

BIO-372

Microbiology

McKinney John

Cursus	Sem.	Type
Life Sciences Engineering	BA6	Opt.
Physics of living systems minor	E	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course will provide an introduction to fundamental concepts in microbiology. Special emphasis will be given to the surprising and often counter-intuitive physical world inhabited by microorganisms.

Content

- The unexpected physics of being small
- Microbial cell structure, inside and out
- Microscale forces and microbial form
- Transmembrane transport phenomena
- Biomechanics of microbial appendages
- Microbial motility and microscale fluid mechanics
- Microbial taxis - random walks and directed motion
- Global nutrient and redox cycles
- Microbial metabolic symbiosis
- Symmetry breaking in microbial differentiation
- Molecular noise and microbial individuality
- Genetic networks and synthetic microbiology
- Fundamentals of virology

Learning Prerequisites**Required courses**

Cycle propédeutique (semestres 1 et 2) et cycle bachelor (semestres 3 et 4) en Sciences et Technologies du Vivant

Recommended courses

Fluid Mechanics for SV, Structural Mechanics

Learning Outcomes

By the end of the course, the student must be able to:

- Explain how microscale forces shape the basic structure of microbial cells
- Explain the mechanics of non-Hookean biomaterials in microbial cell functions
- Explain how low Reynolds number fluid dynamics affect microbial motility
- Explain how low Péclet number transport phenomena affect microbial taxis
- Explain the selectivity of material exchanges between microbes and their environments

- Explain the essential roles of microorganisms in global nutrient and redox cycling
- Explain the molecular and physiological bases of microbial metabolic symbioses
- Explain some of the symmetry-breaking strategies involved in microbial differentiation
- Explain the role of molecular fluctuations in microbial non-ergodic phenotypic variation
- Explain the logic of microbial genetic networks in basic engineering terms
- Explain fundamental concepts in replication and pathogenesis of viruses

Transversal skills

- Access and evaluate appropriate sources of information.
- Summarize an article or a technical report.
- Take responsibility for environmental impacts of her/ his actions and decisions.
- Respect the rules of the institution in which you are working.
- Communicate effectively, being understood, including across different languages and cultures.
- Use a work methodology appropriate to the task.

Teaching methods

Lectures and group exercises

Expected student activities

Attendance of lectures, completion of written exercises in small working groups

Assessment methods

Written exam of 3 hours comprising 14 answers in short-essay format based on 14 questions (2 per week) selected from a list of 28 questions.

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Bibliography

Brock Biology of Microorganisms 13th Edition, by Madigan MT, Martinko JM, Stahl DA, and Clark DP, Published by Benjamin Cummings (© 2012).

Ressources en bibliothèque

- [Brock Biology of Microorganisms / Madigan](#)

Moodle Link

- <https://go.epfl.ch/BIO-372>