

School of Biology

Modules

Normally the pre-requisite(s) for each of the following Honours modules is entry to the Honours Programme(s) for which they are specified, as well as any additional specific pre-requisite(s) given.

General degree students wishing to enter 3000-level modules and non-graduating students wishing to enter 3000- or 4000-level modules must consult with the relevant Honours Adviser within the School before making their selection.

InterDisciplinary (ID) Modules

This School contributes to the following InterDisciplinary modules

ID4001 Communication & Teaching in Science (Section 23)

Biology (BL) Modules

BL3000 Field Course			
SCOTCAT Credits:	10	SCQF Level 9	Semester: 1
Planned timetable:	1-week residential course. This module takes place during the summer vacation.		
This module involves field-based exercises in a range of aquatic and/or terrestrial habitats. Students will examine and measure biodiversity, ecophysiological adaptation, and community structure, with both plant and animal material. Class exercises are used to develop good sampling techniques and to generate and analyse large data sets. Students also work in small project groups to develop individual skills in experimental design, practical manipulations, time-management and personal initiative, and in verbal/written presentation of project results.			
Programme module type:	Compulsory for Ecology and Conservation, Marine Biology, and Zoology. If BL3308 or BL3309 is taken then compulsory for all Biology degree programmes. Optional for Behavioural Biology, Biology and Geology, Biology, Biology and Economics, Biology and Mathematics or Statistics, Biology with French, Biology and/with Psychology, Environmental Biology and Geography, Evolutionary Biology.		
Co-requisite(s):	BL3308 or BL3309	Anti-requisite(s):	BI3321
Learning and teaching methods and delivery:	Weekly contact: Please Contact Department		
	Scheduled learning: 50 hours	Guided independent study: 50 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 50%, Coursework = 50%		
	As used by St Andrews: Coursework = 100%		
Module Co-ordinator:	Prof D Paterson		
Lecturer(s)/Tutor(s):	Prof Paterson, Dr Shuker, Dr J Graves, Dr Defew, Dr Gollety, Mr Edwards.		

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BL3301 Protein Structure and Function			
SCOTCAT Credits:	20	SCQF Level 9	Semester: 1
Planned timetable:	Lectures: 10.00 am Mon, Wed and Fri. Practicals: to be arranged.		
<p>This module builds on the material covered in BL1201 and BL2104 to provide an understanding of more advanced aspects of protein structure and enzymology. The module begins by considering the protein-folding problem. The energetics of protein folding and the dependence of structure on sequence are examined. Protein folding diseases like spongiform encephalopathies are used as examples to highlight the significance of protein folding. The molecular basis of prion diseases is discussed in detail. The second part of the module focuses on the mechanisms of enzymes. This in turn leads into the phenomena of allosteric regulation, signalling cascades and transporter systems and is followed by a consideration of enzymes as pharmacological targets. The third part of the module introduces the major techniques for protein structure determination that are at the heart of modern biochemistry, molecular biology and drug discovery. Strategies for obtaining three-dimensional images of macromolecules by electron microscopy, X-ray crystallography and nuclear magnetic resonance are discussed. The laboratory course associated with this module introduces the fundamentals of safe laboratory practice. It provides grounding in the basic laboratory techniques, including associated calculations, as well as those associated with the study of proteins and enzymes.</p>			
Programme module type:	Compulsory for Biochemistry, Biomolecular Science, Molecular Biology. Optional for Cell Biology, Biology, Neuroscience, and all Biology Joint or Major/Minor Degree programmes.		
Pre-requisite(s):	BL2101 or BL2104		
Required for:	BL4212, BL4215, BL4223		
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.		
	Scheduled learning: 40 hours	Guided independent study: 160 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 83%, Practical Examinations = 0%, Coursework = 17%		
	As used by St Andrews: Coursework = 34%, Written Examination = 66%		
Module Co-ordinator:	Dr U Schwarz-Linek		
Lecturer(s)/Tutor(s):	Dr U Schwarz-Linek, Prof G Taylor, Prof R Griffiths		

BL3302 Gene Regulation			
SCOTCAT Credits:	20	SCQF Level 9	Semester: 1
Planned timetable:	Lectures: 12.00 noon Mon, Wed, Fri. Practicals: to be arranged.		
<p>This module builds on material covered in BL1201 Molecular Biology and BL2104 Biochemistry and Molecular Biology. It first considers the structure of genes and the composition of genomes and then examines genetic activity in eukaryotes in relation to nuclear organisation, chromatin structure and epigenetic mechanisms. Regulation of expression at the levels of gene transcription, RNA processing, RNA stability and translation are next covered in detail, drawing particular attention to the nature of protein-nucleic acid interactions. Specific control mechanisms in different prokaryotic and eukaryotic systems, induced by environmental, cell cycle, metabolic and developmental signals, are highlighted.</p>			
Programme module type:	Compulsory for Biochemistry, Cell Biology, Molecular Biology. Optional for Behavioural Biology, Biology, Evolutionary Biology, Neuroscience, Zoology and all Biology Joint or Major/Minor Degree programmes.		
Pre-requisite(s):	Normally BL2104	Required for:	BL4223
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.		
	Scheduled learning: 39 hours	Guided independent study: 161 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 0%, Coursework = 34%		
	As used by St Andrews: Coursework = 34%, Written Examination = 66%		
Module Co-ordinator:	Dr S Unkles		
Lecturer(s)/Tutor(s):	Dr D Barker, Dr P Coote, Dr D Ferrier, Dr A Koussounadis, Dr S MacNeill, Prof M Ryan, Dr J Sleeman, Dr S Unkles, Prof M White.		

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BL3303 Membranes and Cell Communication				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	1
Planned timetable:	Lectures: 9.00 am Mon, Wed and Fri. Practicals: to be arranged.			
<p>This module deals with the structural and functional organisation of biological membranes. The dynamic molecular components of biological membranes are studied by investigating the mechanisms involved in the control of membrane fluidity, and the biogenesis of new molecular components of the membrane. The central role that biological membranes play in the regulation of the movement of molecules between different extracellular, intracellular and transcellular compartments is also considered. The process of molecular transport is studied at both a theoretical and practical level. The interaction between the structural and functional organisation of the cell membrane is highlighted by studying the specialisation seen in the major transporting epithelial tissues. Topics covered include: (i) structural and kinetic analysis of ligand-receptor interactions; (ii) GTP-binding proteins and the generation of intracellular second messengers: cyclic AMP, cyclic GMP, diacyl glycerol and inositol triphosphate; (iii) the activation of receptor and intracellular protein kinases: serine/threonine and tyrosine kinases; (iv) de-sensitisation of signal responses and receptor 'cross-talk'; (v) direct and indirect activation of plasma membrane ion channels. The practical component includes experiments to illustrate methods used to elucidate signalling pathways as well as providing training in laboratory and transferable skills.</p>				
Programme module type:	Compulsory for Biochemistry, Cell Biology, Molecular Biology, Neuroscience. Optional for Biology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	Normally BL2101	Required for:	BL4224	
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.			
	Scheduled learning: 41 hours		Guided independent study: 159 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 0%, Coursework = 34%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Dr G Prescott			
Lecturer(s)/Tutor(s):	Dr R Ramsay, Dr G Prescott, Dr J Ingledew, Dr J Sleeman, Dr T Smith			

BL3307 Evolution				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	1
Planned timetable:	Lectures: 9.00 am Tue and Thu, 11.00 am Fri. Practicals: to be arranged.			
<p>Topics in this module will include: molecular variation and evolution, including phylogeny reconstruction; the evolution and maintenance of sex; the genetics of continuous traits, and the relative importance of continuous and discontinuous variation in evolution; evolution of population genetic structure; the genetics of speciation, covering the evolution of pre- and post-zygotic isolation, and parapatric, sympatric and island speciation. Practicals will involve computer simulations to investigate a range of evolutionary phenomena, plus use of molecular markers to examine population structure and speciation.</p>				
Programme module type:	Compulsory for Behavioural Biology, Ecology and Conservation, Evolutionary Biology. Optional for Biology, Neuroscience, Zoology and all Biology Joint or Major/Minor Degree programmes.			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.			
	Scheduled learning: 34 hours		Guided independent study: 166 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 0%, Coursework = 34%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Prof T Meagher			
Lecturer(s)/Tutor(s):	Prof T Meagher, Dr D Ferrier, Dr J Graves, Dr D Barker, Prof K Laland, Prof M Ritchie,			

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BL3308 Aquatic Ecology				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	1
Planned timetable:	Lectures: 11.00 am Mon, Tue and Thu. Practicals: to be arranged.			
This module introduces the ecology of aquatic systems beginning with a description of the problems of life in a fluid medium. The module then considers the contrasting conditions that are inherent in freshwater, estuarine and marine systems. The influence of global climate variation and the close coupling between land and sea will be emphasised. Case studies will then be used to introduce the ecology of a variety of aquatic systems including tropical, temperate and polar systems. This module involves a residential field trip to Kindrogan field station in the Scottish Highlands.				
Programme module type:	Compulsory for Behavioural Biology, Ecology and Conservation, Marine Biology. Optional for Biology, Environmental Biology and Geology, Evolutionary Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes.			
Co-requisite(s):	BL3000			
Required for:	BL4301: (BL2105, BL3308, BL3318 or equivalent preferred but not essential)			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.			
	Scheduled learning: 53 hours		Guided independent study: 147 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 14%, Coursework = 20%			
	As used by St Andrews: Coursework = 34%, Written Examinations = 66%			
Module Co-ordinator:	Dr I Matthews			
Lecturer(s)/Tutor(s):	Dr I Matthews, Prof C Todd, Dr P Miller, Dr R Aspden.			

BL3309 Ecosystems and Conservation				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	2
Planned timetable:	Lectures: 12.00 noon Mon, Wed and Fri. Practicals: to be arranged.			
This module will examine how ecosystems function and how they provide services for humans: information which is essential for ecologists, conservationists and land managers. The module will consider examples of natural systems being altered by man to demonstrate how ecosystems function and the consequences of anthropogenic change. Disturbance and regulation in ecosystems, atmospheric and hydrological regulation, (including the green house effect and acidification), soil ecology, conservation and management of natural resources, agricultural and grazed ecosystems (including GMOs), urban ecosystems and aspects of sustainable development will also be discussed.				
Programme module type:	Compulsory for Ecology and Conservation. Optional for Behavioural Biology, Biology, Environmental Biology and Geology, Evolutionary Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	Normally BL2105 or SD2001	Co-requisite(s):	BL3000	
Required for:	BL4254, BL4266, BL4268			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.			
	Scheduled learning: 36 hours		Guided independent study: 164 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 0%, Coursework = 34%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Dr S Northridge			
Lecturer(s)/Tutor(s):	Dr S Northridge, Dr I Matthews, Prof T Meagher			

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BL3310 Bioenergetics				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	2
Planned timetable:	Lectures: 11.00 am Mon, Tue and Thu. Practicals: to be arranged.			
The conversion of one form of energy into another by a biochemical process is at the centre of all life. This module studies the biological systems for conserving energy from food oxidation and light absorption (photosynthesis) and the conversion of the resulting redox energy into chemical energy in the pyrophosphate bonds of ATP. The module also considers electron transfer processes in biology and the energetics of transport processes. Chemiosmotic theory and the principles are considered in detail as are the structure and function of electron and proton transfer systems of energy transducing systems. Practical classes will introduce the student to the methods used in this field of study. The module will comprise twenty lectures, eight hours tutorials/seminars in total, and twelve hours in practical classes.				
Programme module type:	Compulsory for Biochemistry, Biomolecular Science, Molecular Biology. Optional for Cell Biology Biology, Neuroscience and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL2104	Required for:	BL4222	
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.			
	Scheduled learning: 36 hours		Guided independent study: 164 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 0%, Coursework = 34%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Dr J Ingledew			
Lecturer(s)/Tutor(s):	Dr J Ingledew, Dr R Ramsay			

BL3311 Infection and Disease				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	2
Planned timetable:	Lectures: 9.00 am Tue and Thu and 11.00 am Fri. Practicals: to be arranged.			
This module has lectures in three component areas: parasite infections, viral disease, and pathogenicity of common bacterial infections, and will include consideration of host defences and effective treatment. In all three component areas the emphasis will be on understanding at the molecular level.				
Programme module type:	Compulsory for Molecular Biology. Optional for Biochemistry, Cell Biology, Biology, Neuroscience and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	Normally BL2101 and BL2104			
Required for:	BL4211, BL4213			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.			
	Scheduled learning: 38 hours		Guided independent study: 162 hours	
Assessment pattern:	As defined by QAA: Written Examination = 90%, Practical Examination = 0%, Coursework = 10%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Dr P Coote			
Lecturer(s)/Tutor(s):	Dr P Coote, Prof R Randall, Dr T Smith, Dr B Precious, Prof G Taylor, Prof R Elliott, Dr D Jackson, Prof M Ryan			

BL3312 Pharmacology				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	2
Planned timetable:	Lectures: 12.00 noon Mon, Wed and Fri. Practicals: to be arranged.			
This module assumes that students are familiar with the material covered in BL2002 and BL2006. The basic principles of pharmacology will be covered, including evidence to support the modern concept that drugs act via specific receptors present on target tissues and an explanation of our present understanding of laws governing drug-receptor interactions. The concept of agonists, competitive and non-competitive antagonists and the interactions between such classes of drugs will be discussed. The effects of drugs upon the peripheral and central nervous systems and the cardio-vascular system will be covered. How these drugs can be used to understand the function of these systems and to correct their malfunctioning in various disease states will be explained. The practical component will cover the principles of drug action and receptor theory and illustrate the use of bioassays in pharmacological investigations. The practicals aim to help students build a working knowledge of drug names and actions as well as pharmacological concepts.				
Programme module type:	Compulsory for Biomolecular Science, Molecular Biology. Optional for Biochemistry, Cell Biology, Biology, Neuroscience and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL2101	Required for:	BL4234	
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.			
	Scheduled learning: 37 hours		Guided independent study: 163 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 20%, Coursework = 14%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Dr R Ramsay			

BL3313 Neuroscience				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	2
Planned timetable:	Lectures: 9.00 am Mon, Wed and Fri. Practicals: to be arranged.			
This module covers biochemical, cellular and behavioural aspects of the nervous system. It starts with the basic biochemistry of neural membrane proteins such as receptors and channels, and considers the cellular mechanisms of action potential generation and propagation, and synaptic transmission. The physiology of sensory perception is illustrated by examining the visual system, while motor control is considered in terms of vertebrate locomotion. Selected aspects of learning and memory processes are examined from simple invertebrate systems through to the higher primates. Students are given extensive hands-on experience of computer simulation as a learning tool in this course. The associated practical work illustrates the lecture course through experiments on the nerve impulse, sensory processes, and the biochemistry of synaptic transmission.				
Programme module type:	Compulsory for Biochemistry, Biomolecular Science, Molecular Biology, Neuroscience. Optional for Behavioural Biology, Biochemistry, Cell Biology, Evolutionary Biology, Zoology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL2101			
Required for:	BL4230, BL4231, BL4232, BL4234, BL4235			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.			
	Scheduled learning: 36 hours		Guided independent study: 164 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 0%, Coursework = 34%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Prof F Gunn-Moore			
Lecturer(s)/Tutor(s):	Prof F Gunn-Moore, Prof K Sillar, Dr G Miles, Dr W Heitler, Dr W Li			

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BL3315 Developmental Biology				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	2
Planned timetable:	Lectures: 10.00 am Mon, Wed and Fri. Practicals: to be arranged.			
<p>This module considers the enigma of development, how complexity arises from apparent simplicity when an adult develops from an egg. It examines development from fertilisation to maturity in a range of organisms, but concentrates on higher vertebrates including man, and the fruitfly <i>Drosophila</i>. Early-acting mechanisms for generating differences between initially identical cell populations to produce patterning and structure in embryos will be considered. The development of the nervous system will be examined in depth. <i>Drosophila</i> embryonic development and the hormonal control of metamorphosis in flies and amphibians will also be studied.</p>				
Programme module type:	Optional for Behavioural Biology, Neuroscience, Cell Biology, Evolutionary Biology, Molecular Biology, Marine Biology, Zoology and all Biology Joint or Major/Minor Degree programmes.			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars, plus practicals.			
	Scheduled learning: 47 hours		Guided independent study: 153 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 34%, Coursework = 0%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Dr D Ferrier			
Lecturer(s)/Tutor(s):	Dr M Milner, Dr D Ferrier, Dr G Miles, Prof Sillar, Dr G Middleton			

BL3316 Animal Plant Interactions				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	1
Planned timetable:	Lectures: 12.00 noon Tue, 11.00 am Wed, 12.00 noon Thu. Practicals: to be arranged.			
<p>This module concerns the coevolution of plants and animals, including the ecological, behavioural and physiological aspects of their interactions. Pollination biology and the constraints on participating plants and animals are dealt with in depth, including applied aspects of crop pollination, and this is followed by a review of seed dispersal. Then patterns of herbivory by insects, vertebrates and other animals are considered, illustrating the interactions of plant physical and chemical defences and herbivores' reciprocal adaptations from feeding specialisations and host plant selection through to detoxification systems and life history adaptations. Interactions with third parties are also explained, especially plant-fungus-insect systems. There is an introduction to other tritrophic interactions (whereby plants can recruit herbivores' enemies as part of their defences, or recruit ants as biotic plant guards), to insects as plant pests, and to integrated and sustainable approaches to control measures and plant protection.</p>				
Programme module type:	Optional for Behavioural Biology, Ecology and Conservation, Evolutionary Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes.			
Learning and teaching methods and delivery:	Weekly contact: lectures and seminars, plus practicals.			
	Scheduled learning: 42 hours		Guided independent study: 158 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 22%, Coursework = 12%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Prof P Willmer			
Lecturer(s)/Tutor(s):	Prof P Willmer, Prof G Ruxton, Prof S Hubbard, Dr A Karley, Dr J Wishart, Dr S Healy			

BL3318 Biology of Marine Organisms				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	2
Planned timetable:	Lectures: 12.00 noon Tue, 11.00 am Wed and Fri. Practicals: to be arranged.			
<p>This module will include lectures on the range of microbial and metazoan organisms and ecological systems in the marine environment. The coverage will range from bacteria, to algae, invertebrates and vertebrates (fish, birds, reptiles and mammals). The biology of marine organisms is considered in the context of both adaptations at the level of the individual and its expression in terms of large-scale latitudinal and depth-related variations in productivity and food web structure. Examples from the poles to the tropics and from shallow water to the deep ocean will be included. Practicals will be field- and laboratory-based and will provide an experimental introduction to both ecological and physiological problems in marine biology.</p>				
Programme module type:	Compulsory for Marine Biology. Optional for Behavioural Biology, Ecology and Conservation, Evolutionary Biology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	Normally BL2102 and BL2105			
Required for:	BL4257, BL4259, BL4260, BL4301: (BL2105, BL3308, BL3318 or equivalent preferred but not essential)			
Learning and teaching methods and delivery:	Weekly contact: lectures and seminars, plus practicals.			
	Scheduled learning: 39 hours		Guided independent study: 161 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 0%, Coursework = 34%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Dr V Smith			
Lecturer(s)/Tutor(s):	Dr V Smith, Prof C Todd, Prof A Brierley, Prof P Hammond, Prof I Boyd, Dr C Gollety, Dr A Onjanguren, Dr L Rendell, Dr C Smith, Dr S Heinrich			

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BL3319 Animal Behaviour: A Quantitative Approach				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	2
Planned timetable:	Lectures: 11.00 am Mon, Tue and Thu. Practicals: to be arranged.			
<p>This module is designed to provide a broad and multifaceted perspective on animal behaviour, emphasising contemporary theoretical, mathematical and statistical approaches to the discipline. Nobel-Prize-winning ethologist, Niko Tinbergen, pointed out that to understand behaviour fully researchers had to answer four types of questions, about its causation, function, development and evolution. All four areas are covered in the course, which includes lectures on the genetic, neural, physiological and experiential (i.e. learning) influences on behaviour; behavioural development; foraging; sexual behaviour, sexual selection and mate choice; communication, cooperation and culture. The course contains extensive material of a formal theoretical nature, and emphasises quantitative skills throughout. Students will be introduced to new mathematical and statistical approaches within the field.</p>				
Programme module type:	Compulsory for Behavioural Biology. Optional for Ecology and Conservation, Evolutionary Biology, Marine Biology, Zoology, and all Biology or Environmental Biology Joint or Major/Minor Degree programmes.			
Required for:	BL4258, BL4263			
Learning and teaching methods and delivery:	Weekly contact: lectures and seminars, plus practicals.			
	Scheduled learning: 34 hours		Guided independent study: 166 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 7%, Coursework = 27%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Prof K Laland			
Lecturer(s)/Tutor(s):	Prof K Laland, Dr W Hoppitt, Dr M Webster, Dr L Rendell, Dr N Boogert, Prof P Slater, Dr C Templeton, Dr S Healy, Prof M Ritchie, Prof K Sillar, Dr V Janik			

BL3320 Practical Statistics for Biologists				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	1
Planned timetable:	To be arranged.			
<p>Few biologists are statisticians but all biologists use statistics. This series of workshops is designed to build confidence in organising and analyzing data to address biological questions efficiently. The module will help you learn how to identify statistical approaches and how to manage and analyse data in code driven statistical programming packages. An introductory workshops will cover basic concepts and practical training that will be used in a choice of specific workshops that cover applications across the range of Biology.</p>				
Programme module type:	Compulsory for Behavioural Biology, Biology, Ecology and Conservation, Evolutionary Biology, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes. Optional for Cell Biology, Neuroscience			
Required for:	BL4273			
Learning and teaching methods and delivery:	Weekly contact: 2 x 2-hour practicals for each of 4 weeks.			
	Scheduled learning: 24 hours		Guided independent study: 76 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Prof G Ruxton			
Lecturer(s)/Tutor(s):	Dr G Ruxton, Ms L Sibbett, Dr D Barker			

BL3321 Advanced Critical Analysis Reading Party				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	1
Planned timetable:	1 week in summer vacation just prior to Orientation week plus further meetings in semester			
<p>An introductory residential module to Honours study for students studying Cell Biology, Neuroscience and Biology degrees held at the Burn between the resit diet and the start of semester 1. This module introduces students to the skill of critically analysing scientific literature and the methodology behind preparing research proposals. Students will work in groups to develop a grant proposal and present their ideas to a mock research grant panel. In response to detailed feedback students can improve their skills and finally submit an extended referees report on a real grant proposal.</p>				
Programme module type:	Optional for Cell Biology, Neuroscience and all Biology Joint and Major/Minor degree programmes			
Co-requisite(s):	Any 3000-level BL module		Anti-requisite(s):	BL3000
Learning and teaching methods and delivery:	Weekly contact: see planned timetable entry above.			
	Scheduled learning: 40 hours		Guided independent study: 60 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 5%, Coursework = 95%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr G Prescott			
Lecturer(s)/Tutor(s):	Prof F Gunn-Moore, Dr J Sleeman, Dr G Prescott			

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BL3400 Tropical Research and Field Study				
SCOTCAT Credits:	20	SCQF Level 9	Semester:	1
Planned timetable:	4 weeks in field locations.			
<p>The module allows is for students studying with Ooperation Wallacea in terrestrial and marine environments for a minimum of four weeks during the summer vacation. Students will gain experience in researching a variety of habitats and investigate the species in locations such as Indonesia, Honduras, South Africa and Mozambique. Students will be introduced to tropical ecology, sustainable development and conservation, fieldwork and novel research methods under the supervision of experts in those research areas. Students will be expected to maintain a journal of their field studies, in addition to being assessed on the application of field techniques and knowledge. The module will culminate in the production of a detailed research proposal.</p>				
Programme module type:	Optional for Behavioural Biology, Biology, Ecology and Conservation, Evolutionary Biology, Marine Biology, Zoology, and all Biology or Environmental Biology Joint or Major/Minor Degree programmes.			
Learning and teaching methods and delivery:	Weekly contact: Lectures, practicals and occasional seminars.			
	Scheduled learning: 160 hours		Guided independent study: 40 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 20%, Practical Examinations = 10%, Coursework = 70%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr C Peddie			

BL4200 Literature-based Research Project				
SCOTCAT Credits:	45	SCQF Level 10	Semester:	Whole Year
Planned timetable:	To be arranged.			
<p>This project will involve an extensive literature review to investigate a defined hypothesis or problem within the field of biology, appropriate to the degree programme being studied by each student. The project will involve diligence, initiative and independence in pursuing the literature, and the production of a high-quality dissertation that demonstrates a deep understanding of the chosen area of research. Students will be allocated to a member of staff who will guide and advise them in research activities throughout the academic year. The project will be written up in the form of a research dissertation, and presented in the form of an academic poster and an oral presentation.</p>				
Programme module type:	Either BL4200 or PS4050 compulsory for Biology and Psychology. BL4200 or BL4201 or PS4050 compulsory for Neuroscience. Optional for Behavioural Biology, Biochemistry, Biology, Cell Biology, Ecology and Conservation, Evolutionary Biology, Marine Biology, Molecular Biology, Zoology, and all Biology or Environmental Biology Joint or Major/Minor Degree programmes.			
Anti-requisite(s):	BL4201, BL4202, PS4060			
Learning and teaching methods and delivery:	Weekly contact: 1 dedicated meeting with supervisor per week, students should expect to spend the equivalent of 8 weeks full-time on this research project.			
	Scheduled learning: 22 hours		Guided independent study: 428 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 25%, Coursework = 75%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Prof P Willmer			
Lecturer(s)/Tutor(s):	Individual Supervisors across the School of Biology			

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BL4201 Experimental Research Project			
SCOTCAT Credits:	60	SCQF Level 10	Semester: Whole Year
Planned timetable:	To be arranged.		
<p>This project will involve extensive laboratory or field research to investigate a defined problem within biology, appropriate to the degree programme being studied by each student. The project will involve diligence, initiative and independence in pursuing the literature, good experimental design, good experimental and/or analytical technique either in the field or the laboratory, and excellent record keeping. The project will culminate in the production of a high-quality report that demonstrates a deep understanding of the chosen area of research. Students will be allocated to a member of staff within the School of Biology who will guide and advise them in research activities throughout the academic year.</p>			
Programme module type:	BL4200 or BL4201 or PS4050 compulsory for Neuroscience. Optional for Behavioural Biology, Biochemistry, Biology, Cell Biology, Ecology and Conservation, Evolutionary Biology, Marine Biology, Molecular Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes. May be taken for Biomolecular Science (conditions apply)		
Anti-requisite(s):	BL4200, BL4202		
Learning and teaching methods and delivery:	Weekly contact: 1 dedicated meeting with supervisor per week. Students should expect to spend the equivalent of 1 semester full-time conducting supervised research and completing the associated assessments. This time is either condensed into 1 semester or spread out over the academic year depending on the nature of the research and other module choices.		
	Scheduled learning: 320 hours	Guided independent study: 280 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 35%, Coursework = 65%		
	As used by St Andrews: Coursework = 100%		
Module Co-ordinator:	Prof P Willmer		
Lecturer(s)/Tutor(s):	Individual Supervisors across the School of Biology		

BL4202 Research Project in Museum Studies			
SCOTCAT Credits:	45	SCQF Level 10	Semester: 2
Planned timetable:	To be arranged.		
<p>The museum-based research projects entail the independent research of a topic appropriate for display in a Museum of Natural History, of interest to, and understandable by, the general public visiting the Bell-Pettigrew Museum. A 3000-word essay on the topic is prepared that prepares the academic and scientific background to the topic. The topic is then presented to the public through the construction of a museum display in a dedicated flat case at the entrance to the museum. A relevant leaflet and an interactive DVD are also prepared to compliment the display. Finally students give a presentation to a knowledgeable audience on the development of the research project. Students wishing to take this museum-based research project must have passed the module BL4291, Science, Museums and the Public.</p>			
Programme module type:	Optional for Behavioural Biology, Biochemistry, Biology, Cell Biology, Ecology and Conservation, Evolutionary Biology, Marine Biology, Molecular Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes.		
Pre-requisite(s):	BL4291	Anti-requisite(s):	BL4200, BL4201
Learning and teaching methods and delivery:	Weekly contact: 1 dedicated meeting with supervisor per week, students should expect to spend the equivalent of 8 weeks full-time on this research project.		
	Scheduled learning: 320 hours	Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 70%, Coursework = 30%		
	As used by St Andrews: Coursework = 100%		
Module Co-ordinator:	Dr M Milner		
Lecturer(s)/Tutor(s):	Dr M Milner		

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BL4210 Practical Skills for Molecular Biology and Biochemistry				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>Practical skills are the core of research in biochemistry and molecular biology. This module is designed to prepare students for laboratory research projects in internationally competitive research. The module is designed to foster skills such as experimental design, core practical skills, data analysis and excellent record keeping. Each practical requires some prior theoretical familiarity. Emphasis is placed upon experimental design - notably anticipation of experimental outcomes and the choice of appropriate experimental controls. This planning phase is followed by execution of the experiment and analyses of the data.</p>				
Programme module type:	Compulsory for Biochemistry, Biomolecular Science, Molecular Biology Optional for Cell Biology and all Biology Joint or Major/Minor Degree programmes.			
Learning and teaching methods and delivery:	Weekly contact: Seminars and practicals.			
	Scheduled learning: 31 hours		Guided independent study: 119 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 30%, Practical Examinations = 0%, Coursework = 70%			
	As used by St Andrews: Coursework = 70%, Written Examination = 30%			
Module Co-ordinator:	Prof M Ryan			
Lecturer(s)/Tutor(s):	Prof M Ryan, Prof M White			

BL4211 Antimicrobials - Mode of Action and Resistance				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>This module will commence by establishing the fundamental basis of antimicrobial efficacy in terms of selective toxicity, with a brief history of antimicrobials and factors that make the ideal antimicrobial. This will be followed by study of the known inhibitory action of antibacterial and antifungal drugs at the molecular level, and study of the molecular basis of microbial resistance to these drugs. Lastly, potential new sources of antimicrobials will be considered, particularly antimicrobial peptides and 'natural' antimicrobials.</p>				
Programme module type:	Optional for Biochemistry, Cell Biology, Molecular Biology, Biology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL3311			
Learning and teaching methods and delivery:	Weekly contact: Introductory lecture followed by 2 seminars.			
	Scheduled learning: 22 hours		Guided independent study: 128 hours	
Assessment pattern:	As defined by QAA: Written Examination = 50%, Practical Examination = 20%, Coursework = 30%			
	As used by St Andrews: Coursework = 50%, Written Examination = 50%			
Module Co-ordinator:	Dr P Coote			
Lecturer(s)/Tutor(s):	Dr P Coote			

BL4212 How Enzymes Work				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>All cells depend on enzymes to catalyse the reactions that produce the energy required for life and that make and repair DNA, proteins and lipids. Understanding enzymes and their regulation underpins research on, for example, drug development. This module will study how the structures and molecular functions of selected examples enable the biological roles. Topics will include flavoproteins, DNA repair enzymes, nitric oxides synthases and other enzymes depending on the research interests of the academic staff. It will develop deductive skills, literature research, and communication of specific knowledge from reviews and primary research articles, and will encourage integration of previous basic knowledge of bioenergetics, protein structure and function, gene expression and metabolic regulation into the exploration of the cellular roles of enzymes.</p>				
Programme module type:	Optional for Biochemistry, Cell Biology, Molecular Biology, Biology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL3301			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars.			
	Scheduled learning: 20 hours		Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 0%, Coursework = 34%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Dr R R Ramsay			
Lecturer(s)/Tutor(s):	Dr R R Ramsay, Dr J Ingledew, Prof M White			

BL4213 Molecular Virology				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>Viruses as a group include many important human and veterinary pathogens such as influenza virus, hepatitis C virus, foot and mouth disease virus as well as emerging viruses like Ebola virus, and remain a continuing threat to human and animal welfare. This module will consist of a mixture of lectures, tutorials and personal-based learning on aspects of RNA virus host interactions. The topics covered will include comparison of the molecular mechanisms employed by enveloped and non-enveloped viruses to enter and exit from cells, discussion of how small RNA viruses maximise their coding capacity, comparison of the replication of positive and negative strand RNA viruses, discussion of how selected viruses reprogram the host cell to ensure their own replication, description of how RNA viruses intercede with innate immune responses, and understanding of how selected viruses interact with their vectors. In addition, discussion of virus-related topics that have made headline news in recent years will be addressed, and an understanding of the more commonly used molecular techniques to study viruses will be expected.</p>				
Programme module type:	Optional for Biochemistry, Biomolecular Science, Cell Biology, Molecular Biology, Biology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL3311			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars.			
	Scheduled learning: 15 hours		Guided independent study: 135 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 60%, Practical Examinations = 0%, Coursework = 40%			
	As used by St Andrews: Coursework = 40%, Written Examination = 60%			
Module Co-ordinator:	Prof R Randall			
Lecturer(s)/Tutor(s):	Prof R Randall, Dr Ryan, Prof Elliott, Dr Jackson.			

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BL4215 Bacterial Virulence Factors				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>In order to establish an infection in a host, pathogenic bacteria rely on mechanisms to adhere to host tissue, gain entry into cells, escape the host's immune response and spread and survive within or on the host. These processes are mediated by bacterial virulence factors, i.e. proteins and other bacterial products that utilise and subvert diverse host cellular processes for the benefit of the pathogen. In this module students will explore how structural biology has led to significant breakthroughs in understanding the molecular bases of some important bacterial infections.</p>				
Programme module type:	Optional for Biochemistry, Biomolecular Science, Cell Biology, Molecular Biology Biology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL3301			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars.			
	Scheduled learning: 15 hours		Guided independent study: 135 hours	
Assessment pattern:	As defined by QAA: Written Examination = 40%, Practical Examination = 30%, Coursework = 30%			
	As used by St Andrews: Coursework = 60%, Written Examination = 40%			
Module Co-ordinator:	Dr U Schwarz-Linek			
Lecturer(s)/Tutor(s):	Dr U Schwarz-Linek			

BL4216 Structure-based Drug Discovery				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>The process of developing a new drug from conception to the clinic takes on average 15 years and costs over \$800M. There are now many examples of drugs developed based on a knowledge of the three dimensional structure of the target, and all major pharmaceutical companies have structural biology as part of their core drug discovery programmes. Many drugs currently used to combat AIDS were developed from a detailed knowledge of key HIV proteins, as were the two drugs used for influenza. Most major pharmaceutical companies are targeting kinases in the search for new cancer therapies, with international efforts focusing on producing structural details of huge numbers of human kinases. This module will examine case studies of drugs that have been developed with the aid of structure-based methods.</p>				
Programme module type:	Optional for Biochemistry, Biomolecular Science, Cell Biology, Molecular Biology Biology and all Biology Joint or Major/Minor Degree programmes.			
Learning and teaching methods and delivery:	Weekly contact: Seminars, essay, and student presentations in teams representing imaginary drug companies.			
	Scheduled learning: 12 hours		Guided independent study: 138 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 80%, Coursework = 20%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Prof G Taylor			
Lecturer(s)/Tutor(s):	Prof G Taylor			

BL4220 Geomicrobiology - from Gold Mines to Global Warming, how Microbes influence our Planet				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
Geomicrobiology explores the interactions between microbes and materials within inorganic environments and investigates the effects of microbial activity on these substances. Throughout the Earth's history, microbes have successfully colonised numerous and different inorganic environments, and in the process have changed the chemical nature of geological materials therein. The current interest in geomicrobiology has been reawakened by climate change and environmental issues. The module will commence by investigating very early Earth and its initial colonisers 3.7 BYA - the sulphate-reducing and methane-producing anaerobic bacteria - and later development of the aerobic environment. Then issues concerning today's Earth and the consequences of geomicrobial cycling are investigated, as well tomorrow's Earth and the influence of microbial activity on global climate change. What are the future implications of geomicrobiological activity? Finally, hypotheses regarding the geomicrobiology of a variety of newly explored space environments are considered.				
Programme module type:	Optional for Biochemistry, Cell Biology, Ecology and Conservation, Molecular Biology, and all Biology or Environmental Biology Joint or Major/Minor Degree programmes.			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars.			
	Scheduled learning: 22 hours		Guided independent study: 128 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 50%, Coursework = 50%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr S Unkles			
Lecturer(s)/Tutor(s):	Dr S Unkles			

BL4222 Metabolic and Clinical Biochemistry				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
This module extends the students' knowledge of human metabolism and applies it to pathologies. The syllabus includes: a study of the integration of whole body metabolic processes, discussion of the role of biochemistry in investigating and monitoring human disease, the methods of diagnosing and treating some common diseases. Topics will cover integration of whole body metabolism, starvation processes, diabetes, metabolic variability, inborn errors of metabolism, endocrinology, homeostasis, plasma protein metabolism, muscle and hepatic metabolism, drug disposition and metabolism, and defects in glucose and lipid metabolism.				
Programme module type:	Optional for Biochemistry, Biomolecular Science, and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL3310			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars.			
	Scheduled learning: 30 hours		Guided independent study: 120 hours	
Assessment pattern:	As defined by QAA: Written Examination = 40%, Practical Examination = 30%, Coursework = 30%			
	As used by St Andrews: Coursework = 60%, Written Examination = 40%			
Module Co-ordinator:	Dr W J Ingledew			
Lecturer(s)/Tutor(s):	Dr W J Ingledew, Dr R Ramsay and invited NHS staff.			

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BL4223 Chromosome Replication and Genome Stability				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
Highly-efficiently chromosomal DNA replication is essential for all forms of cellular life on Earth and requires the complex interplay of a large range of protein factors in a temporally- and spatially-coordinated manner. In humans, defects in the replication process may lead to genetic disease or cancer. This module will summarise current knowledge of the enzymes and mechanisms of chromosomal DNA replication in bacterial, archaeal and eukaryotic cells with particular emphasis on exploring the diverse range of experimental systems and techniques used in the laboratory to probe the structure, function and regulation of the replication apparatus. Similarities and differences between cellular and viral DNA replication strategies will be explored and diverse aspects of the evolution of the replication machinery highlighted.				
Programme module type:	Optional for Biochemistry, Biomolecular Science, Cell Biology, Molecular Biology, and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	Normally BL3301 and BL3302			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars.			
	Scheduled learning: 22 hours		Guided independent study: 128 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 40%, Practical Examinations = 20%, Coursework = 40%			
	As used by St Andrews: Coursework = 60%, Written Examination = 40%			
Module Co-ordinator:	Dr S A MacNeill			
Lecturer(s)/Tutor(s):	Dr S A MacNeill			

BL4224 Molecular Mechanisms of Membrane Trafficking				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
Membrane trafficking mediates the transport of substances between different cellular organelles and the secretion of substances from cells. As such, regulation of membrane trafficking is applicable to all cell types, but especially to specialised secretory cells such as neurons, which secrete neurotransmitters and pancreatic beta-cells which secrete insulin. This module will consider how molecules control the movement of substances through the secretory pathway, but will focus on how cells regulate the release of contents. Within the module you will look at the proteins involved, the different experiments used to study the process and how model organisms are enhancing our understanding.				
Programme module type:	Optional for Biochemistry, Cell Biology, Molecular Biology, Neuroscience and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL3303			
Learning and teaching methods and delivery:	Weekly contact: Lectures, seminars and fieldwork.			
	Scheduled learning: 18 hours		Guided independent study: 132 hours	
Assessment pattern:	As defined by QAA: Written Examination = 25%, Practical Examination = 20%, Coursework = 55%			
	As used by St Andrews: Coursework = 50%, Written Examination = 50%			
Module Co-ordinator:	Dr G Prescott			
Lecturer(s)/Tutor(s):	Dr G Prescott, Dr J Sleeman			

BL4230 Neurodegeneration and Aging				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>In this module, students will develop a detailed understanding of molecular neuroscience. There will be three main sections. Firstly, how neurons stay alive (e.g. neurotrophic factor signalling cascades) is examined; then how neurons age (e.g. White matter thinning, Gliosis (neuroinflammation), and thirdly, how the nervous system responds to neurodegenerative diseases, in particular Alzheimer's disease. Work will focus at the biochemical and molecular level, so that detailed knowledge of signalling pathways including the kinase cascades from the neurotrophic factors and death pathways will be gained. The module concentrates on three key areas relating to neurodegenerative processes. 1) How neurons stay alive, for example the neurotrophic factor signalling cascades 2) The aging nervous system: Changes that can 'prime' neurons for degeneration, degenerative disorders - risks, pathology, treatments. Including a practical session looking at aging murine brains (histology) and at aging neurons and glia in vitro 3) How the nervous system responds to neurodegenerative diseases, with particular focus on Alzheimer's disease. Work will be especially at the biochemical and molecular level, so that detailed knowledge of signalling pathways including the kinase cascades from the neurotrophic factors and death pathways will be gained.</p>				
Programme module type:	Optional for Biochemistry, Cell Biology, Molecular Biology, Neuroscience, Zoology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL3313			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars.			
	Scheduled learning: 24 hours		Guided independent study: 126 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 66%, Practical Examinations = 14%, Coursework = 20%			
	As used by St Andrews: Coursework = 34%, Written Examination = 66%			
Module Co-ordinator:	Prof F Gunn-Moore			
Lecturer(s)/Tutor(s):	Prof F Gunn-Moore, Dr G Middleton			

BL4231 Neuromodulation				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
<p>Until recently the nervous system was viewed as a black and white world in which neuronal networks carried out tasks using fast chemical synaptic transmission to produce an appropriate network output. However the output of neuronal networks is not fixed but instead is modifiable under different behavioural or developmental circumstances. A major source of flexibility in the output neuronal networks derives from neuromodulation; a process in which the basic operation of the networks remains the same but the strengths of synaptic connections and the integrative electrical properties of neurons in the networks are changed by the actions of a range of neuromodulators. This module explores the diverse range of neuromodulatory mechanisms and outlines their importance in information processing in the nervous system.</p>				
Programme module type:	Optional for Cell Biology, Neuroscience, Zoology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL3313			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars.			
	Scheduled learning: 24 hours		Guided independent study: 126 hours	
Assessment pattern:	As defined by QAA: Written Examination = 50%, Practical Examination = 25%, Coursework = 25%			
	As used by St Andrews: Coursework = 50%, Written Examination = 50%			
Module Co-ordinator:	Prof K Sillar			
Lecturer(s)/Tutor(s):	Prof K Sillar, Dr G Miles, Dr W Heitler			

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BL4232 Neural Mechanisms of Predatory and Avoidance Behaviours				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>Predators and their prey are locked in an evolutionary arms race which continuously refines and improves the abilities of predators to locate and capture prey, and of prey to detect and evade predators. This strong selective pressure has produced some spectacular adaptations in both the nervous systems and the overall anatomy of the animals concerned. This, combined with the usually unambiguous motivation of the animals involved in predator-prey interactions (eat or starve, escape or be eaten) has made such adaptations favoured targets for study by neuroscientists, behavioural scientists, and biomechanicists. Students on this module will undertake a series of guided case studies researching the primary literature, and the module will also include some hands-on laboratory work. The aim is both to uncover some general principles of neural and biomechanical organisation, and also to reveal the variety and ingenuity with which evolution has found different solutions to shared problems.</p>				
Programme module type:	Optional for Behavioural Biology, Cell Biology, Neuroscience, Zoology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL3313			
Learning and teaching methods and delivery:	Weekly contact: Seminars and occasional practical classes			
	Scheduled learning: 24 hours		Guided independent study: 126 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50%			
	As used by St Andrews: Coursework = 50%, Written Examination = 50%			
Module Co-ordinator:	Dr W J Heitler			
Lecturer(s)/Tutor(s):	Dr W Heitler, Prof K Sillar			

BL4234 Synaptic Transmission				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>Extensive and versatile communication between nerve cells using special junctions called synapses endows the nervous system with many complex functions like learning and memory. This module will cover important recent progress in understanding the morphology and ultrastructure of synapses, neurotransmitter synthesis, release and clearance mechanisms, synaptic plasticity, the role of glial cells and the development of neurotransmission. Some laboratory work will provide students with hands-on experience of advanced research methods.</p>				
Programme module type:	Optional for Behavioural Biology, Cell Biology, Neuroscience, Zoology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	Normally BL3312 and BL3313			
Learning and teaching methods and delivery:	Weekly contact: Lectures, seminars and 2 practical classes.			
	Scheduled learning: 19 hours		Guided independent study: 131 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 60%, Practical Examinations = 0%, Coursework = 40%			
	As used by St Andrews: Coursework = 40%, Written Examination = 60%			
Module Co-ordinator:	Dr W Li			
Lecturer(s)/Tutor(s):	Dr W Li, Prof K Sillar, Dr G Miles, Dr W Heitler			

BL4235 Motoneurons: From Physiology to Pathology				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
This module aims to provide in depth knowledge of key aspects of neuronal function and potential dysfunction by focussing on one of the most studied and best characterised classes of neurons in the central nervous system, motoneurons. The module will cover topics such as: the history of motoneurons in neuroscience research; the genetics controlling motoneuron development, the intrinsic electrical properties of motoneurons; synaptic inputs received by motoneurons; motoneuron recruitment; and motoneuron disease.				
Programme module type:	Optional for Behavioural Biology, Cell Biology, Biology, Neuroscience, Zoology and all Biology Joint or Major/Minor Degree programmes.			
Pre-requisite(s):	BL3313			
Learning and teaching methods and delivery:	Weekly contact: Lectures, seminars and 2 practical classes.			
	Scheduled learning: 21 hours		Guided independent study: 129 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 60%, Practical Examinations = 0%, Coursework = 40%			
	As used by St Andrews: Coursework = 40%, Written Examination = 60%			
Module Co-ordinator:	Dr G Miles			
Lecturer(s)/Tutor(s):	Dr W Li, Prof K Sillar, Dr G Miles, Dr W Heitler			

BL4248 Human Physiology of Diving				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Academic year:	Withdrawn for 2012/3 on 7-9-12			
Planned timetable:	To be arranged.			
This module will provide an understanding of diving physics and how pressure changes affect the physiology of the human diver. It will use both tutorials and self-study sessions to cover theoretical topics such as oxygen toxicity, nitrogen narcosis and the symptoms and treatment of decompression illness. Thermal considerations of diving, long-term effects and the physiology of technical mixed gas and rebreather diving will also be investigated. Students will also explore applied topics such as the management of diving casualties and the treatment of diving associated illnesses. The final emphasis will be on how our understanding of diving physiology directs current practice in the UK on safe diving practices.				
Programme module type:	Optional for Marine Biology, Zoology and all Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: 2-hour seminar.			
	Scheduled learning: 26 hours		Guided independent study: 124 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 40%, Practical Examinations = 20%, Coursework = 40%			
	As used by St Andrews: Coursework = 60%, Written Examination = 40%			
Module Co-ordinator:	Dr C Peddie			
Lecturer(s)/Tutor(s):	Dr C Peddie, Dr G Prescott			

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BL4249 Scientific Diving			
SCOTCAT Credits:	15	SCQF Level 10	Semester: 2
Planned timetable:	Full Time 2-3 weeks in March/April		
<p>This module will provide both theoretical and practical experience of the techniques used by scientific divers. The module is restricted to students who have an existing diving qualification (PADI Advanced Open Water Diver or BSAC Sports Diver or equivalent). Seminars during the field trip will cover diving safety, dive project planning, management, risk assessment and the theory behind underwater surveying techniques. Abroad, students will receive training in underwater marine identification, construction and deployment of underwater surveys and sampling techniques, gaining practical experience of recording, analysing and interpreting survey data. Then they conduct a mini-research project using suitable survey techniques and present their findings through a report and a presentation.</p>			
Programme module type:	Optional for Ecology and Conservation, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes.		
Pre-requisite(s):	BL4251, PADI Advanced Open Water Diver or BSAC Sports Diver (or equivalent)		
Learning and teaching methods and delivery:	Weekly contact: Lectures, seminars and practicals.		
	Scheduled learning: 95 hours	Guided independent study: 55 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 45%, Coursework = 55%		
	As used by St Andrews: Coursework = 100%		
Module Co-ordinator:	Dr C Peddie		
Lecturer(s)/Tutor(s):	Dr C Peddie		

BL4251 Tropical Marine Biology			
SCOTCAT Credits:	15	SCQF Level 10	Semester: 1
Planned timetable:	To be arranged		
<p>The goal of this module is to examine the ecological and biological principles underpinning the major tropical marine ecosystems. The module provides an understanding of the ecological processes that control tropical marine ecosystems, and considers the organisms that are characteristic of each. All the major tropical marine habitats will be considered, but with a focus on coral reef, seagrass and mangrove ecosystems. The module also tackles topical research areas on the subject through student-led seminars, which will vary depending on the latest scientific research and the specific interests of participants.</p> <p>On completion of the module, students will have an understanding of coral reef, mangrove and seagrass ecology. They will understand the biology and physiology of corals and be able to identify the major phyla associated with tropical marine ecosystems. The module will also provide an understanding of the threats to tropical marine habitats, current research trends on tropical marine systems, and the scientific approaches and techniques used tackle scientific questions relating to tropical marine biology.</p>			
Programme module type:	Optional for Ecology and Conservation, Evolutionary Biology, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes		
Required for:	BL4249 - unless other pre-requisite(s) for that module held.		
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars.		
	Scheduled learning: 21 hours	Guided independent study: 129 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 50%, Coursework = 50%		
	As used by St Andrews: Coursework = 50%, Practical Examination = 50%		
Module Co-ordinator:	Dr C H Smith		
Lecturer(s)/Tutor(s):	Dr C H Smith, Dr R Spence		

BL4254 Fisheries Research				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged			
This module will provide an introduction to the utilisation of fish stocks in a sustainable way. It will focus on how the status of these stocks can be assessed, the problems associated with determining catch limits, and how advice from fisheries scientists is communicated to managers. There will be a mixture of dedicated lectures (including talks from outside experts), student-led seminars, tutorials and practical computer sessions.				
Programme module type:	Optional for Ecology and Conservation, Marine Biology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Pre-requisite(s):	BL3309			
Learning and teaching methods and delivery:	Weekly contact: Lectures, seminars, tutorials and practicals.			
	Scheduled learning: 25 hours		Guided independent study: 125 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 30%, Practical Examinations = 50%, Coursework = 20%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr C Paxton			
Lecturer(s)/Tutor(s):	Dr C Paxton			

BL4255 Marine and Environmental Biotechnology				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged			
This module will examine the diversity of useful natural products from the sea, consider the ways in which genomic and other approaches are being used to bioprospect for new substances (especially from micro-organisms), learn how genomic approaches are overcoming the problem of unculturability of many marine prokaryotes to find such compounds, and explore some of the more unusual applications of materials derived from marine invertebrates. It will also consider how marine biotechnology is contributing to improved disease control in aquaculture, how it can help the 'greening' of more conventional 'dirty' industries and may enable us to meet our future energy needs via renewable biofuels. The societal, ethical and environmental issues associated with the development of environmental biotechnology are also considered.				
Programme module type:	Optional for Biochemistry, Marine Biology, Molecular Biology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars.			
	Scheduled learning: 21 hours		Guided independent study: 129 hours	
Assessment pattern:	As defined by QAA: Written Examination = 40%, Practical Examination = 30%, Coursework = 30%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr V J Smith			
Lecturer(s)/Tutor(s):	Dr V J Smith			

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BL4256 Marine Bioacoustics				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged			
This module will provide seminar- and practical-based instruction on sound propagation in the ocean, use of sound by marine mammals for communication, orientation, and foraging (as monitored by humans using techniques to record sound). It will also examine sound-based conflicts between humans and marine organisms.				
Programme module type:	Optional for Behavioural Biology, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: Seminars and practicals.			
	Scheduled learning: 24 hours		Guided independent study: 126 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 75%, Practical Examinations = 25%, Coursework = 0%			
	As used by St Andrews: Coursework = 50% (class test = 25%, Practical Examination = 25%), Written Examination = 50%			
Module Co-ordinator:	Prof P Tyack			
Lecturer(s)/Tutor(s):	Prof P Tyack			

BL4258 Foraging in Marine Mammals				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged			
This module will provide primarily seminar and practical-based analysis of the life-history requirements of foraging in marine mammals, geographical and physiological constraints on finding food, food and feeding with a focus on types of prey and adaptations by the prey, adaptations for marine mammals feeding in the marine environment, optimal foraging theory, and optimal diving theory. Initial lectures will focus on theoretical issues and description of methods to study foraging. Students will then conduct case-studies of marine-mammal foraging, which will be presented in a seminar format as a group. Some practical work will also be included.				
Programme module type:	Optional for Behavioural Biology, Ecology and Conservation, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Pre-requisite(s):	BL3319			
Learning and teaching methods and delivery:	Weekly contact: Seminars and occasional lectures and practicals.			
	Scheduled learning: 24 hours		Guided independent study: 126 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 40%, Practical Examinations = 20%, Coursework = 40%			
	As used by St Andrews: Coursework = 60%, Written Examination = 40%			
Module Co-ordinator:	Dr P Miller			
Lecturer(s)/Tutor(s):	Dr P Miller, Prof I Boyd, Dr J Matthiopoulos.			

BL4259 Marine Mammals and Man				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
Marine mammals interact with human activities in a variety of ways and are frequently the focus of more general concerns about the health and exploitation of marine ecosystems. This module explores the impact of these activities on individuals and populations of seals and cetaceans, and vice versa. Most marine mammals species are long-lived and slow reproducing and the impacts of unmanaged human activities can be severe; a number of species or populations are threatened as a result. The module explores how best to provide robust scientific advice to inform conservation and management at local, national and international level.				
Programme module type:	Optional for Ecology and Conservation, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Pre-requisite(s):	BL3318			
Learning and teaching methods and delivery:	Weekly contact: Seminars and occasional lectures and practicals.			
	Scheduled learning: 18 hours		Guided independent study: 132 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 50%, Coursework = 50%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Prof P S Hammond			
Lecturer(s)/Tutor(s):	Prof P S Hammond, Dr S Northridge, Prof I Boyd, Dr A Hall, Dr Gordon			

BL4260 Biological Oceanography				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Academic year:	Withdrawn for 2012/3 on 7-9-12			
Planned timetable:	To be arranged.			
This module will provide primarily seminar based instruction on the fundamentals of Biological Oceanography (BO). A few introductory lectures will focus on basic principles in BO and oceanography, including physical and geochemical principles as they apply to biological oceanography. Students will present seminars on particular focus areas within each lecture topic, based upon reading primary literature. BO is a broad field, so the module will provide an overview of the field with depth in a few chosen areas. At least one practical will be offered on the use of remote sensing data for ocean observation, and we hope to develop a practical of zooplankton sampling. This module should coordinate especially well with marine acoustics and scientific diving.				
Programme module type:	Optional for Ecology and Conservation, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Pre-requisite(s):	BL3318			
Learning and teaching methods and delivery:	Weekly contact: Seminars and occasional lectures and practicals.			
	Scheduled learning: 25 hours		Guided independent study: 125 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 30%, Practical Examinations = 30%, Coursework = 40%			
	As used by St Andrews: Coursework = 70%, Written Examination = 30%			
Module Co-ordinator:	Dr P Miller			
Lecturer(s)/Tutor(s):	Dr P Miller			

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BL4262 Physical Oceanography				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
<p>This module aims to give a broad overview of the concepts and fundamental achievements of physical oceanography. Physical oceanography is the study of physical conditions and physical processes within the ocean, especially the motions and physical properties of ocean waters. A series of lectures will be provided to assure that students have the broad background required to tackle primary literature in this field. Students will present seminars on particular focus areas within each lecture topic, based upon reading primary literature.</p>				
Programme module type:	Optional for Marine Biology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: Seminars and lectures.			
	Scheduled learning: 20 hours		Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examination = 60%, Practical Examination = 40%, Coursework = 0%			
	As used by St Andrews: Coursework = 40%, Written Examination = 60%			
Module Co-ordinator:	Dr L Boehme			
Lecturer(s)/Tutor(s):	Dr L Boehme			

BL4263 The Question of Culture in Cetaceans				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
<p>The existence and extent of social learning and cultural transmission in non-humans is a very active area of current research, as well as of controversy, with an active ongoing debate. The aim of this module is to provide an introduction to this area through considering the conceptual issues and direct and indirect evidence for cultural transmission in cetaceans, the whales and dolphins. We will consider what is meant by the term 'culture', how it can be studied in non-humans, and the evidence for and against such processes being present in cetacean societies.</p>				
Programme module type:	Optional for Behavioural Biology, Marine Biology Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Pre-requisite(s):	BL3319			
Learning and teaching methods and delivery:	Weekly contact: Seminars and lectures.			
	Scheduled learning: 20 hours		Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examination = 40%, Practical Examination = 10%, Coursework = 50%			
	As used by St Andrews: Coursework = 50%, Practical Examination = 10%, Written Examination = 40%			
Module Co-ordinator:	Dr L Rendell			
Lecturer(s)/Tutor(s):	Dr L Rendell			

BL4266 Conservation Research Methods ; Estimating Population Size				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>The conservation of animal and plant populations relies initially on information of population sizes and trends. This information can only be collected by fieldwork. This module teaches the basic field techniques that underpin the monitoring of populations. Each week the theory behind a different technique is introduced, then the technique is practiced in the field, and finally data collected by the technique are analysed and discussed in a workshop at the end of the week, so that a full understanding of a technique and its proper application is gained. The module ends with students carrying out a project applying and integrating the techniques they have learnt.</p>				
Programme module type:	Optional for Ecology and Conservation, Marine Biology, Zoology, and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Pre-requisite(s):	BL3309			
Learning and teaching methods and delivery:	Weekly contact: 5 x 1-week practicals involving a lecture, a field practical and an analysis workshop.			
	Scheduled learning: 40 hours		Guided independent study: 110 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 25%, Coursework = 75%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Prof P S Hammond			
Lecturer(s)/Tutor(s):	Prof P S Hammond			

BL4268 Conservation and Management of Biodiversity				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>This module will focus on the scientific problems associated with the conservation and sustainable use of animals and plants, and on the way in which scientific advice on these issues is provided. Initial lectures will cover sustainable development and the precautionary principle; the causes of extinction; the economics of conservation; management of exploitation; and estimating species richness. After this student-led seminars will cover a range of more specialist issues of current concern. Practical work on population viability analysis, classifying populations using the IUCN criteria, and species richness estimation may be included.</p>				
Programme module type:	Optional for Ecology and Conservation, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Pre-requisite(s):	BL3309			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars per week and occasional lectures and practicals.			
	Scheduled learning: 32 hours		Guided independent study: 118 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 30%, Coursework = 70%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr A Ojanguren			
Lecturer(s)/Tutor(s):	Dr A Ojanguren, Dr M Dornelas			

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BL4270 Plant-environment Interactions				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
This module will provide an analysis of the ways in which plants interact with their physical, chemical and biological environments. This is a wide-ranging course which will bring together current knowledge of the physiological and molecular responses of plants within the wider context of how whole organisms and communities respond to the environment. Topics include: parasitism, plant pathogens and diseases, symbioses, plant stress responses, and human influences such as pollution, bioremediation and genetic modification.				
Programme module type:	Optional for Ecology and Conservation and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars.			
	Scheduled learning: 24 hours		Guided independent study: 126 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 34%, Coursework = 66%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Prof A Tobin			
Lecturer(s)/Tutor(s):	Prof A Tobin, Prof J Raven, Prof S Hubbard			

BL4273 Bioinformatics for Biologists				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
This module is about using computers to search and study protein and DNA sequences, and related data such as mRNA expression levels. Vast quantities of such data are publicly available, and, if viewed in the right way, can provide strong evidence concerning function, structure, and evolution of DNA, RNA, proteins and genes. Because of this, computational analysis has become a crucial component of modern biology, including biochemistry, molecular biology, ecology, evolutionary biology and biomedical research. With hundreds of genome sequences and vast quantities of expression data available, the approach has greater potential than ever before. This module will give an overview of the data, software and methods of analysis, and in-depth practical training in applying bioinformatics techniques to questions of biology and biomedical research. Case studies where researchers use genomes to ask questions about divergence, adaptation and speciation will be discussed. The emphasis of the module is not mathematical, but rather concerns data, the general features of methods, use of software, applications relevant to biology, and results. The module will involve use of computers and simple computer programming, for which training will be provided as part of the module.				
Programme module type:	Optional for Biochemistry, Cell Biology, Evolutionary Biology, Marine Biology, Molecular Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Pre-requisite(s):	Normally BL3320			
Learning and teaching methods and delivery:	Weekly contact: Lectures, practicals and a seminar.			
	Scheduled learning: 23 hours		Guided independent study: 127 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50%			
	As used by St Andrews: Coursework = 50%, Written Examination = 50%			
Module Co-ordinator:	Dr D Barker			
Lecturer(s)/Tutor(s):	Dr D Ferrier, Prof Ritchie, Dr D Barker			

BL4274 Evolutionary Developmental Biology				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
Evolution of new morphologies involves changes to the development of organisms. The field of evolutionary developmental biology is thus becoming established as a major and essential component of any comprehensive understanding of evolutionary biology. This module aims to cover some of the main, current themes in evolutionary developmental biology. Since animal life evolved in the sea, much of what we can learn about the major events in animal evolution can be obtained from studying marine invertebrates. Consequently the examples covered in this module will tend to be drawn from these organisms.				
Programme module type:	Optional for Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: 2-hour seminars.			
	Scheduled learning: 20 hours		Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 50%, Coursework = 50%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr D Ferrier			
Lecturer(s)/Tutor(s):	Dr D Ferrier			

BL4275 Evolution in Action				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
This module will focus on recent developments relating to evolutionary biology, placing particular emphasis on research related to medical or societal application or public policy. Examples of topics to be covered include: emergent diseases, biodiversity policy, conservation management, biological impacts of climate change, and public understanding of science.				
Programme module type:	Optional for Evolutionary Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars.			
	Scheduled learning: 20 hours		Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 20%, Coursework = 80%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Prof T R Meagher			
Lecturer(s)/Tutor(s):	Prof T R Meagher			

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BL4278 Biology of Dinosaurs and Other Extinct Vertebrates				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>It seems natural to use our understanding of extant biology to make inferences about the past. This allows us to test ideas about evolution and biodiversity in a wider context. Additionally, "rewilding" is an active but controversial strand of conservation biology that suggests that where "keystone" species have gone extinct, we should introduce an analogous species. Vertebrates fossilise well, and so offer a good foundation of source material. They are generally large and complex organisms, and we particularly focus on the large representatives of each taxonomic group; this allows us to explore the physical constraints on the functioning of organisms.</p>				
Programme module type:	Optional for Behavioural Biology, Ecology and Conservation, Evolutionary Biology, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars.			
	Scheduled learning: 20 hours		Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 50%, Practical Examinations = 35%, Coursework = 15%			
	As used by St Andrews: Coursework = 50%, Written Examination = 50%			
Module Co-ordinator:	Prof G Ruxton			
Lecturer(s)/Tutor(s):	Prof G Ruxton			

BL4280 Evolution and Human Behaviour				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>Evolutionary biologists, anthropologists and psychologists have taken evolutionary principles and used them to explain a range of human characteristics, such as homicide, religion and sex differences in behaviour. Other researchers are sceptical of these interpretations, and critical of the methods. Moreover, researchers disagree as to the best ways to use evolution to explore humanity, and a number of schools of thought have emerged. This module will introduce and critically evaluate the main evolutionary approaches currently being used, including socio-biology, evolutionary psychology, behavioural ecology and gene-culture co-evolution.</p>				
Programme module type:	Optional for Behavioural Biology, Evolutionary Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars.			
	Scheduled learning: 22 hours		Guided independent study: 128 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 40%, Practical Examinations = 20%, Coursework = 40%			
	As used by St Andrews: Coursework = 60%, Written Examination = 40%			
Module Co-ordinator:	Prof K N Laland			
Lecturer(s)/Tutor(s):	Prof K N Laland, Dr K Cross			

BL4281 Animal Communication and Cognition				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
	Learning to produce sounds is a particularly interesting subject as far as humans are concerned because it is such a notable feature of our own species. Why do we show it, and how did it evolve? As there is little evidence of it in any other primates we need to look further afield for clues. It is found in several other mammalian orders and in three orders of birds, and the evidence for it and nature of it will be examined in these examples. We will discuss why selection may have favoured it in each case. We will also consider vocal learning in a broader sense, including its use in animals that do not themselves produce sounds.			
Programme module type:	Optional for Behavioural Biology, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars.			
	Scheduled learning: 20 hours		Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examination = 50%, Practical Examination = 30%, Coursework = 20%			
	As used by St Andrews: Coursework = 50% (talk = 30% + handout = 20%), Written Examination = 50%			
Module Co-ordinator:	Dr V Janik			
Lecturer(s)/Tutor(s):	Dr V Janik			

BL4282 Biology and Behaviour of Social Insects				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
	This module will examine and compare the biology of the four main groups of social insects: termites, ants, wasps and bees. Sociality in other groups (aphids, beetles) will also be considered briefly. Topics will include the evolution of sociality, social organisation and social control systems, reproductive strategies, and diverse communication modes including pheromonal systems, acoustic systems, and 'bee dances'. Aspects of foraging behaviour and learning abilities will also be considered, particularly for ants (leaf cutter ants, army ants, slave-making ants) and for bees both eusocial and semi-social. There will be strong evolutionary, ecological and behavioural themes, and relevance also to conservation issues.			
Programme module type:	Optional for Behavioural Biology, Evolutionary Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: 1 seminar.			
	Scheduled learning: 27 hours		Guided independent study: 123 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 50%, Practical Examinations = 40%, Coursework = 10%			
	As used by St Andrews: Coursework = 50%, Written Examination = 50%			
Module Co-ordinator:	Prof P Willmer			
Lecturer(s)/Tutor(s):	Dr D M Shuker, Prof P Willmer			

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BL4284 Breeding Systems and Sexual Conflict				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
Studies of mating systems in animals are primarily concerned with how animal societies are structured in relation to sexual behaviour. In plants, where many organisms do not have separate males and females, the term refers to the degree to which individuals are self-compatible or the amount of out-crossing that occurs. The effects of breeding system on sexual selection and sexual conflict, together with the costs of inbreeding and the evolution of mating systems, are central concerns of this module.				
Programme module type:	Optional for Behavioural Biology, Evolutionary Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars.			
	Scheduled learning: 22 hours		Guided independent study: 128 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 50%, Coursework = 50%			
	As used by St Andrews: Coursework = 50%, Practical Examination = 50%			
Module Co-ordinator:	Dr C Smith			
Lecturer(s)/Tutor(s):	Dr C Smith, Dr J Graves, Prof T R Meagher, Prof M Ritchie			

BL4285 Complex Systems in Animal Behaviour				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
Behaving animals form complex systems, and can create complicated and beautiful phenomena, such as flocks of birds, termite nests, and patterns of army ant swarms. This course will look at research that examines animal behaviour from a complex systems perspective, where analyses range from captive housing of entire bird flocks, computer simulation, and use of robots to interact with the animals. Introductory lectures will be followed by seminar-style discussion of the primary literature, computer practicals, and hands-on practicals where students will identify complex systems in animal behaviour around St Andrews.				
Programme module type:	Optional for Behavioural Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: Lectures, seminars and practicals.			
	Scheduled learning: 20 hours		Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 25%, Practical Examinations = 0%, Coursework = 75%			
	As used by St Andrews: Coursework = 50%, Written Examination = 50%			
Module Co-ordinator:	Dr V A Smith			
Lecturer(s)/Tutor(s):	Dr V A Smith			

BL4286 Advanced Topics in Ecology and Evolution				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
<p>In this module, we will consider a number of outstanding questions, from both molecular and whole organism approaches, currently facing ecologists and evolutionary biologists today. These questions include why we get old and why we have sex, through to why the world is (mostly) green and how will life on earth come to an end. These questions will be relevant to both our understanding of the evolution and maintenance of the biosphere as we see it today, and also in terms of understanding humanity's place in that biosphere. We will take Sherratt and Wilkinsons's (2009) recent book Big Questions in Ecology and Evolution as our starting point, with student-led seminars bringing us classic and contemporary primary literature to address the topics in more detail. The result will be an exciting opportunity to get to grips with a number of big problems in ecology and evolution, from the perspective of the very latest research in those areas.</p>				
Programme module type:	Optional for Behavioural Biology, Evolutionary Biology, Marine Biology, Zoology and all Biology or Environmental Biology Joint or Major/Minor Degree programmes			
Learning and teaching methods and delivery:	Weekly contact: Lectures and seminars.			
	Scheduled learning: 20 hours		Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 50%, Practical Examinations = 50%, Coursework = 0%			
	As used by St Andrews: Coursework = 50%, Written Examination = 50%			
Module Co-ordinator:	Dr D Shuker			
Lecturer(s)/Tutor(s):	Dr D Shuker, Prof M Ritchie			

BL4291 Science, Museums and the Public				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1 & 2 (taught twice)
Planned timetable:	To be arranged.			
<p>This module aims to examine how science in general, and natural history in particular, is presented to the public in a variety of locations. The module will commence with an introductory lecture on the history of British museums and collections. Students will then visit various museums and natural history collections in Scotland. At some of these locations Museum staff will talk about their work. After each visit students will illustrate and discuss the displays and compare what they have seen with their local collection, the Bell Pettigrew Museum of Natural History. The second half of the module will focus on producing a display on an aspect of Biology in the two temporary exhibition cases. This can include a powerpoint presentation or film on a DVD player.</p>				
Programme module type:	Optional for all Biology Single Honours degrees or Environmental Biology Joint or Major/Minor Degree programmes			
Anti-requisite(s):	BL4292, ID4001			
Learning and teaching methods and delivery:	Weekly contact: Lectures, seminars and practicals.			
	Scheduled learning: 22 hours		Guided independent study: 128 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 25%, Coursework = 75%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr M J Milner			
Lecturer(s)/Tutor(s):	Dr M J Milner			

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BL4292 History of Genetics and Evolution			
SCOTCAT Credits:	15	SCQF Level 10	Semester: 2
Planned timetable:	To be arranged.		
<p>Over the past century and a half, biology has been dominated by the emergence and rise to prominence of two related fields - genetics and evolution. This module provides the opportunity to examine the development of these two subjects, via the life and work of key figures in these fields, and also to compare the way that biological science worked in the nineteenth century with the way it operates today. The module will start with two lectures on the history of Biology, and students will then read material on the life and times of four key individuals - Darwin, Mendel, Watson and Crick. In each case, both original documents and biographies will be considered, and the materials will then be discussed and compared in tutorials. Other key figures in the field will also be studied, and aberrations such as Francis Galton and eugenics, and T.D. Lysenko and Soviet genetics will be discussed.</p>			
Programme module type:	Optional for all Biology Single Honours degrees or Environmental Biology Joint or Major/Minor Degree programmes		
Anti-requisite(s):	BL4291, ID4001		
Learning and teaching methods and delivery:	Weekly contact: 2 seminars and occasional lectures.		
	Scheduled learning: 20 hours	Guided independent study: 130 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 60%, Practical Examinations = 20%, Coursework = 20%		
	As used by St Andrews: Coursework = 40%, Written Examination = 60%		
Module Co-ordinator:	Dr M J Milner		
Lecturer(s)/Tutor(s):	Dr M J Milner, Prof Ritchie, Prof Meagher, Prof G Taylor, Dr Barker, Dr J Sleeman, Dr D Ferrier		

BL4301 Polar Ecology: A field course in Antarctica			
SCOTCAT Credits:	15	SCQF Level 10	Semester: 2
Availability restrictions:	To be confirmed		
Planned timetable:	To be arranged.		
<p>This module will provide a theoretical and practical introduction to the ecology and key ecosystem components of Antarctica with emphasis on marine ecology, ecosystem functionality and conservation issues. Students will participate in a two-week vessel-based expedition to Antarctica during the austral summer (northern winter). This field trip involves traveling to southern Argentina, conducting at-sea surveys during transit to/from the Antarctic Peninsula, participating in shore-based activities (e.g. observations at penguin colonies, visit to active research station), and exploring Antarctic coastal waters from small boats and the ice-strengthened vessel. Through a series of lectures, student-lead seminars, workshops, on-board practicals and field excursions, students will gain appreciation of and insights into the diversity, complexity, scientific and management challenges of the Antarctic ecoregion.</p>			
Programme module type:	Optional for Ecology and Conservation, Marine Biology, and all Biology or Environmental Biology Joint or Major/Minor Degree programmes		
Pre-requisite(s):	BL2105, BL3308, BL3318 or equivalent preferred but not essential; Medical certificate documenting fit for travel to remote Antarctica		
Learning and teaching methods and delivery:	Weekly contact: Lectures, seminars and practicals over a 2-week period.		
	Scheduled learning: 100 hours	Guided independent study: 50 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 50%, Coursework = 50%		
	As used by St Andrews: Coursework = 100%		
Module Co-ordinator:	Dr S Heinrich		
Lecturer(s)/Tutor(s):	Dr S Heinrich		