LF215-18 Genetics and Evolution

20/21

Department
Life Sciences
Level
Undergraduate Level 2
Module leader
Guy Barker
Credit value
18
Module duration
11 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Genetics and Evolution are the two major unifying themes in biology. At one level evolution can be defined as the changes in gene frequencies in populations with time. An understanding of population genetics and evolutionary genetics is necessary to understand fundamental processes of evolutionary change, and importantly, is necessary to understand the genetic make-up of existing populations observed and studied in real time. This theoretical background is also necessary to understand the use of DNA sequence data and related information in deducing evolutionary relationships. In addition the ability to sequence whole genomes at increasingly affordable costs has dramatically improved our ability to explore the molecular genetic basis of complex variation. This provides enormous potential for advances in food security, human and animal health, and adaptation to climate change including sustainable energy sources. This module will introduce the concepts and techniques in genetics and genomics that can be used to understand and manipulate complex traits, including an introduction to bioinformatic skills.

Module web page

Module aims

Students will gain an understanding of Darwinian evolution in modern molecular terms, and of the methods that underpin modern genome-level analysis.

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.

GENETICS
Introduction to computational biology
Conservation Genetics
Pedigree analysis and linkage mapping
Genetics and Ageing
Personalised nutrition
Gene therapy
Ethical issues
"The End Game" finding a causal gene
Genome-Wide Association Mapping
The Extended Genome

EVOLUTION
Darwin’s argument to explain evolution and adaptation (2 lectures)
The integration of Darwinism and genetics: the rise of the Modern Synthesis
Natural Selection Theory from the Modern Synthesis, and subsequent cracks: Neutral Theory Molecular Evolution
Models in Evolution: game theory, biomorphs, kinship selection
The Tree of Life
Evolution of body plans
Evolution of limbs
Evolution of eyes
Speciation and Patterns of evolution
FIELD TRIP to Natural History Museum
Evolution of the vertebrate head
Evolution of molecular pathways: non-intelligent tinkering is everywhere.
Evolutionary genomics: genome change viewed through the current data revolution

Learning outcomes

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

- Understand (i) The enduring influence Darwinian thought has on modern evolutionary theory.(ii) The ‘Modern Synthesis’ of Darwinism and genetics.(iii) Mechanistic aspects of fundamental evolutionary and population genetic processes at a simple level.Understand (i) the definition of, and distinction between, the different kinds of genetic polymorphism observed in populations, and how polymorphism is maintained.(ii) The consequences of molecular evolutionary theory, including the molecular clock concept, and the use of molecular evolutionary theory for phenetic comparisons and cladistic deductions.(iii) Different mechanisms of speciation.(iv) How macro-evolution can be studied through comparative developmental biology and paleontology(v) How evolution is studied at the genome level in the wake of new technologies.Understand practical molecular genetic methods that will

include advanced pedigree analysis, recombination (linkage) mapping of quantitative variation, and genome-wide association mapping.Understand how molecular genetics plays an important role in our everyday lives.Link understanding of sub-cellular biology with modern genetics to appreciate how the phenotype of whole organism is determined.

Indicative reading list

Freeman, S. and Herron, J. C. Evolutionary Analysis, 4th edn.
(Pearson Education Inc.)
Darwin C. On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life. London, John Murray (1859).

Students are directed to the current literature for an up-to-date appreciation of developments in this area and the module will use a combination of recent review articles and refereed papers exemplifying the techniques and their implementation

Subject specific skills

Understand
(i) The enduring influence Darwinian thought has on modern evolutionary theory.
(ii) The ‘Modern Synthesis’ of Darwinism and genetics.
(iii) Mechanistic aspects of fundamental evolutionary and population genetic processes at a simple level.

Understand
(i) the definition of, and distinction between, the different kinds of genetic polymorphism observed in populations, and how polymorphism is maintained.
(ii) The consequences of molecular evolutionary theory, including the molecular clock concept, and the use of molecular evolutionary theory for phenetic comparisons and cladistic deductions.
(iii) Different mechanisms of speciation.
(iv) How macro-evolution can be studied through comparative developmental biology and paleontology
(v) How evolution is studied at the genome level in the wake of new technologies.

Understand practical molecular genetic methods that will include advanced pedigree analysis, recombination (linkage) mapping of quantitative variation, and genome-wide association mapping. Understand how molecular genetics plays an important role in our everyday lives.

Link understanding of sub-cellular biology with modern genetics to appreciate how the phenotype of whole organism is determined.

Transferable skills

Self directed learning
Adult learning
Critical appraisal of source material

Study

Study time

Type	Required
Lectures	26 sessions of 1 hour (14%)
Practical classes	6 sessions of 1 hour (3%)
Private study	148 hours (82%)
Total	180 hours

Private study description

148 hrs self-study and directed reading

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B1

Assessment component	Weighting	Study time	Eligible for self-certification
In-person Examination	100%		No

The examination for LF215 will be a 1.5 hr 'short answers' paper in June.

- Answer book provided by department

Reassessment component is the same

Feedback on assessment

Pastoral meetings with personal tutor.

Past exam papers for LF215

Availability

Courses

This module is Core for:

- UBSA-3 Undergraduate Biological Sciences
  - Year 2 of C100 Biological Sciences
  - Year 2 of C100 Biological Sciences
- Year 2 of ULFA-C1A1 Undergraduate Biological Sciences (MBio)
- Year 2 of UBSA-4 Undergraduate Biological Sciences (with Intercalated Year)
- Year 2 of ULFA-C1A5 Undergraduate Biological Sciences with Industrial Placement (MBio)