GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Microbial Ecology (C002774)

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

Credits 5.0 **Study time 140 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 1)	English	Gent	peer teaching
			lecture

Lecturers in academic year 2024-2025

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 2024-2025	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, microorganims 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

Group work, Lecture, Peer teaching

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.

Study material

Type: Slides

Name: Slides Microbial ecology
Indicative price: Free or paid by faculty
Optional: no
Language : English
Oldest Usable Edition : Slides are revised each year
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : No

References

-

Course content-related study coaching

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

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

Participation, Assignment

Possibilities of retake in case of permanent assessment

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 thesubsequent 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.