LF104-24 Molecules, Cells and Organisms

22/23

Department
Life Sciences
Level
Undergraduate Level 1
Module leader
Robert Spooner
Credit value
24
Module duration
14 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module lays the foundations for the study of organisms at the molecular, genetic, cellular, tissue and organ levels. It is an essential foundation module for most other modules taught by the School, whose degrees are strongly oriented towards molecular and cellular aspects of biology.

Module web page

Module aims

Following a comprehensive foundation in the principles of molecular biology that underlie genetics, evolution and metabolism, the complexity of intracellular biological systems and subcellular structures is introduced, followed by an introduction to the higher level of intercellular systems and communication. The life and death of a eukaryotic cell are discussed to provide an overview of cell division and its underlying control process, and how the cell cycle responds to growth signals and death signals, resulting in cell proliferation and programmed cell death, respectively. These processes, coupled with differentiation, can transform tissues into organs with sophisticated communication and developmental programs. This underlies the construction of specialised tissues with the ability to remodel tissue from stem cells. Finally, we focus on genetics, at both the

prokaryotic and eukaryotic levels.

Key concepts, observations and interpretations of evidence are discussed, ultimately linking the phenotypes of organisms with the properties of proteins and the genes that encode them.

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.

1. Proteins – molecular design of life, polypeptide bonds, amino acids, protein structure, haemoglobin.
2. Membranes – structure, asymmetry and transport across membranes.
3. Molecular biology – DNA replication, translation, transcription, structure of nucleic acids, manipulating genes.
4. Genetics of prokaryotes – mutagens and mutagenesis, natural selection in bacteria, transformation, conjugation, transduction, Lac operon.
5. Genetics of eukaryotes – Mendel's Laws of Inheritance, autosomal recessive defects, sex linked traits.
6. Introduction to cells and tissues
   Evolution of the cell
   Cell organisation and the cytoskeleton
   Protein trafficking in eukaryotic cells: nuclear transport, protein sorting
   Cell- cell junctions; the extracellular matrix
   Tissue organisation in mammals: how different cell types are organised to form tissues.
7. Tissue homeostasis
   Mechanisms of cell division.
   Control of cell proliferation.
   Cell death and apoptosis.
   Tissue stem cells, the generation of functional cells and tissue renewal.
8. Functioning organisms
   Communication between cells and tissues

Learning outcomes

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

- At the end of this module students should have acquired a thorough foundation of basic knowledge of the molecular biology underlying genetics, evolution and biochemistry, and how DNA information is connected through RNA and protein synthesis to the structure and function of cells and organisms.
- a) A basic understanding of the relationship between structure and function in lipids and proteins.
- b) Knowledge of the chemical formulae for the most important molecules.
- c) An understanding of the structure of DNA and molecular details of the mechanism of its replication
- d) An understanding of the flow of information from DNA to RNA to protein, and molecular details of the processes of transcription and translation.

- e) A basic understanding of the application of key techniques in molecular and cellular biology.
- f) Recognition of some of the key processes in eukaryotic cell biology: division, growth, death, protein transport, the secretory system and cell-cell communication.
- g) Understanding the basis of multicellularity and tissue homeostasis.
- h) Knowledge of the genetics of bacteria, including the mechanisms of genetic exchange, mutation, the concepts of recombination and complementation and regulation of gene expression as exemplified by the lactose operon of Escherichia coli.
- i) A coherent understanding of the classical genetics of eukaryotes, including linkage, inheritance of quantitative characters, cytology and chromosome mechanics.

Indicative reading list

Berg JM, Tymoczko JL, Gatto GJ Jr and Stryer L. Biochemistry, 8th edition (WH Freeman 2015)

Lodish H, Berk A, Kaiser AC, Krieger M, , Bretscher A, Ploegh H, Amon A, and Scott MP. Molecular Cell Biology, 7th edition (WH Freeman 2012)

Griffiths A J F, Wesler S R, Doebley J and Carroll S B. An Introduction to Genetic Analysis, 10th edn. (W H Freeman, 2011).

Alberts B, Johnson A, Lewis J, Morgan D, Raff M, Roberts K and Walter P. Molecular Biology of the Cell, 6th edition (Garland Science 2014)

Subject specific skills

a) A basic understanding of the relationship between structure and function in proteins.
b) Knowledge of the chemical formulae for the most important molecules.
c) An understanding of the structure of DNA and molecular details of the mechanism of its replication
d) An understanding of the flow of information from DNA to RNA to protein, and molecular details of the processes of transcription and translation.
e) A basic understanding of the application of key techniques in molecular and cellular biology.
f) Recognition of some of the key processes in eukaryotic cell biology: division, growth, death, protein transport, the secretory system and cell-cell communication.
g) Understanding the basis of multicellularity and tissue homeostasis.
h) Knowledge of the genetics of bacteria, including the mechanisms of genetic exchange, mutation, the concepts of recombination and complementation and regulation of gene expression as exemplified by the lactose operon of Escherichia coli.
i) A coherent understanding of the classical genetics of eukaryotes, including linkage, inheritance of quantitative characters, cytology and chromosome mechanics.

Transferable skills

1. Critical appraisal of source material
2. Self directed learning
3. Adult learning

Study

Study time

Type	Required
Lectures	53 sessions of 1 hour (22%)
Other activity	6 hours (2%)
Private study	181 hours (75%)
Total	240 hours

Private study description

Independent learning, self directed learning and revision for MCQ exams.

Other activity description

6 (nominal 1 h) test assessments

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 A1

	Weighting	Study time
In-module Test (1) In-module MCQ exams	20%	
In-module Test (2)	20%	
In-module Test (3)	20%	
In-module Test (4)	20%	
In-module Test (5)	20%	

Assessment group R

	Weighting	Study time
Online Examination - Resit	100%	

	Weighting	Study time

- Online examination: No Answerbook required

Feedback on assessment

Instant feedback on in-module tests will be provided by Moodle - scores will be given immediately the test has ended.\r\ncohort level feedback to be provided after each test\r\n\r\n

Past exam papers for LF104

Availability

Courses

This module is Core for:

- Year 1 of UBSA-C700 Undergraduate Biochemistry
- ULFA-C1A2 Undergraduate Biochemistry (MBio)
  - Year 1 of C1A2 Biochemistry
  - Year 1 of C700 Biochemistry
- Year 1 of ULFA-C702 Undergraduate Biochemistry (with Placement Year)
- Year 1 of ULFA-C1A6 Undergraduate Biochemistry with Industrial Placement (MBio)
- UBSA-3 Undergraduate Biological Sciences
  - Year 1 of C100 Biological Sciences
  - Year 1 of C100 Biological Sciences
- Year 1 of ULFA-C1A1 Undergraduate Biological Sciences (MBio)
- Year 1 of ULFA-C113 Undergraduate Biological Sciences (with Placement Year)
- Year 1 of ULFA-C1A5 Undergraduate Biological Sciences with Industrial Placement (MBio)
- UBSA-C1B9 Undergraduate Biomedical Science
  - Year 1 of C1B9 Biomedical Science
  - Year 1 of C1B9 Biomedical Science
  - Year 1 of C1B9 Biomedical Science
- ULFA-C1A3 Undergraduate Biomedical Science (MBio)
  - Year 1 of C1A3 Biomedical Science
  - Year 1 of C1B9 Biomedical Science
- Year 1 of ULFA-C1A7 Undergraduate Biomedical Science with Industrial Placement (MBio)
- ULFA-CB18 Undergraduate Biomedical Science with Placement Year
  - Year 1 of CB18 Biomedical Science with Placement Year
  - Year 1 of CB18 Biomedical Science with Placement Year
  - Year 1 of CB18 Biomedical Science with Placement Year
- Year 1 of UIPA-C1L8 Undergraduate Life Sciences and Global Sustainable Development
- Year 1 of ULFA-B140 Undergraduate Neuroscience (BSc)
- Year 1 of ULFA-B142 Undergraduate Neuroscience (MBio)
- Year 1 of ULFA-B143 Undergraduate Neuroscience (with Industrial Placement) (MBio)

- Year 1 of ULFA-B141 Undergraduate Neuroscience (with Placement Year) (BSc)

This module is Optional for:

- Year 1 of ULFA-C702 Undergraduate Biochemistry (with Placement Year)