COURSE DATA

DATA SUBJECT

Code: 47092
Name: Mechanisms and Biomarkers in Ecotoxicology
Cycle: Master's Degree
ECTS Credits: 5.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología	Facultat de Ciències Biològiques	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología	Ecotoxicología	COMPULSORY

COORDINATION

RAMO ROMERO JOSE JUAN DEL

SIREROL PIQUER M SALOME

TORREBLANCA TAMARIT AMPARO

SUMMARY

The **Mechanisms and Biomarkers in Ecotoxicology** course offers a comprehensive view of how organisms respond to the presence of chemical and physical contaminants in the environment. It analyzes both the effects of substances derived from human activity (xenobiotics) and those caused by physical agents, including thermal alterations and ionizing radiation, which can seriously affect the health of living beings and the balance of ecosystems. It studies the main physiological and molecular mechanisms of resistance to xenobiotics used by organisms to cope with these toxic substances. Furthermore, special attention is paid to endocrine disruption and reproductive toxicology, analyzing how certain compounds can interfere with hormonal regulation and key processes of development and reproduction. Another fundamental component of the course is the use of biomarkers, key tools for detecting exposure to contaminants and assessing their effects on organisms. These indicators allow us to assess the health of living beings and estimate the ecological risk associated with different types of pollution. The application of biomarkers in environmental biomonitoring campaigns is also addressed, facilitating a more precise assessment of the actual impact of pollutants.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

No enrollment restrictions have been specified with other subjects in the curriculum.

COMPETENCES / LEARNING OUTCOMES

-

Acquire the capacity for autonomous and organised learning and for adapting to new situations.

Collaborate effectively in work teams, taking on responsibilities and leadership roles and contributing to collective improvement and development.

Demonstrate critical and self-critical reasoning in the field of the degree, considering aspects such as professional ethics, moral value and the social implications of the different activities carried out.

Design and conduct studies and tests to identify and assess endocrine disruption caused by environmental pollutants.

Develop the ability to work in multidisciplinary teams and to cooperate effectively.

Develop the capacity for analysis, synthesis and critical thinking in applying the scientific method.

Know and understand, within the area of the degree, inequalities based on sex and gender in society; integrate different needs and preferences based on sex and gender into the design of solutions and problem-solving.

Know how to identify the effects of environmental pollutants on reproductive function in animals, including sexual function, gametogenesis, fertilisation and early embryonic development.

Know the animal models used for studying human diseases in relation to environmental pollution.

Learn how to write scientific articles in the fields of environmental pollution and ecotoxicology.

Understand the effects of pollutants on animal and plant physiology.

Use computer tools, statistical methods and data simulation appropriately, applying software and statistics in ecotoxicology and in issues arising from environmental pollution.

Use different bibliographic sources and biological databases.

Use indicators of environmental risks and health-related damage.

DESCRIPTION OF CONTENTS

THEORY

Topic 1. Physiological and Molecular Basis of Xenobiotic Resistance.

Resistance by Behavior Modification. Resistance by Modification of Entry Routes. Resistance by Decreased Availability of the Xenobiotic. Metabolic Resistance. Resistance by Modification of the Target.

Topic 2. Endocrine Disruption

Definition. Environmental endocrine disruptors. Modes of action, low-dose effects, and response types. Exposure during critical life stages and delayed effects. Evidence of endocrine disruption in humans and animals. Effects of mixtures of compounds. Epigenetic modifications and transgenerational effects. Methods for the detection and evaluation of the endocrine-disrupting potential of environmental compounds.

Topic 3. Reproductive and Developmental Toxicology

Interference of environmental contaminants on sexual function, on gametogenesis in males and females, and on events during fertilization and the early stages of embryonic development. Effects on sexual maturation.

Topic 4. Pollution Biomarkers

History, concept, and classification. Types, meaning, and determination methodologies. "Omics" technologies and development of new biomarkers. Application of biomarkers in Adverse Outcome Pathways (AOPs) and environmental risk assessment. Integrated indices. Use in biomonitoring programs.

PRACTICAL ACTIVITIES

Determination of various biomarkers in tissues obtained from animal models. Creation of a poster with the results.

Determination of alterations in insect metamorphosis and reproduction caused by exogenous compounds.

COMPLEMENTARY ACTIVITIES

As part of the in-person activities, the following may be carried out:

SEMINARS: Students will orally present a paper from among the topics proposed by the faculty.

TUTORIALS: Tutorial sessions (individual or group work) may be organized in coordination with the theoretical syllabus, which will help consolidate the subject's competencies.

LECTURES: Attendance at lectures given by members of the scientific community.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	40,00
Laboratory	15,00
Total hours	**55,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	6,00
Independent study and work	61,50
Preparation of lessons	0,00
Preparation for assessment activities	15,00
Resolution of case studies	0,00
Total hours	**82,50**

TEACHING METHODOLOGY

The course is structured as follows:

- Lecture-style theoretical classes, which will be taught sequentially throughout the semester. Tutorials with active student participation are included.
- Practical classes (MANDATORY ATTENDANCE). The total number of classroom hours is divided into 5 sessions. In each session, students complete the proposed activities after reading the previously provided instructions. The practical component cannot be passed if all sessions are not attended.
- The University of Valencia's virtual classroom will be used for all activities to exchange documents and communicate.

EVALUATION

The following distribution is proposed, based on a maximum of 10 points:

- Assimilation of theoretical concepts (up to 5 points) through a written exam. A minimum of 2 points is required to evaluate the remaining activities.
- Assessment of the internship through a written exam (up to 2 points). Participation and the result of a

written exam will be evaluated.
- Continuous assessment (2 points). Participation and utilization of tutorials and internships will be evaluated.
- Assessment of the seminars (up to 1 point). The oral presentation will be evaluated.

REFERENCES

- Blasco, Julián. Marine ecotoxicology : current knowledge and future issues. London, United Kingdom: Academic Press Elsevier, 2016.
- Darbre, P.D. (2021). Endocrine Disruption and Human Health. Elsevier Science & Technology. San Diego. USA.
- Fowler, Bruce A. Molecular biological markers for toxicology and risk assessment. London, UK: Academic Press is an imprint of Elsevier, 2016. Print.
- Gagne, Francois. Biochemical ecotoxicology: principles and methods. Amsterdam: Academic Press, 2014..
- Gupta, Ramesh C. Biomarkers in toxicology. Amsterdam: Academic Press, 2019. Print.
- Khetan, S.K. (2014). Endocrine disruptors in the environment. John Wiley & Sons, Inc. New Jersey. USA
- Muttin, Frédéric. Oil spill studies : healing the ocean, biomarking and the law. London, UK Oxford, UK: Elsevier Ltd. ISTE Press, 2018.
- Natalie Burden, Michelle R. Embry, Thomas H. Hutchinson,vScott G. Lynn, Samuel K. Maynard, Constance A. Mitchell, Francesca Pellizzato, Fiona Sewell, Karen L. Thorpe, Lennart Weltje, James R. Wheeler. (2022) Investigating endocrine-disrupting properties of chemicals in fish and amphibians: Opportunities to apply the 3Rs. SETAC 18 (2). Pag. 442-458
- Norris, D.O. (2007) Vertebrate endocrinology (4th Ed.) Elsevier Academic Press. San Diego, London.
- OECD (Organisation for EconomicCo-operation and Development). (2018). Endocrine disrupting chemicals
- Pivonello, R. & Diamanti-Kandarakis, E. (Eds) (2023). Environmental endocrinology and endocrine disruptors: endocrine and endocrine-targeted actions and related human diseases. (1st ed). Endocrinology Series. Springer Nature, Switzerland.
- Triquet, C, J. C. Amiard, and Catherine Mouneyrac. Aquatic ecotoxicology: advancing tools for dealing with emerging risks. London: Academic Press is an imprint of Elsevier, 2015.