BIO-221

Cell and developmental biology for engineers

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Cursus	Sem.	Type
Life Sciences Engineering	BA5	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The students will learn essentials of cell and developmental biology, with an emphasis on animal model systems and quantitative approaches.

Content

The students will be introduced to fundamental concepts and questions in cell and developmental biology, with an emphasis on animal model systems and quantitative approaches to analyze them. Topics that will be covered include fertilization, cell polarity, genome activation, patterning, axis specification, differentiation, gastrulation, scaling, organogenesis, size control, regeneration, cell death, germ cell specification, cell migration, multicellularity and evolution. Students will learn that developmental systems must have the correct constituents (the what question), positional information (the where question), temporal information (the when question), as well as appropriate relationships between genes, cells, tissues and organisms (the how questions). Parallels will be drawn between various concepts familiar to engineers and developmental systems to highlight underlying guiding principles.

Keywords

Cell biology, developmental biology, quantitative aspects, embryogenesis, model systems (*C. elegans*, *Drosophila*, zebrafish, mouse, ...), research strategies, experimental approaches, mathematical modeling, computer simulations.

Learning Prerequisites

Required courses

Second year Life Sciences BSc, but motivated and equally prepared students from other disciplines are welcome to join.

Learning Outcomes

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

- Explain principles in cell and developmental biology
- Establish parallels between engineering and development
- Model developmental processes
- Assess / Evaluate strengths and weaknesses of different model systems and approaches
- Draw conclusions from experimental data
- Propose experiments to address important outstanding questions

Transversal skills

- Demonstrate a capacity for creativity.
- Demonstrate the capacity for critical thinking
- Summarize an article or a technical report.
- Access and evaluate appropriate sources of information.
- Take feedback (critique) and respond in an appropriate manner.

Teaching methods

Each week, typically the first two hours will consist of lectures given by the teachers, whereas the next two hours will consist of reading, demonstrations and/or exercises, including computer simulations (depending on the week).

Expected student activities

The students are expected to participate actively in all four hours of class. Moreover, four hours of personal study per week are expected on average.

Assessment methods

Owing to the coronavirus situation, this year the evaluation will be in the form of a written exam taking place during the January exam session; details of the exam format will be provided in due time.

Supervision

Office hours	No
Assistants	Yes
Forum	No
Others	Appointments with the teachers by e-mail.

Resources

Bibliography

Some of the illustrations will be drawn from:
Developmental Biology, Gilbert and Barresi, 11th edition, Sinauer, Oxford
Other sources will be indicated on the lecture slides.

Ressources en bibliothèque

- Developmental Biology, Gilbert and Barresi

Notes/Handbook

The lectures slides will also be made available through Moodle.