25 School of Biosciences

BI501		Gene Expression and Its Control				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Spring	I	15 (7.5)	60% Exam, 40% Coursework	Tuite Prof M

Contact Hours

Contact hours (22 hr):
1. 19 lectures (19 hr)
2. 2 revision lectures (2 hr)
3. 1 Supervision (1 hr)

Self-learning (128 hr – including assessments)
1. Directed reading: texts, review papers, primary research papers
2. Assessment 1: data analysis problems
3. Assessment 2: MCQ preparation

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to demonstrate:
1. An understanding of how genes are organised, expressed and controlled in both prokaryotes and eukaryotes
2. Awareness of the contribution of modern molecular and cellular technologies in furthering our understanding of gene expression and its control
3. An appreciation of the importance of fundamental research into gene structure and function for future developments in the fields of human genomics and disease
4. 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:
1. Be able to extract and interpret information at an intermediate level
2. Be able to analyse and evaluate experimental data at an intermediate level
3. 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 XI", Jones and Bartlett Learning, Publishers, 2014 [ISBN-978-1-4496-5985-1] OR/
• 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] OR/
• OR/ 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
• Reece, R.J.R. 'Analysis of genes and genomes' Wiley, 2004, ISBN: 978-0-470-84380-2
• McLennan, A.G., Bates, A.D., Turner P.C., White, M.R.H. Instant notes molecular biology, 4th edition, Oxford : Garland Sciences, 2013

Pre-requisites

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

Restrictions

Stage 2 students only (unless selected as a wild module)

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

Contact hours:
24h lectures
1h supervision
3h practical
2h presentation

Total Self Study: 120 hours
Practical report: 24 hours
Supervision and presentation: 18 hours
Reading and preparation for examination: 78 hours

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:
1. An understanding of key areas of cell biology
2. An understanding of modern microscopic methods for identifying cellular components

The intended generic learning outcomes. On successfully completing the module students will be able to:
1. Development of abilities to handle scientific literature
2. 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, 6th Edition, W.H. Freeman, 2007

Optional texts:
Alberts B, Molecular Biology of the Cell, 3rd Edition, Garland Science Pub., 2008
Alberts B, Essential Cell Biology, 3rd Edition, Garland Science Pub., 2009

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 (unless selected as a wild module)

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
1	Canterbury	Spring	I	15 (7.5)	55% Exam, 45% Coursework	
2	Canterbury	Spring	I	15 (7.5)	100% Exam	Curling Dr E

Contact Hours

Total contact: 28hrs
Lectures 23 hrs
Supervisions 1 hrs
Practical class 4 hrs (includes pre-lab lecture)

Self Study:
Supervision 30 h
Practical report 24 h
Reading and exam preparation 68 h

Learning Outcomes

The intended subject specific learning outcomes – on successful completion of the module students will have knowledge of:
1. Microorganisms of medical importance
2. How the spread of disease can be monitored in the human population.
3. Experimental procedures in handling and identifying bacteria in samples provided to the students during the practical class.
4. The major immune system functions and components, and how cell-cell communication controls immune responsiveness to infectious agents.
5. Microbiological and immunological techniques used to identify pathogens and immune cell subsets.
6. Methods of data acquisition and team work in the laboratory, as evidenced by the practical report assessment.

The intended generic learning outcomes:
1. Interpretation and retrieval of information
2. Analysis and evaluation of data
3. Written communication

Method of Assessment

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

Preliminary Reading

Mims CA, Goering R, Mims' medical microbiology, 4th Edition, Mosby, 2007
Murphy, K., Janeway's Immunobiology, 8th Edition, Garland Science, 2012
Kindt TJ, Goldsby RA, Kuby Immunology, 6th Edition, W.H. Freeman, 2007

Pre-requisites

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

Restrictions

Stage 2 students only (unless selected as a wild module)

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

Contact hours: 24h
1. Lectures 21h
2. Workshops 3h

Self-study: 126h

Learning Outcomes

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 subject specific learning outcomes. On successfully completing the module students will be able to:
1. 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.
2. Describe how malfunction of physiological systems gives rise to disease, using specific examples.
3. Appreciate the relationship between physiology, anatomy and medicine

The intended generic learning outcomes. On successfully completing the module students will have developed the following skills:
1. Retrieval, interpretation and application of information
2. Data analysis and evaluation
3. 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 (unless selected as a wild module)

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	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

Contact hours:
Lectures: 22h
Practicals: 3h
Workshop: 3h

Self-Study:
Practical report: 24h
Workshop: 24h
Reading, revision: 74h

Total: 150h

Learning Outcomes

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

Intended generic learning outcomes:
1. Be able to extract and interpret information at an intermediate level
2. Be able to analyse and evaluate data at an intermediate level
3. Have acquired skills in written communication and receiving critique.
4. 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

• Required Reading:
• Neal MJ, Medical pharmacology at a glance, 5th Edition, Blackwell Pub., 2005
• Rang, H. P, Rang and Dale's pharmacology, 6th Edition, Churchill Livingstone, 2007

Restrictions

Stage 2 students only (unless selected as a wild module)

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	Warren Prof M
1	Canterbury	Autumn	I	15 (7.5)	60% Exam, 40% Coursework	Warren Prof M

Availability

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

Contact Hours

Lectures: 19 hours
Workshops: 2 hours
In-class MCQ test: 1 hour
Computer practical: 2 hours

Recommended reading: 40 hours
Analysis of data from computer practical and preparation for group work: 15 hours
Workshop material: 5 hours
Exam preparation: 50 hours
MCQ test preparation: 16 hours

Learning Outcomes

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 to 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.

Generic learning outcomes.
• Written and/or oral communication skills.
• Skills to analyse data from online genomic and other sources 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, Cox MM, Lehninger Principles of Biochemistry. 5th Edition, W.H. Freeman, 2008
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 ebook (via Library Catalogue)

Restrictions

Stage 2 students only (unless selected as a wild module)

Synopsis *

Electron transport and oxidative phosphorylation in mitochondria: The chemiosmotic hypothesis, mechanism of ATP synthase, ATP yield, disorders associated with mutations in the mitochondrial genome.

Overview of inherited metabolic disease processes: Accumulation of substrate; Accumulation of a normally minor metabolite; Deficiency of product; Secondary metabolic phenomena. Relation to genetics: Autosomal recessive disorders; X-linked recessive disorders; Autosomal dominant disorders; Mitochondrial inheritance.

Metabolism of amino acids and nucleotides: Amino acid metabolism involved in the production of neurotransmitters, role of amino acids in phenylketonuria, purine/pyrimidine degradation, and the onset/treatment of Gout.

The urea cycle: The link between nitrogen and carbon metabolism, and diseases associated with enzyme deficiencies. Treatments for defects in urea cycle enzymes.

Cholesterol metabolism: Biosynthesis and transport of cholesterol, regulation of cholesterol synthesis, hypercholesterolemia/atherosclerosis, and the use of statins to control cholesterol levels.

Vitamins and malnutrition: Vitamin requirements with a metabolic focus of the roles of vitamin A in the visual cycle, vitamin C in connective tissue, vitamin D in bone formation, and vitamin K in blood clotting.

Sugar metabolism: Glucose transporters and disease; Glycogen storage diseases; Pyruvate dehydrogrenase complex defects.

Diabetes and insulin: Diabetic ketoacidosis.

Heme synthesis and breakdown in health and disease: Metabolic defects in heme synthesis and the porphyrias.

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

The subject specific knowledge will be delivered in lectures supported by reference to the recommended texts and the scientific literature. Problem solving skills will be developed in workshops and will be based on the understanding and interpretation of both experimental and genetic data. The practical class will support development of an understanding of the process of photosynthesis and the associated report will develop skills in data analysis and interpretation.

Contact hours: 31
Lectures: 20 hours
Workshops 2 x 2 hours
5 hours practical
In class test 1 hours
Exam 2 hours
Self Study: 119 hours
Recommended reading: 50 hours
Preparation for workshops: 15 hours
Revision and exam preparation: 44 hours

Learning Outcomes

A. An understanding of key modes of metabolic regulation.
B. Understanding key elements of plant and microbial metabolism that are distinct from human metabolism covered elsewhere.
C. Understanding the importance of metabolic processes in biotechnological applications.

Method of Assessment

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

Preliminary Reading

Core Text:
Nelson DL, Cox MM, Lehninger Principles of Biochemistry. 5th Edition, W.H. Freeman, 2008
Templeman Library Classmark q QP 514.2
10 x Core Text Collection [3 Day Loan]
Note: Various editions held in Library [4 x 4th/2005, 11 x 3rd/1999]

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
Templeman Library Classmark q QP 514.2
10 x Core Text Collection [3 Day Loan]

Selected articles from scientific journals may also be recommended.

Pre-requisites

Before taking this module you must take BI520

Restrictions

Stage 2 students only (unless selected as a wild module)

Synopsis *

This module describes the integration of the many chemical reactions underpinning the function of cells. For example, how cells make ATP and use it to drive cellular activities, and how plant cells harvest energy from the sun in the process of photosynthesis.

Part A: Principles of metabolic regulation
Metabolic regulation maintains molecular homeostasis. Metabolic controls that lead to changes in output of metabolic pathways in response to signals or changes in circumstances.
Common points of regulation: reactions far from equilibrium. Examples from carbohydrate metabolism of relationship between equilibrium constants, mass action coefficients and free energy changes.
Metabolic control analysis.
Mechanisms of regulation: examples from e.g. carbohydrate metabolism. Timescale; transcriptional regulation; post-translational modification; signalling via e.g. Ca2+ and metabolites especially AMP.

Part B: Plant metabolism
Photosynthesis
C3 and C4 pathways
Glyoxylate cycle
Secondary metabolites: morphine, quinine, nicotine, caffeine and others

Part C: Microbial metabolic adaptations
Microbial genomics: analysing metabolic pathways using genomic information
Microbial metabolism in the nitrogen cycle
Examples of specialised metabolism: Salmonella, Campylobacter and others
Secondary metabolites: certain antibiotics

Part D: Metabolism in biotechnology
Manipulating microbial metabolism for the production of useful compounds: citric acid, amino acids etc.
Manipulating mammalian cell metabolism in biotechnology: production of complex molecules by animal cells in culture, and its relation to metabolic processes.

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: 33h
Lectures: 24h
Practicals: 5h
Workshops: 2 x 2h

Total Self Study: 117h
Practical write-up: 24h
Reading notes, outside reading for case studies: 24h
Reading, revision: 69h

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to demonstrate:
1. An understanding of the working practices in the United Kingdom National Health Service and the role of a Biomedical Scientist
2. Knowledge and understanding of the general techniques used in Clinical Biochemistry and their use in the assessment of disease
3. 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:
1. Use problem solving skills to analyse case study data and clearly communicate their findings
2. Use analytical and observation skills to interpret immunohistochemical data
3. 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., (2011) Clinical Biochemistry , 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., (2011) Histopathology, 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 (unless selected as a wild module)

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:
1. 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.
2. 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:
1. Application of histological and cytological techniques in a clinical setting including cell and tissue sampling techniques for histological and cytological diagnosis.
2. Use histochemical and immunohistochemical stain techniques for diagnosis and selection of treatment.
3. Microscopic methods used in cellular pathology.
4. Quality control and quality assurance.

BI532 Skills For Bioscientists 2

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
1	Canterbury	Autumn and Spring	I	15 (7.5)	100% Coursework	
1	Canterbury	Autumn and Spring	I	15 (7.5)	50% Coursework, 50% Exam	
1	Canterbury	Autumn and Spring	I	15 (7.5)	60% Coursework, 40% Exam	

Contact Hours

Contact Hours (60h)
Including: Lectures 24h, Practicals 36h

Self Study Hours (90h)
Including: Essay Analysis 20h, Oral Presentations 25h, Mini-project reports 40h, Bioinformatics 5h

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:
1. Demonstrate knowledge and understanding of general techniques in spectroscopy, chromatography, electrophoresis and immunochemistry
2. Demonstrate an understanding and ability to use DNA databases and phylogenetic trees
3. Plan and execute experimental work using a range of experimental techniques
4. Report experimental work both orally and written

The intended generic learning outcomes. On successfully completing the module students will be able to:
1. Demonstrate basic computer skills for use in bioinformatics and data retrieval
2. Demonstrate communication skills in scientific reporting (essay writing, oral presentations and laboratory reports) and in working with others (group work)

Method of Assessment

This module is assessed by coursework:

Essay Analysis (15%) (group assignment) – as a group activity students will be given several essays to compare and mark according to the School guidelines for essay marking under examination conditions. The group will produce a report including a mark and written feedback for each essay.

Presentation (25%) (5 min individual contribution to 20 min group presentation) – as a group activity students will undertake the first part of the project work and will follow a set of defined experiments allowing purification of a protein. Lectures/workshops will take place alongside the practical classes and will focus on the reporting and presentation of experimental work. The group will give an oral presentation of the group element of the project

Mini-project report (55%) (2500 words) – each student will prepare a mini-project report to include the results of the experimental work they carried out working as a pair in mini-project 2. A short literature review will also be incorporated into the report

Bioinformatics assignment (5%) – each student will complete an exercise using techniques introduced in the relevant lectures

Preliminary Reading

Reed, R, Holmes, D., Weyers, J. and Jones, A. Practical Skills in Biomolecular Sciences 4th edition (2013) Prentice Hall
Price, N.C. and Nairn, J. Exploring Proteins – a student's guide to experimental skills and methods (2009) Oxford University Press
Johnson, S. & Scott, J, Study and communications skills for the Biosciences (2009) Oxford University Press.

Pre-requisites

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

Restrictions

Stage 2 students only (unless selected as a wild module)

Synopsis *

A. Communication Skills in Biosciences: Essay writing, oral presentations, laboratory reports, the scientific literature and literature reviews. Working in groups.

B. Techniques in Biomolecular Science: Immunochemistry. Monoclonal and polyclonal antibody production, immuno-chromatography, ELISA and RIA. Electrophoresis, Immunoblotting, Protein Determination, Activity Assays, Purification.

C. Computing for Biologists: Bioinformatics, phylogenetic trees, database searches for protein/DNA sequences.

D. Mini-project – introduction to research skills: Students will work in groups of eight to undertake directed experimental work (Group Project) before extending the project further through self-directed experiments working as a pair (Mini Project).

E. Careers: The programme will be delivered by the Careers Advisory Service and will review the types of careers available for bioscience students. The sessions will incorporate personal skills, careers for bioscience graduates, records of achievement, curriculum vitae preparation, vacation work, postgraduate study, interview skills and action planning.

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

The subject specific knowledge will be delivered in lectures supported by reference to the core text and the scientific literature.
The practical class will support development of an understanding of the relationship between structure and function and their adaptation to the environment.

Contact Hours 30 hours
Lectures 22 hours
Practical classes 8 hours

Self Study Hours 120 hours
Recommended reading 60 hours
Preparation of Practical reports 20 hours
Preparation for in class test 40 hours

Learning Outcomes

a) Ability to describe body plans and the structural organisation of a range of animals
b) Understanding of the physiological role of a range of structures in animals
c) The ability to compare physiological systems across the animal kingdom
d) The ability to describe how physiological systems adapt to specific environmental conditions
e) An practical understanding of classification on the basis of external morphological features in the arthropods.

Method of Assessment

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

Preliminary Reading

Integrated Principles of Zoology (15th ed) C.P. Hickman, L.S. Roberts, S.L. Keen, D.J. Eisenhour, A. Larson, H. L'Anson (2011)

Restrictions

Stage 2 students only (unless selected as a wild module)

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:

A. 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.

B. 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

Contact Hours – 30 hours
Lectures 20 hours
Workshops 4 hours
Practical class 6 hours

Self Study – 120 hours
Recommended Reading 60 hours
Practical Report 15 hours
Problem Solving Exercise 15 hours

Learning Outcomes

The intended subject specific learning outcomes:
a) a knowledge of nutrient acquisition in plants
b) an understanding of the process and regulation of photosynthesis
c) an understanding of plant hormones and their role in the life cycle and responses to the environment
d) an understanding of how plants respond and adapt to environmental conditions

The intended generic learning outcomes:
a) Written communication
b) The ability to generate, analyse and report experimental data
c) 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)

Restrictions

Stage 2 students only (unless selected as a wild module)

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	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 hrs
1. Lectures: 22 hrs
2. Practical introduction: 1 hr
3. Practical: 3 hrs
4. Workshop: 1 hr
5. Feedback: 1 hr

Self study: 122 hrs (including assessments).

The subject specific knowledge will be delivered in lectures supported by reference to the core text and the scientific literature.
Problem solving skills will be developed in the workshop and will be based on the understanding and interpretation of numerical data.
The practical class will support development of an understanding of how antibiotics affect bacteria. The associated report will develop skills in data analysis and interpretation.

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to demonstrate a knowledge and understanding of:
1. The ecological, economic and scientific importance of microorganisms
2. The evolution, taxonomy and biodiversity of microorganisms
3. The structural and metabolic diversity of microorganisms
4. The synthesis and assembly of macromolecular structures of microorganisms
5. 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:
1. Written communication
2. The ability to generate, analyse and report experimental data
3. 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 (unless selected as a wild module)

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.

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:
1. 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.
2. 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:
1. An understanding of how to design and execute a sequence of experiments to address a research question and how to record data
2. Enhanced existing and acquired new experimental skills
3. Developed abilities to identify and solve practical and theoretical problems
4. 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:
1. An appreciation of how scientific research may be translated into business ideas
2. An understanding of the factors that are important in planning and preparing a business plan

Students taking communication projects will have:
1. Developed ability to simplify complex scientific information and adapt it to suit the audience
2. 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:
1. An appreciation of how research leads to knowledge.
2. Developed a clear and concise style of scientific writing that is both informative and lucid
3. Developed skills in the retrieval of scientific information from journals and through electronic searches
4. An understanding of how technologies may be applied/adapted to address a research question.
5. Developed their abilities to work independently and as part of a team - self-motivation, diplomacy, planning and organisational skills and time management .
6. Developed skills in appraising critically and integrating information.
7. Developed skills in communicating science (oral, written or web formats) and in making and defending scientific arguments.

Method of Assessment

Main assessment methods
Written report (80%)
• Laboratory/Computing/Communication projects: 6000 words max
• Dissertations/Business projects: 11,000 words max
Project performance (10%): Weeks 13-24, Spring Term
Oral Presentation (10%): 15 minutes
No examination

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.

Organisation and Content:
Projects are designed by individual members of staff in keeping with their research interests and fall into one of four categories:
• 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

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

Lectures: 24 x 1 hour
Practical/data analysis: 6 hours
Revision workshop: 1-2 hours (addresses learning outcome 11.1)
Self-study: 118 hours (addresses all learning outcomes)

Learning Outcomes

The intended subject specific learning outcomes:
1. Knowledge of the major classes of signalling molecules, their receptors and intracellular signalling pathways.
2. Acquisition of practical and data handling skills associated with monitoring intracellular signalling

The intended generic learning outcomes:
1. Interpretation and retrieval of information
2. Analysis and evaluation of data
3. Written communication skills

Method of Assessment

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

Preliminary Reading

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 *

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	Spring	H	15 (7.5)	65% Exam, 35% Coursework	Mulligan Dr C

Contact Hours

Lectures: 18h
Practicals: Lab 12h
Practical: Computer 3h
Supervision 2h
Workshop 2h
Revision session 1h

Self Study:
Practical report 20h
Problem solving 7h
Workshop preparation 10h
Reading, revision 75h

Learning Outcomes

The intended subject specific learning outcomes:
1. The students should demonstrate an understanding of membrane structure, traffic and transport, and understand the molecular basis of several common genetic diseases in this area.
2. The students should demonstrate ability to integrate data from laboratory and computer-based analyses.

The intended generic learning outcomes:
1. The students should be enabled in a number of computer skills important to final year projects and to scientific research.
2. The students should demonstrate ability to solve honours level problems based on scientific data.

Method of Assessment

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%)

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 (unless selected as a wild module)

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

Contact Hours: 20 hrs
1. Lectures: 18 hrs
2. Symposium: 2 hrs

Self Study: 130 hrs

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:
1. Demonstrate an understanding and knowledge of the molecular basis of microbial pathogenesis in relation to bacterial, viral, parasitic and fungal pathogens.
2. Comprehend, assimilate and present data and concepts on a pathogenesis-related topic.

The intended generic learning outcomes. On successfully completing the module students will be able to:
1. Research and write an essay on a current topic in the field.
2. Work in a small team to prepare and deliver a formal presentation.

Method of Assessment

Essay (20%) 2,500 word limit
Presentation (15%)
Exam, 2 hr (65%)

Preliminary Reading

Mims, CA, The Pathogenesis of Infectious Diseases, 5th ed. (Academic Press, 2001).
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)

Pre-requisites

Before taking this module you must take BI505 Infection and Immunity

Restrictions

Biosciences Stage 3 students only

Synopsis *

A synopsis of the curriculum

Bacterial pathogens:
1. Microbial pathogenicity: variations on a common theme.
2. Methodology of studying bacterial pathogenesis.
3. Virulence factors including toxins and adhesins.
4. Mechanisms of Pathogenesis.
5. Applications of virulence factors in the treatment and prevention of disease.

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

Human fungal pathogens:
1. Fungi and Human Disease - overview of major human fungal infections, clinical picture, diagnosis and mechanisms of transmission, epidemiological aspects of fungal infections.
2. Mechanisms of Pathogenesis - adherence, invasion of eukaryotic cells, morphogenesis, virulence factors: Candida albicans, Aspergillus fumigatus, Cryptococcus neoformans, Histoplasma capsulatum.
3. Whole genome analysis of fungal pathogens
4. Host resistance to infection and antifungal chemotherapy - host defense 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.

Eukaryotic pathogens (parasites):
1. Parasites and pathogenicity, transmission and diversity.
2. Definitions on parasitic lifestyle.
3. Investigations on worldwide parasitic outbreaks (e.g. malaria, trypanosomiasis, cryptosporidiosis) and their socio-economical effects.

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

Lectures 14 hr
Practical 6 hr

Self Study 130 hr - broken down as,
Background reading 62 hr
Assessments 20 hr
Preparation for exam 50 hr

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:
1. Detailed knowledge of the Cell Cycle and its control
2. Changes to the cytoskeleton through the cell cycle and its control.
3. Detailed understanding of apoptosis and its control
4. Detailed knowledge of cell cycle checkpoints
5. Ability to acquire, analyse and interpret microscopy data and present in an appropriate manner

The intended generic learning outcomes. On successfully completing the module students will be able to:
1. Ability to retrieve analyse and evaluate information from textbooks, primary research papers and review articles.
2. Develop written communication skills.

Method of Assessment

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

Preliminary Reading

David O Morgan "The Cell Cycle - Principles of Control." (2006) OUP
A. Murray & T. Hunt "The Cell Cycle – An Introduction." (1994 reissue) OUP
Alberts et al. "Molecular Biology of the Cell." (2007 5th edition)
In addition throughout the course students will be given references to review articles, as well as key landmark research papers.

Pre-requisites

Before taking this module you must take BI503

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	Michaelis Prof M

Availability

PLEASE NOTE: THIS MODULE WILL NOT RUN IN THE 2017-2018 ACADEMIC YEAR

It is strongly recommended that you have taken core stage 1 modules within one of our Biosciences programmes, and that you also take BI606 Pathogens and Pathogenicity while taking this module.

Contact Hours

Contact hours: 26
Lectures: 22 hours
Oral presentations and participation: 4 hours

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

Learning Outcomes

A. An understanding of the different virus families and their main properties.
B. Understanding the fundamental mechanisms of virus replication.
C. Understanding the concepts and functions behind standard virological laboratory assays.

Method of Assessment

100% coursework made up of:
Presentation, 30%: 10 minutes
Written assessment, 60%: 1650 word limit
In class worksheets, 10%: 10 worksheets each of a maximum 100 words

Preliminary Reading

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

Recommended Reading:
Flint, SJ. Principles of Virology, 3rd Edition, ASM Press, 2008
10 x Core Text Collection [3 Day Loan] recommended to purchase
Note: 1st edition held in Templeman Library, Classmark q QJ 360 [2 copies]

Knipe, D. Fields Virology, 5th Edition, Lippincott Williams & Wilkins, 2006.
10 x Core Text Collection [3 Day Loan] recommended to purchase
Note: 2nd edition held in Templeman Library, Classmark q QJ 360 [2 copies]

Pre-requisites

Before taking this module you must take BI505 Infection and Immunity.

Synopsis *

This module surveys the full replication cycle of a broad range of viral families, including newly emerging infectious diseases. The module includes interactive discussions on a number of recent scientific publications that highlight the relevant and important issues in the field of virology today.

Part A: survey of viral families and their properties
Virus families and taxonomy
Viral structure
Viral genomics
Virus replication (overview)
Virus transmission
Viral diseases and host interactions
Anti-viral therapeutics and vaccination

Part B: detailed examination of the different mechanisms of viral replication
Entry
Protein synthesis
Genome replication
Assembly
Budding
Transmission

Part C: fundamental methods in virus research
Key historical methods
Current standard techniques
Novel methods

Part D: virology research design
Grant writing
Oral presentation
Research review and evaluation

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

Contact time: 20 lectures, 20 hrs
Self-study: 130 hours

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:
1. Demonstrate the ability to comprehend the importance of regulation of immune function, with reference to disease states which result when regulation is defective
2. 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:
1. Critically select and interpret information from text books and primary research papers/reviews.
2. Demonstrate an ability to present information accurately in a stipulated format e.g. in an essay format (timed) or concise "camera ready" format (encyclopaedia entry)

Method of Assessment

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

Preliminary Reading

Murphy, K . Janeway's Immunology (8th edition, 2012) Garland Science.
Owen J, Punt J, Stranford S. Kuby Immunology (7th Edition, 2013) W.H. Freeman & Co.

Pre-requisites

Before taking this module you must take 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

Contact Time:
Lectures: 20h
Workshops: 4h
Test: 1h
Revision sessions: 2h

Self Study:
Preparation for the workshops 8h
Preparation for test 10h
Written assignment 30h
Background reading and revision 65h

Learning Outcomes

The intended subject specific learning outcomes:
1. An understanding of the underlying principles of endocrinology at the cellular, biochemical and physiological level.
2. 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
3. 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.
4. 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.
5. The ability to analyse specific metabolic disorders (e.g. diabetes mellitus), from an endocrine perspective within a group setting.

The intended generic learning outcomes:
1. Interpretation and retrieval of information (knowledge management).
2. Analysis and evaluation of data (problem solving).
3. Communication of understanding and analysis through a variety of approaches (group work, tests and written report)
4. Receive and actively use feedback to improve performance.

Method of Assessment

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

Preliminary Reading

Endocrinology. Essential Endocrinology and Diabetes (2012), Holt, R.I.G & Hanley, NA (6th Edition), Blackwell Science.
Clinical Biochemistry Gaw, A., Cowan, R.A., O'Reilly, D.St. J.,et al (1999)
Clinical Biochemistry (2nd Edition) Churchill Livingstone. Ahmed, N (Ed) Clinical Biochemistry (2010) OUP.
Integrated metabolism Core Biochemistry texts recommended for second year modules, for example, Lehninger.
General Physiology Core Physiology texts recommended for first and second year modules, for example, Silverthorn.

Pre-requisites

Before taking this module you must take BI513

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	Spring	H	15 (7.5)	60% Exam, 40% Coursework	Shepherd Dr J

Contact Hours

Contact Hours: Lectures 24 hrs
Self-Study: 126 hrs

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:
1. Describe the factors affecting the production and development of red and white blood cells.
2. Demonstrate an understanding of the processes involved in disease of both red and white blood cells.
3. Understand and recognise the features of a variety of pathological conditions encountered in haematology.
6. Recognise the characteristic changes of blood parameters in selected disease states.

The intended generic learning outcomes. On successfully completing the module students will have developed skills in:
1. Interpretation and retrieval of information (knowledge management).
2. Analysis and evaluation of data (problem solving).
3. Written communication (essay and short answer writing).

Method of Assessment

Assignment (20%) – Case study (1200 words)
Assignment (20%) – Dry practical (1800 words)
Exam (60%) – 2 hours

Preliminary Reading

Haematology. Moore, Knight and Blann (1st edition) Oxford University Press
ISBN 978-0-19-956883-3

Practical Transfusion Medicine (4th edition) Murphy, Pamphilon, Heddle Wiley-Blackwell
ISBN 9780470670514

Mollison's Blood Transfusion in Clinical Medicine (12th edition) Klein and Anstee Wiley-Blackwell
ISBN 9781118689950

Pre-requisites

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

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

Contact Hours: 33 hr
1. Lectures: 24 hrs (12 x 2 hr lectures)
2. Practical: 6 hrs
3. Symposium: 3 hr

Self-study: 117 hrs

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to demonstrate an understanding of:
1. The structural and metabolic diversity of microorganisms
2. Genetic and physiological regulation in microorganisms
3. Experimental approaches used to investigate physiological and genetic control in microorganisms

The intended generic learning outcomes. On successfully completing the module students will have developed skills in:
1. Written communication
2. The ability to generate, analyse and report experimental data
3. The ability to work collectively to analyse and present orally data reported in the scientific literature

Method of Assessment

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

Preliminary Reading

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

Pre-requisites

Before taking this module you must take BI548 Microbial Physiology and Genetics I

Restrictions

Stage 3 Biosciences students only

Synopsis *

1. Introduction: Outline of how physiological homeostasis and adaptation is achieved in the bacterial cell.
2. Experimental approaches used to study microbial physiology and genetics: "Classical" and "reverse" genetics as applied to the study of bacteria. The use of reporter fusions. Transcriptomic and proteomic analysis of gene expression. Deep sequencing and metagenomics. Protein-nucleic acid interactions.
3. Transcriptional and post-transcriptional regulation of gene expression in bacteria: Transcription and translation in bacteria and the diverse mechanisms by which they are controlled. Phase variation and quorum sensing as modes of gene regulation.
4. Complex signalling and physiological control: Selected examples of physiological control in microorganisms, including the Sigma E envelope stress response pathway, regulation in response to nitrogen availability and nitric oxide stress, sensing, and detoxification mechanisms.
5. Microbial biodiversity at the physiological and biochemical level: Diversity of respiratory adaptations. Light harvesting: purple bacteria & cyanobacteria. Photosynthetic electron transport in purple bacteria & cyanobacteria.

Practical on E. coli demonstrating how the envelope stress response factor Sigma E and it's sRNA-controlled target regulate gene expression at the post-transcriptional level using lacZ reporter fusions.
Group presentation of a research paper relating to topic areas in "Complex signalling and physiological control" or "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 = 70 h
Lectures (44 x 1 h)
Revision session (electrophoresis/chromatography) (1 x 2 h)
Problem solving supervisions (4 x 2 h)
Practical/ data analysis workshops (6 x 1.5 h)
Molecular graphics and workshop feedback sessions (7 x 1h)

Self Study = 230 h
Workshop assessments (3 x 18h)
Molecular graphics assessment (18 h)
Preparation for problem solving sessions (4 x 3 h)
Recommended reading (96 h)
Revision/preparation for end-of-year exams (50 h)

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will have:
1. 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.
2. 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, rapid mixing and relaxation apparatus.
3. Experience of web-based tools to retrieve and manipulate protein-related data from international repositories, and the use of molecular graphics and modelling software to analyse protein structure in relation to topology and function.
4. Familiarisation with the instrumentation and the type of data generated by the techniques listed in (2) above using modern research equipment in the Research Facilities and Research Labs of the School of Biosciences.

The intended generic learning outcomes. On successfully completing the module students will have developed skills in:
1. Written communication
2. Handling and analysis of experimental data (including numerical data)
3. Problem solving
4. Use of web tools, data repositories, and computer software.

Method of Assessment

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

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
Whitford, D. (2005) Proteins: structure and function. J. Wiley & sons.
Rhodes G (2006, 3rd ed.) Crystallography made crystal clear. Academic Press

Pre-requisites

Before taking this module you must take BI300 and BI532

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

Contact hours:
Lectures 18 hours
Computing Workshops 16 hours (8 x 2hours)

Self-Study:
Coursework project report 46 hours
Workshop Assessments 20 hours
Personal Study 50 hours

Learning Outcomes

The intended subject specific learning outcomes:
1. An understanding of DNA/protein databases, sequence searching methods, multiple sequence alignments, residue conservation and phylogenetic trees.
2. An understanding of bioinformatics methods for the analysis and prediction of protein structure, function and interactions with small ligands and with other proteins.
3. An understanding of genomics approaches including – genome sequencing, comparative and functional genomics, metagenomics and transcriptomics.
4. The ability to use online resources taught in 11.1 and 11.2 to analyse protein and gene features (including structure, function and interactions).

The intended generic learning outcomes:
1. Bioinformatics computer skills for use in biology and data retrieval/analysis. These are generic bioinformatics skills, which can be used across biological sciences. Data retrieval/analysis are generic to all numerate subjects.
2. Transferable skills including written communication (technical reports and a coursework project. Analytical skills including analysis and presentation of data, writing of reports and a mini project(coursework))

Method of Assessment

Workshop (15% - short answer questions)
Workshop (15% - short answer questions)
Assignment (70% - 2500 words)

Preliminary Reading

There will be 2 core texts for the course:

Lesk A, Introduction to Bioinformatics, 3rd Edition, Oxford University Press, 2008 Templeman Library Classmark QH 323.5 3 x Core Text Collection [1 week loan], 5 x Core Text Collection [Ordinary loan]. Note Edition 2 also held in the library [8 in CTC ordinary loan].

Lesk A, Introduction to Genomics, 1st Edition, OUP, 2011, Not currently available in Templeman Library.

Additionally selected research and review papers will be recommended.

Pre-requisites

Before taking this module you must take BI300, and whilst taking this module you must take BI532

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

Contact hours: 26
Lectures: 22 hours
Oral presentations and participation: 4 hours

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

Learning Outcomes

A. 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.

B. An understanding of the concepts and functions behind standard cell biological, biochemical, and molecular biological assays used in oncological research.

Method of Assessment

Assignment (10%)
Essay (two A4-sized pages using Ariel font 11 point, single-spaced with 1.5cm margins 60%)
Presentation (30%)

Preliminary Reading

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

Recommended Reading:
Robert A. Weinberg. The Biology of Cancer. New York; Abingdon: Garland Science, 2007.
Bruce Alberts. Essential Cell Biology. New York; London: Garland Science, 2011.

Restrictions

Stage 3 Biosciences students only

Synopsis *

This module introduces the basic principles of cancer biology and cancer therapy. It will explain the characteristics of cancer and why the development of more effective anti-cancer therapies is so extremely challenging. The module includes interactive discussions on a number of recent scientific publications that highlight the relevant and important issues at the frontiers of cancer research today.

Part A: Survey of the leading issues in oncology
Origin of cancer
Cancer biology
Cancer therapies

Part B: Fundamental methods applied in oncological research
Key historical methods
Current standard techniques
Novel methods

Part C: Oncology research design
Grant writing
Oral presentation
Research review and evaluation

BI642 Cancer Biology

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

Contact Hours

Total contact hours = 30 hr
Lectures (24 x 1h) 24 hr
Feedback session – assessment 1 2 hr
Feedback session – assessment 2 2 hr
Pre-examination revision lecture 2 hr

Total Self study = 120 hr
Written assessment 1 (News & Views article) 20 hr
Written assessment 2 (Research article evaluation) 20 hr
Background reading relating to lecture content 40 hr
Preparation for examination 40 hr

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:
1. An understanding of the regulation of gene expression, the molecular genetic changes that result in the development of cancer (inherited and/or acquired mutation, infection/inflammation), and an appreciation of how these changes result in uncontrolled cell division (deregulation of the cell cycle, and of the normal apoptotic mechanisms).
2. An understanding of the normal processes by which DNA damage is subject to repair; the limitations of this mechanism, and how this leads to cellular transformation at the molecular level.
3. Knowledge of possible roles of the immune system in inhibiting/promoting tumour development; and of the molecular mechanisms by which cutting edge targeted therapies are revolutionising the working practice of the oncology clinic.

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

Method of Assessment

Assignment 1, 750 words, 20%
Assignment 2 (20%)
Exam, 2 hr (60%)

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 *

The Molecular Biology of Cancer: Regulation of gene expression; Growth factor signalling and oncogenes; Growth inhibition and tumour suppressor genes; the Cell Cycle and apoptosis.
Cancer stem cells and differentiation: chemo-resistance and metastasis.
DNA structure and stability: mutations versus repair.
Tumour immunology: targeted cancer therapies and clinical trial design.

BI643 Neuroscience

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

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 and Assessment Hours: 124
Total Study Hours: 150

Lectures: 20 hrs
Workshops: 6 hrs
1. Group discussion of key ageing research paper(s) (small groups)
2. Data analysis session (whole class or smaller groups)
3. Overview of the module in preparation for revision/exam (whole class)
Self-study: 124 hours

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will have acquired:
1. Knowledge of the major processes underlying the ageing process.
2. 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 have developed skills in:
1. Interpretation and retrieval of information
2. Analysis and evaluation of data
3. Written communication

Method of Assessment

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

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 consists of review articles and primary research publications. The emphasis of this module will be to read and interpret the literature first hand.

Restrictions

Stage 3 Biosciences students only

Synopsis *

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).

BI797 Sandwich Year Assessment

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Autumn and Spring	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 taking the Sandwich Year option will specifically be able to:
1. Demonstrate an awareness of the application of, and ability to apply, degree level scientific knowledge to the workplace
2. Record, analyse and interpret data, and use graphical and statistical methods for presentation, in accordance with scientific convention
3. Perform an independent research project, under supervision, which enhances existing practical and/or theoretical scientific knowledge and skills
4. Structure, develop and defend complex scientific arguments by understanding and applying expanding knowledge base and critically appraising own and published work
5. Develop ability to present and communicate scientific work in various formats

Method of Assessment

Placements are assessed by the following means:

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. Assessment is as follows: (a) Written report 50%; (b) Oral presentation, 20%; (c) Performance on the job, 30%.

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

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	Autumn and Spring	H	120 (60)	Pass/Fail Only	

Learning Outcomes

Demonstrate an awareness of the application of, and ability to apply, knowledge and skills gained during a biosciences degree in the workplace.

Method of Assessment

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.

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:

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.