PRINCIPLES OF EVOLUTION - 2024/5

Module code: BMS1061

Module Overview

Understanding the principles of evolution is essential for the study of biosciences. This module will embed an appreciation of why organisms look, behave and interact with others in the way they do. Students will study the central principles that have led to the diversity of life on Earth today. We will explore the process of natural selection including how the theory was developed and the evidence that supports it, as well as other forces responsible for evolutionary processes. We will study a range of examples including how genomes evolve, how bacteria become resistant to antibiotics, coevolution and how humans evolved to be as we are today. Students will use analytical tools in evolutionary biology research to complete a hands-on laboratory practical.

This module lays the foundations for building knowledge about the general principles of evolution and the evolutionary mechanisms of adaptation, which you will apply in the second year to study animal anatomy and physiology (BMS2062), their role in ecosystems (BMS2070), and the development of microbial communities and antibiotic resistance (BMS2044). Additionally, in the final year, you will apply these principles to animal diversity (BMS3095) and animal behavior (BMS3096).

Module provider

School of Biosciences

Module Leader

SANTORELLI Lorenzo (Biosciences)

Number of Credits: 15

ECTS Credits: 7.5

Framework: FHEQ Level 4

Module cap (Maximum number of students): N/A

Overall student workload

Independent Learning Hours: 77

Lecture Hours: 25

Seminar Hours: 5

Tutorial Hours: 5

Laboratory Hours: 3

Guided Learning: 8

Captured Content: 27

Module Availability

Semester 2

Prerequisites / Co-requisites

None

Module content

Indicative content includes:

Introduction to module, genetic & evolutionary concepts

Basic genetics, mutation, natural selection and survival of the fittest, population drift, isolation and mass extinctions; evidence for evolution and phylogeny

Darwin and theory of evolution by natural selection

The Origin of Life (molecules of Life and the origins of cells), species and the Tree of Life.

Principle of taxonomy and phylogeny

Sexual selection in animals

Evolution of sociality, conflict and cooperation (in animal, plants and microbes)

How evolution drives resistance to antibiotics and pesticides

Evolution of genomes and genomic medicine

Evolution of hominids

Modern application of evolution

Assessment pattern

Assessment type	Unit of assessment	Weighting
Coursework	Group Coursework based on practical	30
Examination	MCQ and short answer exam 90 mins	70

Alternative Assessment

If a student misses the practical, data will be provided in order for them to complete the assessment

Assessment Strategy

The assessment has been designed to assess students' understanding of the main concepts and fundamental information of the content covered in the module. Moreover, group work based on the practical can provide assessment of teamwork, communication skills, analysis, and comprehension.

Summative Assessment:

Group presentation (LO 5, 6, 7, 8)

Exam (LO 1, 2, 3, 4, 6)

Formative assessment will be provided regularly during the module using in-class quizzes and allowing reflective analysis of the results. For the coursework, a formative draft submission will be allowed which will receive individual feedback. A further tutorial will be provided to discuss the most common mistakes of the poster before the final submission.

Module aims

- Introduce the concepts of evolution by natural selection and other forces.
- Explain how evolution shapes traits of extinct and extant organisms.
- Learning how to use software to analyse genomic and protein database and generate phylogenetic trees.
- Describe how genomes evolve and new species arise.
- Apply evolutionary principles to real-world examples, such as the emergence of antibiotic-resistant bacteria or how they affect ecological and epidemiological settings
- Explain how evolution shaped life and biodiversity.
- Communicate scientific concepts related to evolution effectively, using appropriate terminology and evidence-based reasoning.
- Work collaboratively with peers to develop and present original research projects related to evolutionary biology.

Learning outcomes

		Attributes Developed
001	Describe the basic principles of evolution, including natural selection, genetic variation, and population genetics.	K
002	Explain the role of DNA and genetic mutations in evolution, and how they contribute to the diversity of life on earth.	KC
003	Understand the factors which influence changes in genome, morphology, and physiology of organisms	KC
004	Evaluate the evidence for evolution, including fossil records, biodiversity, comparative anatomy, and molecular biology.	K
005	Learning how to use software to analyse genomic and protein database and generate phylogenetic trees	PT
006	Apply evolutionary principles to real-world examples, such as the emergence of antibiotic-resistant bacteria or how they affect ecological and epidemiological settings	CT
007	Communicate scientific concepts related to evolution effectively, using appropriate terminology and evidence-based reasoning.	PT
008	Work collaboratively with peers to develop and present original research projects related to evolutionary biology.	PT

Attributes Developed

C - Cognitive/analytical

K - Subject knowledge

T - Transferable skills

P - Professional/Practical skills

Methods of Teaching / Learning

The learning and teaching strategy is designed to give students a broad understanding of the mechanisms of evolution and how it shapes traits of living organisms.

The delivery of the skills element will be both in class and practical. The class component will be based upon student focused learning based on lectures, seminars, documentaries, and quizzes. Practical to reinforce principles of evolution studied in class. The group assignment will allow for working in teams that will allow peer-peer interaction, thus aiding personal understanding and developing transferable/ social interaction skills. Tutorials and discussion board will enable students to highlight areas that require further explanation or clarification. Regular in-class quizzes will provide formative feedback on students' understanding of the main concepts and content

Indicated Lecture Hours (which may also include seminars, tutorials, workshops and other contact time) are approximate and may include in-class tests where one or more of these are an assessment on the module. In-class tests are scheduled/organised separately to taught content and will be published on to student personal timetables, where they apply to taken modules, as soon as they are finalised by central administration. This will usually be after the initial publication of the teaching timetable for the relevant semester.

Reading list

https://readinglists.surrey.ac.uk
Upon accessing the reading list, please search for the module using the module code: BMS1061

Other information

When studying Evolutionary principles, it is important to consider how the graduate attributes can be integrated to enhance the learning experience and promote a comprehensive understanding of the subject matter. By emphasising the importance of these pillars, the Principles of Evolution module can help students develop critical thinking skills, explore innovative ideas, engage with diverse perspectives, and cultivate a sense of responsibility for the environment and the global community.

Resourcefulness & resilience: The assessments for this module rely on the ability to interpret and understand primary research literature, and to produce data in the practical. The coursework will allow students to develop teamwork skills, problem-solving, decision-making, self-efficacity, self-regulation and confidence.

Global & cultural capabilities: Students will work in small groups during the practical sessions and for an assignment which will encourage and engage students in working with other students from different cultures and abilities to achieve an end goal.

Sustainability: The module will consider the principles by which animals live and are shaped by their environment. These highlight the importance of conservation and sustainability. Sustainability is a critical aspect of evolutionary processes because it focuses on the long-term viability and resilience of species, ecosystems, and the planet as a whole and can also help to maintain the diversity of genetic material within populations, which is critical for evolutionary processes to occur.

Digital capabilities: As part of the coursework, students will work with specific software to perform gene analysis. As part of the assessment, student will use Microsoft Suite software to analyse and present data. Students will also utilize the virtual learning environment SurreyLearn and other digital resources. The skills learned will be applied in the assignments they undertake to equip the students for a variety of modern professions.

Programmes this module appears in

Programme	Semester	Classification	Qualifying conditions
Biochemistry BSc (Hons)	2	Optional	A weighted aggregate mark of 40% is required to pass the module

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Biochemistry MSci (Hons)	2	Optional	A weighted aggregate mark of 40% is required to pass the module
Biological Sciences (Animal Biology and Ecology) BSc (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biological Sciences (Cellular and Molecular Sciences) BSc (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biological Sciences (Infection and Immunity) BSc (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biological Sciences BSc (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Veterinary Biosciences BSc (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module