

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
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**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>