BI501 Gene Expression and Its Control

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	I	15 (7.5)	50% Coursework, 50% Exam	
1	Canterbury	Autumn	I	15 (7.5)	60% Exam, 40% Coursework	
1	Canterbury	Autumn	I	15 (7.5)	70% Exam, 30% Coursework	
1	Canterbury	Spring	I	15 (7.5)	60% Exam, 40% Coursework	Koloteva-Levine Dr N

Contact Hours

Total contact hours: 30
Private study hours: 120
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to demonstrate:
An understanding of how genes are organised, expressed and controlled in both prokaryotes and eukaryotes.
Awareness of the contribution of modern molecular and cellular technologies in furthering our understanding of gene expression and its control.
An appreciation of the importance of fundamental research into gene structure and function for future developments in the fields of human genomics and disease.
An ability to analyse data from laboratory experiments that address issues relating to gene structure and/or expression.

The intended generic learning outcomes.
On successfully completing the module students will:
Be able to extract and interpret information at an intermediate level.
Be able to analyse and evaluate experimental data at an intermediate level.
Have acquired skills in written communication and receiving critique.

Method of Assessment

Assignment 1, word limit 750-1000 words (20%)
Assignment 2, word limit 1500-2000 words (20%)
Exam, 2 hr, (60%)

Preliminary Reading

Core Texts (one of the following):

Krebs, J.E., Goldstein, E.S. and Kilpatrick, S.T. "Lewin's Genes XII", Jones and Bartlett Learning, Publishers, 2018 [ISBN-978-1-284104493]
Krebs, J.E., Goldstein, E.S., Kilpatrick, S.T. "Lewin's Essential Genes 3rd edition" Jones and Bartlett Learning, 2013, [ISBN: 978-1-4496-4479-6]
Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. & Losick, R. "Molecular Biology of the Gene, 7th Edition", Pearson, 2014 [ISBN: 978-0-321-85149-9]

In addition, the following books are recommended for supplementary/background reading:
Craig, N., Cohen-Fix, O., Green, R., Greider, C., Storz, G., Wolberger, C. 'Molecular Biology: Principles of Genome Function', 2nd edition OUP Oxford; 2014, ISBN-13: 978-0198705970
Latchman, D.S. 'Gene Control'. Garland Science, 2014, ISBN-10: 0815365136

Pre-requisites

Before taking this module you must take BI302 Molecular and Cellular Biology

Restrictions

Stage 2 students only

Synopsis *

The module deals with the molecular mechanisms of gene expression and its regulation in organisms ranging from viruses to man. This involves descriptions of how genetic information is stored in DNA and RNA, how that information is decoded by the cell and how this flow of information is controlled in response to changes in environment or developmental stage. Throughout, the mechanisms in prokaryotes and eukaryotes will be compared and contrasted and will touch on the latest developments in how we can analyse gene expression, and what these developments have revealed.

BI503 Cell Biology

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Autumn	I	15 (7.5)	65% Exam, 35% Coursework	Carden Dr M

Availability

It is required that you have taken all the core modules within one of our Bioscience programmes in order to take this module.

Contact Hours

Total contact hours: 30
Private study hours: 120
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:
An understanding of cellular organisation and associated processes.
An understanding of modern procedures for identifying cellular components.

The intended generic learning outcomes. On successfully completing the module students will be able to:
Development of abilities to handle scientific literature
Development of skills in presenting a concise digest of a research area both orally and in written form

Method of Assessment

Presentation (scientific literature) 10 hrs (10%)
Practical Report 24 hrs 1000-1500 words (25%)
Exam, 2 hr (65%)

Preliminary Reading

Core texts:
Lodish HF, Berk A, Kaiser CA, Krieger M, Molecular cell biology, 8th Edition, W.H. Freeman, 2016

Optional texts:
Alberts B, Molecular Biology of the Cell, 6th Edition, Garland Science Pub., 2015
Alberts B, Essential Cell Biology, 4th Edition, Garland Science Pub., 2014
Much of the module material is covered at some (usually more introductory) level in Biology and Biochemistry textbooks, as recommended in other modules - examples include Campbell's Biology and Nelson & Cox's (Lehninger's) Principles of Biochemistry

Restrictions

Stage 2 students only

Synopsis *

The cell is the fundamental structural unit in living organisms. Eukaryotic cells are compartmentalized structures that like prokaryotic cells, must perform several vital functions such as energy production, cell division and DNA replication and also must respond to extracellular environmental cues. In multicellular organisms, certain cells have developed modified structures, allowing them to fulfil highly specialised roles. This module reviews the experimental approaches that have been taken to investigate the biology of the cell and highlights the similarities and differences between cells of complex multicellular organisms and microbial cells. Initially the functions of the cytoskeleton and certain cellular compartments, particularly the nucleus, are considered. Later in the unit, the mechanisms by which newly synthesised proteins are secreted or shuttled to their appropriate cellular compartments are examined.

BI505 Infection and Immunity

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	I	15 (7.5)	100% Exam	Curling Dr E
2	Canterbury	Spring	I	15 (7.5)	55% Exam, 45% Coursework	Curling Dr E

Contact Hours

Total contact hours: 26
Private study hours: 124
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to have a knowledge and understanding of:

The major immune system functions and components, how cell-cell communication controls immune responsiveness to infectious agents and immunopathology.
Microorganisms of medical importance and the diseases they cause.
How the spread of disease occurs in the human population.
Experimental procedures in handling and identifying bacteria in samples provided to the students during the practical class.
Microbiological and immunological techniques used to identify pathogens and immune cells
Methods of data acquisition analysis and presentation as evidenced by the practical report assessment.

The intended generic learning outcomes.
On successfully completing the module students will be able to have a knowledge and understanding of:

Interpretation and retrieval of relevant information.
Analysis and evaluation of data.
Written communication skills.

Method of Assessment

Immunology assessment, 1500 words (22.5%)
Lab Practical Report (22.5%)
Examination, 2 hr (55%)

Preliminary Reading

Murphy, K., Janeway's Immunobiology, 9th Edition, Garland Science, 2017.
Owen, Punt and Stranford, Kuby Immunology, 7th Edition, Macmillan, 2013.
Mims' Medical Microbiology, 5th Edition, Mosby, 2012.

Pre-requisites

Before taking this module you must take BI307 Human Physiology and Disease

Restrictions

Stage 2 students only

Synopsis *

This module will consider the anatomy and function of the immune system and immunopathology and then consider the diseases and microorganisms that affect the different organs and tissues of the human body. Indicative topics will include inflammation, innate and adaptive immunity to pathogens, immune defence mechanisms against bacterial, viral and parasitic infections, antibody classes and functions, antigen processing and presentation, complement, the generation of antibody diversity, cell communication and immunopathology, including autoimmunity, hypersensitivity and transplant rejection. In the medical microbiology section of the module, indicative topics will include epidemiology, virology, parasitology, fungal infections, skin infections, GI tract infections, CNS infections, respiratory tract infections, UTI and STD infections.

BI513 Human Physiology and Disease 2

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Autumn	I	15 (7.5)	60% Exam, 40% Coursework	Phelan Dr P

Availability

BI302 Molecular and Cellular Biology and BI307 Human Physiology and Disease are strongly recommended preparatory modules for this one.

Contact Hours

Total contact hours: 24
Private study hours: 126
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:
Describe the structural organization and function of specific physiological systems of the body and understand how the body systems act in an integrated manner to maintain homeostasis.
Describe how malfunction of physiological systems gives rise to disease, using specific examples.
Appreciate the relationship between physiology, anatomy and medicine

Human physiology and disease is taught over two years. The Stage 1 module (BI307) introduces the subject and covers the physiology of immune, digestive, respiratory, cardiovascular and excretory systems. This Stage 2 module covers endocrine, reproductive, nervous and muscular systems.

The intended generic learning outcomes. On successfully completing the module students will have developed the following skills:
Retrieval, interpretation and application of information
Data analysis and evaluation
Written and oral communication skills

Method of Assessment

In-course test, 1 hr (20%)
Problem solving/case study (20%)
Exam, 2 hr (60%)

Preliminary Reading

Silverthorn, D.U. Human Physiology – An Integrated Approach, Pearson Education. Recent editions suitable; latest is 7th edition (2015)

Restrictions

Stage 2 students only

Synopsis *

Reproductive System: Male and female reproductive systems; Endocrine control of reproduction; Fertilisation; Early embryogenesis; Pregnancy and Parturition; Reproductive disorders.

Muscle: Muscle types: skeletal, smooth and cardiac; Structure of muscle; Molecular basis of contraction; Regulation of contraction including neural control; Energy requirements of muscle; Types of movement: reflex, voluntary, rhythmic; Muscle disorders.

Nervous System: Cells of the nervous system- neurons and glia; Electrical properties of neurons- action potential generation and conduction; Synaptic structure and function- transmitters and receptors; Structural organization of the central nervous system (CNS) and function of individual regions; Organization and function of the peripheral nervous system (PNS)- somatic motor, autonomic (sympathetic and parasympathetic) and sensory; Sensory systems- vision, hearing, taste, smell, pain. Disorders of the nervous system.

Endocrine System: Endocrine glands; Classes of hormones; Mechanisms of hormone action; Regulation of hormone release; Endocrine disorders.

BI514 Pharmacology

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	I	15 (7.5)	60% Exam, 40% Coursework	
1	Canterbury	Spring	I	15 (7.5)	60% Exam, 40% Coursework	Ortega-Roldan Dr J

Availability

It is required that you have taken all the core modules within stage 1 of one of our Bioscience programmes in order to take this module. It is also recommended that you have taken BI307 Human Physiology and Disease.

Contact Hours

Total contact hours: 29
Private study hours: 121
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes on successful completion of the module students will be able to:
Demonstrate an understanding of receptors, ion channels, enzymes and carrier molecules as drug targets.
Describe drug-receptor interactions at the molecular level.
Understand systems pharmacology – e.g. cardiovascular and central nervous systems – and the action of therapeutic agents in diseased states.
Demonstrate both a practical and theoretical knowledge of pharmacological techniques.

Intended generic learning outcomes:
Be able to extract and interpret information at an intermediate level.
Be able to analyse and evaluate data at an intermediate level.
Have acquired skills in written communication and receiving critique.
Have acquired skills in working as a team to solve problems.

Method of Assessment

Data analysis (20%)
In-class clinical case study (20%)
Exam, 2 hr, (60%)

Preliminary Reading

Neal MJ, Medical Pharmacology at a Glance, 8th Edition, Blackwell Pub., 2015
Rang and Dale's Pharmacology, 8th Edition, Churchill Livingstone, 2015

Pre-requisites

Core Stage 1 modules
BIOS3070 Human Physiology and Disease is recommended

Restrictions

Stage 2 students only

Synopsis *

Introduction and basic principles of drug action: key drug targets including major receptor subtypes, ion channels, transporters, and structure-function relationships
Systems pharmacology: the biological basis of diseases states affecting different physiological systems, therapeutic approaches to treating these diseases, and the cellular/molecular mode of action of drugs used. Indicative diseases may include hypertension, asthma, Parkinson's disease, schizophrenia, infertility, depression and anxiety.

BI520 Metabolism and Metabolic Disease

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	I	15 (7.5)	100% Coursework	Lawrence Dr A
1	Canterbury	Autumn	I	15 (7.5)	60% Exam, 40% Coursework	Lawrence Dr A

Availability

It is recommended that you have taken core Stage 1 modules in Biochemistry or Biomedical Sciences

Contact Hours

Total contact hours: 23
Private study hours: 127
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
Understand selected mechanisms that can lead to human metabolic diseases, and their genetic basis.
Recall metabolic maps that relate the main pathways of catabolism and biosynthesis to each other.
Understand how metabolic pathways interact with each other, including those in different tissues.
Understand selected chemical mechanisms that underpin the metabolism studied.

The intended generic learning outcomes.
On successfully completing the module students will have:
Written and oral communication skills.
Skills to analyse data relating to metabolic defects and report results.
Problem solving skills.

Method of Assessment

MCQ Test (20%)
Computer practical report (20%) – 2000 words
Exam, 2 hr, (60%)

Preliminary Reading

Core Text:
Nelson DL, Lehninger Principles of Biochemistry. Editions 5 – 7.
Selected articles from scientific journals may also be recommended.

Recommended Reading:
Clarke, Joe T. R., A Clinical Guide to Inherited Metabolic Diseases. Cambridge: Cambridge University Press, 2006. 3rd ed. e-book edition (via library catalogue).
Osgood M, Ocorr KA, The Absolute, Ultimate Guide to Lehninger Principles of Biochemistry: Study Guide and Solutions Manual, 6th edition, W.H. Freeman, 2012.
Newsholme and Leech, Functional Biochemistry in Health and Disease. Chichester; Wiley, 2009. Hardcopies and e-book (via library catalogue).

Pre-requisites

Prerequisite:
First year core modules for BSc Biochemistry or BSc Biomedical Science

Restrictions

Stage 2 students only

Synopsis *

This module covers the general principles of metabolic disorders and focuses on pathways, enzyme mechanisms, and diseases associated with:
Energy metabolism
Amino acid/nucleotide metabolism
The urea cycle
Cholesterol metabolism
Vitamin metabolism
Heme synthesis/breakdown

BI521 Metabolism and Metabolic Regulation

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Spring	I	15 (7.5)	60% Exam, 40% Coursework	Shepherd Dr M

Availability

It is strongly recommended that you have taken first year Biosciences modules.

Contact Hours

Total contact hours: 29
Private study hours: 121
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:

• Understand key modes of metabolic regulation.
• Understand key elements of plant and microbial metabolism that are distinct from human metabolism covered elsewhere.
• Understand the importance of metabolic processes in biotechnological applications.

The intended generic learning outcomes.
On successfully completing the module students will be able to:

• Demonstrate written and oral communication skills.
• Demonstrate an ability to analyse data from experimental, online and other sources and report results.
• Demonstrate problem solving skills.

Method of Assessment

Main assessment methods
Practical report (25%) Worksheet provided.
Test (15%) 30 questions, standard time allowance 40 min
Exam, 2 hr (60%).

Preliminary Reading

Core Text:
• Nelson DL, Lehninger Principles of Biochemistry. Editions 5 – 7.

Recommended Reading:
• Osgood M, Ocorr KA, The Absolute, Ultimate Guide to Lehninger Principles of Biochemistry: Study Guide and Solutions Manual, 5th edition, W.H. Freeman, 2008
• Selected articles from scientific journals may also be recommended.

Pre-requisites

Prerequisites:
Stage 1 Biosciences Modules
BI520 Metabolism and Metabolic Disease

Restrictions

Stage 2 students only

Synopsis *

Principles of metabolic regulation: Allostery, cooperativity, phosphorylation, and hormonal control. Metabolic regulation in response to cellular energy status.Transcriptional regulation.

Plant metabolism: Photosynthesis, carbon fixation, and secondary metabolites.

Microbial metabolism: Nitrogen cycle, stress responses, omics approaches, metals, and secondary metabolites.

Metabolism in biotechnology: Manipulating microbial metabolism for the production of useful compounds. Manipulating mammalian cell metabolism in biotechnology.

BI525 Investigation of Disease

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Autumn	I	15 (7.5)	100% Coursework	Foster Dr K
2	Canterbury	Autumn	I	15 (7.5)	60% Exam, 40% Coursework	Foster Dr K

Contact Hours

Total contact hours: 33
Private study hours: 117
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to demonstrate:
An understanding of the working practices in the United Kingdom National Health Service and the role of a Biomedical Scientist.
Knowledge and understanding of the general techniques used in Clinical Biochemistry and their use in the assessment of disease.
Knowledge and understanding of the general techniques used in Cellular Pathology and application to the assessment of disease and potential treatment strategies.

The intended generic learning outcomes. On successfully completing the module students will be able to:
Use problem solving skills to analyse case study data and clearly communicate their findings.
Use analytical and observation skills to interpret immunohistochemical data.
Demonstrate ability to function at an intermediate level in a NHS laboratory through their understanding of working practises in Biomedical Science.

Method of Assessment

Practical report (20%) (2000 words)
Case study (20%) (1500 words)
Exam (60%) (2 hour)

Preliminary Reading

Gaw, A., Cowan, R.A et al (2013) Clinical Biochemistry, Fifth Edition, Churchill Livingstone, London
Ahmed, N., (2016) Clinical Biochemistry, Second Edition, Fundamentals of Biomedical Science series, Oxford University Press
Shambyati, B., (2011) Cytopathology, Fundamentals of Biomedical Science series, Oxford University Press
Orchard, G. And Nation, B., (2017) Histopathology, Second Edition, Fundamentals of Biomedical Science series, Oxford University Press

Pre-requisites

Before taking this module you must take BI300 Introduction to Biochemistry and BI308 Skills for Bioscientists.
Whilst taking this module you must take BI532 Skills for Bioscientists 2.

Restrictions

Stage 2 students only

Synopsis *

This module will introduce the student to two of the four main branches of laboratory medicine, Clinical Biochemistry and Cellular Pathology, and begin to develop the skills students will require to work effectively and safely within a clinical setting.

Clinical Biochemistry:
The use of the laboratory, quality assurance and techniques (including Instrumentation and Automation, Clinical Applications, Antigen-Antibody Reactions, Separation techniques) will be introduced using the various screening and testing procedures as below.
Screening for disease – concepts, rationale and screening programmes, application of biochemical techniques to paediatrics and inborn errors of metabolism, tumour markers, liver function, iron and porphyrias, enzymes and their use in laboratory medicine, clinical applications of protein biochemistry, nutrition in health and disease, lipids and atherosclerosis.

Cellular Pathology:
Application of histological and cytological techniques in a clinical setting including cell and tissue sampling techniques for histological and cytological diagnosis.
Use histochemical and immunohistochemical stain techniques for diagnosis and selection of treatment.
Microscopic methods used in cellular pathology.
Quality control and quality assurance.

BI546 Animal Form and Function

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	I	15 (7.5)	100% Coursework	Mansfield Dr F
1	Canterbury	Autumn	I	15 (7.5)	60% Exam, 40% Coursework	Mansfield Dr F

Availability

It is strongly recommended that you have taken the Core stage 1 modules within one of our Bioscience programmes.

Contact Hours

Total contact hours: 31
Private study hours: 119
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:

Describe body plans and the structural organisation of a range of animals.
Understand the physiological role of a range of structures in animals.
Compare physiological systems across the animal kingdom.
Describe how physiological systems adapt to specific environmental conditions.
Demonstrate a practical understanding of classification on the basis of external morphological features in the arthropods.

The intended generic learning outcomes. On successfully completing the module students will be able to have:

The ability to analyse and communicate experimental findings.
Written communication skills.
The ability to integrate information from a variety of sources.

Method of Assessment

Practical report 1 (20%)
Practical report 2 (20%)
Exam, 2 hr (60%)

Preliminary Reading

Hickman, C.P., Roberts, L.S., Keen, S.L., Eisenhour, D.J., Larson, A., L'Anson, H. Integrated Principles of Zoology (16th Ed) (2014)

Pre-requisites

None

Restrictions

Stage 2 students only

Synopsis *

You study the diversity of animal life throughout evolution, including elements of functional anatomy and physiology such as circulation and gaseous exchange, the digestive system, the nervous system and reproduction.

Topics:

Comparative physiology - in this section the diversity of different physiological systems will be studied including circulation, gaseous exchange, feeding and digestion, excretion, nervous tissue and the senses, reproduction and immunology.

Form and Function - in this section a diverse range of taxonomic groups and their characteristics will be studied to understand the relationship between structure and function. How these characteristics equip the animal to survive and succeed in its particular environment will be explored.

BI547 Plant Physiology and Adaptation

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Spring	I	15 (7.5)	60% Exam, 40% Coursework	Foster Dr K

Contact Hours

Total contact hours: 30
Private study hours: 120
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes:
On successfully completing the module students will be able to have:

A knowledge of plant specific features of cellular organisation and processes.
An understanding of the process and regulation of photosynthesis.
An understanding of plant hormones and their role in the life cycle and responses to the environment.
An understanding of how plants respond and adapt to environmental conditions

The intended generic learning outcomes:

Written communication.
The ability to generate, analyse and report experimental data.
Problem Solving.

Method of Assessment

Practical (20%)
Problem solving (20%)
Examination (2h) (60%)

Preliminary Reading

Introduction to Plant Physiology (4th edition) W.G. Hopkins and N.P.A. Hunter, Wiley Publishing (2008)
Plant Biology, A.M. Smith, G. Coupland, L. Dolan, N. Harberd, J. Jones, C. Martin, R. Sablowski, A. Amery, Garland Science (2010)

Pre-requisites

None

Restrictions

Stage 2 students only

Synopsis *

Plant specific features of cellular organisation and processes – cell wall synthesis, cell division, endoreduplication, plasmadesmata
Photosynthesis – mechanism and regulation of photosynthesis, photorespiration, C3, C4 and CAM.
Plant hormones and signalling – e.g. auxins, gibberellins, cytokinins etc and their roles in tropism, photoperiodism, and flowering.
Adaptation and stress response – environmental stress, acclimatisation and adaptation.

BI548 Microbial Physiology and Genetics I

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	I	15 (7.5)	50% Coursework, 50% Exam	
1	Canterbury	Spring	I	15 (7.5)	50% Coursework, 50% Exam	Buscaino Dr A
1	Canterbury	Spring	I	15 (7.5)	60% Exam, 40% Coursework	Buscaino Dr A

Contact Hours

Total contact hours: 28
Private study hours: 122
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to demonstrate a knowledge and understanding of:
The ecological, economic and scientific importance of microorganisms.
The evolution, taxonomy and biodiversity of microorganisms.
The structural and metabolic diversity of microorganisms.
The synthesis and assembly of macromolecular structures of microorganisms .
Genetic and physiological regulation in microorganisms.

The intended generic learning outcomes. On successful completion of the module, students will be able to demonstrate skills in:
Written communication.
The ability to generate, analyse and report experimental data.
Mathematical problem solving.

Method of Assessment

Workshop (20%) 1000 word limit
Practical write up (30%) 1000 word limit
Exam, 2 hr (50%)

Preliminary Reading

Microbiology, An Evolving Science. Slonczewski and Foster (3rd Edition) W.W. Norton and Company

Pre-requisites

Before taking this module you must take BI324 Genetics and Evolution

Restrictions

Stage 2 students only

Synopsis *

Introduction: The ecological, medical, scientific and commercial importance of bacteria. Bacterial evolution and taxonomy.

Microbial biodiversity at the structural level: Composition of the average bacterial cell and basic bacterial cell structure. Gram positive and gram negative. Archea. Organisation of DNA. Membranes and the transport of small molecules into and out of the cell. Peptidoglycan and LPS and their importance in pathogenesis. The location and function of proteins. Capsule, flagella and adhesins.

Introduction to growth, fuelling and biosynthesis: Division by binary fission, including growth equations. Growth in batch and chemostat cultures; liquid vs. solid media. Nutritional and non-nutritional factors affecting growth (temperature, osmolarity, pH and antibiotics). Physiological state and balanced growth. Adaptation to extreme conditions.

Microbial biodiversity at the physiological and biochemical level: The diversity in bacterial metabolism (nutrient sources (particularly carbon and nitrogen)), photosynthesis, aerobic and anaerobic growth and alternative terminal electron acceptors. Fermentation. The inverse relationship between growth factor requirements and biochemical complexity. The ecological significance of bacteria.

Synthesis, localisation and assembly of macromolecular structures: DNA replication and transcription. Translational and protein localisation, assembly of flagella and adhesins. Membranes, including LPS. Peptidoglycan. Antibiotics that inhibit peptidoglycan biosynthesis. Capsules.

Microbial communities and ecology: growth and survival in the real world (e.g. soils and sediments), studying populations and individuals. Biofilms and complex communities. Diauxie and growth.

Signalling and physiological control: Introduction to bacterial genetics. The regulation of gene expression at the transcriptional and post-transcriptional level in response to environmental factors Chemotaxis.

Practical: "Antibiotics" in which students follow the growth of bacteria upon treatment with bacteriostatic and bactericidal antibiotics and answer questions about data concerning the mode of action of antibiotic resistance presented in the laboratory manual.

Workshop: "Growth and viable counts" in which the students are given numerical data + growth equations and have to define factors such as (i) dilutions needed to give specific cell numbers, (ii) generations of growth to achieve specific cells numbers (iii) growth rate/doubling time. Designed to give students the skills required to manipulate bacterial cells to achieve correct cell density and growth phase for practical work.

BI549 The Genome

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Spring	I	15 (7.5)	100% Coursework	Ellis Dr P
1	Canterbury	Spring	I	15 (7.5)	50% Coursework, 50% Exam	Ellis Dr P

Contact Hours

27 Contact hours comprising lectures, lab practical and computer analysis workshop
123 Hours of private study
Total hours for the module 150

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module, students will be able to demonstrate:

An understanding of the composition and structure of complex eukaryotic genomes.

An understanding of how genes and genomes vary between individuals, the origins of this variation, and the modern molecular technologies used to measure genetic and genomic variation.

Technical skills in working with DNA and carrying out basic bioinformatics and genomic analysis of nucleotide sequences.

An understanding of the information that can be inferred from genomic sequence data, including identification of individuals, assessment of population structure (ethnic background) and phenotype prediction including medically-relevant information.

An understanding of the uses to which this information can be put, such as forensic analysis, medical diagnosis and historical research.

An understanding of methods of genome editing and the ethical issues surrounding it.

The intended generic learning outcomes. On successfully completing the module students will be able to:

Communicate information, arguments and analysis to specialist and non-specialist audiences.

Analyse and communicate experimental findings.

Understand the limits of their knowledge and how this influences their analyses and interpretations of data.

Method of Assessment

Laboratory practical report – approx. 1,500 words (25%)
Computer analysis workshop report – approx. 1,500 words (25%)
Exam – 2hrs (50%)

Preliminary Reading

Relevant chapters from core undergraduate biology textbooks, e.g. Campbell's Biology.

Dudley, J.T. and Karczewski, K.J. (2013) Exploring Personal Genomics, Oxford University Press. ISBN: 9780199644490.

Lesk, A. (2017) Introduction to Genomics (3rd edition), Oxford University Press. ISBN: 9780198754831.

Additionally selected peer-reviewed research and review papers will be recommended.

Pre-requisites

BI302 Molecular & Cellular Biology
BI324 Genetics & Evolution

Synopsis *

This module will introduce students to the importance of genome-wide DNA sequence analysis in a range of different fields of study including forensic science, medical diagnosis and historical research. They will acquire a full grounding in the basic biology of how sequence data is acquired and analysed, and engage with up-to-date methods of DNA sequence analysis in the practical sessions. At the broad level, the module will be structured around the following 4 themes:

What is a genome? This addresses genome content and structure, including both functional and non-functional elements of the genome such as the simple "junk" DNA repeats used for forensic identification.

Understanding genomic variation. This addresses the molecular causes of genomic variation between individuals – i.e. what makes us all unique – and the technical methodologies used to detect genomic variation.

What are the implications of being able to read DNA? This covers the extent to which we can infer phenotype from genomic sequence – e.g. how much you can tell about a person once their genome has been sequenced. Specific examples may be drawn from forensic science, medical diagnosis and historical analysis.

What are the implications of being able to write or edit DNA? This addresses nascent and future technology for genome editing – what can it achieve, what are the risks, what are the ethical issues?

BI600		Research Project				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	H	30 (15)	100% Project	Kad Dr N
3	Canterbury	Spring	H	30 (15)	100% Project	Kad Dr N

Learning Outcomes

The intended subject specific learning outcomes.

Students taking all project types will have:

• Developed an in-depth understanding of an advanced research topic within the fields of Biochemistry, Biology, or Biomedical Science through study of the peer-reviewed primary scientific literature.
• Developed an appreciation of the how scientific knowledge advances through research e.g. the timescales, challenges, limitations, impact of technological advances.

Students taking wet/dry (computing-based) laboratory projects will have:

• An understanding of how to design and execute a sequence of experiments to address a research question and how to record data
• Enhanced existing and acquired new experimental skills
• Developed abilities to identify and solve practical and theoretical problems
• An awareness of the safety implications of laboratory work and knowledge of good laboratory practice (wet lab projects only).

Students taking dissertation projects will have:

• Developed critical analysis: ideas for novel experiments, clearly designed to address specific questions within the chosen topic. Furthermore, will understand the limitations and the practicability of the experimental process.

Students undertaking business projects will have:
• An appreciation of how scientific research may be translated into business ideas
• An understanding of the factors that are important in planning and preparing a business plan.

Students taking communication projects will have:
• Developed ability to simplify complex scientific information and adapt it to suit the audience
• Gained experience of presenting current scientific research to a general audience making it accessible and interesting.

The intended generic learning outcomes.
On successfully completing the module students will have:
• An appreciation of how research leads to knowledge.
• Developed a clear and concise style of scientific writing that is both informative and lucid.
• Developed skills in the retrieval of scientific information from journals and through electronic searches.
• An understanding of how technologies may be applied/adapted to address a research question.
• Developed their abilities to work independently and as part of a team - self-motivation, diplomacy, planning and organisational skills and time management.
• Developed skills in appraising critically and integrating information.
• Developed skills in communicating science (oral, written or web formats) and in making and defending scientific arguments.

Method of Assessment

Assessment for all project types is by written report with student performance and oral presentation:

Written report(s) & student performance: 90% (for dissertation and business projects this is comprised of 80% written report and 10% performance, for communications projects the written report is 60%, communication component 20% and performance 10%, for laboratory and computing projects 70% written report and 20% performance).

Presentation: 10%

For all projects, the performance rating assesses the abilities of the students to plan and manage the project work, work effectively (within a laboratory environment, if appropriate) and independently, retrieve, interpret and appraise the scientific literature, discuss ideas, concepts and approaches. Performance also assesses project specific skills: practical research ability (laboratory projects), design and/or use of computer packages (computer/web projects), development of a business idea (business projects), imagination and ideas for effective communication of science (communication projects). The written report assesses the student's knowledge and understanding of the project and the background literature, and general presentation/writing skills (clarity of style, attention to detail etc). The presentation assesses both subject knowledge and communication skills.

Preliminary Reading

Reading is entirely project-specific, to be discussed with academic supervisor.

Pre-requisites

None.

Restrictions

Biosciences Stage 3 students only

Synopsis *

Early in the Autumn term, projects are assigned to students by the project co-ordinator (a member of academic staff), where possible in accordance with student choice. Students then meet with their project supervisor to discuss the objectives of the project and obtain guidance on background reading. During the Autumn term students write a brief formative literature review on the project topic providing them with a good background before embarking on the project work.

The main project activities take place in the Spring term. Students taking laboratory projects spend 192 hours (24 hours per week for 8 weeks) in the lab planning, carrying out and documenting experiments. A further 108 hours are allowed for background reading and report writing. There are informal opportunities to discuss the project work and relevant literature with the supervisor and other laboratory staff. Formal meetings may be arranged at the discretion of the student and supervisor. Students undertaking non-laboratory projects are based in the library or, occasionally, in the laboratory; they are expected to dedicate 300 hours to their project work. Non-laboratory students are strongly encouraged to meet with the supervisor at least once a week to discuss progress and ideas and to resolve problems. At the end of the formal project time, students are allowed time to complete the final project report, although they are encouraged to start writing as early as possible during the Spring term. The supervisor provides feedback on content and style of a draft of the report. In addition, students are expected to deliver their findings in presentation lasting 10 minutes with 5 minutes of questions.

• Wet/Dry Laboratory and Computing: practical research undertaken in the teaching laboratories, or on computers followed by preparation of a written report
• Dissertation: library-based research leading to production of a report in the style of a scientific review
• Business: development of a biotechnology business plan
• Communication: similar to dissertation projects but with an emphasis on presenting the scientific topic to a general, non-scientist audience

BI602 Cell Signalling

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Autumn	H	15 (7.5)	60% Exam, 40% Coursework	Goult Dr B
2	Canterbury	Autumn	H	15 (7.5)	65% Exam, 35% Coursework	Goult Dr B
2	Canterbury	Spring	H	15 (7.5)	100% Coursework	

Availability

It is required that you have taken all the core modules within stage 2 of one of our Bioscience programmes in order to take this module.

Contact Hours

Total contact hours: 32
Private study hours: 118
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
Have:
• Knowledge of the major classes of signalling molecules, their receptors and intracellular signalling pathways.
• Acquisition of practical and data handling skills associated with monitoring intracellular signalling.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
Have a knowledge and understanding of:
• Interpretation and retrieval of information.
• Analysis and evaluation of data.
• Written communication skills.

Method of Assessment

Main assessment methods
Practical report (20%) - 2000 words
Test,1hr (short answer/mini essay questions (20%)
Exam, 2 hr (60%)

Reassessment methods
Reassessment Instrument: 100% exam

Preliminary Reading

Recent editions of:
• Lodish H et al. Molecular Cell Biology, Freeman & Co
• Nelson, J, Structure and Function in Cell Signalling, John Wiley and Sons Ltd
• Hancock JT, Cell Signalling, Oxford University Press
• Lim W, Mayer B, Pawson T. Cell Signalling – Principles and Mechanisms, Garland Science

Restrictions

Biosciences Stage 3 students only

Synopsis *

A synopsis of the curriculum
The module begins by overviewing the diverse mechanisms used by cells to communicate, considering the main modes of cell-cell communication, the major classes of signalling molecules and the receptor types upon which they act. It then focuses on nuclear, G-protein coupled, and enzyme linked receptors covering in molecular detail these receptors and their associated signal transduction pathways.

Introduction:
Principles of Cell Signalling.
Cell Adhesion and Cell Communication (adhesion and gap junctions).
Signalling Molecules: Hormones, neurotransmitters, growth factors.
Receptor Types: Nuclear, G-protein coupled, Ion-channel linked, Enzyme-linked.

Nuclear Receptors:
Cellular location and molecular organisation of receptors. Structure/function/activity relationships. Receptors as sequence-specific DNA binding proteins.

G-Protein Coupled Receptors:
Receptors coupled to heterotrimeric guanine nucleotide binding proteins (G proteins). Composition and classification of G-proteins, their activation and modulation by toxins and disease.
Second Messengers and Protein Phosphorylation (kinases and phosphatases).
Cyclic Nucleotide-Dependent Systems: G proteins in regulation of adenylyl cyclase-cAMP-protein kinase A (PKA) and guanylyl cyclase-cGMP pathways. Physiological roles e.g. in visual transduction and glycogen metabolism.
Inositol lipids in signal transduction: Regulation of phospholipase C. Inositol polyphosphates (e.g. IP3) and diacylglycerol (DAG) in regulation of Ca++-dependent kinases. Roles in specific cellular responses e.g. regulation of protein kinase C.

Interactions of Signalling Pathways:
'Cross-Talk' between different pathways and messenger molecules.

Enzyme Linked Receptors:
Receptor tyrosine kinases (RTKs), e.g. epidermal growth factor receptor (EGF) family and insulin receptor, and their varied roles in cellular metabolism, cell behaviour, development and disease.
Molecular organisation of receptors, autophosphorylation of intracellular domains.
Intracellular signalling pathways: activation of monomeric G-protein Ras, leading to activation of the mitogen activated protein (MAP) kinase cascade.
Integration of signalling components: Role of adapter proteins (e.g. GRB2) and their protein-protein interaction domains (SH2, SH3 etc.) in linking ligand-receptor complexes to intracellular proteins.

Practical: Characterisation of G-protein coupled receptors using a cAMP-linked reporter gene assay.

BI604 Biological Membranes

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	15 (7.5)	65% Exam, 35% Coursework	
1	Canterbury	Autumn	H	15 (7.5)	70% Exam, 30% Coursework	
1	Canterbury	Spring	H	15 (7.5)	65% Exam, 35% Coursework	Mulligan Dr C
1	Canterbury	Spring	H	15 (7.5)	70% Exam, 30% Coursework	Mulligan Dr C

Contact Hours

Total contact hours: 38
Private study hours: 112
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
• Demonstrate an understanding of membrane structure, traffic and transport, and understand the molecular basis of several common genetic diseases in this area.
• Demonstrate ability to integrate data from laboratory and computer-based analyses.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
• Be enabled in a number of computer skills important to final year projects and to scientific research.
• Demonstrate ability to solve honours level problems based on scientific data.

Method of Assessment

Main assessment methods
Practical (17.5%) 2500 word limit based on combined computer and wet lab investigation
Assignment (17.5%) Problem from past exam paper, 2500 word limit
Exam, 2 hr (65%)

Reassessment methods
Reassessment Instrument: 100% exam

Preliminary Reading

Core texts:
• Alberts et al. "Molecular Biology of the Cell" or Lodish et al. "Molecular Cell Biology".
AND One of the standard biochemistry texts (e.g. Lehninger/Nelson & Cox, Voet & Voet, Stryer etc.).
In addition, students will be given references to articles in a number of key review journals (Annual Review series, Trends series, Current Opinions series), and to primary research papers in (among others) Journal of Cell Biology, Journal of Biological Chemistry and Cell.
Supplementary (available in the Library).
• Luckey. M, "Membrane Structural Biology" Yeagle, P.L. “Membranes of cells”, 2nd edn. Jones, M.N. and Malcolm, N. “Micelles, monolayers, and biomembranes”.

Restrictions

Stage 3 students only

Synopsis *

Cells and subcellular compartments are separated from the external milieu by lipid membranes with protein molecules inserted into the lipid layer. The aim of this module is to develop understanding of both the lipid and protein components of membranes as dynamic structures whose functions are integrated in cellular processes.

BI606 Pathogens & Pathogenicity

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	15 (7.5)	65% Exam, 35% Coursework	Tsaousis Dr A

Contact Hours

Total contact hours: 20
Private study hours: 130
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
• Demonstrate an understanding and knowledge of the molecular basis of microbial pathogenesis in relation to bacterial, viral, parasitic and fungal pathogens.
(Biomedical Sciences programme outcomes: A4, A6, A7, A8, A9, A12, A15, A16, B1, B2, B3, B5, B8)
• Comprehend, assimilate and present data and concepts on a pathogenesis-related topic.
(Biomedical Sciences programme outcomes: A4, A15, A16, B1, B2, B5, B8, B2, B3, B4, B5, B6, C4, C6)

The intended generic learning outcomes.
On successfully completing the module students will be able to:
• The ability to understand, analyse and assess published scientific data.
(Biomedical Sciences programme outcomes C4, D1)
• The ability to assess presented scientific data and concepts, providing constructive feedback.
(Biomedical Sciences programme outcomes B3, C6)
• Written communication skills.
(Biomedical Sciences programme outcomes B3, B4, C4, C6, D1, D3 D4, D5)

Method of Assessment

Main assessment methods:
Written assessment (2000 - 2500 words): 35%:
Exam (2h) Essays: 65%

Reassessment methods:
100% Exam

Preliminary Reading

Mims, CA, The Pathogenesis of Infectious Diseases, 5th ed. (Academic Press, 2001) or a latter edition.
Fields, BN, Knipe DM, Howley PM, Fundamental Virology, 3rd ed. (Lippincott-Raven, 1996)
Wilson BA, Salyers, AA, Whitt, DD, Bacterial Pathogenesis, A Molecular Approach, 3rd ed. (ASM Press, 2011)
Fungal Pathogenesis: Principles and Clinical Applications, Edited by RA. Calderone and RL. Cihlar, Marcel Dekker, Inc., 1st ed. (CRC Press, 2001)
The rest of the suggested reading will consist of review articles and primary research publications. There is going to be given emphasis during this course on how to effectively read and interpret the literature first hand.

Pre-requisites

BI505 Infection and Immunity.

Restrictions

Biosciences Stage 3 students only

Synopsis *

Part A: Eukaryotic pathogens (parasites)
Parasites and pathogenicity, transmission and diversity.
• Parasites and pathogenicity, transmission and diversity.
• Mechanisms of Pathogenesis and methods for studying them.
• Microbial pathogenicity: variations on a common theme.
• Definitions on parasitic lifestyle.
• Investigations on worldwide parasitic outbreaks and their socio-economical effects.
• Eukaryotic pathogens and their effect in the microbiome.

Part B: Bacterial pathogens
• Methodology of studying bacterial pathogenesis.
• Virulence factors including toxins and adhesins.
• Applications of virulence factors in the treatment and prevention of disease.

Part C: Viral pathogens
• Viruses and Human Disease - transmission and spread, overview of important human virus infections, mechanisms of transmission (Aerosol, Oral-faecal, Sexual etc.), epidemiology - patterns of endemic and epidemic disease.
• Mechanisms of Pathogenesis - spread in the body, disease mechanisms, mechanisms of cell killing (Herpes simplex and Polio), immunopathology and auto-immune disease.
• Virus infection – long term consequences for the host, escape through mutation and natural selection, disabling the immune system, avoidance mechanisms.
• Viruses and Cancer - mechanisms of virus transformation (EBV, Retroviruses & Papilloma), viruses and human cancer (Cervical carcinoma, Hepatocellular Carcinoma & Burkitt Lymphoma).

Part D: Human fungal pathogens
• Fungi and Human Disease - overview of major human fungal infections, clinical picture, diagnosis and mechanisms of transmission, epidemiological aspects of fungal infections.
• Mechanisms of Fungal Pathogenesis - adherence, invasion of eukaryotic cells, morphogenesis, virulence factors.
• Host resistance to infection and antifungal chemotherapy - host defence mechanisms to fungal infections, role of the humoral and cellular immune response, antifungal chemotherapy: azoles, polyenes, echinocandines and antimetabolites, future developments for the treatment of fungal infections.

BI610 The Cell Cycle

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	H	15 (7.5)	65% Exam, 35% Coursework	Mulvihill Dr D

Contact Hours

Total contact hours: 20
Private study hours: 130
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to have:

• Detailed knowledge of the Cell Cycle and its control.
(Bio: 5, 6, 8, 19; Bc: 4, 5, 6, 8,)
• Changes to the cytoskeleton through the cell cycle and its control.
(Bio: 5, 6, 8, 9, 10, 19; Bc: 5, 6, 8)
• Detailed understanding of apoptosis and its control.
(Bio: 5, 6, 7, 8, 10, 19; Bc: 4, 5, 6, 8)
• Detailed knowledge of cell cycle checkpoints.
(Bio: 5, 6, 8, 9, 10, 19; Bc: 5, 6)
• Ability to acquire, analyse and interpret microscopy data and present in an appropriate manner.
(Bio: 6, 8, 9, 13, 16, 22, 24; Bc: 8, 9, 14, 16, 22)

The intended generic learning outcomes.
On successfully completing the module students will be able to have:

• Ability to retrieve analyse and evaluate information from textbooks, primary research papers and review articles.
(Bio 23, 31; Bc 23, 27)
• Develop written communication skills.
(Bio – 25, Bc – 25)

Method of Assessment

Main assessment methods
Practical report - 200 word limit per question (25%)
Assignment - 1,000 word limit (10%)
Exam, 2 hr (65%)

Reassessment methods
100% Exam

Preliminary Reading

• David O Morgan "The Cell Cycle - Principles of Control." (2006) OUP
• Murray & T. Hunt "The Cell Cycle – An Introduction." (1994 reissue) OUP
• Alberts et al. "Molecular Biology of the Cell." (2007 5th edition)

Pre-requisites

Prerequisite:
BI503 Cell Biology

Restrictions

Stage 3 Biosciences students only

Synopsis *

The module introduces the student to cell cycle and teaches how its precise regulation is essential for all life. The course will introduce to the students the current understanding of cellular reproduction and how it emerged. The initial lectures will describe the important breakthroughs in cell cycle research in their historical and experimental context. The course will go on to give the students a detailed understanding of the key events that occur and how they are regulated by mechanisms conserved from yeast to man. Key topics that will be discussed include:
• Mitotic kinases (including Cdks, Polo, aurora).
• Microtubule reorganisation (including spindle formation and regulation).
• Actin reorganisation (including regulation of cell growth, endocytosis, and cell division)
• Checkpoints (including Spindle assembly checkpoint, DNA damage checkpoint).
• Meiosis.
• Apoptosis.
• Organelle reorganisation (e.g. nuclear and golgi reorganisation).
• Cancer and the cell cycle.
• Cell cycle related pathologies.

The final lectures will then introduce the students to how generating computer models of the cell cycle are playing a crucial role in defining novel avenues for research into therapies for cell cycle related diseases.

BI620 Virology

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	15 (7.5)	100% Coursework	
2	Canterbury	Autumn	H	15 (7.5)	100% Coursework	Michaelis Prof M

Contact Hours

Contact hours: 24 hrs
Lectures: 22 hrs
Oral presentations and participation: 2 hrs

Self-Study: 124 hrs
Recommended reading, preparation for class and article evaluations: 66 hrs
Written assessment (grant proposal): 33 hrs
Preparation for oral presentation: 25 hrs

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will have:
• An understanding of our current knowledge base in selected fields of virology, the leading issues/hot topics in this area, and limitations of the current knowledge in the field of virology.
• An understanding of the concepts and functions behind standard cell biological, biochemical, and molecular biological assays used in virological research.

The intended generic learning outcomes.
On successfully completing the module students will have developed:
• The ability to understand, analyse and assess published scientific data.
• The ability to assess orally-presented scientific data and concepts, providing constructive feedback.
• The ability to design and conceptualise experiments to address specific scientific questions.
• Written and oral communication skills.
• Problem solving skills.

Method of Assessment

Article evaluation worksheets (short worksheets to be used for preparation of in class discussions): 10%
Written assessment (short technical summary based on a selected article discussed in class): 60%
Oral presentation (10 min presentation of the technical summary assignment; the presentation will occur after receipt of feedback on the written assessment, allowing for refinement of the technical summary and providing an opportunity to address concerns raised in the written feedback): 30%

Preliminary Reading

Core Text: Selected articles from scientific journals will be provided from Templeman Library electronic journal collections.

Pre-requisites

Level 5 or equivalent knowledge of biomedical science.

Synopsis *

The module aims to develop understanding and analytical skills in virology, based around interactive seminars wherein students will analyse, present, and discuss the relevant research literature. The students will gain experience in scientific design, literature analysis, scientific communication, and the analysis of experimental data.

BI622 Advanced Immunology

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	15 (7.5)	65% Exam, 35% Coursework	Curling Dr E

Contact Hours

Total contact hours: 23
Private study hours: 127
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
• (Level 6) demonstrate the ability to comprehend the importance of regulation of immune function, with reference to disease states which result when regulation is defective.
• (Level 6) demonstrate an ability to critically evaluate current theories of immunological function and processes.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
• (Level 6) critically select and interpret information from textbooks and primary research papers/reviews.
• (Level 6) demonstrate an ability to present information accurately in a stipulated format e.g. in a) an in class test timed essay format or b) in a concise "camera ready" format (encyclopaedia entry).

Method of Assessment

Main assessment methods
In class Timed Essay (21%)
Encyclopaedia entry (14%)
2 hour Examination (65%)

Reassessment methods
100% exam

Preliminary Reading

• Murphy, K. and Weaver, C. Janeway's Immunobiology (9th edition, 2017) Garland Science
• Owen J, Punt J and Stranford, S. Kuby Immunology (7th Edition, 2013) Macmillan Publishing

Pre-requisites

Prerequisite:
BI505 Infection and Immunity

Restrictions

Stage 3 Biosciences students only

Synopsis *

The aim of this Advanced Immunology module is to review topical aspects of advanced immunology with emphasis on the regulation of the immune response, and the role of dysfunctional immune systems in the aetiology of a variety of disease states. Indicative topics include antigen processing and presentation, transplant rejection, autoimmunity, hypersensitivity, cell migration homing and extravasation, cytokines, tumour immunology, mucosal immunology and autophagy.

BI626 Integrated Endocrinology and Metabolism

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	15 (7.5)	65% Exam, 35% Coursework	Foster Dr K
1	Canterbury	Spring	H	15 (7.5)	65% Exam, 35% Coursework	

Contact Hours

Total contact hours: 27
Private study hours: 123
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
Have:
• An understanding of the underlying principles of endocrinology at the cellular, biochemical and physiological level.
• The ability to describe, using illustrative examples, the different control mechanisms at work within the endocrine system both in the maintenance of whole body homeostasis and in disease.
• An understanding of the methods available for the diagnosis of specific endocrine diseases including the measurement of electrolyte and hormone levels, and the role of dynamic testing.
• The ability to integrate clinical and biochemical data to evaluate the most probable cause of key endocrine disorders, including a rationale for the most appropriate treatment regimes.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
Have a knowledge and understanding of:
• Interpretation and retrieval of information (knowledge management).
• Analysis and evaluation of data (problem solving).
• Communication of understanding and analysis through a variety of approaches (group work, tests and written report).

Method of Assessment

Main assessment methods
Test (10.5%) (1h)
Case Study (24.5%) (2500 words maximum)
Exam (65%) (2 hr)

Reassessment methods
100% exam

Preliminary Reading

• Clinical Biochemistry Gaw, A., Cowan, R.A., O'Reilly, D.St. J.,et al (2013)
• Clinical Biochemistry (2nd Edition) Churchill Livingstone. Ahmed, N (Ed) Clinical Biochemistry (2016) OUP
• Endocrinology. Essential Endocrinology and Diabetes (2012), Holt, R.I.G & Hanley, NA (6th Edition), Blackwell Science

General Physiology Core Physiology texts recommended for first and second year modules, for example, Silverthorn.
Integrated metabolism Core Biochemistry texts recommended for second year modules, for example, Lehninger.

Pre-requisites

Prerequisite:
BI513 Physiology

Restrictions

Stage 3 Biosciences students only

Synopsis *

This module focuses on the endocrine system, which in conjunction with the nervous system, is responsible for monitoring changes in an animal's internal and external environments, and directing the body to make any necessary adjustments to its activities so that it adapts itself to these environmental changes.

The emphasis will be on understanding the underlying principles of endocrinology, the mechanisms involved in regulating hormone levels within tight parameters in an integrated manner and the central importance of the hypothalamic-pituitary axis.

During the lectures each major endocrine gland or functional group of glands will be explored in turn and specific clinical disorders will be used to illustrate the role of the endocrine organs in the maintenance of whole body homeostasis. The systems studied will include the following: thyroid gland, parathyroid gland and bone metabolism, adrenal gland, renal hormones (water and salt balance), pancreatic hormones, gut hormones and multiple endocrine neoplasia, gonadal function and infertility.

Consideration will be given to the methods available for the diagnosis of specific endocrine diseases, including the measurement of electrolyte and hormone levels, and the role of dynamic testing.

The role of the endocrine system in integrating metabolic pathways will be emphasised throughout the module and particular scenarios such as infertility, diabetes mellitus.

BI627 Haematology and Blood Transfusion

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	15 (7.5)	60% Exam, 40% Coursework	
1	Canterbury	Spring	H	15 (7.5)	60% Exam, 40% Coursework	Shepherd Dr J

Contact Hours

Total contact hours: 24
Private study hours: 126
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
• Show an understanding of the factors affecting the production and development of red and white blood cells.
• Demonstrate knowledge of the processes involved in disease of both red and white blood cells.
• Recognise the features of a variety of pathological conditions encountered in haematology.
• Demonstrate an understanding of the factors involved in the maintenance of haemostasis and how they interact.
• Understand the principles of blood component replacement therapy and the associated risks.
• Recognise the characteristic changes of blood parameters in selected disease states.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
Demonstrate knowledge and understanding of:
• Interpretation and retrieval of information (knowledge management).
• Analysis and evaluation of data (problem solving).
• Written communication (essay and short answer writing).

Method of Assessment

Main assessment methods
Assignment (20%) - Case Study – 1200 word limit
In Class Test (20%) - 2 hours
Exam (60%) – 2 hours

Reassessment methods
100% Exam

Preliminary Reading

• Haematology. Moore, Knight and Blann (1st edition) Oxford University Press ISBN 978-0-19-956883-3
• Mollison's Blood Transfusion in Clinical Medicine (12th edition) Klein and Anstee Wiley-Blackwell ISBN 9781118689950
• Practical Transfusion Medicine (4th edition) Murphy, Pamphilon, Heddle Wiley-Blackwell ISBN 9780470670514

Pre-requisites

Prerequisites:
BIOS3070: Human Physiology & Disease I
BIOS5130: Human Physiology & Disease II

Restrictions

Stage 3 Biosciences students only

Synopsis *

This module describes the anatomy, physiology, pathology, and therapy of the blood and blood forming tissues, including the bone marrow. It covers a wide range of disorders including haematological malignancies, infection with blood-borne parasites that cause malaria, and inappropriate clotting activities such as deep vein thrombosis.

Haematology:
An introduction to haematology: module outline, aims and objectives
Haemopoiesis and the bone marrow
The red cell: structure and function
Inherited abnormalities of red cells
Anaemias: acquired and inherited
White blood cells in health and disease
An introduction to haematological malignancies
Bleeding disorders and their laboratory investigation
Thrombophilia
Blood-borne parasites

Blood transfusion:
The ABO and Rhesus blood group systems
Other blood group systems
Blood banking techniques

BI628 Microbial Physiology and Genetics II

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Autumn	H	15 (7.5)	60% Exam, 40% Coursework	Moore Dr S

Contact Hours

Total contact hours: 33
Private study hours: 117
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
Have a knowledge and understanding of:

• The structural and metabolic diversity of microorganisms.
• Genetic and physiological regulation in microorganisms.
• Experimental approaches used to investigate physiological and genetic control in microorganisms.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
Have a knowledge and understanding of:

• Written communication.
• The ability to generate, analyse and report experimental data.
• The ability to work collectively to analyse and present orally data reported in the scientific literature.

Method of Assessment

Main assessment methods
Practical (20%) 1000 word limit
Presentation (20%) 15 minute group presentation
Exam, 2 hr (60%)

Reassessment methods
Like-for-like

Preliminary Reading

• Slonczewski J. and Foster J. Microbiology an Evolving Science. Third Edition. W.W. Norton & Co

Pre-requisites

Prerequisite:
BI548 Microbial Physiology and Genetics I

Restrictions

Stage 3 Biosciences students only

Synopsis *

A synopsis of the curriculum
1. Outline of microbial physiology and genetics part II
2. Microbial taxonomy and phylogenetics
3. Microbial homeostasis - regulation of primary and secondary metabolism
4. Genomic regulation - Transcriptional and post-transcriptional regulation of gene expression
5. Experimental approaches used to study microbial physiology, microbial genomes and gene expression
6. Microbial biochemistry
7. Microbial biodiversity and complex signalling in the environment
8. Application of microbes in biotechnology

Practical on bacterial transcriptional regulation using gene-expression reporter fusions
Group presentation of a research paper relating to topic areas on "Microbial biodiversity at the physiological and biochemical level".

BI629 Proteins: Structure and Function

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	30 (15)	60% Exam, 40% Coursework	Williamson Dr R

Contact Hours

Total contact hours: 70
Private study hours: 230
Total study hours: 300

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to have:

• An understanding of the structural organisation and biophysical properties of proteins together with their physiological function in terms of catalysis, ligand binding and as components of molecular machines.
(Biochemistry programme outcomes: A1, A2, A4, A5, A11, B2)
• An understanding of how the structure and function of proteins are studied and characterised using current biophysical methods such as mass spectroscopy, x-ray diffraction, nuclear magnetic resonance, fluorescence, circular dichroism, electron microscopy, atomic force microscopy and rapid mixing apparatus.
(Biochemistry programme outcomes: A4, A5, A10, A11, B2)
• Experience of web-based tools to retrieve and manipulate protein-related data from international repositories, and the use of molecular graphics software to analyse protein structure in relation to topology and function.
(Biochemistry programme outcomes: A4, A5, A10, B2, B3, B4, B6, C4, D1, D3, D4)
• Familiarisation with the instrumentation and the type of data generated by the techniques listed in 8.2 above using modern research equipment in the Research Facilities and Research Labs of the School of Biosciences.
(Biochemistry programme outcomes: A4, A5, A10, B2, B3, B4, B5, B6, C1, C4, C5, D1, D3, D4)

The intended generic learning outcomes.
On successfully completing the module students will be able to have a knowledge and understanding of:

• Written communication.
(Biochemistry programme outcomes: A11, D2)
• Handling and analysis of experimental data (including numerical data).
(Biochemistry programme outcomes: B3, B4, B5, C5, C6, D1, D3, D4)
• Problem solving.
(Biochemistry programme outcomes: B2, B4, B5, B6, D1, D3)
• Use of web tools, data repositories, and computer software.
(Biochemistry programme outcomes: C4, D1, D3, D4)

Method of Assessment

Main assessment methods
Course work assignments (x4). Handling, analysis and interpretation of experimental data. (10% each)
Exam 1 (2h) Essay (30%)
Exam 2 (2h) Problem solving (30%)

Reassessment methods
100% Exam

Preliminary Reading

• Williamson, M. (2011) How Proteins Work. Garland Science
• Lesk, A.M. (2010, 2nd ed.) Introduction to Protein Science. Architecture, function and genomics. Oxford University Press
• Price & Nairn (2009) Exploring Proteins. Oxford University Press
• Rhodes G (2006, 3rd ed.) Crystallography Made Crystal Clear. Academic Press
• Steven, Baumeister, Johnson & Perham (2016) Molecular Biology of Assemblies and Machines.

Pre-requisites

Prerequisites:
BI300 Introduction to Biochemistry
BI532 Skills for Bioscientists 2

Restrictions

Stage 3 Biosciences students only

Synopsis *

The module will cover the structural analysis of proteins and protein assemblies using techniques such as fluorescence, circular dichroism, mass spectrometry, atomic-force microscopy, cryo-EM, X-ray crystallography and NMR. It will also look at protein folding, molecular processing, de novo design, engineering and modelling. The module will also investigate the relationship between protein structure and function and cover the principles and practice of enzymology, ligand binding, and enzyme catalysis.

BI638 Bioinformatics and Genomics

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	15 (7.5)	100% Coursework	Wass Dr M

Contact Hours

Total contact hours: 32
Private study hours: 118
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
• Use DNA/protein databases, sequence searching methods, generate multiple sequence alignments, analyse residue conservation.
• Use bioinformatics methods to analyse and model protein structure, function and interactions with small ligands and with other proteins.
• Understand genomics approaches including – genome sequencing, comparative and functional genomics.

The intended generic learning outcomes.
On successfully completing the module students will be able to use:
• Bioinformatics skills for data retrieval and analysis across the biosciences' disciplines. Data retrieval/analysis are generic to all numerate subjects.
• Transferable skills including written communication (technical reports and a coursework project).
• Analytical skills including analysis and presentation of data, writing of reports and a project (coursework).

Method of Assessment

Main assessment methods
Workshop (20% - short answer questions)
Assignment (80% - 2500 words)

Reassessment methods
100% Exam

Preliminary Reading

• Lesk A, Introduction to Bioinformatics, 4th Edition, Oxford University Press, 2014
• Lesk A, Introduction to Genomics, 3rd Edition, OUP, 2017

Additionally selected peer-reviewed research and review papers will be recommended.

Pre-requisites

Prerequisite:
BI300 Introduction to Biochemistry
BI532 Skills for Bioscientists 2

Restrictions

Stage 3 Biosciences students only

Synopsis *

Bioinformatics Data sources & Sequence analysis: Databases and data availability. Using sequence data for analysis – sequence searching methods, multiple sequence alignments, residue conservation, Protein domains and families.

Protein Bioinformatics Methods: Protein structure and function prediction. Prediction of binding sites/interfaces with small ligands and with other proteins. Bioinformatics analyses using protein data.

Genomics: An introduction to the analysis of genomic data, primarily focussing on the data available from genome sequencing – how it can be used to study genetic variants and compare genomes (i.e. comparative and functional genomics).

BI639 Frontiers in Oncology

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	15 (7.5)	100% Coursework	Michaelis Prof M

Availability

It is strongly recommended that you have taken core stage 1 and 3 modules within one of our Biosciences programmes

Contact Hours

The subject specific knowledge and generic skills will be delivered and developed through a combination of lectures and interactive discussions/presentations of scientific publications.
Oral communication skills, and the ability to assess orally-presented data, will be developed though formal and informal presentations with evaluations.

Contact hours: 24 hrs
Lectures: 22 hrs
Oral presentations and participation: 2 hrs

Self-Study: 124 hrs
Recommended reading, preparation for class and article evaluations: 66 hrs
Written assessment (grant proposal): 33 hrs
Preparation for oral presentation: 25 hrs

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will have:
• An understanding of our current knowledge base in oncology, the leading issues/hot topics in this area, and limitations of the current knowledge in the field of oncology.
• An understanding of the concepts and functions behind standard cell biological, biochemical, and molecular biological assays used in oncological research.

The intended generic learning outcomes.
On successfully completing the module students will have developed:
• The ability to understand, analyse and assess published scientific data.
• The ability to assess orally-presented scientific data and concepts, providing constructive feedback.
• The ability to design and conceptualise experiments to address specific scientific questions.
• Written and oral communication skills.
• Problem solving skills.

Method of Assessment

Article evaluation worksheets (short worksheets to be used for preparation of in class discussions): 10%
Written assessment (short technical summary based on a selected article discussed in class): 60%
Oral presentation (10 min presentation of the technical summary assignment; the presentation will occur after receipt of feedback on the written assessment, allowing for refinement of the technical summary and providing an opportunity to address concerns raised in the written feedback): 30%

Preliminary Reading

Core Text: Selected articles from scientific journals will be provided from Templeman Library electronic journal collections.

Pre-requisites

Level 5 or equivalent knowledge of biomedical science

Restrictions

Stage 3 Biosciences students only

Synopsis *

The module aims to develop understanding and analytical skills in oncology, based around interactive seminars wherein students will analyse, present, and discuss the relevant research literature. The students will gain experience in scientific design, literature analysis, scientific communication, and the analysis of experimental data.

BI642 Cancer Biology

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	15 (7.5)	60% Exam, 40% Coursework	
1	Canterbury	Spring	H	15 (7.5)	100% Exam	Michaelis Prof M
1	Canterbury	Spring	H	15 (7.5)	60% Exam, 40% Coursework	Michaelis Prof M

Contact Hours

Total contact = 24 hr

Lectures (11 x 2h) 22 hr Outcomes 8.1, 8.2, 9.1-9.3
Pre-examination revision lecture 2 hr Outcomes 8.1, 8.2, 9.1-9.2

Self study = 120 hr

Written assessment 1 (News & Views article) 40 hr Outcomes 8.1, 8.2, 9.1-9.3
Background reading relating to lecture content 40 hr Outcomes 8.1, 8.2, 9.1-9.2
Preparation for examination 40 hr Outcomes 8.1, 8.2, 9.1-9.3

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
8.1 An understanding of the nature of cancer and the (molecular) processes underlying cancer formation and progression.
8.2 Knowledge of the principles underlying anti-cancer therapies.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
9.1 Development of written communication skills at a standard appropriate for level 6 study
9.2 Acquisition of information from a wide range of information resources, including journals, books, electronic databases); maintenance of an effective information retrieval strategy
9.3 The ability to understand, analyse and critically assess published scientific data

Method of Assessment

End of module examination (60%)
Two essay-type answers from a choice of four (testing outcomes 8.1, 8.2, 9.1-9.3)

Continuous assessment (40%)
Assessment 1: Coursework, Critical analysis of a question or topic (40% of module mark) (testing outcomes 8.1, 8.2, 9.1-9.3)

Preliminary Reading

Core text

Pecorino, L. Molecular Biology of Cancer: Mechanisms, Targets and Therapeutics (3rd edition) Oxford University Press. 2012. ISBN 978-0199577170

Supplementary materials

Selected articles from scientific journals will be provided from the Templeman Library electronic journal collections.

Weinberg, R.A. The Biology of Cancer. New York; Abingdon: Garland Science, 2007
Alberts, B., Essential Cell Biology. New York; London: Garland Science 2011.

Restrictions

Stage 3 students only

Synopsis *

Cancer formation and progression; underlying factors, cancer cell heterogeneity, uncontrolled cell division, invasive growth/ metastasis formation.

The Molecular Biology of Cancer: (Proto-)Oncogenes, tumour suppressor genes, cell cycle control, cell death.

Cancer therapies.

BI643 Neuroscience

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Spring	H	15 (7.5)	60% Exam, 40% Coursework	

Contact Hours

Contact Hours: 24 hours
1. Lectures: 20 hours
2. Workshops: 4 hours

Self-study: 126 hours

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to demonstrate:
1. An appreciation of the cellular and molecular complexity of the nervous system gained through knowledge of:
    a. How the nervous system develops
    b. how nerve cells communicate at synapses
2. An understanding of the relationship between the brain and behaviour
3. An understanding of acquired and inherited neurological diseases
4. An appreciation of the significant achievements of research in neuroscience and the many unanswered questions

The intended generic learning outcomes. On successfully completing the module students will have developed skills in:
1. Comprehending complex scientific topics
2. Sourcing, reading and evaluating scientific literature
3. Written and oral communication

Method of Assessment

Assignment, mini-literature review, 2,000 words (40%)
Exam, 2 hr (60%)

Preliminary Reading

Principles of Neural Science, Kandel, Schwartz, Jessel, Siegelbaum, Hudspeth, 5th ed (2012)
Fundamental Neuroscience, Squire, Berg, Bloom, du Lac, Ghosh, Spitzer, 4th ed (2012)
Research articles available from Templeman Library journal collections

Pre-requisites

Before taking this module you must take BI307: Human Physiology and Disease I, and BI513: Human Physiology and Disease II

Restrictions

Stage 3 Biosciences students only

Synopsis *

The module is divided into three roughly equal sized units, each dealing with a specific aspect of neurobiology. Throughout, both the normal system and diseases and disorders that arise as a consequence of abnormalities will be covered.

Unit 1: Development of the Nervous System
Looks at how the complex and intricately wired nervous system develops from a simple sheet of neuroepithelial cells by addressing the cellular and molecular basis of neurulation (formation of the brain and spinal cord), neurogenesis, differentiation and survival of nerve cells, axon growth and guidance, synapse formation.

Unit 2: Signalling at the Synapse
Considers the molecules and mechanisms involved in transmission of signals between nerve cells: neurotransmitters and neuromodulators, molecular mechanisms of transmitter release, neurotransmitter receptors and transporters.

Unit 3: The Brain and Behaviour
Explores how the nervous system controls a variety of behaviours including learning, memory and sleep.

BI644 Biology of Ageing

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Spring	H	15 (7.5)	60% Exam, 40% Coursework	Tullet Dr J

Availability

It is required that you have taken all the core modules within stage 1 and 2 of one of our Bioscience programmes in order to take this module.

Contact Hours

Total Contact Hours: 26
Independent Study Hours: 124
Total Study Hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
Demonstrate:
• Knowledge of the major processes underlying the ageing process.
• Acquisition of practical and data handling skills associated with analysing lifespan and age-related decline data sets.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
Have a knowledge and understanding of:
• Interpretation and retrieval of information
• Analysis and evaluation of data
• Written communication skills

Method of Assessment

Main assessment methods

Assignment 1: Essay, 20%, Maximum 1500 words
Assignment 2: Data handling exercise, 20%, Maximum 1500 words
Examination, 2 hr, 60%

Reassessment methods
Like-for-like composite reassessment where one piece of like-for-like assessment will be set that will address all the coursework learning outcomes for any failed components

Preliminary Reading

• Austad, S.N. Why We Age (1997) (Wiley)
• Ricklefs, R.E., C.E. Aging: A Natural History (1995) (Scientific American Library) (W H Freeman & Co)

The rest of the suggested reading fill consist of review articles and primary research publications. The emphasis of this course will be to read and interpret the literature first hand.

Restrictions

Stage 3 Biosciences students only

Synopsis *

A synopsis of the curriculum
The module overviews the importance of studying ageing, the organisms and methods used to do so and considers how organisms age together with providing a detailed understanding of the processes and molecular mechanisms that govern ageing.

Introduction
Importance and principles of ageing research
Why do organisms age and theories of ageing: e.g. Damage theory, telomeres, genetics and trade off theories.
How ageing and lifespan is measured
Overview of processes and pathways controlling ageing

Methods in ageing research
Model Organisms: Benefits and problems associated with studying ageing in model organisms. Including: Yeast, worms, flies, mice, primates.
Systems approaches to studying ageing: e.g. high throughput DNA/RNA sequencing, high throughput proteomics and, metabolomics. Pros and cons of these methods, what we have learned from them.

Signalling pathways that control ageing
Insulin signalling pathway and Target of Rapamycin (ToR) pathway
Organisation of pathways and the molecules involved, how they were discovered to be implicated in lifespan and ageing, ways of modelling and studying their molecular detail in animals e.g. genetic/ epistasis analysis
The processes downstream of these pathways that allow them to control lifespan/ageing e.g. stress resistance, autophagy, reduced translation, enhanced immunity etc…
Cross-talk between pathways.
Dietary restriction, lifespan and ageing
How dietary restriction works in different organisms, what signalling pathways and processes it affects.

Diseases of ageing
What these are e.g. Alzheimers, Huntington's
Overview of 'normal ageing' associated processes e.g. muscle weakening.
How they can be studied in model organsims and the importance of ageing research for treating these disorders.

Ethics of ageing research
Pros and cons of studying ageing with a goal of extending human lifespan e.g. insurance, health system, social, psychological implications.

Workshop 1: Group discussion of key ageing research paper(s) (small groups).
Workshop 2: Data analysis session (whole class or 2-3 groups).
Workshop 3: Overview of the module in preparation for revision/exam (whole class).

BI650 Advances in Eukaryotic Diversity and Evolution

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn	H	15 (7.5)	100% Coursework	

Contact Hours

Lectures: 18 x 1 hour
Group discussion workshop: 2 hours
Field work - expedition - sampling: 3 hours
Laboratory practical: 3 hours
Self-study: 118 hours

The curriculum will be delivered through the lecture series and the workshop will be used to reinforce aspects of eukaryotic evolution and diversity. The associated field work and laboratory practical will allow development of data handling and analytical skills.
• Total Contact Hours: 26
• Independent Study Hours: 124
• Total Study Hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
• Developed knowledge of the major processes underlying eukaryotic diversity and evolution
• Acquired a set of practical data and handling skills associated with taxonomy, diversity and evolution of microbial eukaryotes.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
• Retrieve information with subsequent interpretation
• Analyse and evaluate data
• Improve written communication skills

Method of Assessment

Main assessment methods
This module will be assessed by 50% exam (2 hours) and 50% coursework (15% essay and 35% laboratory practical report).

Reassessment methods
Reassessment of this module will be retrieved by 50 % exam in addition to 50% coursework marks accumulated by the student during the term, which will count towards the calculation of the module mark after a resit.

Preliminary Reading

Core reading list:
• W. Foissner and D. L. Hawksworth, (2009) Protist Diversity and Geographical Distribution (Springer)
• L A. Katz and D. Bhattacharya (2006) Genomics and Evolution of Microbial Eukaryotes (Oxford University press)
Recommended list:
• J. Archibald (2014) One Plus One Equals One: Symbiosis and the evolution of complex life (Oxford University press)
• N. Lane (2005). Power, Sex, Suicide: Mitochondria and the Meaning of Life. (Oxford University Press)
• N. Lane (2009). Life Ascending: The Ten Great Inventions of Evolution. (Profile Books)
The rest of the suggested reading will consist of review articles and primary research publications. There is going to be given emphasis during this course on how to effectively read and interpret the literature first hand.

Pre-requisites

Pre-requisite: BI323 – Biodiversity; BI324: Genetics and Evolution

Progression

The programmes of study to which the module contributes
The module will be core for stage 3 students undertaking the BSc Biology and related programmes

Restrictions

The module will be core for stage 3 students undertaking the BSc Biology and related programmes.

Synopsis *

This module will introduce the students to the diversity of eukaryotic organisms (mainly microbes in the six domains of the eukaryotic tree of life), theories on endosymbiotic events (chloroplasts & mitochondria), organellar adaptations and diversity, primary and secondary acquisition of other organelles, lateral gene transfer in eukaryotes, adaptations to extreme environments (from anoxia, to salinity and to parasitism), community evolution (microbiome) and the evolution of multi-cellularity.

Lectures will cover the following major topics: eukaryotic diversity, genomes and eukaryote phylogeny; the theories of eukaryogenesis; introduction to major eukaryotic clades (fungi etc); the evolution of parasitism and of multicellularity; extreme eukaryotic microbiology; microbial eukaryotes and the microbiome; and the evolution of microbial communities

Group discussion Workshop: on the theories of eukaryogenesis
Field practical: Field sampling: soil, aquatic and animal microbiome
Laboratory practical: Culturing, taxonomy and data analysis

BI797 Sandwich Year Assessment

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	H	120 (60)	100% Coursework	

Contact Hours

This is a work-based learning programme. Training on-the-job is provided by the hosting organisation with monitoring by the School of Biosciences. Whilst on placement (for the most part at a single location throughout the placement), students remain registered at UoK. They are expected to remain in contact with both their Academic Advisor and the academic Coordinator of the Sandwich Year who monitors progress, oversees the assessment of this module and liaises with the hosting institution. Academic Advisors will visit their student on-site at least once close to the start of work and upon any other reasonable request. At this meeting, the advisor should brief the local supervisor on assessment procedures and criteria and seek an informal assessment of the student's abilities and performance. A report from the meeting outlining the work being undertaken, the skills being developed and performance to date is then prepared for the attention of the Programme Coordinator. All students return to UoK once during the course of the placement; this Return Day provides an opportunity to meet other students and academic staff, to discuss progress, and to present the work and skills being developed in an informal setting. Day-to-day activities and training are delegated to employers, specifically to the student's supervisor, with monitoring by the Biosciences Coordinator.
Towards the end of the placement, students prepare a final written report on their work for submission to the University. A “de-brief” meeting for all placement students takes place shortly after they return to the University for their final year to discuss and share their experiences with one another and the Programme Coordinator. Placement students present their work orally at an annual dedicated Sandwich Students Symposium open to all Biosciences students and staff and to external placement supervisors. This is followed by a reception and networking event where students searching for placements can meet returning students and visiting supervisors.

Learning Outcomes

Students will spend between 9-12 months working at the organisation hosting their placement.

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
• Demonstrate an awareness of the application of, and ability to apply, degree level scientific knowledge to the workplace.
• Record, analyse and interpret data, and use graphical and statistical methods for presentation, in accordance with scientific convention.
• Perform an independent research project, under supervision, which enhances existing practical and/or theoretical scientific knowledge and skills.
• Structure, develop and defend complex scientific arguments by understanding and applying expanding knowledge base and critically appraising own and published work.
• Develop ability to present and communicate scientific work in various formats.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
• Apply their developing scientific knowledge productively for understanding their work.
• Make informed and effective use of available resources (e.g. information technology, library) in acquiring, analysing, managing and presenting data, information and knowledge necessary for the planning and execution of work/study activities.
• Understand the notion of professional ethics and responsibilities.
• Understand the role of the individual within an organisation.
• Appreciate and evaluate both individual and teamwork contributions to work place activities and projects through work experience.
• Work effectively independently and within a team developing planning, organisational time management, communication, negotiation and interpersonal skills.
• Exploit feedback from peers, supervisors and colleagues to enhance any or all aspects of performance.
• Demonstrate an awareness of career opportunities for bioscience graduates, and an appreciation of the wider application of degree studies, and hence be in a position to make better informed judgements about career plans and the role of further post-graduate training.

Method of Assessment

Placements are assessed by the following means:

Main assessment methods
Supervisor performance (30%)
Written report – max 600 words (50%)
Oral presentation – 10-15 minutes (20%)

Formative assessment of placements involves:
(a) Site visit by School of Biosciences' academic advisor (see 15 above) involving discussions with student and supervisor about progress, project etc.
(b) Interim assessment of performance and demonstrated abilities, roughly mid-way through the placement period, conducted by the placement supervisor with guidance on standards expected from academic staff in the School of Biosciences (student's academic advisor and programme coordinator). Placement supervisor and academic staff are expected to discuss the assessment with the student in a constructive manner, providing opportunity to identify and address any areas for development during the remainder of the placement.
(c) Return Day (to School of Biosciences) for all placement students, during the second half of the placement period, involving: an oral presentation in open forum by the student, with feedback provided by academic/research staff, and opportunity to discuss plans for, and progress with, report preparation with academic advisor and programme co-ordinator.

Summative assessment of placements is based on:

(a) Written report on the placement work, including a reflective document evaluating the placement in terms of knowledge and skills gained and influence on career plans. This is submitted on completion of the placement and evaluated by two members of academic staff in the School of Biosciences.
(b) Oral presentation (and Abstract) - given in open session as part of a symposium on return to UoK and evaluated by three academic staff in the audience
(c) Performance and demonstrated abilities on the job, evaluated by the placement supervisor with guidance from academic staff in the School of Biosciences (academic advisor and programme coordinator) on standards expected.

The assessment of the placement contributes 10% to the overall degree mark.

Reassessment methods
Like-for-like

Preliminary Reading

Research papers, reports, technical etc. Literature relevant to the work placement and associated project(s).

Pre-requisites

Prerequisite:
Registration for any Biosciences BSc degree
Approval by the School (based on grades achieved at Stage 1 and general performance)

Restrictions

To continue on, or transfer onto, a degree programme with a sandwich year students must achieve an overall average mark of 60% in stage 1 modules.

Synopsis *

A placement typically is a 9-12 month internship with a commercial or public sector or charity organisation which provides opportunities for the student to develop graduate level subject-specific and generic employability skills. Choice of placement by student will be guided and facilitated at UoK with the learning outcomes listed above in mind. It is requested by UoK that the student be closely guided in work (usually with a named supervisor) involving specialist training. Placements are expected to have a scientific research focus and incorporate a project element that may be written up as a scientific report, however, the specific type of work undertaken may vary significantly from placement to placement. The research project should occupy not less than thirty percent of the sandwich year.

BI798 Professional Year

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Whole Year	H	120 (60)	Pass/Fail Only	

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
• Demonstrate an awareness of the application of, and ability to apply, knowledge and skills gained during a biosciences degree in the workplace.

The intended generic learning outcomes.
On successfully completing the module students will be able to:
• Perform independent work under supervision, which enhances generic graduate level employability skills
• Develop ability to record, analyse, interpret and communicate information in various formats in accordance with the norms of the business.
• Make informed and effective use of available resources (e.g. information technology, library) in acquiring, analysing, managing and presenting data, information and knowledge necessary for the planning and execution of work/study activities.
• Understand the notion of professional ethics and responsibilities.
• Understand the role of the individual within an organisation.
• Appreciate and evaluate both individual and teamwork contributions to work place activities and projects through work experience.
• Work effectively independently and within a team, developing planning, organisational, time management, communication, negotiation and interpersonal skills.
• Exploit feedback from peers, supervisors and colleagues to enhance any or all aspects of performance.
• Demonstrate an awareness of career opportunities for bioscience graduates, and an appreciation of the wider application of degree studies, and hence be in a position to make better informed judgments about career plans and the role of further post-graduate training.

Method of Assessment

Main assessment methods
Module is assessed on a Pass/Fail basis made up of the following elements of assessment:

Supervisor performance (30%)
Written report – max 600 words (50%)
Oral presentation – 10-15 minutes (20%)

Formative assessment of placements involves:
(a) Site visit by School of Biosciences' tutor/academic advisor involving discussions with student and supervisor about progress, project etc.
(b) Interim assessment of performance and demonstrated abilities, roughly mid-way through the placement period, conducted by the placement supervisor with guidance on standards expected from academic staff in the School of Biosciences (student's tutor/academic advisor and programme coordinator). Placement supervisor and academic staff are expected to discuss the assessment with the student in a constructive manner, providing opportunity to identify and address any areas for development during the remainder of the placement.
(c) Return Day (to School of Biosciences) for all placement students, during the second half of the placement period, involving: an oral presentation in open forum by the student, with feedback provided by academic/research staff, and opportunity to discuss plans for, and progress with, report preparation with tutor/academic advisor and programme co-ordinator.

Summative assessment of placements is based on:
(a) Written report on the placement work, including a reflective document evaluating the placement in terms of knowledge and skills gained and influence on career plan. This is submitted on completion of the placement and evaluated by two members of academic staff in the School of Biosciences.
(b) Oral presentation (and Abstract) given in open session as part of a symposium on return to UoK and evaluated by three academic staff in the audience.
(c) Performance and demonstrated abilities on the job, evaluated by the placement supervisor with guidance from academic staff in the School of Biosciences (student's tutor/academic advisor and programme coordinator) on standards expected.

Placements are assessed as pass-fail based on evaluation of (a) Written report (b) Oral presentation (c) Performance on the job. Students are required to attain a pass level in each component of assessment.

Reassessment methods
Like-for-like

Preliminary Reading

Papers, reports, technical etc. literature relevant to the work placement and associated project(s).

Pre-requisites

Registration for any Biosciences BSc degree programme
Approval by the School (based on grades achieved at Stage 1 and general performance)

Progression

The programmes of study to which the module contributes to:

Biochemistry with a Professional Year
Biomedical Science with a Professional Year
Biology with a Professional Year

Synopsis *

A placement will normally be a 9-12 month internship with a commercial, public sector or charity organisation which provides opportunities for the student to develop graduate level employability skills. Choice of placement by the student will be guided and facilitated at UoK with the learning outcomes listed above in mind. It is requested by UoK that the student be closely guided in work (usually with a named supervisor). The specific type of work undertaken may vary significantly from placement to placement. The work may have a scientific or non-scientific focus. Indicative examples are marketing and sales, manufacturing, business and management.