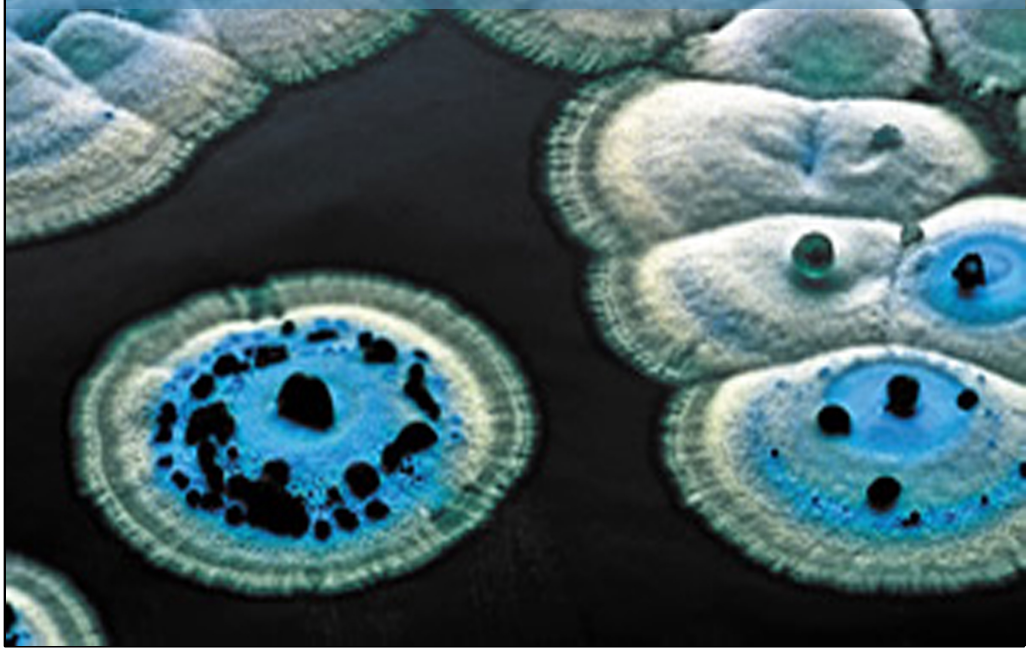
Microbiology (BIO-372)



EPFL-SV's Curriculum in Microbiology & Immunology

- 3rd year Bachelor, Autumn (BA5):
  BIO-310 Immunology
  Instructors: Bruno Lemaitre & David Suter
- 3rd year Bachelor, Autumn (BA5):
  BIOENG-399 Immunoengineering
  Instructor: Li Tang
- 3rd year Bachelor, Spring (BA6):
  BIO-372 Microbiology
  Instructor: John McKinney
- 1st year Master, Autumn (MA1):
  BIO-479 Immunology (Advanced Topics)
  Instructor: Andrea Ablasser
- 1st year Master, Autumn (MA1):
  BIO-413 Planetary Health (Sustainability)
  Instructor: Nicola Banwell
- 1st year Master, Spring (MA2):
  BIO-477 Infection Biology
  Instructor: Melanie Blokesch

Please (!!!) do not print out my slides

"I am the Lorax. I speak for the trees.
I speak for the trees, for the trees have no tongues.
And I'm asking you, sir, at the top of my lungs.
Oh please do not cut down another one."

Note the slide no.

Structure of the course

Classes: Wed. @ 14:15 - 16:00 in room CE 1.106: Exercises
Wed. @ 16:15 - 18:00 in room CE 2: Lectures

Grading: 60% Exams (three exams during the semester)
20% Exercises (self-graded and peer-graded)
20% Miniprojects (small teams)

Website: https://moodle.epfl.ch/course/view.php?id=407

I will post my lecture slides on Moodle. My slides will include references and notes – which will be useful in preparing for the exams! – so please make sure you read them. I will post optional supplementary reading on Moodle and I will answer questions via the Moodle forum, so please make sure you are subscribed.

Structure of the course

Weeks 01-05	Weeks 05-09	Weeks 09-14
01: Lecture > 02: Exercises 02: Lecture > 03: Exercises 03: Lecture > 04: Exercises	05: Lecture > 06: Exercises 06: Lecture > 07: Exercises 07: Lecture > 08: Exercises	09: Lecture > 10: Exercises 10: Lecture > 11: Exercises 11: Lecture > 12: Exercises
04: Miniprojects	08: Miniprojects	12: Miniprojects
05: First Exam	09: Second Exam	13: Third Exam
		13: Miniprojects
		14: Presentations 14: Poster session

Four levels of understanding (and grades)

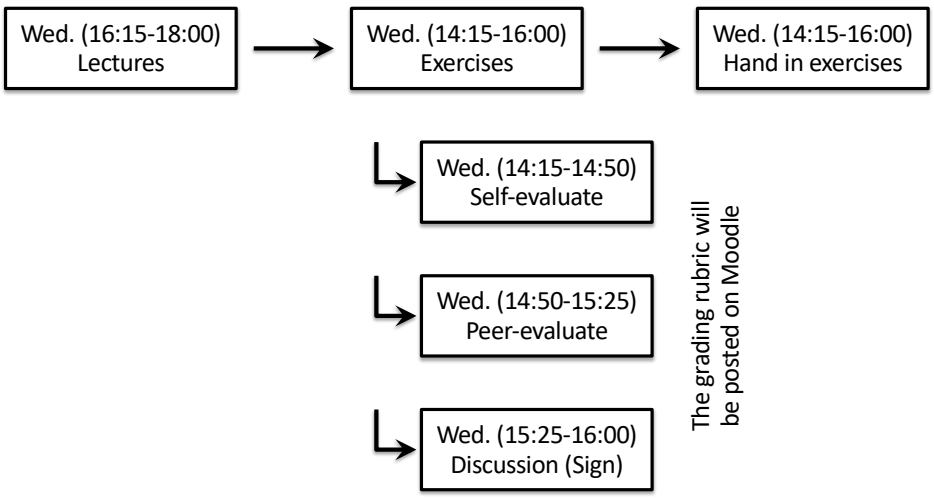
1. *Memorize* facts. Ex: At a defined pressure *P*, small cells are more resistant to osmotic rupture than large cells. Grade: 3.0

2. *Memorize* relationships. Ex: Small cells are more resistant to osmotic rupture than large cells because cell wall tension is lower in small cells. Grade: 4.0

3. *Describe* quantitatively. Ex: Small cells are more resistant to osmotic rupture than large cells because cell wall tension is lower in small cells because $T = Pr$ (Laplace's Law). Grade: 5.0

4. *Understand* mechanically. Ex: Small cells are more resistant to osmotic rupture than large cells because cell wall tension is lower in small cells because $T = Pr$ (Laplace's Law) because the orthogonal (useful) component of cell wall tension increases as the radius of curvature decreases. Grade: 6.0

How the exercises will be graded

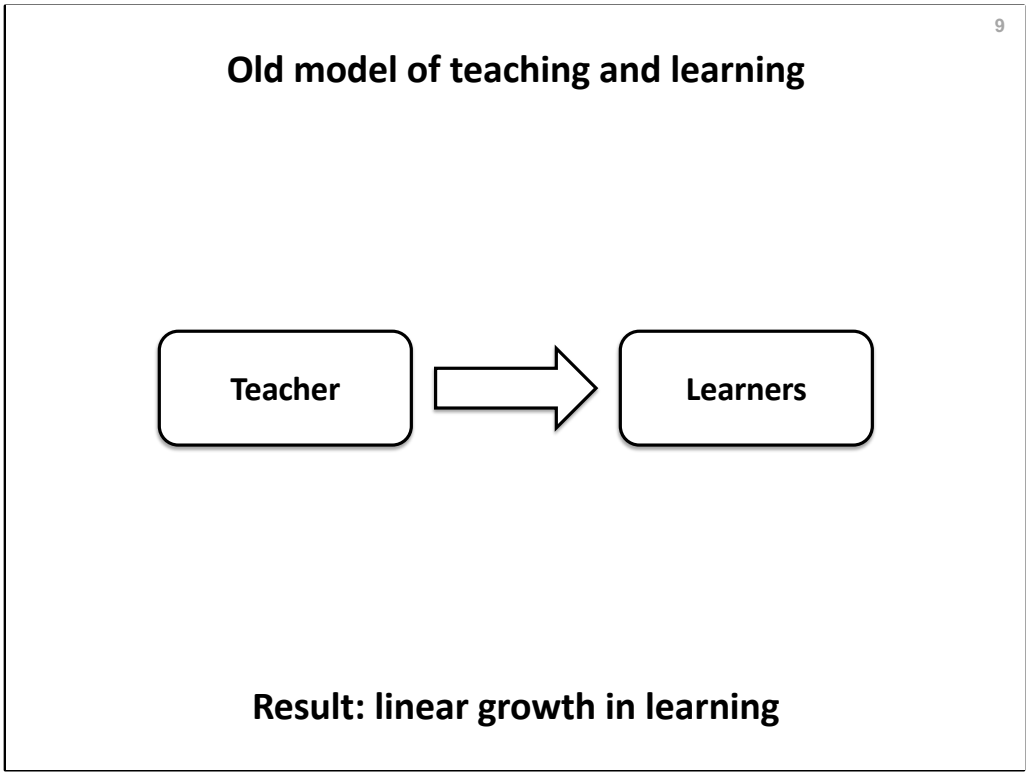


The exercises will count for 20% of the final grade

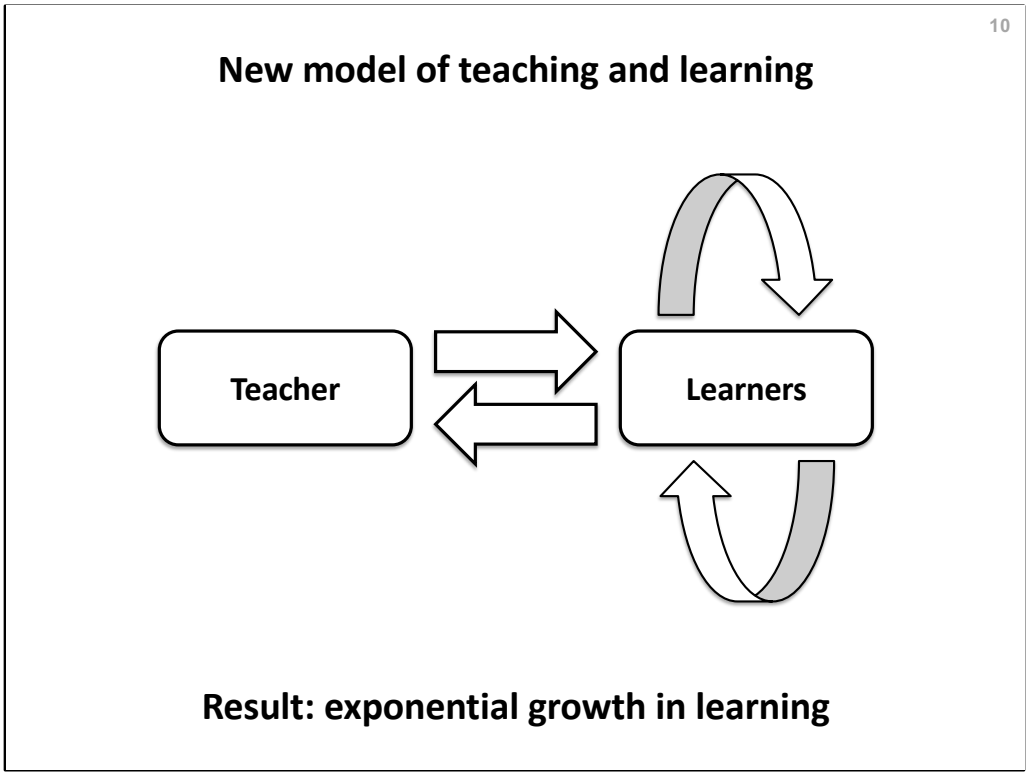
How the miniprojects will be graded

Week 04 (2025.03.12) Miniproject 1st Session	Select your teammates Discuss research topics
Week 08 (2025.04.09) Miniproject 2nd Session	Finalize your research topics Discuss structure and content
Week 12 (2025.05.14) Miniproject 3rd Session	Finalize structure and content
Week 13 (2025.05.21) Miniproject 4th Session	Finalize team posters (due 2025.05.22) and oral presentations (due 2024.05.26)
Week 14 (2025.05.28) Miniproject 5th Session	Team presentations (14:15-16:00) Team poster session (16:15-18:00)

The miniprojects will count for 20% of the final grade



Old model of teaching and learning. The teacher teaches. The students learn. The flow of information is one-way. Teaching and learning are limited to the contents of *one* brain (the teacher's). Result: linear growth in learning.



New model of teaching and learning. The teacher teaches *and* learns. The students learn *and* teach - to each other and to the teacher. The “teacher” is both a teacher *and* a learner. The “learners” are both learners *and* teachers. The flow of information goes in multiple directions. Teaching and learning draw upon the contents of *many* brains (the “teacher’s” and the “learners’”). Result: exponential growth in learning.

The Dreaded but Inevitable Exams

Where: CE 1.106

When: March 19th, April 16th, May 21st

Content: 5 questions per week (15 questions per exam)

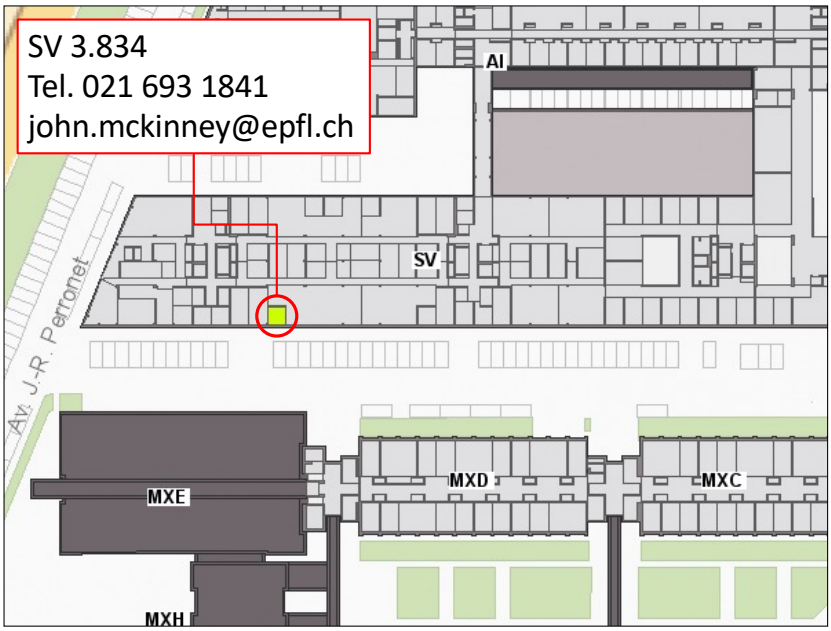
Format: Multiple choice and short essay questions
Complete sentences not required
Drawings and diagrams encouraged

> Exams are in English but you may respond in English or in French (or both).

> Questions are concept-oriented to test your understanding of *concepts* more than your memorization of *facts*.

The three exams will count for 60% of the final grade

If you are having trouble, ask me for help ASAP!



Teaching Assistant for BIO-372 “Microbiology”

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Please let me know if I talk too fast

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Why use in-class “clicker” questions?

Inputs:

Active learning is more engaging (and more effective).

Active learning emphasizes “thinking” over “memorizing”.

Peer-to-peer instruction (proven efficacy).

Outputs:

Students achieve better understanding and retention.

Students’ grade point average goes up.

Students’ failure rate goes down.

Note the red border

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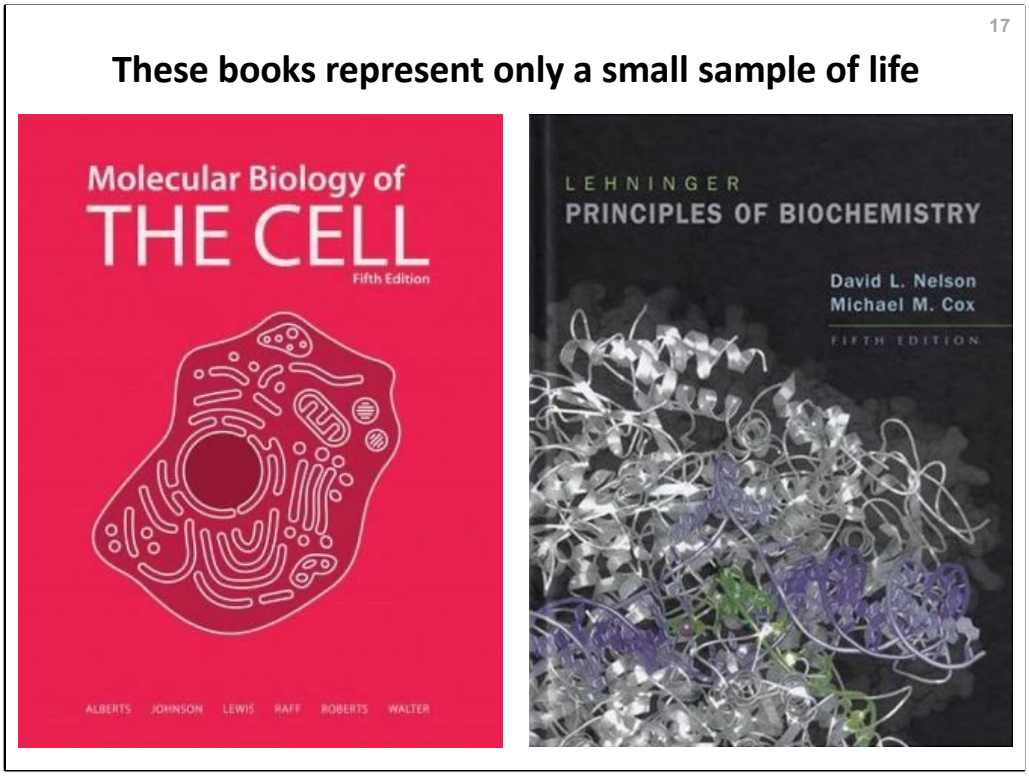
The concept of “the biochemical unity of life”

"Anything found to be true of *Escherichia coli* must also be true of elephants, only more so."

Jacques Monod (1954)

The Nobel Prize in Physiology or Medicine 1965 was awarded jointly to Jacques Monod, François Jacob, and André Lwoff *"for their discoveries concerning genetic control of enzyme and virus synthesis"*.



SOURCE: https://www.techtimes.com/articles/155821/20160504/99-999-percent-of-earths-1-trillion-microbial-species-remain-undiscovered-scientists.htm

99.999 Percent Of Earth's 1 Trillion Microbial Species Remain Undiscovered!

Our planet may be home to a staggering 1 trillion microbial species – 99.999 percent of which remain unearthed, according to a new study. Two biologists from Indiana University – associate professor Dr. Jay Lennon and postdoc fellow Dr. Kenneth Locey – created the biggest microorganism database of its kind by using combined animal, plant, and microbial data from government, academic, and citizen science records. The output: an estimate of more than 5.6 million identified species from 35,000 places across the world except Antarctica. They then applied mathematical scaling laws to predict the number of species at a certain landscape. They discovered that across communities of both microscopic and larger plant/animal groups, the same scaling laws applied: as the number of organisms in a given community increased, the number of species grew. Until now, we haven't known whether aspects of biodiversity scale with something as simple as the abundance of organisms. As it turns out, the relationships are not only simple but powerful, resulting in the estimate of upwards of 1 trillion species," said Locey. Lennon said estimating the number of species on the planet is among biology's greatest challenges today, with new genetic sequencing methods only recently offering a large pool of new information. "We've done a pretty good job of cataloguing macrobes . . . but the rate we are exploring new [plants and animals] is slowing down," he told Christian Science Monitor, also citing that it is only in the last two to three decades that scientists learned how to identify microbes. Microbes are the most abundant life on Earth, meaning biologists are still missing out on a huge chunk of their population. These species include single-celled organisms like bacteria and archaea and certain types of fungi, with 10,000 varying kinds of bacteria on 1 square centimeter (0.155 square inch) of a human arm at any time. Moreover, humans greatly rely on these microbes for a rich array of functions, including digestion, nutrient cycling, and clean water. There could be many more roles these organisms play in everyday life but haven't been recognized as such. The significantly undersampling of microorganism has led to new efforts in the last few years, including the collection of the Human Microbiome Project of the National Institutes of Health and the Tara Oceans Expedition's marine microorganisms. "[This research] highlights how much of that diversity still remains to be discovered and described," echoed Simon Malcomber of the National Science Foundation's Dimensions of Biodiversity, which funded the study. Despite this gap, he added, about 40 percent of the global economy keeps depending on biological resources.

How microbes might describe us humans

"Vertebrates: a subphylum of ridiculously large, energetically inefficient, short-lived, and reproductively "challenged" multicellular organisms with pathetically limited metabolic capabilities.

(Oh, and they have backbones, too. Weird!)

Fortunately, they are comparatively rare."

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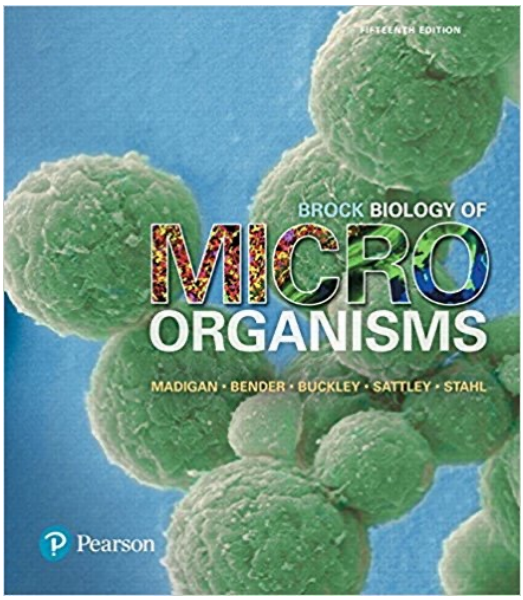
You are strongly encouraged to acquire this book



SOURCE: Madigan MT, Bender KS, Buckley DH, Sattley WM, Stahl DA, *Brock Biology of Microorganisms [15th edition]*, published by Benjamin Cummings, Pearson Education Inc., San Francisco © 2018.

This book is available in hardback or as a Kindle e-book.

Any questions?