GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Epigenetics (C002706)

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

Credits 3.0 **Study time 80 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 1)	English	Gent	seminar
			lecture

Lecturers in academic year 2024-2025

Vanden Berghe, Wim	WE14	lecturer-in-charge

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Master of Science in Teaching in Science and Technology(main subject Biochemistry and Biotechnology)	3	A
Master of Science in Biochemistry and Biotechnology	3	A
Exchange programme in Biochemistry and Biotechnology (master's level)	3	A

Teaching languages

English

Keywords

DNA methylation, chromatin, histon code, postion effect, gene regulation, epigenetic variation, epimutation, imprinting, gene silencing, RNAi, ncRNA, biomarker, therapy, drug

Position of the course

Epigenetics refers to heritable patterns of gene expression which do not depend on alterations of genomic DNA sequence. With the discovery of RNAi pathways and the histone code, epigenetics has become a popular and fast evolving research topic in cell biology. The aim of the course is presenting an overview of epigenetic phenomena in plants and animals by noncoding RNAs, DNA or histone modifications related to regulation of gene expression. Topics include: methylation based epigenetics, chromatin based epigenetics, epigenetic gene regulation, epigenetic variation, epigenetic gene silencing, RNAi, transcriptional and posttranscriptional gene silencing, restriction modification in bacteria, role of methylation in development, imprinting and X-inactivation, evolutionary role of epigenetics, environmental epigenetics, nutritional epigenetics, behaviour & epigenetics, microbial epigenetics, analytical epigenetic methods, clinical diagnostics, epigenetic drugs.
This course contributes to the following program competencies: Ma.WE.BB.1.1 – Ma.WE.BB.1.5, Ma.WE.BB.2.1 – Ma.WE.BB.2.6, Ma.WE.BB.3.1 – Ma.WE.BB.3.6, Ma. WE.BB.4.1 – Ma.WE.BB.4.4, Ma.WE.BB.5.1 - Ma.WE.BB.5.4, Ma.WE.BB.6.1 – Ma.WE. BB.6.5, Ma.WE.BB.7.RES.1 – Ma.WE.BB.7.RES.2

Contents

- An Introduction to Epigenetics (definition, histoncode, chromatin remodelling, DNA methylation)
- Nuclear architecture and epigenetics
- Chromatin Modifications by Polycomb Complexes
- RNAi and epigenetic silencing
- Transcriptional silencing, posttranscriptional silencing, paramutation and epialleles
- Maternal/paternal imprinting, loss of imprinting and tumorigenesis in mammals
- X chromosome inactivation and dosage compensation

- Transposons and evolution
- Examples of epigenetic regulation in model organisms
- Epigenetic effects of ncRNAs in Cell Biology and Diseases
- Epigenetics in Cancer and Stem cell Biology
- Epigenetics and its Genetic Syndromes
- Epigenetics and Immunity
- Epigenetics and Behaviour
- Epigenetics and Cardiovascular Disease
- Epigenetics and Aging
- Epigenetic response to diet or environmental factors
- Epigenetic Drugs and therapy
- Evolutionary aspects of epigenetics
- Experimental analytical approaches in epigenetics and clinical diagnostics

Initial competences

Previous education in the life sciences equivalent with the level of Master of Science in Biochemistry and Biotechnology, specifically good knowledge of Molecular Genetics, Molecular Biology and Gene technology.

Final competences

1 The student will have insight in epigenetically controlled gene expression, essential for silencing repetitive and transposable elements, locus control regulation and occuring during cell differentiation, sex differentiation, gametogenesis and imprinting.
2 The student will understand impact of epigenetics in various physiological and pathological conditions in different model organisms
3 The student can apply epigenetic knowledge to design experiments for gene silencing and functional gene analysis.
4 The student is familiar with various chromatin analysis tools applied in epigenetic research and clinical diagnostics
5 The student is able to understand, interpret and apply specialized scientific literature on epigenetics.

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, Peer teaching

Extra information on the teaching methods

The lectures presentations and/or exercises are available via Ufora. The workcolleges consist of lectures presented by the students. Each student can choose a subject, for which articles are provided, summarize it in a poster-abstract/presentation and present it to the group in about 20 minutes after which the subject is discussed with all students.

Study material

Type: Handouts

Name: Handout slides available at Ufora website
Indicative price: Free or paid by faculty
Optional: no
Language : English
Number of Pages : 600
Oldest Usable Edition : slides of last year
Additional information: Supporting info will be available online as pdf documents via ufora website

References

Articles and reviews
Epigenetics in biology and medicine, M. Esteller
Epigenetics, D. Allis, T. Jenuwein, D. Reinberg, ML Caparros

Course content-related study coaching

In addition to discussions with the lecturers during the lectures and work colleges,

the students can contact and Prof. Dr. W. Vanden Berghe (w.vandenberghe@ugent.be) (WE14-UGent) or wim.vandenberghe@uantwerpen.be (Cell Death Signaling - Epigenetics lab -UAntwerpen) by email to deepen their understanding of the subject.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment with multiple-choice questions, Peer and/or self assessment, 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

Oral assessment, Participation, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Extra information on the examination methods

Half of the points are given for the posterabstract and powerpoint presentation about an epigenetic subject chosen by the student (based on a research paper). The other half of the points is based on the quality of the answers given to written exam.

Calculation of the examination mark

25% oral presentation + poster abstract
75% written exam

Facilities for Working Students

Recorded vidoelectures avaiable
Oral presentation agreed upon appointment