

Microbial Ecology (C002774)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size (nominal values; actual values may depend on programme)
Credits 5.0 Study time 140 h Contact hrs 34.5 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	English	Gent	microteaching	7.5 h
			lecture	17.5 h

Lecturers in academic year 2020-2021

Willems, Anne	WE10	lecturer-in-charge
Verbeken, Annemieke	WE11	co-lecturer
Verleyen, Elie	WE11	co-lecturer
Vyverman, Wim	WE11	co-lecturer

Offered in the following programmes in 2020-2021

	crdts	offering
Master of Science in Teaching in Science and Technology (main subject Biology)	5	A
Master of Science in Biology	5	A
Exchange Programme in Biology (master's level)	5	A

Teaching languages

English

Keywords

Microbial ecosystems, microbial communities, microbial interactions, geomicrobiology, plant-bacteria interactions

Position of the course

The course is part of the Ecology cluster in the Master program Biology. The courses General Microbiology; Mycology, Community- and Systems Ecology; and Algology and Protistology, from the Biology bachelor program, provide the foundation for this course. The course provides an overview of the role of microorganisms in different ecosystems and of molecular techniques to study microbial diversity (theoretical and in practice), ecosystem function and evolution. Questions addressed: where and in what types of environments do microorganisms occur, how do microorganisms interact with each other and with other organisms, in what way do microorganisms influence the environment, how can we use properties of microorganisms in managing the environment (soil sanitation, water purification), in agriculture or in biotechnology.

Contents

1. Introduction

What ecosystem functions do microorganisms perform?

How many micro-organisms are there and how important are their activities?

2. Biodiversity assessment: how can we study microbial communities and populations?

Culture-dependent methods

Viable non-culturable status

Biodiversity of fungi and fungal-bacterial interactions

Community analysis (including DGGE, FISH)

Metagenomics I: Who is present?

3. Primary producers

Overview of systems and mechanisms

- Phototrophs

a. Chlorophyll-based systems

b. Rhodopsin-based systems

c. Chlorophyll-based vs. rhodopsin-based systems

- Chemolithotrophs

a. Hydrogen oxidation

b. Oxidation of sulfur compounds

c. Oxidation of iron

d. Nitrification and anammox

- Methanogenesis

- Methanotrophy

Importance of these systems in global primary production

Functional diversity of phytoplankton

4. Decomposition and mineralisation by reducers

Importance of bacterial decomposition of organic material in various (aerobic, anaerobic) systems

Measuring activities using radioisotopes or stable isotopes

Specialized recycling of the largest phytomass: wood decay by fungi

Detection of functional genes in environmental samples

Metagenomics II: What functions are present?

5. Interactions between micro-organisms

Microbial communication: quorum sensing

The summum of plant-fungus interactions: mycorrhiza

Initial competences

Students are familiar with general concepts in biology, ecology, microbiology and biochemistry as introduced in the courses in the bachelor program Biology.

Final competences

- 1 To explain the parameters that influence the distribution and metabolic activity of microbial life.
- 2 To describe the contribution and importance of micro-organisms in ecosystem function in different habitats.
- 3 To explain the interrelations (collaboration, competition, predation, succession) between different functional microbial groups in ecosystems.
- 4 To explain the principle of quorum sensing and its ecological importance.
- 5 To compare the different approaches to investigate the microbial composition of ecosystems (community analyses, isolation-based methods and functional analyses).
- 6 To critically consider the advantages and disadvantages of different methods to investigate the microbial composition of ecosystems.
- 7 To understand the importance and consequences of the viable-non-culturable status of bacteria, including pathogenic bacteria.
- 8 To explain the different bacterial strategies of using light energy.
- 9 To compare the different chemolithotrophic options for primary production.
- 10 To explain the role of microorganisms in biodegradation of organic compounds (including plant material) and in bioremediation.
- 11 To appreciate the importance of microorganisms for plant life, in particular the contribution of nitrogen-fixers and mycorrhiza, plant pathogens, microorganisms for biocontrol and plant-growth-promotion.
- 12 To integrate and critically evaluate new information together with related information from other disciplines.
- 13 To report new information both orally and in writing to peers (possibly in a second language).

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

Lecture, microteaching

Extra information on the teaching methods

Theory is provided in lectures using Powerpoints that are made available electronically. In addition in a microteaching assignments students develop a topic, individually or in small groups, starting from a few publications that are provided. They present this information to fellow students and teachers in a presentation, followed by a question and answer session.

Learning materials and price

Lecture material (powerpoint presentations and pdf files of recent papers) is electronically available.

Estimated cost: 25 EUR

References

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Course content-related study coaching

Questions and problems can be addressed individually via e-mail, on appointment, or during the lectures and exercises.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions

Examination methods in case of permanent evaluation

Participation, assignment

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

Theory: written exam.

Microteaching: evaluation is based on the presentation of a topic that was prepared in groups and on personal participation in the subsequent discussion in class (posing and answering questions).

Calculation of the examination mark

Periodical evaluation: 80%

Non-periodical evaluation: 20%. This is the valuation of the microteaching assignment.

In the second exam period, the same marks for non-periodical evaluation are again taken into account for 20% of the total.