

Module Information

Module Code	Module Title	Semester	Mod. Credits
LSM3252	Evolution and Comparative Genomics	2	4

Module Description

This module aims to build on students' foundation in evolutionary concepts and to advance their knowledge and skills related to comparative biology. Lectures, laboratory and field activities present and apply the theory of evolution as the unifying discipline in biology, as well as enhance the integrated understanding of four main themes: natural selection, palaeobiology, the tree of life and comparative genomics. Overall, the module emphasises the importance and application of evolutionary biology for explaining a wide variety of phenomena in biology, from the history of life to genes, genomes and cellular processes.

Eligibility and requirements

Prerequisites (prior knowledge required): LSM1105

Corequisites: NIL

Precluded modules (if any): NIL

Instructional methods

The following instructional methods will be employed:

- 1) Lecture
- 2) Tutorial
- 3) Laboratory (Dry/Wet)
- 4) Expedition/Site/Field visit
- 5) Inquiry-based or Research

Assessment modes

The following assessments will be employed:

- 1) Practical reports = 30%
- 2) Quirks of evolution = 20%
- 3) Open book test = 20%
- 4) Group project = 30%

Contact information for Module Coordinator and other instructors

Dr Huang Danwei (Module Coordinator)

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Course content and syllabus

Natural selection:

Recap natural selection, population genetics, selection and drift, neutral theory, evolution at multiple loci, species and speciation.

Palaeobiology:

History of life, geologic time scale, fossil record, extinction, palaeoecology, biogeography, biostratigraphy, fossil taxa.

Tree of life:

Understanding relationships, inferring and reading trees, fossil calibration, diversification rates, evolutionary trends, trait evolution.

Comparative genomics:

Evolution of genome size, structure and organisation, complex traits, horizontal gene transfer, gene regulatory networks, metagenomics.

Learning activities

The following learning activities will be employed to achieve the learning outcomes of knowledge, cognitive skills, generic skills and/or attributes development stated in the 'Intended Learning Outcomes' below:

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|---|------------------------------------|
| 1) Case Studies, | 6) Laboratory Activities (Wet/Dry) |
| 2) Expedition/Field Trip/Site Visit | 7) Problem-based Learning |
| 3) Group Discussion or Discussion Forum | 8) Report/Essay Writing |
| 4) Group/Individual Presentation | |
| 5) Group/Individual Project | |

a. Lectures and tests convey fundamental evolutionary biology concepts using multidisciplinary case studies, group discussions and problem-based learning to foster general understanding, interdisciplinary thinking and ability to apply and evaluate evolutionary theory on a wide variety of phenomena.

b. Laboratory and field activities introduce students to case studies and require students to collect data as a group, and individually analyse and solve problems based on the data, developing skills in written communication, analytical and critical thinking, as well as collaboration and teamwork.

c. Quirks of evolution requires students to create and maintain a portfolio of evolutionary ideas and applications, with discussions among classmates, using Microsoft Teams, developing skills in written communication, analytical, critical and interdisciplinary thinking, and fostering adaptability and learnability.

d. Group project requires students to develop a study to test and report on an evolutionary hypothesis or discover an evolution pattern based on data collected and analysed, developing skills in written and oral communication, analytical and quantitative thinking, problem-solving, as well as collaboration and teamwork.

Intended Learning Outcomes

Knowledge development

After taking this module, students should be able to:

- (a) Explain how evolution is the unifying discipline in biology
- (b) Apply evolutionary principles on diverse phenomena from the history of life to genomes and cellular processes
- (c) Demonstrate integrated understanding of four main themes: natural selection, palaeobiology, the tree of life and comparative genomics.

This module will provide the opportunities to develop the following cognitive skills, generic skills and attributes:

Very Good Opportunities	Good Opportunities
1) Adaptability & Learnability 2) Collaboration & Teamwork 3) Interdisciplinary Thinking 4) Analytical & Critical Thinking 5) Verbal/Oral Communication 6) Written Communication 7) Evaluate: Review, Check & Critique 8) Apply: Use, Execute & Implement 9) Understand: Question, Connect & Explain	1) Problem-solving & Decision-making 2) Quantitative Thinking 3) Digital & Information Literacy 4) Create: Ideate, Plan, Generate & Produce 5) Remember: Recognize, Recall & Know

Required and/or recommended readings

Bergstrom CT, Dugatkin LA. Evolution. W. W. Norton & Company.
 Nature Education (<http://www.nature.com/scitable/knowledge/evolution-13228138>)
 PBS Evolution (<http://www.pbs.org/wgbh/evolution>)
 Berkeley Understanding Evolution (<http://evolution.berkeley.edu>)