COURSE DATA

Data Subject	
Code	43058
Name	Biomarkers of pollution
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2139 - M.U. en Contaminación, Toxicología y Sanidad Ambient. 12-V.2	Faculty of Biological Sciences	1	Second term

Subject-matter

Degree	Subject-matter	Character
2139 - M.U. en Contaminación, Toxicología y Sanidad Ambient. 12-V.2	3 - Environmental toxicology	Optional

Coordination

Name	Department
TORREBLANCA TAMARIT, AMPARO	357 - Cellular Biology, Functional Biology and Physical Anthropol.

SUMMARY

Environmental toxicology needs to relate the presence of a pollutant in the environment to a valid prediction of the risk it poses to living beings. Biomarkers provide a measure of the exposure or effect of the contaminant on organisms. Their use in bio-monitoring campaigns for ecosystems is constantly increasing since they allow us to know the general "health" of the organisms that inhabit the contaminated ecosystems and are indicative of the nature of the polluting substances to which they are exposed.

The study of this matter is basic to know one of the most powerful tools available to evaluate the impact of pollutants on living things in different ecosystems, in addition to predicting the risk associated with their presence.

It is a subject with 3 ECTS credits, which is located in the second semester of the master. It has an applied character, oriented to the evaluation of specific situations that occur in the environment.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

OUTCOMES

2139 - M.U. en Contaminación, Toxicología y Sanidad Ambient. 12-V.2

- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
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- Capacidad de análisis, síntesis y razonamiento crítico en la aplicación del método científico.
- Capacidad para el aprendizaje autónomo y organizado y para la adaptación a nuevas situaciones.
- Comprensión del mundo natural como producto de la evolución y de su vulnerabilidad frente a la influencia humana.
- Desarrollo de un compromiso ético y capacidad de participación en el debate social.
- Comprender los mecanismos de toxicidad de contaminantes.
- Diseñar y ejecutar programas para la prevenir la contaminación del medio acuático continental y del litoral.
- Valorar integralmente del estado de salud del medio ambiente.
- Realizar ensayos del ciclo de vida.
- Realizar diagnóstico de problemas ambientales.
- Diseñar los indicadores específicos para un riesgo ambiental concreto.

LEARNING OUTCOMES

SKILLS TO ACQUIRE.
¬ To handle scientific terminology properly and become familiar with their sources.
¬ To get an integrated view of the defense mechanisms of adaptation to the environment of animals. Make sense of foreground, interrelate and apply.
¬ Ability to analyze data, choosing the right method, critical evaluation and interpretation of experimental results in various forms of expression (tables, graphs ...).

¬ Acquire synthesis capacity to collect, coherently and in an organized way, information or data of different origins.
¬ Meet the management of basic scientific instrumentation typical of Biomarkers determination.

SOCIAL SKILLS
¬ Develop capacity for critical thinking, fostering communication and discussion with a view to stimulating individual creative ability.
¬ Ability to work in groups when dealing with problematic situations collectively.
¬ Ability to build a comprehensive text written and organized.
¬ Ability to speaking to a public audience, such as the class itself, by exposure or intervention in a debate on a topic or controversial issue.
¬ Ability to interact with both the teacher and with peers.
¬ Interest in social and economic application of science and in particular the Environmental Toxicology.
¬ Interest in popular science and the impact of science on culture and consciousness of society.
¬ Professional training. Acquisition of scientific and technical knowledge related to resistance to xenobiotics that will facilitate the work in Environmental Toxicology in a society in continuous technological progress.

DESCRIPTION OF CONTENTS

1. THEORY

UNIT 1.- Biomarkers: Concept, classification and specificity. Relationship between the adverse effects of contamination and biomarkers. Scientific basis for the use of biomarkers in monitoring pollution and its effects.
UNIT 2.- Physiological variables as a biomarker. Physiological status. Scope for growth.Caloric content. Hematology. Metabolites present in plasma.
UNIT 3.- Esterases: general and classification. Characterization of the enzymatic activity of B-esterases. Cholinesterases in vertebrates and invertebrates and their use as biomarkers of exposure and effect to organophosphate and carbamate pesticides. Determination of cholinesterase activity
UNIT 4.- Use of the enzymes involved in the biotransformation processes as biomarkers. Phase I enzymes: cytochrome P450 CYP1A. Phase II enzymes: glutathione transferase, UDP-glucuronyl transferase.
UNIT 5.- Metallothioneins. Biochemical characteristics and mechanisms of induction of its synthesis. Quantification methods. Examples of use in real situations
UNIT 6.- Porphyrins and synthesis of the heme group. Inhibition of delta-amino levulinic acid dehdratase (ALA-D) activity as an indicator of lead exposure. Blood carboxylated porphyrin levels as indicators of

exposure to organochlorine compounds. Hemoglobin adducts.
UNIT 7.- Biomarkers related to oxidative stress: oxidative status of glutathione, glutathione reductase activity, catalase activity, peroxidase activity, superoxide dismutase activity. Protein carbonylation. Lipid peroxidation.
UNIT 8.- Biomarkers of genetic damage. Alkaline elution test for DNA strand break. Comet test for DNA strand break. Test for chemical adducts in DNA. Detection of micronuclei.
UNIT 9.- Genomics and proteomics in the development of new biomarkers.
UNIT 10.- Integrated indexes and communication of scientific results

2. PRACTICAL (IN THE LABORATORY)

Laboratory determination of various biomarkers in tissues of different animal species

3. COMPLEMENTARY ACTIVITIES

As part of the face-to-face activity, the following may be carried out:
LECTURES: Attendance at lectures given by members of the scientific community.
TUTORIALS: Work (individual or group) may be proposed to help consolidate the skills of the subject.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	21,00	100
Development of group work	7,00	0
Study and independent work	12,00	0
Preparation of evaluation activities	16,00	0
Preparing lectures	10,00	0
TOTAL	**66,00**	

TEACHING METHODOLOGY

The course is structured as follows:

- Lectures on theory to develop the fundamental knowledge and the methodology to be used.

- Practical classes (compulsory attendance). The total number of classroom hours is divided into 2 sessions of 3 hours each. In each session, students carry out the proposed activities after having read the instructions previously provided. The practical part cannot be passed if all the sessions have not been attended.

- In all activities the virtual classroom of the Universitat de València will be used for the exchange of documents and communication

EVALUATION

The following distribution of a maximum of 10 points is proposed:

- Assimilation of theoretical concepts (up to 6 points) by means of an exam. It is necessary to obtain at least 2.5 points in order to be able to mediate with the rest of the activities.

- Assessment of practical work (up to 3 points). Participation, presentation of a report and practical questionnaire will be assessed.

- Complementary activities: up to 1 point.

REFERENCES

Basic

- Blasco, Julián. Marine ecotoxicology : current knowledge and future issues. London, United Kingdom: Academic Press Elsevier, 2016. Print.

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. Print.

Gross, Elisabeth M., and Jeanne Garric. Ecotoxicology : new challenges and new approaches. London Kidlington, Oxford: ISTE Press Ltd Elsevier Ltd, 2019. Print.

Gupta, Ramesh C. Biomarkers in toxicology. Amsterdam: Academic Press, 2019. Print.

Muttin, Frédéric. Oil spill studies : healing the ocean, biomarking and the law. London, UK Oxford, UK: Elsevier Ltd. ISTE Press, 2018. Print.

Pope, Carey N., and Jing Liu. An introduction to interdisciplinary toxicology from molecules to man. London: Academic Press, 2020. Print.

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. Print.