Cellular and Molecular Biomarkers (C004346)

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

Credits 4.0   **Study time 100 h**

Course offerings in academic year 2026-2027

A (semester 2)   English   Gent

Lecturers in academic year 2026-2027

Cajaraville, Miren	LEIOA01	lecturer-in-charge
Orbeo, Amaia	LEIOA01	co-lecturer

Offered in the following programmes in 2026-2027	**crdts**	**offering**
International Master of Science in Marine Biological Resources	4	A

Teaching languages

English

Keywords

biomarkers, pollution, health assessment, biomonitoring, risk assessment,

Position of the course

Directed at students aiming to specialize in environmental toxicology, with a focus on cell and molecular biology; global/updated view of environmental problems and the use of cell/molecular responses as early warning signals (biomarkers) of ecosystem health in pollution assessment.

Aims at providing a global/updated view of environmental toxicology and the use of cell/molecular responses as early warning signals (biomarkers) of ecosystem health in pollution assessment.

At the end of the Unit, the student should be aware of the relevance of the cellular and molecular mechanisms of accumulation/detoxification of metal and organic xenobiotics, in relation to the diagnosis of toxic levels relevant to biomonitoring, biological effects assessment, ecosystem health, and environmental risk assessment.

Contents

1 Introduction to cellular and molecular biomarkers of pollution: examples and applications in monitoring programmes.
2 Biomarkers and bioassays for endocrine disrupting environmental pollutants.
3 Techniques to measure cell and molecular biomarkers.
4 Toxicity of metallic pollutants, in relation to cellular accumulation and storage processes.
5 In vitro alternative methods in biomarker development: potential of mussel cells primary cultures for toxicity testing of environmental pollutants.
6 Generation of oxyradicals and oxidative stress in marine organisms.
7 Mechanisms of pollutant-induced peroxisome proliferation and rationale, for use as a biomarker in environmental pollution assessment.
8 Biotransformation of organic xenobiotics.
9 Lysosomal perturbations as indicators for toxically-induced cell damage.
10 Biomarkers for assessment of toxicant-caused DNA damage.
11 Challenges for use of biomarkers in environmental monitoring and risk assessment.

Practicals: Biomarkers of exposure to metals. Assessment of peroxisome proliferation. Lysosomal biomarkers. Genotoxicity assessment. Seminars: Application of biomarkers to case studies.

Initial competences

Basis of bioscience or animal science and environmental sciences

Final competences

1 Understand the mechanisms of action incorporation into cells, as well as the cellular strategies to detoxify and/or sequester physiological metals at toxic concentrations and xenobiotic metals, depending on the characteristics and speciation of metals.

2 Understand the cellular and molecular responses to pollution by organic xenobiotics, including their biotransformation, involvement in oxyradical generation, and mechanisms and strategies of cellular and molecular adaptation.

3 Understand the cellular and molecular pathways that lead to toxicant-caused genotoxic and non-genotoxic DNA and chromosomal damage, including repair mechanisms, and further development of preneoplastic and neoplastic diseases.

4 Understand the importance of pollutant effects on cell signalling and homeostasis of the endocrine system, with emphasis in ecologically-relevant effects on reproduction.

5 Understand the implications of the changes at cellular and molecular level, in the general health condition of the individuals and the natural populations, with the aim of achieving a reasonable and sustainable exploitation of natural resources.

6 Understand the rationale for the use of cellular and molecular responses to pollutants in environmental monitoring and in environmental risk assessment, including the limitations and challenges of the approach. Role of emerging toxico-genomics and proteomics in new biomarker discovery.

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

Extra information on the teaching methods

Lectures 20
Practicals 13
Seminars 5
Computer class 2

Study material

None

References

Course content-related study coaching

Assessment moments

end-of-term assessment

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

Skills test, Oral assessment, Written assessment, Assignment

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

Skills test, Oral assessment, Written assessment, Assignment

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

Written/oral examination + participation, job performance assessment, report

Calculation of the examination mark

Personal report (100%), attendance and Notebook of practicals may be used to apply correction factors