LF321-15 Advanced Evolutionary Biology

26/27

Department
Life Sciences
Level
Undergraduate Level 3
Module leader
Georgy Koentges
Credit value
15
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This new Advanced Evolution module provides students with a combination of taught lecture elements about advanced evolutionary topics, flanked by classroom support sessions. It is run by a number of SLS members who study evolution. This module enables a significant amount of independent work that culminates in students making posters and films/videocasts about their evolutionary topics of choice on the basis of objects presented to them which they can photograph on the microscope and at the macro level. Because of this, we might have to cap the student number to 45. This module also contains the option of a joint museum visit to either the NHM (London) or the Oxford Museum of Natural history or the Lapworth Museum: to given students the opportunity to interact with local palaeontologists/experts there (some are alumni of our previous courses), and to showcase attractive careers within and beyond academia in the area of Evolutionary biology.

Module aims

In LF133 students were introduced into the basic body plans of animals and plants and their diversity. in LF263 (Evolution) we have then drawn together similar phenomena visible across the whole animal and plant tree and have provided exemplars for how molecular changes at the level

of chromatin, gene-regulatory elements, genes, proteins can and has effected structural changes. We have also introduced students into mechanisms of selection and how they can work at the population level. It has also laid the basis for genomic studies to establish trees and to trace genomic changes across evolution. This new module extends these threads at a more advanced level by

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Lectures:This course will provide you with about 18 lectures on key topics of evolutionary biology. Part of our syllabus are also several vignette lectures where local experts (this year: Prof Koentges, Prof Allaby, Dr Puxty, Prof Gifford, Dr Smith) will talk about their own research - to bring you as close to the cutting edge as possible. The composition of lecturers for these vignettes is anticipated to change from year to year.

Support sessions: Additionally, we will also provide, similar to the Evolution module LF263, in classroom support sessions that are based on object-based teaching (microscope slides, fossils, skulls, butterflies etc).

Workshop:Towards the end Prof Allaby will run a workshop on evolutionary genomics.

Museum visit: We will also organise as a voluntary component the visit to one of the Natural History Museums (NHM, Oxford Museum or Lapworth) that gives you access to other experts and an idea of the academic and non-academic work environments for Evolutionary Biologists.

The lectures we provide are meant to accompany your independent work that will for the basis of the assessment of this module. This module will be 100% in module assessed. Your work will have three components:

1. Production of a film (10-15mins)
2. Production of a poster.
3. evolutionary genomics workshop assignment (20%)
   For the film and the poster you will get the chance to take your own microscopy and macro images of interesting biological objects (microscopy slides of animals, plants, shells, butterflies, etc), with our guidance and help. The task is then to investigate the evolutionary reasons for the structures you are seeing. This will involve placing these objects into a phylogenetic context, understanding and deciphering the molecular, transcriptional,signalling pathways underpinning these structures. You will then turn these into stories you can tell to a scientific and non-scientific audience: in the shape of a film/video podcast and a poster.

Learning outcomes

By the end of the module, students should be able to:

- Provide a deep molecular and cellular understanding of the drivers of evolutionary novelty and change in animals, plants and microbes.
- Critically assess developmental and molecular mechanisms underlying evolutionary novelty,

including phylogenetic hourglass patterns and key transitions such as tetrapod evolution and hominid brain development.
- Analyse the evolutionary impact of major global events (e.g. mass extinctions such as the Permo–Triassic or end-Cretaceous) on biodiversity, ecosystem structure, and lineage diversification before, during, and after the crisis.
- Interpret genomic signatures of population processes, including bottlenecks, admixture, and horizontal gene transfer, and apply these to reconstruct evolutionary histories in humans and other taxa.
- Examine the interplay between evolution, development, and culture, including the genetic and developmental bases of communication and speech, and the genomic consequences of domestication and recent human evolution since the Neolithic.

Indicative reading list

Reading lists can be found in Talis

Research element

We will accompany and guide you to take microscopy and macro photos of interesting objects. Your task will be to explain the evolutionary underpinnings of the way they look: whether that is the wing patterns of butterflies, the presence of particular fossils and their shapes or genomic sequence comparisons.

Interdisciplinary

This work will traverse different areas of science, from transcription factor biology to biochemistry, genomics, chromatin biology, anatomy (animals and plants), palaeontology, and ecosystems research. The aim is to learn to assess how changes at each level of biological regulation can have impacts on the higher levels, from single amino acid changes to changes in brain anatomy. As part of our work, we will venture into the most recent human evolution (of the last 10,000 years), we are venturing into human history, and what one can learn from analysing human and plant genomic sequences.

Subject specific skills

You will learn
a. how to place animals and plants into phylogenetic trees.
b. how to derive from such placements information about character evolution that can explain morphology.
c. You will get in-depth knowledge of molecules, pathways at each level of biological organisation (from chromatin to gene regulatory regions to genes, proteins, networks, all the way to structures, populations and macroevolutionary perspectives. Such perspectives are usually part of different disciplines, from gene regulation to biochemistry to palaeontology and Ecosystems research.

Transferable skills

You will learn the underpinnings of how organisms are studied by evolutionary biologists using state of the art analytical and experimental tools, what inferences can be drawn from the data obtained.
Secondly, you will learn how you can present your work to a wider scientific and non-scientific audience: you will familiarise yourself with podcasting/video tools to explain complex causal connections that can explain things the way they are.

Study

Study time

Type	Required	Optional
Lectures	18 sessions of 1 hour (12%)	
Demonstrations	1 session of 2 hours (1%)	
Supervised practical classes	3 sessions of 2 hours (4%)	
External visits	(0%)	1 session of 6 hours
Private study	69 hours (46%)	
Assessment	55 hours (37%)	
Total	150 hours	

Private study description

revise lecture contents.
work out narrative for poster and film
familiarize yourself with the technicalities of
a. generating images (under supervision) from objects.
b. film making - helped by audiovisual team as available.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D

	Weighting	Study time	Eligible for self-certification
Producing a film about an	50%	35 hours	Yes (extension)

	Weighting	Study time	Eligible for self-certification
evolutionary biology topic - based on images taken by the student.			
Student will, under our guidance, take photos (microscopy and/or macro) of interesting (and beautiful) scientific objects, will examine by themselves the deeper evolutionary, phylogenetic and molecular underpinnings of these objects to explain their structure and evolutionary significance. In private work student will then establish a narrative and make a film about this journey of discovery. If students want to collaborate, this is possible as long as each student gets an equal share in the intellectual work involved and each contribution is made fully visible to us upon submission of the work.			
Make and submit a poster on moodle	20%	15 hours	Yes (extension)
Make and submit poster on moodle. Indicate your part of the poster. You can either do this in a group or on your own. No oral presentation required.			
In module assessment answering questions of the evolutionary genomics workshop	20%	4 hours	Yes (extension)
data analysis following Robin Allaby workshop .			
Reflective essay about film and poster	10%	1 hour	No
Student writes a reflective assay about their journey, how they examined the object of interest, how they studied its phylogeny and molecular structure. This reflective essay, done in a face-to-face in classroom exam setting (closed book) is a way of authenticating the student's own efforts on their journey for film and poster.			

Assessment group R

	Weighting	Study time	Eligible for self-certification
Film	100%		No
Film submission, 15 mins on an EvoDevo Topic.			

Feedback on assessment

Moodle submission and moodle-based individual feedback of film and poster contributions.

Past exam papers for LF321

Availability

Pre-requisites

Students need to familiarise themselves with the full contents of BS110 (Animal and Plant Biology) and should have done LF263, as the current course is based on the knowledge imparted in these modules. However, students from other disciplines and tracks who are willing to familiarise themselves with those contents (via Lecture capture) before the commencement of the module are most welcome.

Courses

This module is Optional for:

- Year 3 of UBSA-C700 Undergraduate Biochemistry
- Year 3 of ULFA-C1A2 Undergraduate Biochemistry (MBio)
- Year 4 of ULFA-C702 Undergraduate Biochemistry (with Placement Year)
- Year 3 of ULFA-C1A6 Undergraduate Biochemistry with Industrial Placement (MBio)
- Year 3 of UBSA-3 Undergraduate Biological Sciences
- Year 3 of ULFA-C1A1 Undergraduate Biological Sciences (MBio)
- Year 4 of ULFA-C113 Undergraduate Biological Sciences (with Placement Year)
- Year 3 of ULFA-C1A5 Undergraduate Biological Sciences with Industrial Placement (MBio)
- Year 3 of UBSA-C1B9 Undergraduate Biomedical Science
- Year 3 of ULFA-C1A3 Undergraduate Biomedical Science (MBio)
- Year 3 of ULFA-C1A7 Undergraduate Biomedical Science with Industrial Placement (MBio)
- Year 4 of ULFA-CB18 Undergraduate Biomedical Science with Placement Year
- Year 3 of ULFA-B140 Undergraduate Neuroscience (BSc)
- Year 3 of ULFA-B142 Undergraduate Neuroscience (MBio)
- Year 3 of ULFA-B143 Undergraduate Neuroscience (with Industrial Placement) (MBio)
- Year 4 of ULFA-B141 Undergraduate Neuroscience (with Placement Year) (BSc)