

Gene Regulation and Epigenetics (I002621)

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

Credits 3.0 **Study time 90 h**

Course offerings and teaching methods in academic year 2024-2025

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|----------------|---------|------|--|
| A (semester 2) | English | Gent | independent work seminar lecture |
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Lecturers in academic year 2024-2025

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|-------------|------|--------------------|
| Kyndt, Tina | LA25 | lecturer-in-charge |
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Offered in the following programmes in 2024-2025

| | crdts | offering |
|--|--------------|-----------------|
| Master of Science in Bioscience Engineering: Cell and Gene Biotechnology | 3 | A |
| Exchange Programme in Bioscience Engineering: Cell and Gene Biotechnology (master's level) | 3 | A |

Teaching languages

English

Keywords

Eukaryotic gene regulation, epigenome, DNA methylation, histone modifications, gene silencing, chromatin, paramutation, imprinting, stress responses, signal transduction

Position of the course

In this course various mechanisms that influence gene expression and protein production in eukaryotes will be discussed: chromatin configuration, DNA methylation, RNA based gene silencing. The importance of gene regulation for the normal development of organisms will be highlighted. The dynamic response of a cell upon influences by the environment (stress responses, signal transduction) will be explained.

Contents

1. Background
2. Transcriptional regulation and translational regulation
3. Epigenetic mechanisms
 - a. DNA methylation
 - b. Chromatin-based epigenetic mechanisms
 - c. Gene silencing: small and long non-coding RNAs (PTGS and TGS)
 - d. uORFs
4. Regulation at the post-translational level: signal transduction
 - a. Stimuli - receptors
 - b. Messengers
5. Role of epigenetic regulation during development
 - a. examples in animals (parental imprinting)
 - b. examples in plants (transposable elements, paramutation, vernalisation)
6. Role of gene regulation during stress and disease
 - a. cancer, medical diagnostics
 - b. abiotic and biotic stress in plants
7. Seminar on Ethics by guest lecturer

Initial competences

Basic knowledge biochemistry, molecular biology, gene technology

Final competences

- 1 Insight into the complex gene regulatory networks in eukaryotic organisms.
- 2 Have knowledge about the role of gene regulation in normal biological processes.
- 3 Have knowledge about disturbances of gene regulation which occur during disease and stress responses
- 4 Discuss scientific literature about epigenetic processes.
- 5 Critically analyze the ethical aspects concerning the described techniques.

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

Seminar, Lecture, Independent work

Extra information on the teaching methods

This course involves oral lectures and a guest seminar. The students have to write a assignment about two selected scientific articles related to the course content, in which these articles have to be summarized and critically assessed.

A recommended handbook as well as the slides are distributed for free via UFORA.

Study material

None

References**Course content-related study coaching**

by email or personally (after the class or on appointment)

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

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Extra information on the examination methods

Participation (during seminar), assignment, and written exam

Calculation of the examination mark

Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.