive & uncompetitive inhibition. Mechanism of action of enzymes.

Metabolism
Overview of interacting biochemical pathways in the cell and their regulation/cross-talk. Focus primarily on ATP generation via carbohydrate metabolism through Glycolysis, Krebs cycle and oxidative phosphorylation. Fate of pyruvate. Gluconeogenesis. Regulation of metabolic pathways, energy demands. Fatty acid metabolism, beta-oxidation.

Methodology/Practical exercises will be performed to learn the principles of working with the following areas. The theory behind some more advanced methodologies will be covered in lectures.
The use of pipettes and making up solutions (e.g. testing accuracy and repeatability, making up buffers and solutions, calculations). UV-Visible Absorption Spectrophotometry (e.g. absorption spectrum analysis, biuret method). Separation of Bioconstituents (e.g. Gel Filtration). Proteins (e.g. Protein Extraction, protein concentration estimation, SDS-PAGE). Enzymology (e.g. Alkaline phosphatase assay, determination of Km and Vmax). Carbohydrates (e.g. determination of glucose concentration). Lipids (e.g. thin layer chromatography of lipids).

LEARNING & TEACHING RESOURCES
n/a

Format of Lecture Series
Lecture delivery will engage with a variety of methods including on-line movie animations, visual demonstrations, large diagrams for illustration purposes as well as information from personal experience in the field and slide handouts. Novel methods using smartphone app/web-based quizzes will also be utilised. Course material and revision quizzes will be made readily available on a virtual learning environment (VLE) for student access. The combination of these methods will facilitate in re-enforcing the student's understanding of some of the technical and mechanistic processes involved. Various aligned classroom assessment techniques will also be employed. These may include the background knowledge probe, the one minute paper, small group interaction and discussion, question & answer sessions, team presentations to class colleagues, pop-quizzes and open ended questioning. Access to course textbooks will be provided through the DkIT eBook service which will allow students 24/7 access to suitable reading material. A range of self-assessment, self-reflection and peer learning exercises will be built in to deliveries of both lectures and practical sessions.

Virtual Learning Environment (VLE)
All lecture notes will be provided to the students through a VLE. This VLE will also be used for access to helpful YouTube video clips and peer reviewed publications of interest to the course. Students will have 24/7 access to the VLE allowing them to download and study at their own pace and in their own time. Screencast and Podcast tutorials will also be made available to the students to download and listen to in their own time. This will facilitate learning and understanding for all students, but in particular the international students.

Formative Assessments
Throughout the semester, students will be provided with formative assessments both in lectures and in laboratory environments. These are designed to facilitate group work in problem solving situations. These assessments are built in to the lecture and practical components.

Keeping up-to-date with the life science industry
Breakthroughs in the life science will be sent to the students on a regular basis. This will involve novel developments in the field in addition to postings on jobs/careers in the industry. This concept facilitates the students in preparing for life after college in the life science industry.

ASSESSMENT STRATEGY
n/a

Practical labs/sessions
Practical / Skill set tests / Lab write-up reports. In the practical sessions, students will focus on improving their practical skill set, while also dealing with obtaining and analysing data in addition to drawing conclusions from the data. Students will also perform formative competency skill set tests (e.g. pipette tests, graph tests, data handling test, data interpretation tests etc.) all generated to assist understanding and improve technique. Students will work on an interactive lab manual which will contain in-class exercises for review. Group (Peer-assisted learning) work will be encouraged. Technology use will also be encouraged throughout (for example using excel for graphing / trend line generation etc.). The requirement to complete exercises in the practical manual and/or submit certain laboratory reports in combination with ongoing formative assessments is intended to act as serious encouragement for students to focus on the laboratory work. Marks for these exercises/reports will be based on students' ability to record primary data, calculate derivatives from these, display these data, comment on their meaning in the context of the actual experiment and associated theory, and discuss limitations to the experiment and the results obtained. An incremental marking system will be employed to improve feedback uptake while a suite of technologies will be utilised to enhance assessment in practical sessions (see www.teamshp.ie). For example, some aspects such as custom recorded pre-practical videos in combination with smartphone based quizzes, electronic lab notebooks, VLE based rubrics and various digital feedback approaches may be employed.

Short answer / diagram / MCQ exams
A continuous assessment exam will take place in the module. This will require the students to answer selected short answer questions in addition to drawing diagrams of cellular processes. Formative quizzes will be performed throughout the module to facilitate learning and understanding of topics covered in addition to preparing the students to the style of this summative exam.

Module Assessment

Assessment Breakdown	%
Course Work	20.00%
Practical	30.00%
Final Examination	50.00%

Module Special Regulation

Assessments

Full Time On Campus

Course Work

Assessment Type	Short Answer Questions	**% of Total Mark**	20
Marks Out Of	0	**Pass Mark**	0
Timing	S1 Week 8	**Learning Outcome**	1,2,3
Duration in minutes	60		

Assessment Description
A multiple choice / short answer / sketch / fill in the blanks exam will be performed to examine the knowledge and understanding the students have gained of the material covered between weeks 1 and 7 of the second term.

No Project

Practical

Assessment Type	Practical/Skills Evaluation	**% of Total Mark**	30
Marks Out Of	0	**Pass Mark**	0
Timing	Every Week	**Learning Outcome**	1,3,5,6
Duration in minutes	180		

Assessment Description
Students will participate in weekly laboratory-based practical sessions in which formative assessments will be performed in interactive group settings (e.g. problem based learning, quizzes, protocol review exercises, practical skill competency tests, worksheet completion etc.). Summative practical laboratory reports and/or the lab manual will be submitted/reviewed during the module. Further details are presented in the indicative content section of this document.

Final Examination

Assessment Type	Formal Exam	**% of Total Mark**	50
Marks Out Of	0	**Pass Mark**	0
Timing	End-of-Semester	**Learning Outcome**	1,2,3,4
Duration in minutes	120		

Assessment Description
End-of-Semester Final Examination

Module Workload

Workload: Full Time On Campus					
Workload Type	*Contact Type*	*Workload Description*	*Frequency*	*Average Weekly Learner Workload*	*Hours*
Lecture	Contact	3 x 1 hour interactive lectures per week.	Every Week	3.00	3
Practical	Contact	1 x 3 hour laboratory session	Every Week	3.00	3
Directed Reading	Non Contact	Notes / Paper / Textbook reading	Every Week	2.00	2
Independent Study	Non Contact	Self / group study	Every Week	5.00	5
				Total Weekly Learner Workload	13.00
				Total Weekly Contact Hours	6.00

This module has no Part Time On Campus workload.

Module Resources

Recommended Book Resources

Berg, Tymoczko and Stryer.. (2015), Biochemistry, 8th. WH Freeman.
Lodish, Berk, Kaiser, Krieger, Scott, Bretscher, Ploegh and Matsudaira.. (2016), Molecular Cell Biology, 8th. WH Freeman.
David P. Clark. (2012), Molecular Biology, 2nd. Elsevier.
William H. Elliott, Daphne C. Elliott. (2014), Biochemistry and molecular biology, 5th. Oxford ; New York : Oxford University Press.
David Sheehan. (2009), Physical Biochemistry, 2nd. Wiley.
Keith Wilson and John Walker. (2010), Principles and techniques of biochemistry and molecular biology, 7th. Cambridge University Press.
David Nelson and Michael Cox. (2017), Lehninger Principles of Biochemsitry, 7th. WH Freeman.
H. John Smith and Claire Simons. (2005), Enzymes and their inhibition : drug development, CRC Press.

Supplementary Book Resources

Robert K. Murray et al.. (2015), Harper's illustrated biochemistry, 30th. McGraw-Hill Medical.
Mary K. Campbell, Shawn O'Farrell. (2018), Biochemistry, 9th. Brooks Cole; Cengage.
Robert A. Copeland. (2000), Enzymes: a practical introduction to structure, mechanism, and data analysis, 2. Interscience.
Colleen Smith, Allan Marks, Michael Lieberman. (2013), Basic Medical Biochemistry', 4th. Lippincott, Williams and Wilkins.
David Hames, Nigel Hooper. (2011), BIOS Instant notes in Biochemistry, 4th. Garland Science.

This module does not have any article/paper resources

Other Resources

Textbook collection online with DkIT, Access online textbooks through DkIT's dawsonera and eBrary collection (go to DkiT library site to begin).
Up to date science breakthrough website, www.breebio.com.
Website, Online Bioinformatics Tools: www.expasy.org.
Online publication database, www.sciencedirect.com, (log in through DkIT library webpage for access to subscribed journals).
Online publication database, www.pubmed.com.
Website, Bioconnect Ireland; www.biotechnologyireland.com.