

**COURSE DATA****Data Subject**

Code	43056
Name	Physiological principles of resistance to xenobiotics
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2021 - 2022

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
GARCERA ZAMORANO, MARIA DOLORES	23 - Functional Biology and Physical Anthropology

SUMMARY

The course "**Physiological basis of resistance to xenobiotics**" is responsible for transmitting basic and applied knowledge on the physiological mechanisms used by organisms to cope with the presence in the environment of toxic substances caused usually by human activity (xenobiotics). The acquisition of this knowledge is accompanied by a set of competencies and skills that lead to a full professional training.

The study of this subject is essential to understand how the presence of xenobiotics in the environment can alter some physiological functions in animals, so that they are able to survive its toxic effects.

It is a matter with 3 ECTS. Efforts to acquire theoretical concepts represent 2.2 ECTS credits, while the practice represents 0.8 ECTS credits. It has an applied nature, oriented to the assessment 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 bioensayos de ecotoxicidad en suelos y aguas.
- Realizar ensayos del ciclo de vida.
- Realizar diagnóstico de problemas ambientales.

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 Applied Physiology.

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. Physiological basis of resistance to xenobiotics

LESSON 1. INTRODUCTION. Xenobiotics: entry pathways and targets. Resistance and tolerance. Types and general mechanisms of resistance. Factors influencing the development of resistance.

LESSON 2. FROM EXPOSURE TO THE TARGET. Absorption versus elimination: behavioral resistance, resistance by change in pathways. Distribution: accumulation / sequestration. Biotransformation: metabolic resistance. Effects on target molecules: resistance by target modification.

LESSON 3. BEHAVIORAL RESISTANCE. Stimulus-dependent mechanisms. Stimulus- not dependent mechanisms.

LESSON 4. RESISTANCE DUE TO CHANGE IN THE PATHWAYS. Decreased penetration: alterations of the cuticle. Modifications of the intestinal epithelium.

LESSON 5. REDUCTION IN THE AVAILABILITY OF THE XENOBIOTIC. Warehousing. Binding to intracellular proteins. Accumulation in tissues.

LESSON 6. METABOLIC RESISTANCE. Phase I biotransformation. Flavinmonooxygenases. P450 enzymes. Involvement of P450s in resistance to insecticides.

LESSON 7. METABOLIC RESISTANCE. The carboxyl/cholinesterase family. Importance of esterases in insecticide resistance.

LESSON 8. METABOLIC RESISTANCE. Phase II biotransformation. Glutathione S-transferases. GSTs and development of resistance. Membrane transporters.

LESSON 9. RESISTANCE BY TARGET MODIFICATION. Modified acetylcholinesterase. Kdr resistance. Rdl resistance.

PRACTICAL WORK. Measurement of enzyme activities associated with insecticide resistance (carboxylesterase and acetylcholinesterase activity, inhibition of acetylcholinesterase activity by an organophosphate insecticide) in two insect strains (*Blatella germanica*), one sensitive and one insecticide-resistant.



TUTORIALS. Analysis and review of the practical work results.

SEMINARS. Students will deepen a topic proposed by the teacher.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	21,00	100
Development of group work	8,00	0
Study and independent work	8,00	0
Preparation of evaluation activities	22,00	0
Preparing lectures	10,00	0
TOTAL	69,00	

TEACHING METHODOLOGY

The course **is divided into**:

-Lectures with a total of 10 hours to be taught sequentially throughout the course, so that they are integrated with the other proposed activities.

-Practical work (MANDATORY ATTENDANCE). The total hours are divided in two three-hour sessions. In each session, students complete the proposed activities after reading the instructions provided in advance. You may not pass the practical work if you have not attended all sessions

-The collective Tutorials. There will be a one-hour long tutorial in the course.

- Seminars (MANDATORY ATTENDANCE) will be prepared individually or in groups (depending on the number of students) by the students on the theme proposed by the teacher. They will be presented at two 1.5 hour-long session.

-Tests to check out the knowledge acquired in the lectures and practical work.

For all activities it will be used the virtual classroom platform of the University of Valencia.

EVALUATION

We propose the following distribution of a maximum of 100 points:

1. Assimilation of knowledge and concepts (up to 50 points).
2. Seminars (presentation, content, and participation) (up to 50 points).



REFERENCES

Basic

- Forbes, V.E. (ed). (1999) GENETICS AND ECOTOXICOLOGY. Taylor and Francis, Inc. 231 pp
- Gilbert, L.I.; Iatrou, K. And Gill, S.S. (eds). (2005) COMPREHENSIVE MOLECULAR INSECT SCIENCE. Elsevier Ltd. Vol 6. 488 pp.
- Hill, R.W.; Wyse, G.A. and Anderson, M. (2006) FISIOLÓGIA ANIMAL. Editorial Médica Panamericana.

Additional

- Gilbert, L. I. (ed). (2012) INSECT MOLECULAR BIOLOGY AND BIOCHEMISTRY
<http://www.sciencedirect.com/science/book/9780123847478>
- Insecticide Resistance Action Comitee <http://www.irac-online.org/>

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available