The School of Biological Sciences

MODULE OPTIONS FOR VISITING STUDENTS

ABOUT THE DEPARTMENT

The School of Biological Sciences offers an exciting range of single honours degree programmes in organismal and molecular biosciences. All our modules are taught by specialist staff with high professional standards and international reputations. We take great pride in our approachability, friendliness and the support that we offer our students. In the National Student Survey 2016, the School received a satisfaction rating of 93% from final year students.

ENTRY REQUIREMENTS

Modules in the School of Biological Sciences are open to all Study Abroad and International Exchange students, provided previous experience in and knowledge of relevant aspects of Biology or Chemistry can be evidenced.

- Please note that Full Year Modules that run through Terms 1 and 2 cannot be taken by students visiting during Term 2 only.

- Some Full Year Modules may be taken in Term 1 for half credit.

Term 1 = Autumn Term
Term 2 = Spring Term

The information contained in the Module outlines on the following pages is correct at the time of publication but may be subject to change as part of our policy of continuous improvement and development.
## Level One:

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Module Title</th>
<th>Credits</th>
<th>Term(s)</th>
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</thead>
<tbody>
<tr>
<td>BS1030</td>
<td>Principles of Molecular Bioscience</td>
<td>30 credits</td>
<td>Term 1</td>
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<td>• This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.</td>
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<td>• Pre-requisites: Equivalent to UK A Level Chemistry.</td>
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<tr>
<td>BS1040</td>
<td>Diversity of Life</td>
<td>30 credits/15 credits*</td>
<td>Full Year/ Term 1*</td>
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<tr>
<td>BS1050</td>
<td>Ecology: Animal Behaviour to Environmental Conservation</td>
<td>30 credits/15 credits*</td>
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<tr>
<td>BS1060</td>
<td>Living Systems: Animal and Plant Physiology</td>
<td>30 credits</td>
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<td>BS1070</td>
<td>Cell Biology and Genetics</td>
<td>30 credits</td>
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<tr>
<td>BS1090</td>
<td>Biochemistry: The Molecular Basis of Life</td>
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**Level Two:**

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<tr>
<td>BS2005</td>
<td>Microbiology</td>
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<td>• Pre-requisites: Equivalent to BS1070.</td>
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<tr>
<td>BS2010</td>
<td>Invertebrate Biology: Structure, Behaviour and Evolution</td>
<td>15</td>
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<tr>
<td>BS2020</td>
<td>Plant Life: From Genes to Environment</td>
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<td>• Pre-requisite: Equivalent to BS1070.</td>
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<td>BS2040</td>
<td>Cell Dynamics: Division and Movement</td>
<td>15</td>
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<tr>
<td>BS2050</td>
<td>Human Physiology in Health and Disease</td>
<td>15</td>
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<tr>
<td>BS2060</td>
<td>Developmental Biology</td>
<td>15</td>
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|             | - This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
|             | - This Module runs in Term 1 only. It begins in September.  
|             | - Pre-requisites: Equivalent to BS1060, BS1070.  |
| BS2090      | Insects, Plants and Fungi: Ecology and Applications | 15      | 2     |
|             | - This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
|             | - This Module runs in Term 2. It begins in January.  
|             | - Pre-requisites: Equivalent to BS1040, BS1050.  |
| BS2120      | Biological Data Analysis and Interpretation      | 15      | 1     |
|             | - This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
|             | - This Module runs in Term 1 only. It begins in September.  |
| BS2140      | Animal Behaviour                                 | 15      | 2     |
|             | - This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
|             | - This Module runs in Term 2. It begins in January.  
|             | - Pre-requisites: Equivalent to BS1050.  |
| BS2150      | Applications of Molecular Genetics in Biology    | 15      | 1     |
|             | - This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
|             | - This Module runs in Term 1 only. It begins in September.  
|             | - Pre-requisite: Equivalent to BS1070.  |
| BS2160      | Evolution                                        | 15      | 1     |
|             | - This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
|             | - This Module runs in Term 1 only. It begins in September.  
<p>|             | - Pre-requisites: Equivalent to BS1050.  |</p>
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</table>
| BS2510     | Bioenergetics, Biosynthesis and Metabolic Regulation | 15 credits | Full Year/ Term 1*  | This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
This Module runs for the full year, but students attending in Term 1 only may take it for half the credit.*  
Pre-requisites: Equivalent to BS1090.       |
| BS2520     | Protein Structure and Function                   | 15 credits | Term 1                 | This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
This Module runs in Term 1 only. It begins in September.  
Pre-requisites: Equivalent to BS1090.       |
| BS2530     | Molecular Biology                                | 15 credits | Full Year              | This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
This Module runs for the full year only.  
Pre-requisites: Equivalent to BS1090, BS1070. |
| BS2540     | Molecular and Cellular Immunology                 | 15 credits/7.5 credits* | Full Year/ Term 1*  | This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
This Module runs for the full year, but students attending in Term 1 only may take it for half the credit.*  
Pre-requisites: Equivalent to BS1070.       |
| BS2550     | Neuronal and Cellular Signalling                  | 15 credits/7.5 credits* | Full Year/ Term 1*  | This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
This Module runs for the full year, but students attending in Term 1 only may take it for half the credit.*  
Pre-requisites: Equivalent to BS1060, BS1090. |
| BS2560     | Pharmacology and Toxicology                      | 15 credits | Term 2                 | This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
This Module runs in Term 2. It begins in January.  
Pre-requisites: Equivalent to BS1030, BS1060. |
**BS2570**  |  Physical Biochemistry for Life Scientists  |  15 credits  |  Term 1  
- This Module is *available* to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
- This Module runs in *Term 1 only*. It *begins in September*.  
- Pre-requisites: Equivalent to BS1030, BS1090.  

**Level Three:**  

**BS3030**  |  Biology of Parasitic Diseases  |  15 credits  |  Term 1  
- This Module is *available* to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
- This Module runs in *Term 1 only*. It *begins in September*.  
- Pre-requisites: Equivalent to BS2150, BS2530 or BS2005.  

**BS3060**  |  Conservation Biology  |  15 credits  |  Term 2  
- This Module is *available* to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
- This Module runs in *Term 2*. It *begins in January*.  
- Pre-requisites: Equivalent to BS1040, BS1050.  

**BS3090**  |  Entomology: Pure and Applied  |  15 credits  |  Term 1  
- This Module is *available* to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
- This Module runs in *Term 1 only*. It *begins in September*.  
- Pre-requisites: Equivalent to BS2010.  

**BS3120**  |  Population and Community Ecology  |  15 credits  |  Term 1  
- This Module is *available* to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
- This Module runs in *Term 1 only*. It *begins in September*.  
- Pre-requisites: Equivalent to BS1040, BS1050.  

**BS3160**  |  Behavioural Ecology  |  15 credits  |  Term 2  
- This Module is *available* to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.  
- This Module runs in *Term 2*. It *begins in January*.  
- Pre-requisites: Equivalent to BS1050, BS2140.
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<tr>
<td>BS3180</td>
<td>Marine Ecology and Biodiversity</td>
<td>15</td>
<td>Term 2</td>
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<td>- Pre-requisites: Equivalent to BS1040, BS1050.</td>
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<td>BS3190</td>
<td>Climate Change: Plants and the Environment</td>
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<td>Term 2</td>
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<tr>
<td>BS3510</td>
<td>Molecular and Medical Microbiology</td>
<td>15 credits/ 7.5 credits*</td>
<td>Full Year/ Term 1*</td>
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<td>BS3520</td>
<td>Seed Biology</td>
<td>15</td>
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<tr>
<td>BS3530</td>
<td>Applications of Advanced Molecular Biology Methods</td>
<td>15 credits/ 7.5 credits*</td>
<td>Full Year/ Term 1*</td>
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<td>- Pre-requisites: Equivalent to BS2530.</td>
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<td>BS3540</td>
<td>Cell and Molecular Biology of Cancer</td>
<td>15 credits/ 7.5 credits*</td>
<td>Full Year/ Term 1*</td>
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<tr>
<td>BS3560</td>
<td>Proteomics, Genomics and Bioinformatics</td>
<td>15 credits/7.5 credits*</td>
<td>Full Year/ Term 1*</td>
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<td>BS3570</td>
<td>Human Embryology and Endocrinology</td>
<td>15 credits/7.5 credits*</td>
<td>Full Year/ Term 1*</td>
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<td>BS3580</td>
<td>Cell and Molecular Neuroscience</td>
<td>15 credits/7.5 credits*</td>
<td>Full Year/ Term 1*</td>
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<td>BS3590</td>
<td>Molecular Basis of Inherited Disease</td>
<td>15 credits</td>
<td>Term 1</td>
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- Pre-requisites: Equivalent to BS2520, BS2530.

- This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.
- This Module runs for the full year, but students attending in Term 1 only may take it for half the credit.*
- Pre-requisites: Equivalent to BS1060, BS2050, BS2060, BS2550.

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- This Module runs for the full year, but students attending in Term 1 only may take it for half the credit.*
- Pre-requisites: Equivalent to BS1060, BS2550.

- This Module is available to all INTERNATIONAL EXCHANGE and STUDY ABROAD students.
- This Module runs in Term 1 only. It begins in September.
- Pre-requisites: Equivalent to BS1060, BS1070, BS1090, BS2530.
INFORMATION ON FIRST YEAR MODULES

BS1030 – Principles of Molecular Bioscience – Dr J McEvoy
The goal of this module is to provide the students with a sound knowledge of fundamental chemistry essential to the proper understanding of life processes and laboratory experiments. By the end of the module students should understand the concept of chemical bond and intermolecular interactions in a biological context, appreciate the role of energy in chemical and biochemical changes, comprehend concepts of chemical equilibrium and reaction rate, consolidate their knowledge of acid-base phenomena in aqueous solutions, particularly with respect to amino acids and peptides, appreciate the relationship between structure and function in biology, understand the principles of biological reaction mechanisms, interpret UV/visible and IR spectroscopic information, improve and extend laboratory skills in making careful, quantitative measurements and carry out consequent calculations, and, be able to carry out, record and interpret chemical and physical manipulations on organic substances.

Value - 30 credits
Suitable - 1st year
Available - 1st term
On - Monday (all day) and Tuesday (all day)
Prerequisites - A2 Level Chemistry or equivalent

BS1040 – The Diversity of Life – Dr B Thomas
The module provides an introduction to the five Kingdoms of living organisms. A broad introduction to evolution and natural selection will lead into an evolutionary approach to the classification of organisms, and an introduction to bioinformatics. The development of life cycles and evolution of reproductive strategies and transport systems will provide a common theme throughout the module. The special features of the main groups will be examined, particularly with respect to functional anatomy, ecological success and species diversity. A number of themes will be explored in groups of lectures, including relevance of groups of organisms to man and the influence of man on biodiversity. Practicals will include handling of preserved (and live) specimens, preparation of taxonomic keys, drawing, data analysis and presentation. Demonstrations will be used to illustrate the diversity of different groups.

Value - 30 credits
Suitable - 1st year
Available - 1st term and 2nd term
On - Thursday (all day)
Prerequisites- A2 Level Biology or equivalent

BS1050 – Ecology: Animal Behaviour to Environmental Conservation –
Prof J Koricheva
This module provides an introductory understanding of some of the principles of ecology, ranging from biodiversity conservation to animal behaviour. Students are introduced to key UK habitats, the adaptations of organisms to the problems of living in such environments and the interactions between the organisms themselves, as well as fostering an understanding of ecological methods. Practical skills related to sampling techniques, biostatistical analyses and experimental design are taught as part of the major ecological themes. The module applies a “top-down” approach, from biomes to individuals, covering seven major themes: biogeochemical processes; British ecosystems; community ecology; population ecology; evolutionary and molecular ecology; ecophysiology; current ecological issues; and, behavioural ecology.
Value - 30 credits
Suitable - 1st year
Available - 1st term and 2nd term
On - 1st term: Tuesday (all day), 2nd term: Monday (all day)
Prerequisites - A2 Level Biology or equivalent

BS1060 – Living Systems: Animal and Plant Physiology – Dr J Beauchamp
This module explores fundamental physiological processes required for communication, obtaining and distributing nutrients and maintaining the internal environment within multicellular organisms. The module begins with the principles of physiology, focussed on mammals. It covers the structure and function of the nervous system, with examples of how animals sense and respond to the external environment and control movement. This is followed by an overview of circulatory systems and how they integrate with respiratory systems and the kidneys to maintain an appropriate internal environment for cellular function. The role of the circulatory system in communication through hormonal signalling and the interface with the nervous system is introduced. The structure and function of the digestive tract to enable animals to obtain nutrients to generate the energy required for life. The second part of the module discusses the growth and development of plants, the principle source of energy and nutrients for many animals. The module covers the transport of material within plants and regulation of plant development. Man’s influence on the improvement of plant quality and yield will also be considered.
Value - 30 credits
Suitable - 1st year
Available - 2nd term
On - Tuesday and Friday (all day)
Prerequisites - A2 Level Biology or equivalent

BS1070 – Cell Biology and Genetics – Dr P Devlin
Cell biology focuses on the structure and function of prokaryotic and eukaryotic cells. The origin of life is considered, and the diversity of microbes is investigated. The course explores cell subcellular organisation and the relationship between the structure and function of the main organelles. This module also incorporates essential numeracy skills for biological scientists which includes consideration of hypothesis testing, experimental design and basic statistical comparisons.
**Genetics** covers the structure and organisation of: chromosomes, mitosis, meiosis and recombination, the structure and inheritance of DNA, transcription, translation, regulation of gene expression, the organisation of prokaryotic and eukaryotic genomes, and techniques and applications of recombinant DNA technology.

**Value**  
- 30 credits

**Suitable**  
- 1st year

**Available**  
- 1st term

**On**  
- Wednesday (all morning) and Friday (all day)

**Prerequisites**  
- A2 Level Biology or equivalent

**BS1090 – Biochemistry: The Molecular Basis of Life – Dr W Lucchesi**
This module will provide a general understanding of the main concepts of classic biochemistry (protein structure/function, kinetics and metabolism) combined with a knowledge of the modern applications to industry and diagnostics. Topics covered include biochemistry methods focusing on techniques with applications in diagnosis and research; enzyme function, enzyme kinetics and regulation of enzyme activity; metabolism and metabolic energy; biosynthesis of metabolic fuels and natural products.

**Value**  
- 30 credits

**Suitable**  
- 1st year

**Available**  
- 2nd term

**On**  
- Monday (all day); Tue (all day); Thu (morning)

**Prerequisites**  
- A2 Level Chemistry or equivalent

**INFORMATION ABOUT SECOND YEAR MODULES**

**BS2005 – Microbiology – Dr S Dissanayke**
The module aims to introduce key concepts in microbiology, which encompasses studies in bacteria, viruses, and eukaryotic microbes. The historical milestones in this field of research will be considered, as well as the background of the important methodologies used in microbiology research. The module will include information on how microbes are classified, and how the different types of microbes are distinguished. We will discuss bacterial growth and differentiation, including genetic regulation. The module will explain the importance of microorganisms in health and disease, including human welfare issues such as opportunistic infections and the role of microorganisms in cancer. We will also consider how microorganisms can be used in research. This module is an essential prerequisite for the third year module BS3510 Molecular and Medical Microbiology.

**Value**  
- 15 credits

**Suitable**  
- 2nd year

**Available**  
- 2nd term

**On**  
- Tuesday

**Prerequisites**  
- BS1070

**BS2010 – Invertebrate Biology: Structure, Behaviour and Evolution – Prof M J F Brown**
The module involves a broad and in-depth study of the invertebrate phyla. The main focus will be on understanding body-plans, how structure relates to behaviour, and evolutionary relationships. The module will also examine invertebrate diversity and ecological importance. The practicals are an integral part of the module, and are designed to introduce techniques relevant to the study of invertebrates. These include experiments, dissection, microscopy, and preparation of whole mounts and
staining sections for microscopical study.

**Value** - 15 credits

**Suitable** - 2nd year

**Available** - 1st term

**On** - Thursday

**Prerequisites** - BS1040

### BS2020 – Plant Life: From Genes to Environment – Dr E López-Juez

The module examines primarily the most advanced (flowering) plants, their evolution, developmental and functional biology. In part one, the origin and diversification of flowering plants is discussed, as it is reflected in their reproductive biology. In the second part the ‘building’ of a plant is analysed, with reference to the meristems, pools of ‘stem cells’ in which it primarily takes place. Part three reviews mechanisms by which the photosynthetic apparatus adapts to current light conditions or to water/CO$_2$ availability. Part four examines some case studies of the role and mode of action of plant hormones. Part five reviews plant environmental sensors of abiotic and biotic factors, key to adapt plant development and behaviour to the prevailing conditions. The mode of action of such sensors, and the responses that they evoke, are discussed. Part six touches upon plants in the context of their domestication (“accelerated evolution”) in the hands of humans and in relation to global environmental change, the impact it has on plants and of the role plants can play in reducing it.

**Value** - 15 credits

**Suitable** - 2nd year

**Available** - 2nd term

**On** - Monday

**Prerequisites** - BS1070

### BS2040 – Cell Dynamics: Division and Movement – Prof L Bögre

The module will focus on the following key areas of modern cell biology: cell cycle, cell growth and differentiation, apoptosis, cell senescence, cell polarity, cell shape and cell motility, organelle origin and functions. Will give theoretical knowledge in modern cell biology methods, including microscopy and live cell imaging. Will introduce basic concepts on evolutionary constraints in cellular functions and links between cellular functions and development.

**Value** - 15 credits

**Suitable** - 2nd year

**Available** - 2nd term

**On** - Tuesday

**Prerequisites** - BS1060

### BS2050 – Human Physiology in Health and Disease – Dr J Beauchamp

The module will focus on the functions and integration of selected human physiological systems and how these are disrupted by disease.

**The endocrine system:** The thyroid gland will be used to explain the role of the hypothalmo-pituitary axis, feedback loops and multi-system response; the stress response to illustrate endocrine and nervous system integration in long- and short-term physiological response. How hormonal and neural signals integrate to regulate gastrointestinal activity, secretion and transit to ensure efficient digestion, and then
to maintain blood glucose homeostasis in the absorptive and postabsorptive states will be discussed.

**Skeletal muscle:** The specialised structure of the skeletal muscle cell and the molecular basis of contraction will be discussed, including excitation-contraction coupling, the role of Ca$^{2+}$, cross-bridge cycling, tetanic contraction and fibre types. Aspects of nerve/muscle communication including the neuromuscular junction, Golgi tendon organs and spindles will be covered, together with the significance of motor units and recruitment for whole muscle function.

**Cardiovascular system:** The structure and function of cardiac muscle will be covered together with aspects of cardiovascular physiology including cardiac output and the control of arterial pressure, together with cardiac failure, arrhythmia and cardiomyopathy. The composition of blood will be discussed, including examples of blood disorders along with the haemostatic mechanisms that prevent blood loss following vessel damage.

**The respiratory system:** This topic will include respiratory surfaces and surfactant, the mechanics of respiration and gas exchange and the integration of respiration and cardiovascular output.

**BS2060 – Developmental Biology – Dr E López-Juez**
Multicellularity has allowed living things to achieve levels of complexity and sophistication impossible at the single cell level. This module will explore the mechanisms by which zygotes establish or make use of basic body plan axes, and how subsequent cellular differentiation and interaction is achieved and results in the variety of tissues and organs that build an animal body. The module will focus on model organisms in which both embryological and genetic approaches have been developed, and will explore axis establishment, segmentation, cellular differentiation, organ development, and the widely-shared signalling pathways that underpin them.

**BS2090 – Insects, Plants and Fungi: Ecology and Applications – Prof A C Gange**
The module will cover the effects of herbivorous insects on plants and the ways in which plants defend themselves against attack. Beneficial effects such as pollination will also be addressed. The ecology of fungi pathogenic on insects and plants will be covered as well as fungi that are beneficial to plants (endophytes and mycorrhizas).
BS2120 – Biological Data Analysis and Interpretation – Dr S Papworth
This module provides an introduction to the use of statistical methods in biological sciences. Emphasis is placed on understanding how questions in biology can be answered quantitatively using statistics. The most important and widely used descriptive, associative and comparative statistical tests are illustrated, especially how and when they can be used. Key concepts of statistical sampling and experimental design in biology are introduced. Exercises give students hands-on experience of using statistical techniques.

Value  - 15 credits
Suitable  - 2nd year
Available  - 1st term
On  - Wednesday
Prerequisites  - None

BS2140 – Animal Behaviour – Dr S Portugal
The module demonstrates the great variety of animal behaviour occurring across the range of animal taxa and in different ecological situations. The module outlines the major theories that seek to explain animal behaviour, such as kin selection, cooperation and altruism. In depth case studies will be used to illustrate the advantages of the main methods used to study animal behaviour, and how they can be applied to studying different types of behavioural questions.

Value  - 15 credits
Suitable  - 2nd year
Available  - 2nd term
On  - Friday
Prerequisites  - BS1050

BS2150 – Applications of Molecular Genetics in Biology – Dr W Lucchesi
This module outlines the molecular tools currently available for the exploration of genetic diversity in a range of organisms, and for the genetic manipulation of microorganisms, plants, and animals, and describes how genetically modified, transgenic organisms can be produced by a variety of transformation methodologies. Examples of the application of molecular genetic strategies in basic biological and biomedical research and in areas as diverse as crop improvement, pest management, vaccine development, microbial evolution, human inherited disease and cancer are presented and discussed.

Value  - 15 credits
Suitable  - 2nd year
Available  - 1st term
On  - Friday
Prerequisites  - BS1070

BS2160 – Evolution – Dr F Ubeda de Torres
Evolution is the study of how the genotypic and phenotypic compositions of populations change through time. This module covers the foundation of evolutionary biology and the mechanisms that have shaped organisms since life began. How the evolutionary synthesis came to be; the origin of variation; the allelic composition of a population and how different processes, including natural selection, modify this composition; and adaptation. These topics lead to considering how we can study
evolution using phylogenetic methods. Finally, we consider the mechanisms of speciation and the special topic of human evolution.

**BS2510 – Bioenergetics, Biosynthesis and Metabolic Regulation – Dr J McEvoy**

Basic bioenergetics and respiratory electron transport, including concepts of oxidative phosphorylation and chemiosmotic theory; proton-translocating ATPase; structure and function of the respiratory chain. Biosynthetic pathways and their regulation, covering sugar nucleotides, storage polysaccharides, amino sugars and glycoproteins; the regulation of carbohydrate metabolism (including caloric homeostasis); the distribution and biosynthesis of isoprenoids, cholesterol, lipids and fat soluble vitamins; protein prenylation and glycosylation.

**Value** - 15 credits  
**Suitable** - 2nd year  
**Available** - 1st term  
**On** - Tuesday  
**Prerequisites** - BS1050

**BS2520 – Protein Structure and Function – Dr M Soloviev**

The module covers the principles of protein structure, including secondary structure, motifs and domains, and protein folding in vivo. Methods for separation, purification, detection, structural and functional analysis of proteins are considered. The module also covers protein-protein interactions, and the principles of protein engineering and design, as well as the mechanisms of enzyme catalysis and regulation, with specific examples. The practical class will provide experience in using fundamental techniques in protein separation and analysis such as SDS-PAGE and Western blotting. The coursework also involves the structure and function prediction of an unknown protein sequence using bioinformatics tools.

**Value** - 15 credits  
**Suitable** - 2nd year  
**Available** - 1st and 2nd terms  
**On** - 1st term; Thursday, 2nd term; Wednesday  
**Prerequisites** - BS1090

**BS2530 – Molecular Biology – Dr C Wilkinson**

The module covers the physical and chemical structure of DNA, recombinant DNA technology, DNA replication, gene organisation and structure, RNA and protein synthesis. The laboratory experiments cover a range of molecular biology techniques based on the theme of gene characterisation. This module also includes sessions in numeracy for molecular biologists and statistical skills.

**Value** - 15 credits  
**Suitable** - 2nd year  
**Available** - 1st and 2nd term  
**On** - Thursday and Friday  
**Prerequisites** - BS1070 and BS1090
BS2540 – Molecular and Cellular Immunology – Dr W Lucchesi
This module examines the specific immune system at the molecular level, dealing with the structure and function of the soluble and cell surface proteins involved. Subjects include: the immune response and acquired immunity; antibody structure and function; antibody diversity and clonal selection; genetics of immunoglobulin expression; the complement system; antibody techniques; monoclonal antibodies hypersensitivity reactions (allergies); the activity of T cells; major histocompatibility complexes, their role in transplant rejection and non-self-recognition; and, HIV and AIDS.

Value - 15 credits
Suitable - 2nd or 3rd year
Available - 1st and 2nd term
On - 1st Term: Tuesday, 2nd Term: Wednesday
Prerequisites - BS1070

BS2550 – Neuronal and Cellular Signalling – Dr P Alifragis
This module covers the principles of signalling in the nervous system, including electrical signalling along neurons and synaptic transmission. Different types of neurotransmitters will be considered and their receptors and intracellular signal transduction pathways will be studied. We will study the role and action of Acetylcholine, GABA and glutamate. The role of voltage-gated and ligand-gated ion channels will be discussed, including the role of potassium and calcium ion channels. The second term of the module will focus on central cell signalling pathways. Lectures include an introduction to drug development from an industrial and research perspective. The module will also cover the basis of cell signalling, from the outside of the cell (membrane receptors) to key intracellular mechanisms. These will include kinase (and phosphatase) activity, the second messengers heterotrimeric G proteins and small GTPases, cAMP, calcium and two important families of inositol-containing compounds. Examples of disease-related signalling will be highlighted throughout. Finally the module will introduce a range of model systems for neuroscience research.

Value - 15 credits
Suitable - 2nd or 3rd year
Available - 1st and 2nd term
On - 1st term, Thursday; 2nd term, Friday
Prerequisites - BS1060 and BS1090

BS2560 – Pharmacology and Toxicology – Dr P E Chen
The module aims to explain the chemical, physiological and biochemical factors which influence the efficacy of drugs. Topics covered include: drug-receptor interactions and the principal methods for receptor identification and characterisation, routes of administration of drugs, physico-chemical and physiological aspects of drug absorption and distribution, pathways of drug metabolism and excretion, renal clearance and ultra-filtration, mechanism of action of the major classes of analgesic and anti-depressant drugs, principles of toxicology and the major mechanisms of free radical induced tissue damage, pharmacology of the autonomic nervous system and the neuromuscular junction, general and local anaesthetic agents.

Value - 15 credits
Suitable - 2nd year
Available - 2nd term
On - Monday
Prerequisites - BS1030 and BS1060

BS2570 – Physical Biochemistry for Life Scientists – Dr M Soloviev
The module aims to provide the theoretical basis and examples of applications of physical methods for the study of biological molecules. The module considers the behaviour of macromolecules in solution, electronic spectroscopy methods such as fluorescence, phosphorescence and circular dichroism, mass spectrometry and its application to studies of biological macromolecules; MS, MS-MS, quantitative MS, Surface Plasmon Resonance, interferometry, biocalorimetry, scanning force microscopy and an introduction to nanobiotechnology.

Value - 15 credits
Suitable - 2nd year
Available - 1st term
On - Monday
Prerequisites - BS1030 and BS1090

INFORMATION ABOUT THIRD YEAR MODULES

BS3030 – Biology of Parasitic Diseases – Dr J Tovar-Torres
This module explores the principles of parasitism and the protective mechanisms employed by immuno-competent hosts to limit the spread of infection. It outlines the biological strategies used by a range of unicellular and multicellular organisms to colonise its host causing disease in human and non-human hosts. Case studies on the pathology and the cellular immunity elicited by various parasites are explored. The immune evasion strategies used by widely distributed human parasites to protect themselves from immune attack are also reviewed. The principles and prospects of anti-parasitic vaccination in the 21st century are presented and discussed.

Value - 15 credits
Suitable - 3rd year
Available - 1st term
On - Tuesday
Prerequisites - BS2005 or BS2150 or BS2530

BS3060 – Conservation Biology – Dr S Papworth
The module covers the biological basis of the great threats to biodiversity – habitat loss and fragmentation, intensive agriculture, over-harvesting and natural resource exploitation, alien species, disease and global climate change – and the approaches developed by conservation biologists to overcome these threats at local and global scales. The potential for subjectivity in conservation decision-making and the crucial importance of science-based conservation is stressed. Practical work is part of the assessment and involves writing an invasive species management plan.

Value - 15 credits
Suitable - 3rd year
Available - 2nd term
On - Friday
Prerequisites - BS1040 and BS1050

BS3090 – Entomology: Pure and Applied – Prof J Koricheva
The module aims to provide students with a sound understanding of insect biology, addressing aspects of their physiology and biology. Insects are the most numerous animals on the planet and the basic information will enable students to appreciate
why this is so. Insects are of conservation importance and part of the module will focus on beneficial insects such as pollinators and saproxylic (dead wood feeding) species and focus on the reasons for their decline. The module also aims to introduce students to practitioners in entomology, showcasing research at the School, CABI and Rothamsted Research. The final aim of the module is to improve students’ communication skills. Students will improve their verbal skills through the making of a podcast and their written skills through the production of an information leaflet for the general public.

**Value** - 15 credits  
**Suitable** - 3rd year  
**Available** - 1st term  
**On** - Thursday  
**Prerequisites** - BS2010

**BS3120 – Population and Community Ecology – Prof V Jansen**

In this module the principles of population and community ecology are explained, using examples from animal and plant assemblages. It focuses on population growth, inter- and intra-specific competition, trophic relations and the factors which regulate populations. The ecological processes that contribute to community organisation, such as food web structure, body size, succession and natural disturbances are considered. The role of population and community ecology in the maintenance of biodiversity is emphasised. A proposal writing exercise and assignments, which will involve the use of computer simulations, are included.

**Value** - 15 credits  
**Suitable** - 3rd year  
**Available** - 1st term  
**On** - Friday  
**Prerequisites** - BS1040, BS1050

**BS3160 – Behavioural Ecology – Dr R Riesch**

The module demonstrates how the behaviour of animals can be explained in an ecological and evolutionary framework. The emphasis is upon functional and evolutionary hypotheses and testing models that seek to explain how animals find and use key resources (such as food, breeding territories, mates).

**Value** - 15 credits  
**Suitable** - 3rd year  
**Available** - 2nd term  
**On** - Thursday  
**Prerequisites** - BS1050, BS2140

**BS3180 – Marine Ecology and Biodiversity – Dr D Morritt**

The module will begin with a brief introduction to the marine environment and oceanography. Following on from this a number of topical subjects will be used to illustrate recent developments in the field of marine ecology. The biodiversity and biogeography in the marine environment will be illustrated with reference to selected habitats, namely coral reefs and the deep ocean. The biology of the deep ocean, in particular the biology of mid-water and hydrothermal vent communities, will include consideration of technological advances in deep ocean exploration. This theme will be developed further in lectures on tracking studies, behaviour and conservation of marine megafauna, e.g. sharks, sea birds and marine mammals. The topical issues of marine pollution (including plastics pollution), ocean acidification and global climate change will be considered with respect to effects on marine biodiversity. Topicality is also maintained during coursework: pairs of students prepare
BS3190 – Climate Change: Plants and the Environment – Dr A Devoto
The module will give an advanced treatment of the effect of global climate change on the interaction between plants and the environment and will provide new opportunities to consider at various levels (ecological, physiological and molecular) the reaction of plants to environmental changes. Topics include a historical perspective on plants and humanity, microbial science and crop improvement.

Value - 15 credits
Suitable - 3rd Year
Available - 2nd Term
On - Tuesday
Prerequisites - BS1060, plus BS2020 recommended

BS3510 – Molecular and Medical Microbiology – Dr S Dissanayeke
This module will present advanced topics in molecular microbiology with particular emphasis on bacteria and pathogenic eukaryotes. Topics include pathogen mechanisms for infection, the host immune response to infection, vaccine development, gastrointestinal health and disease, resistance to antibiotics, anti-parasite chemotherapy and the genetic and biochemical validation of parasite drug targets in the kinetoplastidae.

Value - 15 credits
Suitable - 3rd year
Available - 1st and 2nd terms
On - 1st term: Thursday, 2nd term: Friday
Prerequisites - BS1070, BS2005; plus BS2540 recommended

BS3520 – Seed Biology: From Molecular & Conservation Biology to Industrial Applications – Prof G Leubner
Plant seeds and fruits are of central importance to human existence as they constitute the beginning and the end of most food supply chains (food security and sustainability). They are the delivery systems of agricultural biotechnology and a cornerstone of ecosystem conservation (seed banking). Topics of the lectures include a solid introduction into the fundamental processes of seed development and food reserve deposition, germination and reserve mobilisation, as well as the utilisation of seeds for molecular pharming. The evolution of the seed habit and the biomolecular paleobotany of fossil seeds focus on the key advantages and diversity of seeds and fruits which evolved in interaction with climate change. The morphological diversity of seeds and fruits includes a one-day visit and practical at Kew’s Millennium Seed Bank. This is followed by the biophysics of seed dispersal and the developmental biomechanics of seed fibres and seed germination. Further topics include a deeper insight into the molecular mechanisms underlying seed dormancy, germination and persistence in the soil bank, and their environmental control including by abiotic and biotic stress factors. The module also covers technologies used by the seed industry to improve crop seed quality and the research in agricultural biotechnology of wheat of Rothamsted Research at Harpenden. The lecture is complemented by module work in small groups on
selected topics from the actual literature which is presented at the "seed conference". Websites: 'The Seed Biology Place' - www.seedbiology.eu, 'Kew’s Millennium Seed Bank' - www.kew.org/science-conservation/save-a-seed-prosper/millenium-seed-bank/, 'Rothamsted Research' - www.rothamsted.ac.uk

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**BS3530 – Applications of Advanced Molecular Biology Methods – Prof R Williams**

Molecular biology research provides a key approach underpinning modern research that is employed in a wide range of systems including animal and plant models, as well as the simple social amoeba, *Dictyostelium*. This approach often employs the production and use of transgenic and knockout genetically modified organisms and the analysis of gene regulation and expression in response to the environment and in circadian rhythms. This module will describe these modern functional genomics studies, at an advanced level, with particular reference to current research applications.

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**BS3540 – Cell and Molecular Biology of Cancer – Prof L Bögre**

This module will cover selected topics in molecular cell biology relevant to cancer, including: cell-cell adhesion and signalling; stem cells. We cover the importance of the cytoskeleton, including microtubule structure and their functional roles for cell division, cell cycle and polarity, cell dynamics and diseases. Additional topics on cancer biology include oncogenes, tumour suppressor genes, caretaker genes and the signalling and regulatory pathways these are involved in. The module covers the cellular, tissue and developmental barriers that have to be broken for the development of cancer. These will include apoptosis, senescence, angiogenesis and metastases. The module will also include case studies and novel research avenues for diagnosis and the rational treatment of cancer.

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**BS3560 – Functional Genomics, Proteomics and Bioinformatics – Dr A Devoto**

The module will give an advanced treatment of structure-function relationships in proteins and of new opportunities for the use of genome-wide analyses in dissecting regulation in biological systems. Gene and protein networks will also be discussed. Topics include, post-genomic science; modes of specific recognition in mediating protein interactions; domains and functions; and, protein engineering. Students complete a guided introduction to bioinformatics resources. This assesses individual competencies and practical skills as each student will have to analyze separate datasets and develop own conclusions on the function of a gene/protein within a network through the analysis of databases and literature.
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<tr>
<td>BS3570</td>
<td>Human Embryology and Endocrinology</td>
<td>Dr J Murdoch</td>
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<tr>
<td>BS3580</td>
<td>Cellular and Molecular Neuroscience</td>
<td>Dr P Alifragis</td>
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<tr>
<td>BS3590</td>
<td>Molecular Basis of Inherited Disease</td>
<td>Dr R Yáñez</td>
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**BS3570 – Human Embryology and Endocrinology – Dr J Murdoch**
This module will cover select aspects in the development of human embryos and the function of particular endocrine systems. Topics covered in detail include early embryonic development, with formation of the three cell layers during gastrulation and the specification of anterior-posterior and left-right axes. The formation and patterning of the brain and spinal cord will be discussed, including the cellular and molecular processes involved. The effects of genetic and environmental insults in causing birth defects will be considered and the preventative action of folic acid treatment will be discussed. Techniques for deciphering the cause of birth defects will be considered, including the role of model organisms and the process of positional cloning. Other topics include the embryonic processes involved in craniofacial development and craniofacial defects. The development of the thyroid, parathyroid and adrenal glands will be covered, with detail on the synthesis, regulation and action of parathyroid and adrenocortical hormones. Sexual determination and differentiation will be discussed. Reproductive endocrinology will cover the regulation of reproductive function in males and females, including the hormonal changes associated with pregnancy. The processes of egg and sperm maturation and fertilization will be covered, leading us back to early preimplantation development. This module is three quarters Embryology.

**Value**: 15 credits  
**Suitable**: 3rd year  
**Available**: 1st and 2nd terms  
**On**: 1st term, Monday; 2nd term, Wednesday  
**Prerequisites**: BS2520, BS2530

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<tr>
<td>BS3580</td>
<td>Cellular and Molecular Neuroscience</td>
<td>Dr P Alifragis</td>
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This module covers brain development, function and disorders. We discuss the cellular and molecular mechanisms of brain development with particular reference to the cerebral cortex. We discuss in detail the synthesis, storage and release of neurotransmitters. We will review the molecular basis of learning and memory. We will also study the cellular and molecular basis of brain disorders, including neurodegenerative disorders, particularly Alzheimer’s disease, as well as epilepsy and bipolar disorder. The module also includes lectures from a clinician, on the cellular and molecular basis of neuroprotection in preterm babies and infants.

**Value**: 15 credits  
**Suitable**: 3rd year  
**Available**: 1st and 2nd term  
**On**: 1st term: Wednesday, 2nd term: Friday  
**Prerequisites**: BS1060 and BS2550

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<tr>
<td>BS3590</td>
<td>Molecular Basis of Inherited Disease</td>
<td>Dr R Yáñez</td>
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The module provides an introduction to the theory, technology, and clinical practice of human molecular genetics: the metabolic and molecular bases of human inherited disease, mapping disease genes, the human genome project, bioinformatics, clinical aspects of the biochemistry of inborn errors of metabolism, and therapeutic approaches. The module is taught in relation to a selected range
of illustrative genetic disorders and inborn errors of metabolism such as muscular dystrophies, cystic fibrosis, haemophilia, lysosomal storage disorders, haemoglobinopathies, mitochondrial respiratory chain disorders, neurotransmitter synthesis disorders, lipoprotein diseases and primary immunodeficiencies. This module is taught primarily by external lecturers who are experts in the field.

Value - 15 credits
Suitable - 3rd year
Available - 1st term
On - Friday
Prerequisites - BS1060, BS1070, BS1090, BS2530

Please note that module information is given as accurately as possible but is subject to change in the course of continual updating and review of modules.