

## Evolutionary Morphology (C004274)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 5.0**

**Study time 150 h**

**Course offerings and teaching methods in academic year 2023-2024**

A (semester 1)

English

Gent

lecture

seminar

peer teaching

independent work

**Lecturers in academic year 2023-2024**

Chatrou, Lars

WE11

lecturer-in-charge

Adriaens, Dominique

WE11

co-lecturer

Bogaert, Kenny

WE11

co-lecturer

**Offered in the following programmes in 2023-2024**

[Master of Science in Teaching in Science and Technology\(main subject Biology\)](#)

crdts 5

offering A

[Master of Science in Biology](#)

5

A

[Exchange Programme in Biology \(master's level\)](#)

5

A

**Teaching languages**

English

**Keywords**

Form, specialisations and adaptations, evolutionary constraints, evolutionary radiations, evolutionary reproductive strategies, morphological co-evolution, evolutionary origin of major body plans (origin of multicellularity), evolutionary patterns in phylogenetic trees, morphospace, modelling

**Position of the course**

As part of the major 'Biodiversity and Evolutionary Biology', this course deals with concepts and underlying mechanistic processes that guide phenotypic evolution. It focusses on evolution characterised by a transforming but functioning phenotype within a given biotic and abiotic context, resulting from interacting natural selection, extinction and survival of the fittest.

More specifically, this course aims to:

- 1 provide a proper and in-depth understanding of concepts, patterns and processes that define and guide morphological evolution, using examples of all major clades of living organisms.
- 2 provide a broad overview of ruling theories, hypotheses and models that are applied to explain evolutionary morphological processes, in order to be able to link different processes as well as to be able to formulate new hypotheses;
- 3 gather and synthesize in a focused way the relevant information from the literature for preparing lecture notes and to give a lecture to a different kind of audience (students vs laymen);
- 4 emphasises the importance of proper science communication to explain evolution, especially that of the phenotype.

This course offers a thematic approach to morphological knowledge acquired in the introductory courses of biodiversity of all major clades of organisms, but now applied to morphological patterns in a phylogenetic-evolutionary framework.

**Contents**

Morphology exhibits a gradation of complexity ranging from (apparently) morphologically simple organisms to highly complex organisms. However, some common patterns are recognisable, such as homology vs. analogy, convergence, reduction, modular organisation, constraints,

morphological integration, etc. Some patterns and processes are universal across all major clades of living organisms, whereas others are clade-specific. Key is, however, that the life strategy of every organism reflects the evolutionary history, which can explain why particular phenotypic modifications (adaptive or not) may or may not result in a relatively rapid adjustment of morphology.

During this course, examples from algae, land plants, fungi and animals will be used to illustrate and discuss how morphological modifications have evolved, as well as why and how certain patterns have emerged. Specific topics that will be tackled are:

- 1 Form, specialisations and adaptations
- 2 Evolutionary constraints
- 3 Evolutionary radiations
- 4 Evolutionary reproductive strategies
- 5 Morphological co-evolution
- 6 Evolutionary origin of major body plans: origin of multicellularity

This will be combined with two computer-based workshops:

- 1 'Evolutionary patterns in phylogeny'
- 2 'Exploring evolutionary morphospace through modelling'

During microteaching, students (in groups of max. 2) will present and discuss current issues in evolutionary morphology (e.g. focusing on conflicting or controversial hypotheses).

### **Initial competences**

The course builds on knowledge and skills gained during biodiversity and morphology focused courses, as well as courses on developmental biology. A basic knowledge of plant, fungi and animal morphology is expected, as well as the basic underlying developmental processes.

### **Final competences**

- 1 The student has a good knowledge of morphological structure and diversity, can apply relevant terminology, with attention to the differences in homology and analogy.
- 2 The students have obtained a good understanding of the different mechanistic processes underlying evolutionary transformations of phenotypes, and at what level they are to be situated.
- 3 The student has a good understanding of the applicability of morphology in a phylogenetic-evolutionary framework, with strengths and weaknesses.
- 4 The student has acquired knowledge of models and concrete examples of morphological evolution in the major clades of living organisms.
- 5 Students can perform a critical interpretation and thorough analysis of evolution with respect to terms like "natural selection", "adaptation" and "survival of the fittest", and current hypotheses and models that are associated with it.
- 6 The student is able to independently present, summarize and evaluate the primary scientific literature of this discipline about a well-defined topic.
- 7 Students can communicate in written and oral way about a specific topic in evolutionary morphology of animals based on a synthesized and structured lecture at an academic level, which is a group activity.
- 8 Students can formulate research driven hypotheses with respect to morphological evolution.

### **Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

### **Conditions for exam contract**

This course unit cannot be taken via an exam contract

### **Teaching methods**

Seminar, Lecture, Independent work, Peer teaching

### **Extra information on the teaching methods**

- Lectures
- practical PC room classes: two sessions where computer software will be used to (1) explore phylogenetic patterns in morphological variation, and (2) explore morphospace in relation to constraints and functional performance.
- In groups of max. two students, current issues in evolutionary morphology will be presented and discussed. This can be about conflicting or controversial hypotheses, paradigms or theories that have shifted over time, or novel insights. Each presentation will be followed by a discussion with the lecturers and the fellow students. Hence, participation in all microteaching sessions is obligatory.

### **Learning materials and price**

Presentations and course materials are available through Ufora

## **References**

- Ambrose BA, Purugganan M (eds.) (2013) Annual Plant Reviews, The Evolution of Plant Form: Volume 45. The Evolution of Plant Form. Wiley-Blackwell, Oxford, UK.
- Bromham L, Cardillo M (2019) Origins of biodiversity – an introduction to macroevolution and macroecology. Oxford University Press.
- Cronk QCB (2009) The Molecular Organography of Plants. Oxford University Press, Oxford, UK.

## **Course content-related study coaching**

The teachers and practicum supervisors are open to questions from the students during the lectures, practicums and work colleges, and via Ufora. The classes given by the students will be followed by a feedback.

## **Assessment moments**

end-of-term and continuous assessment

## **Examination methods in case of periodic assessment during the first examination period**

Written assessment with open-ended questions

## **Examination methods in case of periodic assessment during the second examination period**

Written assessment with open-ended questions

## **Examination methods in case of permanent assessment**

Skills test, Participation, Peer and/or self assessment

## **Possibilities of retake in case of permanent assessment**

examination during the second examination period is possible in modified form

## **Extra information on the examination methods**

- Examination methods in case of periodic evaluation: Written preparation and oral discussion, open questions and specific examples from the lectures and concepts that are discussed during the microteaching presentations.
- Examination methods in case of permanent evaluation: The students give a 15 minute presentation on a specific topic for the entire group of students

## **Calculation of the examination mark**

The score from the periodic exam counts for 65% of the total score, and the oral presentation for 35%. The participation during the PC exercises will also be taken into account, in that full participation is required for both workshops. Students who are legitimately absent during the workshops or microteaching will be given an alternative assignment. Unjustified absence to the workshops and the microteaching results in a total score of maximally 7/20 (exam and assignments), irrespective of the scores for the exam and/or microteaching.