**School of Biosciences**

**Guide to Module Choices for Incoming Exchange Students**

**2020/21**

**Introduction**

This booklet sets out the modules offered to exchange students visiting the School of Biosciences in University of Birmingham in 2020-21. We make a wide range of modules available to incoming exchange students.

**Credits**

If a student is here for one semester they should take 60 credits.[[1]](#footnote-1) If a student is here for a full year they should take 120 credits. Students who are here both semester 1 and 2 should ideally take 60 credits in each semester.[[2]](#footnote-2)

**Selecting Appropriate Modules**

Exchange students come to Birmingham from a wide variety of countries, and they will be at different stages of their degrees. Incoming students may take modules that are aimed at first year students, second year students and third year students. Each module has a school code. The first number in the code indicates the year. So BIO325 is a Year 3 module, BIO268 is a Year 2 module, etc.

Please note: *Year 1 = Level C Year 2 = Level I Year 3 = Level H*

Students must check that their sending university is happy with their module selections. The responsibility is with the student.

All modules are worth 20 credits, except for BIO172, BIO173, BIO174 and BIO230 which are 10 credit modules.

**Non-Biosciences Modules**

Students may take modules from other schools if their home university permits this and if it is compatible with the student’s timetable. However, it is the student’s responsibility to find out whether the timetables are compatible, and to get in touch with different tutors in each school to make such arrangements possible. The staff in the School of Biosciences will only deal with Biosciences modules.

**PLEASE NOTE:**

Students only in attendance for Semester 1 will sit an alternative assessment in place of any exam unless otherwise stated.

# Module Availability 2020-21

There may be timetabling constraints with some module combinations where students have selected across different levels. Should this be the case students will be asked to choose alternative module(s) following the publication of the timetables.

**Year 1 (Level C)**

| **Code** | **Banner** | **Module** | **Semester** | **Credits** |
| --- | --- | --- | --- | --- |
| BIO143 | 22652 | Physical Biochemistry | 2 | 20 |
| BIO145 | 22924 | Introduction to Evolution & Animal Biology | 1 | 20 |
| BIO152 | 23318 | Cell Biology & Physiology | 1 | 20 |
| BIO154 | 23320 | Genetics I | 2 | 20 |
| BIO171 | 27806 | Ecological Concepts and Plant Sciences | 2 | 20 |
| BIO172 | 28777 | Introduction to Microbiology | 2 | 10 |
| BIO173 | 28776 | Fundamentals of Biochemistry | 1 | 10 |
| BIO174 | 28778 | Metabolism | 2 | 10 |
| BIO175 | 30143 | Human Nutrition & Metabolism | 2 | 20 |

The following modules cannot be taken together:

BIO152 and BIO173

BIO174 and BIO175

**Year 2 (Level I)**

| **Code** | **Banner** | **Module** | **Semester** | **Credits** |
| --- | --- | --- | --- | --- |
| BIO213 | 18540 | Topics in Medical Biosciences | 1 | 20 |
| BIO230 | 19822 | Molecular Biology and its Applications (Must attend exam after Christmas) | 1 | 10 |
| BIO237 | 13282 | Plant Sciences: from cells to the environment | 1 | 20 |
| BIO258 | 22397 | Microbes and Man | 1 | 20 |
| BIO261 | 23326 | Proteins and Enzymes | 2 | 20 |
| BIO262 | 23328 | Membranes, Energy and Metabolism | 1 | 20 |
| BIO268 | 24985 | Cell and Developmental Biology | 2 | 20 |
| BIO270 | 24986 | Field course: Adaptations to Aquatic Environments (Limited capacity) | EASTER | 20 |
| BIO273 | 26999 | Human Structure and Function | 2 | 20 |
| BIO277 | 28780 | Evolution of Humans and Other Animals | 1 | 20 |
| BIO278 | 28822 | Animal Biology: Principles & Mechanisms | 2 | 20 |
| BIO279 | 30145 | Critical Issues for 21st Century Ecosystems | 2 | 20 |

The following modules cannot be taken together:

BIO262 and BIO277

BIO273 and BIO279

**Year 3 (Level H)**

| **Code** | **Banner** | **Module** | **Semester** | **Credits** |
| --- | --- | --- | --- | --- |
| BIO305 | 23344 | Molecular Basis pf Bacterial Infection | 2 | 20 |
| BIO317 | 25343 | Bacterial Gene Regulation | 2 | 20 |
| BIO325 | 11221 | Eukaryotic Gene Expression | 1 | 20 |
| BIO335 | 28011 | Human Health & Disease | 1 | 20 |
| BIO336 | 27876 | Conservation Practice: Genes to Ecosystems | 2 | 20 |
| BIO351 | 30948 | Omics for Biomedical Research | 2 | 20 |
| BIO352 | 30790 | Current developments and advances in Eukaryotic Genetics | 2 | 20 |
| BIO353 | 31872 | Global Challenges and Plant Sciences | 2 | 20 |
| BIO379 | 14675 | Cellular Neurobiology | 1 | 20 |
| BIO380 | 25349 | Human Evolution | 2 | 20 |
| BIO387 | 21893 | Cancer Biology | 1 | 20 |
| BIO389 | 22393 | Adaptation to changing environments | 2 | 20 |
| BIO397 | 25197 | Living in Groups: Collective Behaviour in Animals | 1 | 20 |

The following cannot be taken together:

BIO305 and BIO351

BIO317 and BIO336

BIO335 and BIO387

BIO350 and BIO397

BIO353 and BIO380

BIO388 and BIO389

| **03 22652 BIO143**  | **Physical Biochemistry** | **Credits: 20** |
| --- | --- | --- |
| **Level: C** | Semester: 2 | **Staff responsible: Dr K Fütterer** |
| **Module Description:** | The module seeks to establish an understanding of the fundamental physical laws that biochemical reactions and processes. Why does a reaction go forward? How much substrate is left x seconds after starting the reaction? How does pH influence enzyme-catalysed reactions and how does the rate of turnover relate to concentration of enzyme and availability of substrate? These are some of the questions examined in this module.  |
| **Module Outcomes:** | At the end of the module the students will be able to: * Understand how pH affects ionisations states of ionisable groups in proteins and, as a consequence, how subtle changes in pH can affect enzyme activity.
* Understand how thermodynamics and kinetics allow a quantitative description of biochemical processes.
* Master a basic set of mathematical tools to predict biochemical equilibria; to describe the time-dependence of (enzyme-catalysed) chemical reactions; and to quantify the relationship between substrate concentration(s) and reaction rates in enzyme-catalysed reactions.
* Relate molecular and structural features of a selected set of enzymes to the mechanism of rate enhancement.
* Understand how knowledge of evolutionary relationships between proteins provides insights into the conservation of structure and molecular mechanism of protein function.
* Know and understand a simple set of experimental techniques to study enzymes, their substrates and reactions they catalyse.
* Know and understand a simple set of experimental techniques to study enzymes, their substrates and reactions they catalyse
 |
| **Pathways:** | This Module sits squarely alongside BIO171, Ecological Concepts and Plant Sciences and Environmental Biology in that it covers many aspects of ‘whole animal biology’. You will find that the module prepares you for some of the second year modules such as the field courses as part of BIO259, Glacial Ecology in Norway, and BIO237, Plant Sciences: from cells to the environment. In addition to up to date knowledge the module provides a range of applied skills from practical sessions where you are encouraged to translate theory into practice. The skills you develop in generating data during practical sessions prepare you well for modules in the second year and are early preparation for the scientific writing you will undertake in projects and dissertations in the third year. |
| **Delivery:** | Lectures, workshops, laboratory practical’s, in-class assessment |
| **Assessment:** | Continuous Assessment (40%) Comprised of:* Practical’s (20%)
* Class test (20%)
* Workshop (0%) Formative but attendance required

Sessional examination in May/June (60%) * Multiple Choice Questions (40%)
* Compulsory short answer and quantitative problem questions (60%)
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| **Banner: 03 22924 BIO145**  | **Introduction to Evolution and Animal Biology**  | **Credits: 20** |
| --- | --- | --- |
| **Level: C** | Semester: 1 | **Staff responsible: Dr S J Reynolds**  |
| **Module Descriptions:** | This first year module provides a broad introduction to whole animal biology.The first half of the module provides a gentle introduction to evolution by exploring the history of evolutionary thinking that led to our modern understanding of evolutionary processes such as natural selection, gene flow and speciation. Examples of evolution are taken from both the animal and plant kingdoms to illustrate some of the core concepts. We also consider human evolution in some detail in this first half of the module. In the second half the focus shifts to include the key principles of animal anatomy, behaviour, ecology, morphology and physiology as we consider the basic biology of selected taxa such as birds, insects and mammals. Students are shown how such knowledge can be applied through assessed practical sessions that develop skills in observation, illustration, and the handling and simple analysis of data generated in class. |

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| --- | --- |
| **Module outcomes:****Pathways:** | By the end of the module students should be able to* understand the development and current impact of evolutionary thought
* outline the mechanisms of the origin and early development of life
* Demonstrate a working knowledge of the mechanism of natural selectionunderstand the need for, and the parameters of, taxonomydefine `species? And `selection? In a number of contexts.
* Interpret adaptations in terms of increased fitness and environment
* understand the genetic mechanisms underpinning evolution
* Outline the major phenotypic changes and the potential selective pressures driving the evolution of humans.
* Relate the functional morphology and physiology of different animal groups to their wider biology
* understand the methods by which the behaviour of animals is studied, recorded and interpreted
* carry out laboratory experiments, reflect on these and record, analyse and interpret results
* apply knowledge in data-handling and problem-solving

This Module sits squarely alongside BIO171, Ecological Concepts and Plant Sciences and Environmental Biology in that it covers many aspects of ‘whole animal biology’. You will find that the module prepares you for some of the second year modules such as the field courses as part of BIO259, Glacial Ecology in Norway, and BIO237, Plant Sciences: from cells to the environment. In addition to up to date knowledge the module provides a range of applied skills from practical sessions where you are encouraged to translate theory into practice. The skills you develop in generating data during practical sessions prepare you well for modules in the second year and are early preparation for the scientific writing you will undertake in projects and dissertations in the third year. |
| **Delivery:** | Lectures, Laboratory practical’s, computer workshop, in class and independent assessments, including peer assessment |
| **Assessment:** | **In Course-Assessment (30%)*** Two short practical reports (15% each)

**Sessional examination in May/June (70%):*** Consisting of a two hour paper in two parts: MCQs and compulsory SAQs
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| **03 23318 BIO152**  | **Cell Biology and Physiology** | **Credits: 20** |
| --- | --- | --- |
| **Level: C** | Semester: 1 | **Staff responsible: Dr S Brogna** |
| **Module Descriptions:** | In the first part of the module, the components of the cell are introduced and discussed in terms of their structure and function. This includes sections on membranes and membrane bound organelles, and the flow of materials inside the cell. There will be an emphasis on understanding the experimental basis. The next part of the module covers the basics of human and animal physiology and reproduction. It covers underlying concepts such as homeostasis, and outlines in more detail the cardiovascular system, endocrinology, immunology, and neurophysiology. It aims to highlight the important relationships between these systems and the connections between cell biology, anatomy and physiology The final part of the module covers the basics of reproduction gametogenesis, fertilisation and reproductive cycles and reproductive strategies in humans and animals. The module will have practical’s that will permit the students to study aspects of cell membrane properties and physiology These practical’s are tightly allied to the lectures and are designed to give experimental insights about our understanding of cell biology and animal physiology. |
| **Module outcomes:****Pathways:** | By the end of the module, students should be able to: Understand concepts of cell biology and the relationship between cell biology and functionality for the physiological systems studied; Understand concepts of human and animal physiology and reproduction; Carry out and understand practical exercises in specific aspects of cell biology and physiology; Undertake independent learning activities in an enquiry-based manner. understand and be able to carry out basic statistical techniques for comparing data sets including a t test and chi squared test; be able to use Excel for these analysesThis is a foundation module for a number of others in year two, three and four. These particularly include BIO262 (Membrane, Energy and Metabolism), BIO268 (Cell and Developmental Biology). The module is also propaedeutic to final year modules such as BIO379 (Cellular Neurobiology), BIO387 (Cancer Biology) and BIO384 (Human Reproductive Biology and Development). The module includes three laboratory practicals which among other lab tasks aim to prepare you for working in a laboratory when doing final year projects. The module is also beneficial to any animal and human biology modules or projects |
| **Delivery:** | 33hr Lectures, 8hr Practical classes, 2hr workshops. |
| **Assessment:** | **Continuous Assessment (30%) comprising:*** Pre and post lab assessments based on the practical element

**2 hour written unseen examination (70%)** * consisting of a 2 hour paper in two parts: MCQs and compulsory SAQS
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| **03 23320 BIO154**  | **Genetics I** | **Credits: 20** |
| --- | --- | --- |
| **Level: C** | Semester: 2 | **Staff responsible: Dr L Crompton** |
| **Module Descriptions** | Students will receive a comprehensive introduction to modern genetics.in both prokaryotic and eukaryotic organisms, including humans. This module will cover molecular genetics (the study of the physio-chemical nature of genes and how they work) and transmission genetics (the study of how genes and the characters they determine are shuffled into new combinations and passed from individual to individual). The topics that will be covered will include: information, how it is stored, transmitted, and translated; the regulation of gene expression; the genetics of bacteria and viruses; the cell cycle in eukaryotes and its regulation; mitosis and meiosis; gene linkage and chromosome mapping;; DNA damage and DNA mutation.br />Basic principles will be illustrated in practical classes and considerable attention will be given to solving problems in transmission genetics. |
| **Module Outcomes:** | By the end of the module students should be able to:* show knowledge and understanding of all parts of the syllabus
* apply their knowledge to solving simple problems in transmission genetics
* formulate hypotheses as well as design and carry out experiments to test them
* construct genetical hypotheses and test them, using simple statistical methods where appropriate
* appreciate the different methods used for genetical analysis in prokaryotic and eukaryotic organisms
 |
| **Pathways:** | Understanding the basic concepts of genetics is essential for all contemporary bioscience students and the ideas you will encounter in this module pervade many areas of the life-sciences. Understanding the mechanisms of inheritance and evolution is an essential part of understanding microbes, plants and animals, as well as health, disease, ecology and behaviour. You will use bacteria and plants to investigate genetic phenomena and knowing something about the biology of these organisms is important to properly use them as model organisms which allow us to explore general issues in biology.  You will also be expected to understand the molecules involved in genetic processes and the basic biochemistry of DNA replication, mutation, gene expression, recombination and DNA repair.  Finally the module involves important experimental design and data processing and thus the general skills you learn from this will be applicable to other courses.  This module therefore provides you with a key foundation stone for your degree and will link with not just second year genetics, but with basically any other Biosciences course that you do.  Understanding the language of genetics should be part of your skills as a Bio scientist. |
| **Delivery:** | 34hr Lectures, 12 hr Practical Sessions & 4 hr workshops |
| **Assessment:** | **In-course assessment (30%) comprising:*** Practical Reports 10%
* Workshop Problems 10%
* MCQ Class Test 1

**2 hour written examination in May/June (70%)** * comprising multiple-choice and short-answer questions
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| **03 27806 BIO171**  | **Ecological Concepts and Plant Biology** | **Credits: 20** |
| --- | --- | --- |
| **Level: C** | Semester: 2 | **Staff responsible: Dr Juliet Coates** |
| **Module Description:** | This module provides a broad overview of the biology of our environment. As plants are key to shaping our environment the course fosters an understanding of the biology of higher plants with emphasis on plant physiology structure/function relationships, developmental processes and the exploitation of plants by humans. A set of basic plant physiological processes are considered, with special reference to physiological modifications that have ecological agricultural and economic consequences. The course also covers plant hormones, life cycles, reproduction and evolution, all of which are key to environmental stability and feeding the planet. There is focus on Arabidopsis, which has become the model species for plant molecular genetic research. However, the course also considers crop plants, including crop domestication and methods for crop improvement including crop genetic You will consider definitions and methods to quantify animal and plant biodiversity in its many forms and some key concepts in animal ecology. You will study the relationship between animals and their environment, some of their behavioural and physical adaptations and the methods used to study them. You will then look at the use of modern DNA-based techniques that have defined the field of molecular ecology. Interesting and perplexing biological problems relating to population structures, speciation, biodiversity and conservation can only have been addressed by the use of genetic markers. These genetic markers of the past two decades are now giving way to whole genome-based studies of natural populations, which are opening new doors for fundamentally understanding the origin and maintenance of ecologically important attributes of animal and plant species.  You will consider the diversity of the planets biome in light of how environments vary across the globe. The various anthropogenic pressures on these environments will also be examined including habitat fragmentation, invasive species and pollution, in particular, emphasizing the effects of increased temperatures and levels of greenhouse gases that are driving climate change. A range of strategies will be considered to facilitate conservation of the natural world and sustainable solutions in agricultural situations, including the use of GM crops. |
| **Module Outcomes** | By the end of the module students should be able to:* understand how plant structure and function are interrelated in key physiological and developmental processes
* Understand how plants were domesticated and how the continual improvement of crop plants will meet the demands of an expanding global population.
* Describe the different types of natural environments.
* Outline the major threats to biodiversity.
* Understand key principles and methods in animal ecology.
* Evaluate the advantages and disadvantages of a range of sustainable solutions to threats to the environment.
* Plan, carry out, analyse and interpret simple experiments in the laboratory, including in groups.
* Analyse experimental data, compare data sets using statistical tests, show anunderstanding of probability and use of Student Test
* Use a range of quantitative methods of assessing environmental diversity. Develop skills in scientific writing.
 |
| **Delivery:** | Lectures, Laboratory practical’s  |
| **Assessment:** | **Continuous Assessment (30%) comprising:*** Satisfactory engagement with Peer wise MCQ web site (5%)
* Practical write-up and statistical analysis (25%)

**2 hour written examination in May/June (70%)*** Comprising multiple-choice and short-answer questions (70%)

Resit examinations will cover the whole course, i.e. theoretical aspects and practical aspects |

| **Banner: 03 28777 BIO172**  | **Introduction to Microbiology** | **Credits: 10** |
| --- | --- | --- |
| **Level: C** | Semester: 2 | **Staff responsible: Dr Lodge** |
| **Module Description:** | This module will provide Biological Sciences and Human Biology students with broad introduction to microbiology. You will learn about the major microbial groups: bacteria, fungi, protists, archaea and viruses. Common themes will be explored including how microorganisms are studied, microbial lifestyles, their key structural components, and the key features of the different types of microbial cell. Lab practical classes will provide opportunities to develop important competencies in handling, isolating and growing different types of microorganisms as well as introducing methods for analysing the effect of different growth conditions. |
| **Module outcomes:** | By the end of the module students should be able to:* describe the key features of the major microbial groups and understand key similarities and differences between them
* explain how their key structural components allow these small organisms to exist in diverse environments
* Demonstrate an understand the evolutionary relationships between and within prokaryotic and eukaryotic microorganisms
* apply an understanding of the principles underlying isolation and growth of different types of microorganisms and methods for analysing the effect of different growth conditions;
* Demonstrate an understanding of aseptic technique and develop competencies in safe handling of microorganisms work as a group to resolve a real life infectious disease control problem.
 |
| **Delivery:** | Lectures, practical classes, on-lines quizzes, workshops |
| **Assessment:** | **Continuous Assessment (30%) comprising**:Pre lab assessment 10%Peer marked practical manual 10%Video test on understanding of aseptic technique and safe handling of microorganisms**Sessional examination in May/June (70%)** consisting of a 1.5 hour paper in two parts: MCQs and compulsory SAQsReassessment: 1.5 hour Supplementary Examination:* Resit mark for the module is based solely on exam performance. Continuous assessment marks are not counted. Resit examinations will cover the whole course, i.e. theoretical aspects and practical aspects.
 |

| **Banner: 03 28776 BIO173**  | **Fundamentals of Biochemistry** | **Credits: 10** |
| --- | --- | --- |
| **Level: C** | Semester: 1 | **Staff responsible: Dr Madigan** |
| **Module Description:** | This module will provide Biochemists with in-depth study of metabolism as a progression from the semester 1 module Fundamentals of Biochemistry (10 credits). We will discuss the metabolism of carbohydrates and pyruvate, and of fatty acids in detail. We will emphasise the experimental techniques, evidence and unifying concepts behind our current understanding of metabolic processes. The module will also provide an introduction to the field of microbiology to equip Biochemists to choose the Level I Microbiology course should they wish.  |
| **Module Outcomes** | By the end of the module students should be able to:* demonstrate understanding of the features of metabolism exemplified by the major pathways of carbohydrate and fat metabolism
* interpret some disorders of metabolism by analysis of clinical data in case studies
* demonstrate observational, manipulative, numerical and deductive skills, and write reports (through experience gained in the practical and data-handling classes)
* develop improved skills of independent learning and verbal reporting in the clinical case studies
* develop knowledge of core microbiology including the gut microbiome and knowledge of how to culture microorganisms
 |
| **Delivery:** | Lectures, laboratory practical, workshop, two case studies |
| **Assessment:** | **Continuous Assessment (30%) comprising**:* Laboratory practical report (15%)
* Case study (15%)

**1.5 hour wrirrten examination in January (70%)**Reassessment: 1.5 hour Supplementary Examination. Resit mark for the module is based solely on exam performance. Continuous assessment marks are not counted. Resit examinations will cover the whole course, i.e. theoretical aspects and practical aspects. |
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| **Banner: 03 28778 BIO174**  |  **Metabolism** | **Credits: 10** |
| --- | --- | --- |
| **Level: C** | Semester: 2 | **Staff responsible: Dr Madigan** |
| **Module Description:** | This module will provide students with in-depth study of metabolism as a progression from the semester 1 module Fundamentals of Biochemistry (10 credits). We will discuss the metabolism of carbohydrates and pyruvate, and of fatty acids in detail. We will emphasise the experimental techniques, evidence and unifying concepts behind our current understanding of metabolic processes..  |
| **Module outcomes:** | * demonstrate understanding of the features of metabolism exemplified by the major pathways of carbohydrate and fat metabolism
* interpret some disorders of metabolism by analysis of clinical data in case studies
* demonstrate observational, manipulative, numerical and deductive skills, and write reports (through experience gained in the practical and data-handling classes)
* develop improved skills of independent learning and verbal reporting in the clinical case studies
* develop knowledge of core microbiology including the gut microbiome and knowledge of how to culture microorganisms
 |
| **Delivery:** | Lectures, laboratory practical, workshop, two case studies |
| **Assessment:** | **Continuous Assessment (30%) comprising**:* Laboratory practical report (15%)
* Case study (15%)

**1.5 hour written examination in May/June (70%)** |
|  |  |

| **03 18540 BIO213** | **Topics in Medical Biosciences**  | **Credits: 20** |
| --- | --- | --- |
| **Level: I** | **Semester 1**  | **Module Organiser: Dr J Heath** |
| **Module Description:** | In this module you will study four key areas: blood constituents and their functions. You will learn about the types and roles of blood cells, haemoglobin synthesis and degradation, blood coagulation and homeostasis, blood lipids, and immunology methods. * Cancer. You will learn about the biology of human cancer, the role of genetics and environmental factors in the origin of cancer and the development of anti-cancer treatments.
* Neurobiology. You will learn about molecular neurobiology and neurotransmitters and how they affect brain functions such as memory and how the brain responds to opiates.
* Pharmacology. You will learn about the biochemical principles of drug/target interactions, different types of drug actions on their target and the distribution and metabolism of drugs.In the workshop you will learn about sources of information on anti cancer drug effects, clinical trial outcomes and analysis of drug efficacy in the light of costs.

This module builds upon aspects of biochemistry, cell biology and physiology learnt in year 1 and will be useful for a number of advanced modules such as cell signalling, neurobiology, cancer biology and immunology taken in years 3.  |
| **Module outcomes.****Pathways:** | By the end of the module students should be able to:* Independently and in controlled conditions demonstrate, an understanding of the blood system, its cellular and protein components and their roles.
* Independently and in controlled conditions demonstrate an understanding of molecular neurobiology with particular reference to the action of neurotransmitters.
* Independently and in controlled conditions demonstrate an understanding of the mode of action, clinical efficacy and cost of treatment for of a number of drugs which affect different physiological systems and are used in the treatment of various diseases

This module applies and builds upon some of the knowledge gained in the 1st year modules in Biochemistry (BIO151), Enzymes & metabolism (BIO107), Human Biochemistry (BIO139) and Cell biology and Physiology (BIO152). The knowledge gained from this module provides a basis of understanding for the more molecular-medical related modules in the 3rd year, such as Cellular signalling (Bio319), Molecular and cellular mechanisms of toxicity and cancer (BIO304), Cancer biology (BIO387) and Cellular neurobiology (BIO379).   |
| **Delivery:** | Lectures, practical’s, case studies, video. |
| **Assessment** | * Cancer drug discovery and development **report (30%)**
* 2 hour written examination in May/June comprising essay and short answer questions **(60%)**
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| **03 30143 BIO175** | **Human Nutrition and Metabolism**  | **Credits: 20** |
| --- | --- | --- |
| **Level: C** | Semester: 2 | **Module Organiser: TBC** |
| **Module Description:** | Upon completion of this module, students will be aware of, and be able to demonstrate understanding of the basic biochemistry that underpins the functioning of the human body. Four broad themes will be explored here* Nutrition- including recall of nutrient groups and basic processing within the body , exploring deficiencies and overdose problemsEnergy metabolism
* Pathways involved in release of ATP from biomolecules including both anabolic and catabolic reactions
* Practical biochemistry techniques- Research led practical aspects to introduce students to common biochemical techniques used in research studiesRegulation and Deregulation of metabolic pathways.
* The control of metabolic pathways including the effect of enzyme/ protein denaturisation, redox, key enzymes and starvation
 |
| **Module outcomes:** | By the end of this module you should be able to:1. Demonstrate a detailed understanding of important aspects of human nutrition.
2. Describe some of the techniques used to isolate cellular components and to purify and characterise proteins
3. Demonstrate understanding of the features of metabolism exemplified by the major pathways of carbohydrate, protein and fat metabolism
4. Interpret disorders of metabolism by analysis of clinical data in case studies
5. Demonstrate observational, manipulative, numerical and deductive skills, and write reports (through experience gained in the practical’s and in the clinical case studies)
 |
| **Delivery:** | Work based learning activities, laboratory practical classes, lectures  |
| **Assessment:** | **In Course Assessments** (30%)* Practical write ups (25%)
* Case study (5%)
* Workshop (10%)

**1.5 hour end of year exam** (60%)Reassessment: Supplementary Examination to include aspects of the case study and workshops as well as lecture material |
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| **03 19822 BIO230** | **Molecular Biology and its Applications** | **Credits: 10** |
| --- | --- | --- |
| **Level: I** | **Semester 1** | Module Organiser: Dr Julia Lodge**Teaching Staff:**  |
| **Module Description:** | This second-year core module will build on key information covered in the first year by developing further an understanding of molecular biology, its empirical bases, and its applications in modern biological science. The module will: * introduce advanced techniques in molecular biology
* develop an understanding of the diverse applications of this technology across the range of the Biological Sciences
* provide hands-on experience of basic cloning and molecular biology techniques
* Build a sound theoretical basis on which teaching in the second and third year can build in all areas of biology.
 |
| **Module Outcome****Pathways:** | **On successful completion of this module you should be able to:** * Understand how the basic techniques in genetic cloning can be applied to solve a variety of simple cloning problems
* Devise simple experiments to identify, clone and analyse a bacterial, animal or plant gene
* Understand the impact of genomics, on our understanding of gene function.
* explain using examples how molecular biotechnology can be applied to diverse applications such as studying populations, DNA fingerprinting, medicine, forensics, environmental monitoring, agronomics and diagnosis of genetic disease
* Be able to work with the types of data associated with molecular biology

This module builds on what you learned in the first year genetics. It is core to all aspects of the Biosciences and you will find that the technologies that are introduced in this module have been exploited to further our understanding in areas as diverse as ecology, medicine and biochemistry. Second and third year modules will follow on themes which have been introduced in BIO230. If your interests are in molecular aspects of biology these links will be obvious to you. Even if you are more interested in whole organisms and ecology you will find that molecular approaches are widely used in these fields. Did you know that High Throughput sequencing has been used to identify organisms sampled by collecting windscreen splatter? This gives us a more accurate picture of the diversity of organisms present. |
| **Delivery:** | Lectures, practical classes, workshop, computer simulation and self-learning activities. |
| **Assessment****Feedback** | **Continuous assessment: (33%):*** 90 minute data-handling test

**One hour examination in January (67%)*** Comprising of multiple choice questions

You will be able to complete your workshop and practical manuals and hand these in for formative feedback. There will also be an interactive feedback and revision session to help you to prepare for the data handling test. |

| **03 13282 BIO237** | **Plant Sciences: from cells to the environment Credits: 20** |
| --- | --- |
| **Level: I** | **Semester 1** | **Module Organiser: Graeme Kettles****Teaching Staff:**  |
| **Module Description:** | The aim of this module is to develop an understanding of how plants function, via their development and physiology, in relation to key influences in their natural environment. This includes both a consideration of physical factors, and the influences of other interacting organisms, some of which have positive consequences for plant performance, others of which are very detrimental. The module takes an integrative view of plant function at both the single cell and the whole plant level. The module will reflect the growing emphasis on integrating physiological, molecular and more recent computational approaches to (I) understand how plants develop and function and (ii) engineer plants for non-ideal environments. The modules exploit developing and pre-existing research strengths within the School. |
| **Module Outcomes****Pathways:**  | By the end of this module the student will be able to: * Know and understand how plants perceive and respond to a range of physical stimuli and signals in order to better adapt themselves to their environment.
* Understand the role of model plants including Arabidopsis in determining plant functions and be able to apply knowledge from model plants to crop plants. Understand the fundamentals of plant development
* Understand the key ways in which plants perceive, transduce and respond to various signals from their environment. Understand how plants interact with other organisms (biotic interactions).
* Design and execute scientific experiments and write scientific reports.
* Apply knowledge to problem solving and data handling.
* Including reading the scientific literature.

This module sits between your first year studies in BIO171, Ecological Concepts and Plant Sciences and the more research-focussed modules in the final year (BIO389, Adaptations to changing Environments, BIO398 Plant Science in the 21st Century) as well as a wider range of final year projects. You will find that the module complements some of the second year field courses such as BIO259, Glacial Ecology in Norway. In addition to up to date knowledge the module provides a range of modern techniques increasingly used in plant science research. The skills you develop in collecting and analysing and writing up experimental data build on the *Arabidopsis* exercise you undertook in BIO171 and provide an excellent preparation for the scientific writing you will undertake in projects and dissertations in the final year. |
| **Delivery:** | Lectures, workshops, laboratory practical’s, in class assessments  |
| **Assessment** | Continuous Assessment (30%)* Practical write up in the form of a scientific paper
* Formative MCQ and peer marking exercise

Sessional examination in May/June (70%)* 2 hour paper comprising essay and short answer questions.
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| **03 22397 BIO258** | **Microbes and Man** | **Credits: 20** |
| --- | --- | --- |
| **Level: I** | Semester: 1 | **Module organiser: Dr Julia Lodge****Teaching Staff:**  |
| **Module Description:****Pathways:** | In this module you will learn about how microorganisms impact on humans, both in the context of health and disease and by looking at how humans have exploited microorganisms. In the Human Health and Disease section you will learn about three of the major groups of disease causing microorganisms; bacteria, fungi and viruses, with emphasis on the underlying mechanisms by which these organisms cause disease. As the course progresses you will begin to recognise that common themes underpin our understanding of the diseases caused by these quite different groups of microorganisms; these themes will be explored in the overview session at the end of this section of the course. Many of the topics in the Exploitation of Microorganisms section also relate to protecting human health, including antibiotic, vaccine and medicinal protein production. You will also look at how our understanding of microbes has been enhanced by genome sequencing and how microorganisms can be abused as agents of bio warfare and bioterrorism. In the practical component of the course you will carry out and compare classical and molecular approaches used for the identification of bacteria. This will give your hands on experience of handling bacteria and give you the opportunity to put into practice the aseptic technique that you learned in the first year. The molecular approach for identification is based on PCR and sequencing and will build on what you learned in the first semester module Molecular Biology and its Applications (BIO230). In the Fungal growth and virulence? Workshop you will work through data on fungal growth in liquid and solid culture and on different methods for the assessment of fungal virulence.In the Fungal growth and virulence” workshop you will work through data on fungal growth in liquid and solid culture and on different methods for the assessment of fungal virulence.This module builds on the first year module Microbiology and Infectious Disease (BIO153). It is essential for students wishing to specialise in Microbiology during their degree course and those wishing to study Applied and Environmental Microbiology (BIO303) or Molecular Basis of Bacterial Infection (BIO305) in the final year. It also provides essential microbiology for students pursuing subjects of related interest such as Genetics and Human Biology. |
| **Module outcomes:** | By the end of the module the student should be able to:* Demonstrate an understanding of the nature and biology of bacteria, fungi and viruses and their medical and economic importance
* Discuss the common themes that underpin our understanding of the diseases caused by different groups of microorganisms
* Describe, using specific examples, how microorganisms have been exploited by humans and how this relates to their underlying characteristics
* Demonstrate practical skills required for the investigation of micro-organisms, and discuss the different techniques employed
* Analyse and interpret data in order to make judgements and formulate arguments. Work as a group to produce a microbiology resource.
 |
| **Delivery:** | Lectures, practical classes and workshops |
| **Assessment:** | Continuous Assessment (40%)* Group assignment to produce a microbiology resource (20%)
* Data handling test based on the workshops and practical work (20%)

Written examination (60%)* 2 hour paper with essay and short answer questions.
 |
| **Feedback** | On line feedback on your microbiology resource. There will be a feedback and revision session based on the formative assessment to help you to prepare for the data handling test. |

| **03 23326 BIO261** | **Proteins and Enzymes** | **Credits: 20** |
| --- | --- | --- |
| **Level: I** | Semester: 2 | **Module Organiser: Dr M Baker****Teaching Staff: Drs Madigan, White, Winn, Prof Dafforn** |
| **Module Description:** | The module aims to examine how the three -dimensional structures of proteins relate to their particular functions. It first describes common protein motifs and homology modelling. It then explains the biophysical basis behind techniques used for protein characterisation; including circular dichroism, fluorescence, NMR spectroscopy, X-ray crystallography and analytical ultracentrifugation. It evaluates methods to determine the rates of enzymes and the mechanisms of enzyme action, and examines the structure and function of protein complexes |
| **Module outcomes:** **Pathways:** | By the end of the module the student should be able independently to :* Explain how the amino acid sequence of a protein is related to its structure and hence to its function, including simple ideas of protein evolution and common secondary structure motifs.
* Describe common protein folds and structural motifs, and relate these to the functional roles of motifs, and how the structures are stabilised.
* Evaluate techniques used to determine the primary, secondary, tertiary and quaternary structures of proteins, and explain the biophysical principles behind these techniques.
* Discuss the mechanisms underlying the catalysis of reactions by certain enzymes and methods used to determine enzyme rates and mechanims.
* Analyse and interpret numerical data of ligand binding, UV spectroscopy, pH and enzyme kinetics, including the use of SigmaPlot.
* Download, display, and examine protein structures from the RSC protein data base.

The course continues from the descriptions of proteins, enzymes and biophysical techniques in first year modules.  It complements BIO262 in the first semester and aspects of CHM252, in particular spectroscopy. Students are expected to know the relevant material from these modules. Natural Sciences students who have not taken these modules should inform the course organiser, in case they need additional background reading or support. Information from this module will form part of the basis of BIO340 in the third year. It is also relevant to many of the third year modules, in particular BIO311- ‘Structures of Destruction’.In addition to the academic content, this course develops data handling skills and begins to discuss experimental design and interpretation, both in the workshops and in the practical classes. |
| **Delivery:** | Lectures, practicals, computer cluster sessions, data-handling classes, posters.  |
| **Assessment:** | **Continuous assessment (35%)*** Practical write up - 15%
* Data-handling test - 20%

**2 hour examination (65%)*** This will be a 2 hour examination comprising of essay questions and short- answer questions. These may include some data-handling problems.
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| **03 23328 BIO262**  | **Membranes, Energy & Metabolism** | **Credits: 20** |
| --- | --- | --- |
| **Level: I** | Semester: 1 | **Module Organiser: Dr Scott White****Teaching Staff: Dr Alderwick, Dr Kreft, Dr Knowles, Dr Dunn** |
| **Module Description:** | This course aims to illustrate the pivotal role of biological membranes in the cell physiology of prokaryotes and eukaryotes, including both plant and animal cells. Lectures and student-centred activities will explore this subject under three broad themes.● The role and properties of membranes: lipid and protein components; how membranes define compartments; techniques and methodologies.● Energy generation within the cell: electron-transfer pathways; generation of ATP; oxidative phosphorylation and photosynthesis.● Metabolism: gluconeogenesis and the pentose phosphate pathway; the Calvin cycle; regulatory mechanisms and the control of metabolic pathways; the influence of hormones and other factors. |
| **Module Outcomes:** | By the end of the module students should be able to:* explain the principles of membrane fusion and give an account of the various methods used to study membranes;
* Calculate bioenergetic parameters based upon redox values and other types of data; describe the properties and functions of electron transfer pathways and their protein and redox components;
* explain the integration of anabolic metabolism with photosynthesis and energy metabolism;
* Compare and contrast microbial energy systems with those of eukaryotes; recall the metabolic pathways and discuss how they function within the cell; explain the concepts of allostery, metabolic flux, and hormonal regulation of metabolism.

In addition, through participation in practical classes, workshops and group work, students should be able to:* Follow experimental protocols to investigate enzyme catalysed cleavage of phospholipids, lipid separation and redox reactions;
* record and analyse experimental TLC and redox potential data;
* complete lab reports on the module experiments, evaluate data and draw conclusions;
* Analyse data from bioenergetics and membrane studies by tackling problem-based questions.
 |
| **Pathways:** | The module builds on concepts taught in Year 1, the essential roles of lipids and membranes, how energy is generated and stored and how metabolism is regulated. The module links well with other Year 2 modules, e.g. Microbes and Man, Cell Physiology and Proteins and Enzymes, especially when analysing individual protein and enzyme components of biological membranes. Whether studying lipid components, analysing transport through membranes or calculating bioenergetic parameters, data handling is an essential skill that we will develop in the practical’s and data-handling workshops. The module is an invaluable foundation for several Year 3 modules, including Cell Signalling, Microbiology, and Biochemical Data Handling and Interpretation. |
| **Delivery:** | Lectures, Practical’s, Data handling classes and directed independent learning. |
| **Assessment:** | **In-course Assessment – 30%** * Practical 1 Snake Venom – 15%
* Practical 2 Redox consisting of pre-practical test and Lab write-up 15%

**Examination May/June – 70%*** 2 hour written examination in May/June consisting of essay and short answer questions.
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| **03 24985 BIO268**  | **Cell and Developmental Biology** | **Credits: 20** |
| --- | --- | --- |
| **Level: I** | **Semester 2** | **Module Organiser: Dr Yun Fan.****Teaching Staff:**  TBC |
| **Module Description:** | This module will cover relevant areas in the understanding of cell and developmental biology, with a major focus on the methods and model systems employed in these areas. Particular focus will be placed on the synthesis and trafficking of proteins in the cell, as well as the mechanisms through which cells physically interact with each other and the extracellular matrix to regulate differentiation and function. Development of multicellular organisms will be analysed from the regulation of stem cell function to the differentiation of organs. |
| **Module outcomes:****Pathways:** | By the end of the module you will be able to:* describe relevant model systems for use in Cellular and Developmental Biology
* evaluate relevant methods in Cellular and Developmental Biology
* Recognize, recall and define terms and processes relevant to the study of the cytoskeleton, cell adhesion, the extracellular matrix, cell migration and epithelial differentiation
* critically evaluate stem cell biology
* discuss the mechanisms regulating organogenesis and differentiation
* understand the complexity of programmed cell death and how it is involved in development

This module builds on information regarding Molecular Cell Biology and Cellular Physiology obtained in the first year (e.g. BIO152: Cell Biology and Physiology), as well as methodological approaches linking to information previously gained in first year modules (e.g. BIO139: Human Biochemistry). Aspects of this module will be important in third year modules (e.g. BIO387: Cancer Biology, as well as BIO384: Human Reproductive Biology and Development, and BIO398: Plant Sciences in the 21st Century). The practical component of this module will teach students methods for the analyses of cultured cells. |
| **Delivery:** | 24 Lectures, 2 interactive sessions and one practical |
| **Assessment** | **In-course assessment (30%)*** Practical write-up (10%)
* Class test (20%)

**Examination in May (70%)**2 hour written examination in May/June consisting of essay and short answer questions |

| **Banner: 03 24986 BIO270**  | **Field course: Adaptations to Aquatic Environments** | **Credits: 20** |
| --- | --- | --- |
| **Level: I** | Semester: 2Easter vacation  | **Module Organiser: Dr Julia Lodge****Teaching staff: Dr Julia Lodge, Dr Steve Publicover, Dr Julia Myatt, Dr Neil Hotchin** |
| **Module Description:** | The module is a field course based in Orielton Pembrokeshire. You will be able to spend 2 days on the sea shore at Orielton examining the conditions on the sea shore that make it a unique life support system, and how representatives of different animal and plant phyla have adapted their behaviour and physiology to meet the variable conditions prevailing in their natural environment. A major feature of the course is the opportunity to spend a further 4 days as part of a small group on a project designed to examine physiological or behavioural adaptations to aquatic environments. This work will then be written up independently. Students will be expected to present their findings orally. The module will allow students to develop planning and organisational skills as well as skills of experimental design, data analysis, communication and teamwork.The lecture component of the module will introduce you to the biotic and abiotic characteristics of the marine environment with particular reference to the littoral (shore) zone. You will learn about the abundance and diversity of animals and plants that inhabit the marine littoral and their specific adaptations to life in this challenging and highly unpredictable environment.Note that this course will only run if sufficient numbers of students are recruited. If the ceiling is not reached students may be offered another related field module or asked to take an additional conventional module. |
| **Module Outcomes:** | By the end of the module students should be able to:1. Identify key species found on the seashore environment at Orielton.
2. Explain, using specific examples, how environmental conditions change in different zones of the seashore environment, and how these changes influence the distribution, abundance and diversity of the resident fauna and flora.
3. Describe the range of physiological and behavioural adaptations that allow organisms to survive and reproduce in this environment
4. Show competence in some basic field, lab and analytical techniques for studying animal and plant diversity and distribution
5. Keep a formal record of data collected in the field using a field journal
6. Work in small teams and individually to solve the practical and theoretical problems encountered during field or laboratory projects
7. Write up an independent research project to provide an evidence base supporting the

achievement of learning outcomes 1-6Present the results of research/practical work and communicate these findings orally. |
| **Pathways:** | This Field Course module is part of a suite of field based opportunities offered to second and third year Biological Sciences and Natural Sciences students. It is ideal for students who want to develop field study skills or to study animals and plants in the field. It builds on the environmental biology part of First Year Ecological Concepts and Plant Sciences and on *Introduction to* Evolution and Animal Biology. It works well with second year modules: Animal Biology. In the final year students who wish to do further field work can choose to take the field project module and there are also opportunities to do a field based project. |
| **Delivery:** | One week filed course, 12 hours of lectures. |
| **Assessment:** | Essay on the sea shore environment (20%)Species identification test (20%) Written report on field course project (35%)Field course performance: including individual species description and field note book (15%) Oral presentation (10%) |
| **Feedback:** | Feedback is provided on the essay before the field work component of the module. Opportunities for formative feedback on your project report are provided during the field course. |
| **Additional Information** | The field course will run during the Easter vacation, you should be aware that this will impinge on revision time for your summer examination; students often bring revision with them. You will be required to be available for 8 days, during the Easter Vacation; this includes travel to and from the field studies centre. Students are required to make a contribution towards the cost of the field course (£200).  |

| **03 26999**  | **BIO273** | **Human Structure and Function** | **Credits: 20** |
| --- | --- | --- | --- |
| **Level: I** | Semester: 2 | **Module Organiser: Dr Eleanor Cull** | **Teaching staff: To be announced** |
| **Module Description:** | Having completed this challenging and diverse module, students will have a broad appreciation of the structure of the human body, and how this relates to its function and evolutionary origin. Anatomy is taught under four major themes: (1) Anatomy as a science – understanding the human body from the point of view of evolution and development; (2) Microanatomy – a brief survey of the cellular organisation of body tissues; (3) The structure and function of body systems – a survey of the topography of the entire body from a systems-based perspective, with consideration of how the gross anatomy relates to the function of each system; (4) The human body in a broader context – further discussion of the importance of evolution and development using specific illustrative examples. The module employs a diverse range of teaching methods including interactive lectures and the discussion of real-life clinical cases. Students should be aware that some lectures contain graphic images and videos of surgical operations and diseases.  |
| **Module Outcomes:****Pathways:** | By the end of the module students should be able to:* Discuss the different approaches to thinking about human structure and function
* Demonstrate an appreciation of the complex links between development, evolution and human structure and function
* Discuss the evolution of some of the major anatomical adaptations of *Homo sapiens*
* Describe the basic topographical anatomy and histology of the systems of the human body
* Discuss the relationship between the structure and function of cells, tissues, organs and systems
* Compare the structure and function of the human body with the bodies of other vertebrates and explain the relevance of such comparisons
* Analyse, from the point of view of evolution and development, the apparently anomalous organisation of certain anatomical features
* Outline the real-world applications of a sound understanding of human structure and function
* Use the primary literature to defend a particular anatomical fact presented in a textbook
* Develop an understanding of the three dimensional arrangement of body structures
* Communicate in a variety of ways including posters

**BIO273 builds on topics initially established in the following 1st year modules:**BIO139, BIO145, BIO152 and BIO152L**BIO273 also complements the content of other second year modules, notably:**BIO213, BIO268, BIO277 and BIO278 |
| **Delivery:** | Lectures, practical’s, workshops |
| **Assessment:** | **In course assessment** – 40% comprising:* Practical write-up (20%)
* MCQ Test (20%)

**Examination** – 60%* 2 hour written examination in May/June consisting of essay and short answer questions
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| **03 28780**  | **BIO277** | **Evolution of Humans and Other Animals** | **Credits: 20** |
| --- | --- | --- | --- |
| **Level: I** | Semester: 1 | **Module Organiser:** **Dr Blanchard** | **Teaching Staff: Dr Chappell, Dr Brandstaetter, Dr Myatt** |
| **Module Description:** | The primary aim of this module is to provide students with a comprehensive understanding of comparative animal biology in an evolutionary context. Humans are part of the animal kingdom, and our own evolution is also best understood from this perspective. We will develop student understanding of evolution in the four dimensions in which it occurs: genetic, epigeneic, behavioural and symbolic, and how these dimensions interact in different ways in different species during the process of evolutionary change. We will explore numerous examples that point to the fact that evolution shapes biodiversity, not merely by the rise and fall of species over millions of years, but also by the often rapid transition of species traits from one form to another at pace with rapid environmental changes, some caused by humans. Having obtained this broad overview, we will focus on the processes by which evolution operates in the four dimensions, resulting in adaptation and/or speciation, by studying key themes in animal biology, such as the evolution of the circadian system, sociality, locomotion and tool use. In so doing, the course will expand student understanding of core evolutionary concepts such as convergent evolution and units of selection, and will broaden their knowledge of the origins and maintenance of biodiversity.  The module will include a number of practical’s to give students experience of handling and interpreting fossil material, particularly Mesozoic reptiles and great apes, including early hominins. These practicals will help students understand the extent to which it is possible to infer behaviour, social organisation, culture, ecological context etc. of extinct animals from the fossil record. We will also have workshops to facilitate thought experiments on the evolutionary consequences of future events (e.g. major climate change or key species being wiped out) and to debate, within the group, pressing questions surrounding evolution.   |
| **Module outcomes:****Pathways:** | By the end of the module students should be able to:* Understand that in addition to genetic inheritance, epigenetic, behavioural and cultural inheritance provides variation on which natural selection can act
* Critically compare and synthesize information from molecular biology and behavioural ecology to develop an integrated underestanding of the four dimensions through which evolution occurs
* Describe major events in animal evolution and their impact on biodiversity
* Explain how human adaptations show that modern humans and our ancestors have been subject to the same evolutionary processes as the rest of the animal kingdom
* Understand the origins of different forms of similarity between different species, and be able to differentiate between them, using examples
* Understand and discuss evolutionary principles sufficiently well to be able to 1) conduct thought experiments on the evolutionary consequences of future events and 2) convey evolutionary principles and events in an appropriate way for school children to understand
* Work as a team to examine fossil remains to establish genus/species, morphological similarities and key life history traits
* Formulate and express own ideas concisely through independent learning and writing
* Construct a logically sound well structured argument when writing and be able to recognise and critically analyse weak arguments when reading them
* Use the skills gained in the peer marking sessions to reflect on ways to improve their own academic writing

BIO277 links to the evolutionary principles and introduction to human evolution covered in BIO145, and provides a firm basis for the final year module in Human Evolution (BIO380). Since the course seeks to understand the forces that have driven human evolution, it also links to all courses that address the way in which animals, particularly mammals, interact with their physical and social habitats, and thus their ecology. |
| **Delivery:** | Large Group (120) lectures, smaller group (60) practical’s, large group workshops including small groups of discussion |
| **Assessment:** | In Course Assessment (100%)* A group produced poster to present evolutionary principles to miseum visitors (25%)
* On-Canvas pre/post practical quizzes linked in with the lecture mateiral (25%)
* A final maximum 2000 word essay (50%) to be completed over the Christmas holiday. Students will be able to choose from four questions, designed to synthesise subject areas. The aim is to focus on developing skills in critical analysis and synthesis, rather than on short-term recall of information.

Reassessment: 2,000 word essay chosen from four questions to be completed by the re-sit exams |

| **03 28222**  | **BIO278** | **Animal Biology: Principles and Mechanisms** | **Credits: 20** |
| --- | --- | --- | --- |
| **Level: I** | **Semester 2** | **Module Organiser:** **Dr Mary Blanchard** | **Teaching Staff: Dr Publicover, Dr Chappell, Dr Myatt** |
| **Module Description** **Module outcomes:****Pathways:** | The central theme of this module is to cover aspects of comparative Zoology. Animals display specific adaptations in their morphology, physiology, and behaviour to the environments they live in. These adaptations reflect the ecological diversity and adaptive radiation of animals. During this module we will explore how environmental adaptation has. It will also consider animals? Responses to human related environmental changes, such as those caused by climate change and urbanisation. The module consists of lectures, practicals and interactive tutorials, i.e. workshops that will build the foundation for the practical work and encourage independent active learning.By the end of the module students should be able to: Demonstrate an understanding of different animal systems and how they are morphologically, physiologically, and behaviourally adapted to the environments they live in. Demonstrate an understanding of how animals adapt to cope with environments human altered environments. Collect, record, handle, interpret and write-up scientific data and be able to apply skills this knowledge to novel problems. This module sits between your first year studies in BIO145 and BIO152 and the more research focussed modules in the final year, such as BIO392, BIO397, and a wider range of final year projects. The knowledge you will acquire in this module will provide an excellent preparation for the scientific writing you will undertake in final year projects in the fields of Neuroscience, Circadian Biology, and Animal Behaviour. |
| **Delivery:** | Lectures, practicals and tutorials. |
| **Assessment** | ***Continuous assessment*:** 40% comprising:Practical report write up with a formative and summative element and a component of peer marking (20%)Project proposal summary 500 words (20%)Examination in May (60%)Two hour examination comprising essay and short-answer questions.  |

| **03 30145**  | **BIO279** | Critical Issues for 21st Century Ecosystems | **Credits: 20** |
| --- | --- | --- | --- |
| **Level: I** | Semester: 2 | **Module Organiser:** Dr Nigel Maxted |  |
| **Module Description:** | **Module Aim**: To provide core skills in ecosystem knowledge and lead into for third year research led-modules. **Module background**: This module will provide a second-year module that bridges the generalised first year and research-focussed third year modules in ecology/conservation. It will provide you with an ecosystem approach which is truly dynamic in its content and delivery, reacting to issues of the ‘moment’. It is an opportunity for you to experience research-led teaching as the themes taught in the module are directly related to core College research themes.**Module structure**: The module would be structured around four semi-independent topics related to critical issues in biosystems/ecosystems that map onto expertise within both BIOS and GEES. The topics covered each year may include for example: Climate change, Food security, Pollution, Over-harvesting, Threatened ecosystems, Anthropomorphic ecosystems, Ecosystem valuation & conservation.* **Lectures** will be based around case studies that promote skills training but not exam assessment.
* **Practical/skills session:** These will include off site visits and will allow you the opportunity to collect and analyse ecological data
* **Mini-projects:** Students will select one of the four topics and undertake the mini-project. Students will work in groups containing a deliberate mix of Bio and GEES students to get diversity of skills and perspectives.
 |
| **Module outcomes:** | **By the end of the module the student will be able to:*** Explain key scientific, political and ethical issues associated with global and local ecosystem valuation, threats and maintenance.
* Design and organise experiments, collect, record, analyse and interpret data.
* Discuss strategies and techniques to sustain ecosystem services for humankind in the future.
* Present results orally and in written format suitable for a scientific paper or conference presentation, individually or as a group, so as to contribute to the existing scientific knowledge base.
 |
| **Delivery:** | Large-group lectures, small group problem solving, tutorials, seminars. |
| **Assessment:** | Topics assessment (40% of module mark): * Class test to include data interpretation and analysis and SAQs (25%).
* Ministerial briefing (15%).

Mini-project assessment (60% of module mark): * 1 page Project plan (group 15%),
* 15 min group research report presentation (group 25%)
* 2,000-word project report (individual 60%).

Reassessment: Repeating failed components, module mark capped at the pass mark. |

| **03 23344**  | **BIO305** | Molecular Basis of Bacterial Infection | **Credits: 20** |
| --- | --- | --- | --- |
| **Level: I** | Semester 2 | **Module Organiser:**  Luke Alderwick |  |
| **Module Description:** | During this module, students will become familiar with a number of important human pathogens and gain a detailed mechanistic understanding of how these bacteria cause infection at the molecular level. Drawing on a range of state-of-the-art experimental and analytical approaches, including analysis of genome sequence data, students can expect to discover a more in depth approach to pathogen biology which is the molecular basis of bacterial infection. Through lectures, case studies and computer- and lab-based practical classes students will become familiar with the principles and practice of research addressing the molecular basis of bacterial infection and how this thriving area of science underpins a major our objective of discovering the next generation of antibiotics. Students will thus gain an integrated view of the subject which will equip them for postgraduate research in this area and for employment ; as clinical scientists |
| **Module outcomes:** | By the end of the module the student should be able to: * Describe the molecular mechanisms that bacteria use to cause disease, including the evolution, ecology, genetics and regulation of virulence.
* Outline the pathogenesis of selected bacterial infections.
* Explain the biogenesis of the bacterial cell envelope and its components, highlighting their roles in virulence and interactions with the metazoan immune system.
* Elucidate the mechanisms for targeting virulence-related proteins to and across the cell envelope, including the biogenesis and function of relevant multi-protein complexes.
* Understand the mode of action of current antibiotic treatments and what is being done to develop the next generation of antibiotics.
* Describe the structure and evolution of bacterial genomes and the molecular genetics that contribute towards pathogenicity and virulence.
* Understand the concept of comparative bacterial genomics.
* How to perform BLAST searches, sequence alignments and other additional bioinformatics analysis (via EXPASY) to make predictions on bacterial gene function
* Demonstrate a basic competence in the analysis of laboratory experiments relevant to bacterial pathogenesis...
 |
| **Delivery:** | Lectures, Laboratory practical work, project work involving sequence data analysis and interpretation |
| **Assessment:** | In-course assessment (30%)* Laboratory practical assessment

3 hour written examination in May (70%) |

| **03 25343**  | **BIO317** | **Bacterial Gene Regulation** | **Credits: 20** |
| --- | --- | --- | --- |
| **Level: H** | **Semester: 2** | **Module Organiser: Professor Busby** | **Teaching Staff: Prof Thomas, Dr Grainger, Dr Bhatt** |
| **Module Description:** | The ability of bacteria to survive in a variety of environments depends on their ability to regulate gene expression in response to various environmental signals. In this module, students will learn how proteins regulate transcription by their interaction with DNA, resulting in changes in metabolism, transposition, differentiation and phage. Particular attention is paid to the process of transcription by RNA polymerase, the role of sigma factors in controlling transcription specificity how environmental signals are transmitted across the cytoplasmic membrane, and the way that sequential expression of sigma factors determines cascades of gene expression during differentiation. This module introduces students to (I) the different levels of regulation during gene expression in bacteria and the mechanisms whereby control is exerted (ii) current methods for studying gene expression and regulation. It also provides opportunities for students to prepare work based on original scientific literature, and to present the material through formal delivery and informal discussion. Student's problem solving ability is developed through data handling classes. |
| **Module outcomes** | By the end of the module students should be able to* Understand the different levels of gene control in bacteria, including the circuits that allow differentiation and multicellular behaviour.
* Be conversant with the current methodology for studying gene expression and control.
* Be able to work in groups and alone to solve problems relating to gene expression and regulation
* Be able to analyse and explain orally current work based on the primary scientific literature.

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| **Delivery:** | Lectures, tutorials/data handling |
| **Assessment:** | **In-course assessment - 30%*** Data-handling Test

**3 hour written examination in May - 70%** * Reassessment: Resit in August
 |

| **03 11221 BIO325** | **Eukaryotic Gene Expression** |  **Credits: 20** |
| --- | --- | --- |
| **Level: H** | **Semester: 1** | **Module Organiser: Dr Minchin****Teaching Staff: Dr Brogna, Dr Soller** |
| **Module Description:** | Regulation of gene expression in eukaryotes is essential for development and physiological function in health and disease. The undoubted complexity of multicellular organisms arises from the differential expression of the genetic material, which is essentially the same in all cells. What makes humans different to other mammals is not major difference in gene content, but differences in the expression of homologous genes. The module will initially cover generic features of the transcription machinery, the role of regulatory proteins in controlling gene transcription and the importance of chromatin structure. This will lead into a more detailed analysis of the control of gene transcription and its role in development, health and disease. It will then cover the mechanisms of post-transcriptional pre-mRNA processing, mRNA degradation and translation. More in depth coverage will discuss the how post-transcriptional processes can be controlled to regulate gene expression. Students will also learn about the importance of non-coding RNAs including miRNAs. The biological importance of post-transcriptional control will be illustrated by discussions of topics including gene imprinting, x-chromosome inactivation, nonsense-mediated decay.The course is taught as a series of lectures. In addition, communication skills will be developed in a series of “News & Views” workshops in which students will develop the ability to research, critically evaluate, assimilate, and précis information and then produce a written report. The other in course assessment is in the form of an examination style essay. This gives students the opportunity to practice examination skills, particularly how to structure an essay to answer an examination question and how to use additional material in their answer. The feedback on this assessment will help you to develop these skills further |
| **Module Outcomes:** | By the end of the module students should be able to recognise, recall and define terms relevant to the study of: * Nuclear organisation
* Gene transcription by RNA Polymerases II
* Control of gene transcription by activator and repressor proteins, co-activators and co-repressors
* Epigenetics
* Pre-mRNA processing (5? capping, polyadenylation and splicing)
* mRNA translation and turnover
* Post-transcriptional control of gene expression.
* Define the key molecular mechanisms that control the expression of eukaryotic genes;
* Describe nuclear organisation and its role in gene expression
* Explain the regulation of gene transcription of eukaryotic genes, including critically evaluating the roles of different factors during the transcription cycle
* Explain and contrast different epigenetic mechanisms used to control gene expression
* Discuss the role of gene expression in development, health and disease
* Describe pre-mRNA processing and discuss how transcription and pre-mRNA processing are coupled.
* Discuss how gene expression can be controlled post-transcriptionally (editing, alternative splicing and polyadenylation)
* Describe and evaluate current approaches in gene therapy for correcting RNA processing defects
* Explain and contrast the role of miRNAs and siRNA in control of gene expression
* Analyse, interpret, precis and comment on the impact of the scientific literature.

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| **Delivery:** | Lectures and Workshops |
| **Assessment:** | In-Course Assessment (30%); Examination style essay question3 hour examination in May (70%) |

| **03 28011 BIO335** | **Human Health and Disease** | **Credits: 20** |
| --- | --- | --- |
| **Level: H** | **Semester: 1** | **Module Organiser: TBC** |
| **Module Description:****Module Outcomes:** | This is a challenging module using a selection of common disease states to illustrate some advanced aspects of anatomy and physiology. Additionally, students will be exposed to concepts relevant to clinical practice and also introduced to ethical principles that are applied in research and clinical settings.By the end of the module students should be able to.* Discuss the concepts of `health? And `disease?
* Show an understanding of the anatomy and physiology relevant to cancer, cardiovascular disease and trauma which can be applied to unfamiliar scenarios
* Discuss some of the ethical implications of clinical practice and also of laboratory research Apply and integrate relevant anatomical and physiological knowledge and skills acquired from topics covered in modules from all years of their degree programmes
* Understand the importance of some basic clinical skills Participate in group discussions of basic and applied research and ethics Create a written resource for communicating complex science using non-technical language
 |
| **Pathways:**  | This module builds on the material covered in BIO273 (Human Structure and Function). BIO335 complements content delivered in a number of other third year modules including BIO384 and BIO387. |
| **Delivery:** | Lectures, seminars, laboratory practical’s, clinical skills practical’s |
| **Assessment:** | **In-course assessment – 30%*** Policy Briefing document

**3 hour written examination in May/June – 70%*** Final year students who miss their examinations due to mitigating circumstances will be required to sit them at the next opportunity (i.e. Summer Exam Period of the following year)
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| **03 27876 BIO336** | **Conservation Practice: Genes to Ecosystems** | **Credits: 20** |
| --- | --- | --- |
| **Level: H** | Semester: 2 | **Staff responsible: Nigel Maxted** |
| **Module Description:** | **This is a stand-alone module but complements GGM317 Biodiversity and Conservation Management which runs in Semester 1** The course examines the scientific basis for conservation, its genetic foundation, why population size is critical and how biodiversity is maintained either in nature or at a backup location. The relevance of key areas of biology, such as genetics and ecology, to conservation practice are emphasised using case study examples for primate, bird, carnivore and plant genetic resource, as well as freshwater and upland peat habitat, conservation. A practical approach to conservation is further illustrated by a review of environmental ethics, ecosystem services, ecological restoration and how conservation action can be enhanced by working with local communities. |
| **Module outcomes:** | By the end of the module students should be able to:* Have gained an understanding of key scientific, political, economic and ethical issues associated with conservation biology, both globally and locally.
* Be able to discuss the strategies and practical techniques used to conserve biodiversity at the genetic, species and habitat levels, and set practical conservation in the local community development context.
* Have an understanding of how the basic principles of conservation biology are applied to major groups of taxa and specific habitats, which provides the ability and confidence to formulate effective management policies and conservation strategies.
* Have acquired general skills in acquisition of knowledge, problem solving and the presentation of ideas.
 |
| **Delivery:** | 19hrs Lectures, 12hr seminars, 2hrs tutorials |
| **Assessment:** | **In-course assessment - 50%** * Mock grant application (50%)

3 hr written Examination in May/June - 50%* Resit exams are not available for level 3 (final year) modules
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| **03 30948 BIO351** | **Omics for Biomedical Research** | **Credits: 20** |
| --- | --- | --- |
| **Level: LH** | Semester: 2 | **Staff responsible: John Colbourne** |
| **Module Description:** | The aim of this module is to familiarise students with the `state-of-the-art? Omics approaches used in biomedical research and to demonstrate how omics technologies have led to identification of novel biomarkers that will enable a future medical need for personalised/stratified medicine. During this module the students will cover the following topics:  1. Introduction to 'omics' technologies  2. Genomics  3. Transcriptomics  4. Epigenomics  5. Proteomics  6. Metabolomics  7. Integration of multi-omics data  Standard lecture formats will be used to introduce the students to various omics approaches and technologies and will include research-led teaching tutorials from leading experts to discuss current leading research. Furthermore, students will be presented with a series of assessed case studies focusing on several omics-based approaches to achieve a better understanding of how omics technologies are applied to specific areas of research. In addition, the students will have the opportunity to answer specific scientific questions using appropriate omics technologies in a series of assessed computer based workshops. This will provide the students with first-hand experience of learning about the multiple steps (e.g. experimental design, experimental step, data analysis and interpretation) involved in using omics platforms in research. |
| **Module outcomes:** | By the end of the modules, students should be able to* Compare and critically evaluate a range of cutting edge omics technologies and platforms and assess their application to biomedical research
* Apply the knowledge they have gain throughout the course to critically compare different technologies and choose the most appropriate tools to answer specific biological questions
* Critically evaluate the criteria of a great experimental design for different omics technologies and formulate an ideal omics experiment
* Select and apply appropriate resources for analysis, visualisation and interpretation of omics data.
 |
| **Delivery:** | Lectures, seminars and workshops. |
| **Assessment:** | * Four short reports (1000 words) of the workshop sessions, with one report being a formative assessment (60%)
* One recorded PowerPoint presentation (30%)
* Interaction in the three Case studies during research seminars (10%)
 |

| **03 30790 BIO352** | **Current Developments and Advances in Eukaryotic Genetics**  | **Credits: 20** |
| --- | --- | --- |
| **Level: H** | Semester: 2 | **Staff responsible: Module Organiser: Dr Sanchez-Moran****Teaching Staff: Dr Leach** |
| **Module Description:** | Genetics underpins all aspects of biology and recent developments in genomics together with novel analytical approaches are providing new insights into the molecular basis and evolution of genetic variation. This module will examine genetic variation from the chromosomeal level through to populations focusing on humans and relevant examples from model organisms. The module will study the dynamics of chromosome organisation during mitosis and meiosis; how chromosome variation is related to ageing, cancer and genome instability and chromosome evolution. The genetic control of qualitative and complex quantitative traits such as intelligence, body weight and hypertension will be considered together with the methodologies that have been developed to identify the genes involved. Students will be given tutorials and workshops to help you with this part of the module. |
| **Module****outcomes:****Pathways:** | By the end of the module, students should be able to: Demonstrate an awareness of the importance of genetic variation; Understand the theoretical framework underpinning the analysis of genetic variation; Understand the implications of genetic variation in regard to genetic disease; the identification of quantitative traits and genome evolution; Describe the experimental approaches that are used to investigate genetic variation at all levels ranging from chromosomes to populations; Analyse and interpret data produced by these experiments This Module follows your first and second year studies in Genetics (BIO154 & BIO265). You will find that the module concentrates in Eukaryotic genetics especially in human genetics. You will use the knowledge that you developed in Genetics I (BIO154) in the especially about how is stored the genetic information, and how it is transmitted: mitosis and meiosis; how DNA damage produces mutations. Furthermore, you also will use the accumulated knowledge in Genetics II (BIO265) especially about the organisation and structure of genes and genomes in higher eukaryotes; the basis by which genetic variation arises and is transmitted from generation to generation; the phenomenon of epigenetic inheritance; the molecular basis of gene regulation and the methods used to analyse gene expression. Students will familiarise with a range of genetical techniques applicable to humans and other higher eukaryotes that could be useful for a wider range of final year projects. You will find that the module complements the third year modules BIO325 “Eukaryotic Gene Expression”, BIO387 “Cancer Biology” and BIO398 “Plant Science in the 21st Century”. The skills you will develop in analysing data and researching bibliography during your in-course assignments will provide you with an excellent preparation for your exams and project dissertations in the final year. |
| **Assessment:** | **In-course Assessment** (35%)* Quantitative analysis (mini-project)

**3 hour written examination in May - (65%)****Reassessment: Not available for Level H modules.** |
|  |  |

| **03 31872 BIO353** | **Global Challenges and Plant Science** | **Credits: 20** |
| --- | --- | --- |
| **Level: H** | Semester: 2 | **Module Organizer: Christine Foyer.****Teaching Staff:**  |
| **Module Description:** | This module aims to show how plant science underpins current real-world problems such as food supply, biofuel production and climate change using up-to-date scientific literature and interactive teaching sessions.  Specifically, you will learn how plants respond to changes in the environment and how plant growth and development can be analysed and manipulated using state-of-the-art experimental techniques. You will read research papers and learn how to critically analyse them to facilitate learning. You will use case studies to illustrate broader principles of plant science, and how these lead to ways to address global challenges such as improving crop production. The module content will include: (i) Plants? Importance in society and the economy: the past and the future. (ii) How plants cope with stresses including climate-related changes and threats from other organisms using hormone- and cell-signalling pathways. (iii) Regulation of plant developmental processes. (iv) Understanding how plant breeders use next-generation sequencing and QTL-based approaches to generate new, improved crop varieties. (v) Explore the need for genetically modified crop plants and how they can be used in modern agricultural practices.  The subject-based aims of this course are to foster the learning of plant science, and to extend knowledge of the range of techniques that are currently used in this research area. Skills-based aims are to foster the ability to interpret data, to understand hypothesis-driven scientific research and to present findings of your analyses.. |
| **Module outcomes:** | By the end of the module students should be able to: * Understand how modern plant science tackles real-world problems and apply this knowledge to a range of situations.
* Understand recently published papers in selected areas of plant science
* Summarise and present results of independently reviewed literature to others.
* Critically review reports of experiments in plant science, including interpretation of experimental data.
* Design experimental strategies that could be applied to answer specific questions in the plant science discipline
 |
| **Assessment:** | **In-course assessment 50%** * Written work assimilating, analysing and summarising data from a range of scientific studies in a form suitable for stakeholders (such as industry or government) to address real-world food security issues. (25%)
* Scientific paper analysis (25%)

**3hr written examination in main summer examination period (50%)** |

| **03 14675 BIO379** | **Cellular Neurobiology** | **Credits: 20** |
| --- | --- | --- |
| **Level: H** | **Semester: 1** | **Module Organiser: Dr Hidalgo****Teaching Staff: Dr Hidalgo**  |
| **Module Description:** | This module examines current progress on the understanding of central nervous system development and function, based upon the exploitation of anatomical, genetic, molecular and advanced physiological techniques. The physiology and molecular biology of neurons is examined. These topics will be covered: how neuorons work; synaptic transmission and plasticity, and the techniques to record it; how the brain works; how all the above are grounded on nervous system development. We will pay particular attention to cellular, genetic and molecular mechanisms. Most if not all mechanisms that give rise to the nervous system are conserved in all animals, but they were often discovered using model organisms. Thus, we will compare findings from the fruit-fly Drosophila, the worm C.elegans and vertebrate models like birds and rodents. These mechanisms include, cell fate (e.g. neural or glial) determination, regulation of growth, adjustment of neuronal and glial cell number through the control of cell survival and cell proliferation, axon guidance and targeting, formation of topographic maps in the brain, synapse formation and elimination structural plasticity, learning and memory. Structure enables brain function, which in turn influences brain structure. Thus, we will look at how when things go wrong, these same principles and mechanisms result in brain disease. Conversely, we will explore how developmental mechanisms can be used to promote brain health, and regeneration and repair upon injury or disease. Thus we will look at brain diseases, e.g. neurodegenerative diseases, depression and spinal cord injury, multiple sclerosis, etc., and current therapeutic approaches on how to treat or mend the diseased or damaged CNS. Throughout these topics, we will look at how technological innovation has driven progress, and will explore cutting-edge techniques, such as optogenetics to stimulate neurons with light, and stem cell transplantations to mend the diseased brain... . |
| **Module Outcomes:****Pathways:** | By the end of the module, students should be able to:* Understand and explain the mechanisms of synaptic transmission and synaptic plasticity and electrophysiological techniques for study of nerve cell function.
* Understand and explain the cellular and genetic bases of neural circuits and how they drive behaviour.
* Understand and explain the fundamental principles of cognition.
* Understand and explain the genetic, molecular and cellular mechanisms of nervous system development.
* Know how to present scientific data
* Assess primary information from the scientific literature and make evidence-grounded decisions on scientific work

This module follows from BIO274, which dealt with nervous system function and behaviour. You would also benefit from background on cell biology and developmental biology, e.g. BIO268. |
| **Delivery:** | Lectures, tutorial sessions, occasional students seminars/discussions |
| **Assessment:** | **In-Course Assessment (30%)*** Written exercise: “Be a referee”: review a paper – as a referee following guidelines set by a journal. Approx. 2000 words

**3 hour written examination in may (70%)** |

| **03 25349 BIO380** | **Human Evolution** | **Credits: 20** |
| --- | --- | --- |
| **Level: H** |  **Semester: 2** | **Module Organiser: Mary Blanchard****Teaching Staff: Dr Chappell, Dr Deppe, Dr Myatt, Prof. May** |
| **Module Description:** | The module will cover differing but complementary aspects of modern thinking about human evolution. Students will learn about the theories for the development of some of the most important features of human evolution, such as bipedalism, as well as considering aspects of behavioural evolution including the evolution of language, society and racism. The module will also consider to what extent human evolution is still occurring and what influences this. This component will include aspects of evolutionary pressure between humans and their pathogens and to what extent modern medicine interferes with these processes. |
| **Module** **Outcomes:****Pathways:** | By the end of the module the student should be able to: * Recognize, recall and define terms relevant to the study of the behavioural and genetic components of human evolution and be able to discuss the evolutionary processes and relevant theories underpinning the evolution of humans and their pathogens.
* Work as a team to analyse and interpret the scientific literature to compare and critically analyse contrasting theories of key controversial issues in human evolution and present a short presentation to the class and lecturers.
* Independently write a 1000-word essay, bringing your own interpretation to the papers and topic studied in learning outcome.

.BIO380 follows on directly from the broad introduction to human evolution, adaptation and behaviour provided in BIO263. It also relates to coverage of evolutionary principles introduced in BIO145. Since the course seeks to understand the forces that have driven human evolution, it links to all courses that address the way in which animals, particularly mammals, interact with their physical and social habitats, and thus their ecology. |
| **Delivery:** | Lectures, practical classes, workshop |
| **Assessment:** | **In-course assessment – 30%*** Poster on a given topic

**Exam (70%)*** Three hour written open book, computer based exam. Answer one essay question (50%) where three scientific papers and a topic will be given in advance. Answer one critical analysis question (20%) where students will be given the paper in advance.
 |

| **03 21893 BIO387** | **Cancer Biology** | **Credits: 20** |
| --- | --- | --- |
| **Level: H** | **Semester: 1** | **Module Organiser: Dr Hotchin** **Teaching Staff: Prof Heath, Dr Khanim, Dr Petermann, Dr Tomlinson** |
| **Module Description:** | This module will consider multiple aspects of Cancer Biology and therapeutic opportunities that are arising for the treatment of these diseases.This module will consider the pathways that regulate cell division and survival that become subverted in malignant cells. Major advances in this area have occurred as a result of biochemical and genetic investigations in a wide range of organisms. These have revealed a core set of molecular mechanisms which are highly conserved between species. The essential elements include specific extracellular signals which coordinate cell proliferation by activating specific signalling pathways inside the cell. These pathways converge upon the transcriptional activation of a number of genes whose activity is required to induce the processes leading to the replication of DNA and subsequent completion of the cell cycle.In parallel analysis of genetic alterations that occur in the formation of tumours has revealed a class of tumour suppressor genes with fundamental significance for cell multiplication in higher eukaryotes such as man. Loss of tumour suppressor gene function permits cells to proliferate under conditions where their normal counterparts cannot.The expansion of a population of cells involves a balance between cell division and cell death. Programmed cell death is an important feature of normal physiology and inhibition of cell death can facilitate the growth of tumours. Recent advances suggest that active cell death - apoptosis - involves a specific set of biochemical processes which have many analogies to those involved in normal cell proliferation. This module will consider how tumours develop and progress and how recent advances in understanding these processes have identified new ways of targeting cancers. |
| **Module outcomes:****Pathways:** | By the end of the module the student should be able to show understanding of the following processes.* The biology of cell multiplication in vitro and in vivo, including phases of the cell cycle, and how the cell cycle progression is regulated by cyclin/cyclin dependent kinases growth factors and how they signal via cell surface receptors to effect gene transcription and progress through the cell.
* cycle the role of oncogenes and tumour suppressor genes in normal cell cycle control and in cancerDNA damage and repair mechanisms
* The biological features of naturally occurring tumours
* the mechanisms involved in malignant tumour formation, including angiogenesis and metastasis
* The biochemical mechanisms involved in programmed cell death (apoptosis) and its relevance to development of cancer epidemiology, cancer risk and prevalence genetic predisposition to tumour formation recent developments in cancer diagnosis, therapy and prevention Communicate a complex scientific article to a non-specialised scientific audience.

This module builds on the genetics, molecular and cellular biology knowledge you have gained in years 1 and 2 and applies this to our current understanding of cancer biology. This mode will be particularly relevant of those of you undertaking literature reviews or research projects where knowledge of cell signalling is required. The continual assessment part of the module is specifically designed to complement the lecture material and develop the reading and writing skills required to achieve high marks in your final examination. |
| **Delivery:** | The module is primarily based upon lectures; there is no lab component. The lectures are supplemented with video-based teaching and students are supplied with references in the form of reviews and original research articles. |
| **Assessment:** | **In-course assessment – (30%)*** News and Views article on a topic designed to reinforce and supplement the material covered in lectures 1000 words

**3 hour written examination in May – (70%)** |

| **03 22393 BIO389** | **Adaptation to changing environments** |  **Credits: 20** |
| --- | --- | --- |
| **Level: H** | **Semester: 2** | **Module Organiser: Dr Klaus Futterer****Teaching Staff: Prof Jon Green** |
| **Module Description:** | Since its inception, life on earth has had to adapt to changing environmental conditions - this represents a driving force of evolution. This module examines how organisms detect and respond to changes in their environment, and reviews the different behavioural, physiological and molecular mechanisms underpinning environmental (stress) adaptation. Understanding these organism-environment interactions forms the very foundations of ecology. Examples are provided from a range of organisms, but a specific focus is given to terrestrial invertebrates (insects) and plants. The term “environment” covers a broad spectrum of spatial scales, from changes occurring at the cellular level, to large scale geographic differences between major climatic zones (polar, temperate and tropical). The process of “change”, and adaptation to these changes, will in turn be discussed across a broad spectrum of timescales. These include: i) the requirement for rapid adaptation to potentially dramatic shifts in environmental conditions, e.g. when a parasite first enters its host; ii) longer-term changes and adaptations across seasonal timescales, e.g. hibernation/insect diapause, and finally iii) adaptation on an evolutionary timescale, e.g. the ‘Red Queen’ hypothesis, across scenarios of past environmental changes, and extending out to current predictive climate change models.The main aims of this module are to provide students with information, guidance, and access to resources, that will allow them to:* Gain an in depth understanding of how organisms respond and adapt to changes in their environment.
* Recognize that the term “environment” covers a continuum of spatial scales from molecular environments within cells, to broad-scale geographic environments and climatic zones.
* Appreciate that adaptation to environmental change for an individual organism is transient and occurs across a temporal spectrum of seconds to seasons. For species, adaptation is long-term, but not fixed/permanent, and occurs across a timescale of generations.
* Interpret the potential impact of climate change on species, communities and ecosystems. Specifically with respect to how the rate of environmental change may limit effective adaptation, and so result in changes in species distribution and abundance patterns.
* Become effective independent learners, capable of analysing and interpreting the scientific literature to help formulate and express their own ideas.
 |
| **Module Outcomes****Pathways:** | By the end of this module students should be able to: * Recognize, recall and define terms relevant to the study of:
* Biological clocks
* Seasonal adaptations of insects (e.g. diapause)
* Temperature and desiccation stress ecophysiology of insects and plants
* Polar terrestrial ecology
* Ecotoxicology
* Molecular mechanisms underpinning stress adaptation and the tools used to study these phenomena.
* Daphnia biology
* Explain and contrast the adaptive mechanisms by which organisms overcome the stresses associated with rapid changes in their environment, seasonal transitions, regional climates and global climate change.
* Describe responses to environmental stress at the molecular level, e.g. changes in membrane lipid composition, metabolic shifts, the synthesis of molecular chaperones etc., and evaluate the use of model organisms in ecophysiological research.
* Discuss the evolutionary processes, and relevant theories, underpinning adaptation to changing environments.
* Analyse and interpret the scientific literature to provide an evidence base supporting the achievement of learning outcomes 2-4, and in set exercises.
* Formulate and express their own ideas through independent learning and writing skills.
* Identify research areas and produce a justified plan of experimentation

BIO389 builds on topics initially established in the following 1st and 2nd year modules: **BIO145** Introduction to Evolution and Animal Biology; **BIO171** “Ecological Concepts and Plant Sciences”, and some content from **BIO152** “Cell Biology and Physiology”; **BIO259** “Alpine Ecology Field Trip”; and **BIO237** “Plant Sciences: from Cells to Environment”. BIO389 also complements aspects of other 3rd year modules, including **BIO398** “Plant Science in the 21st Century” and **BIO336** “Conservation Practice: Genes to Ecosystems”.While there are no pre-requisites for this module, additional background reading will be required if these earlier modules have not been taken. This is especially relevant to any GEES students selecting this module that may have taken a different range of modules en-route to their final year. |
| **Delivery:** | Lectures |
| **Assessment:** | **In-course Assessment – (30%)*** Grant writing exercise: Students are given individual topics for which they are expected to write a short grant application, i.e construct hypotheses, propose methodologies, outline strategic relevance etc.

**3 hour written examination in May – (70%)** |

| **03 25197 BIO397**  | **Living in Groups: Collective Behaviour in Animals** | **Credits: 20** |
| --- | --- | --- |
| **Level: H** | Semester: 1 | **Module Organiser: Dr Blanchard****Teaching Staff: Drs Brandstaetter, Chappell, Deppe & Reynolds** |
| **Module Description:** | In biology we strive to understand how genes interact to drive the cell, how cells interact to form whole organisms and how these organisms interact to form groups and societies. This module will focus on the final level of organisation: animals in groups. We are all familiar with the sights of vee-flying geese, shoals of fish splitting around a predator and groups of primates grooming. How do these groups coordinate their movements and navigate? Do they follow set rules or use a higher level of cognitive ability to make decisions? Do they work together or cooperate to obtain food and evade predators? How are leaders decided upon? Groups have been notoriously difficult to study: keeping track of multiple individuals, often with different individual traits, interacting dynamically is not possible with a pen and notebook. Recent developments in technology and computing, however, have begun to make the study of such questions, particularly in large groups, more feasible. By combining theoretical models with the empirical data now available, scientists are beginning to get a grasp on the dynamics of large collectives of individuals.  Living in a group has both advantages and disadvantages and group structure needs to be fluid in response to changes in the environment or individuals within the group. One of the key methods used to understand the structure of groups is Social Network Analysis (SNA). Using nodes (individuals) and edges (an affiliation between them) we can address questions such as ‘which individual has the most social contacts’ and ‘are there key linking individuals in the population’? In the last decade there has been an increase in the number of studies using these techniques to study animals ranging from dolphins to primates and our understanding of group structure and the roles different individuals play has increased dramatically.By taking what we known about animals at the individual level and asking questions about the group we are building up a better picture of the rules they may follow and how such strategies have evolved. The majority of animals live in groups at some stage of their lives and the dynamics of a group impact on the individual and vice versa, the behaviour of an individual can impact on the group. Therefore the study of groups is crucial to complete our understanding of the functions and mechanisms underlying the behavioural ecology of many species. The main aim of this module is to introduce you to some of the group types present in the nature, how they undertake key life processes: breeding, foraging, predator avoidance and moving, how they facilitate such behaviours (i.e. communication, navigation methods) and some of the pitfalls of group life. |
| **Module Outcomes:****Pathways:** | At the end of the module students will be able to:* Recognise, recall and define some of the advantages and disadvantages of living in a group and provide examples from animal groups.
* Define and describe some of the fundamental rules and concepts underlying group behaviour and structure including inclusive fitness, cooperation, optimal group size and spatial positioning.
* Explain some of the factors that can influence group structure e.g. individual differences (personality, motivation), environment and communication method.
* Describe and explain how groups function during key life activities: breeding, foraging, avoiding predators and moving, in addition to the impact of disease, in groups of insects, birds, fish and mammals. Discuss some of the evolutionary implications of different strategies.
* Use Social Network Analysis to manipulate data, create sociograms to visualise data and extract and interpret some key network measures.
* Discuss the primary mechanisms of learning and memory formation as well as spatio-temporal orientation and navigation at both the individual and group level. Be able to describe and evaluate examples from nature.
* Discuss how the principles of decision-making, leadership and information flow impact on collective movement and behaviour.
* Participate in group discussions and individually prepare a poster and a brief ‘flash’ presentation to sell your poster.
* Explain science to a public audience by independently writing a piece for the news on a recent peer-reviewed study, highlight the key points, discuss where it slots into previous research and identify future research areas.
* Link processes at the molecular, cellular, tissue, organ, and whole-organism level that result in particular physiological and behavioural traits.
* Distinguish between ultimate and proximate factors determining complex natural behaviour and describe the role of biological time keeping systems in the regulation of daily rhythmicity and annual routines.

This module builds directly on knowledge gained in the first year module **BIO145 Introduction to Evolution and Animal Biology** and the second year module **BIO274 Animal Biology.** As a **behavioural ecology** module it also links in with and follows on from other modules such as **BIO171 Ecological Concepts and Plant Sciences**, **BIO263 Human Evolution, Adaptation and Behaviour** and the second year **field courses**.  In the final year it complements a number of the other modules available including: **BIO336 Conservation Practice: Genes to Ecosystems; BIO380 Human Evolution** and **BIO389 Adaptation to Changing Environments**. |
| **Delivery:** | Large-group lectures, small-group workshop, small-group oral presentation, independent written work. |
| **Assessment:** | **In-course Assessment – 40%*** 600 word online news piece. Students with authorised absence for the online news piece will repeat the exercise using a new paper not used by the other students.

**3 hour written Examination in May - 60%** |

1. Exceptions to this need to be agreed with the student’s Home University. [↑](#footnote-ref-1)
2. 20 Birmingham Credits = 10 ECTS Credits [↑](#footnote-ref-2)