

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

Code	43047
Name	Effects of pollution
Cycle	Master's degree
ECTS Credits	9.0
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	First term
3108 - Environmental Health, Pollution and Toxicology	Doctoral School	0	First term

Subject-matter

Degree	Subject-matter	Character
2139 - M.U. en Contaminación, Toxicología y Sanidad Ambient. 12-V.2	1 - Core training	Obligatory
3108 - Environmental Health, Pollution and Toxicology	1 - Complementos Formación	Optional

Coordination

Name	Department
BOLUDA HERNANDEZ, RAFAEL	25 - Plant Biology
CAMACHO GONZALEZ, ANTONIO	275 - Microbiology and Ecology
TORREBLANCA TAMARIT, AMPARO	23 - Functional Biology and Physical Anthropology

SUMMARY

This subject deals in a multidisciplinary way with the effects of environmental pollution on living beings and ecosystems thanks to the participation of lecturers specialised in each of the aspects it deals with. It is a compulsory subject that is situated in the first four-month period of the Master's degree. The subject is divided into 5 parts according to its content: effects on animals, effects on human health, effects on aquatic ecosystems, effects of pollution on soils, effects of pollution on plants and plant ecosystems.

Effects on animals



Environmental pollution has effects on animals at different levels of organisation and integration. Chemicals or other environmental stressors such as temperature produce alterations at the subcellular and cellular level in the first instance, altering enzyme function, membrane permeability and other processes. These changes can ultimately alter cellular integrity and function and have a negative effect on different aspects of the animal's physiology.

Health effects

Humans are not immune to the effects of pollution. It is widely recognised that the environment plays a fundamental role in human health, making research and monitoring of the environment of great importance.

Effects of pollution on aquatic ecosystems

This section provides an overview of the different types of effects of aquatic pollution, and the processes that cause them.

Effects of pollution on soils

The aim of this section is to transmit basic knowledge about the properties and behaviour of soils. The acquisition of this knowledge is accompanied by a series of competences and skills that will lead to full professional training. Its study is fundamental for all those who intend to specialise in the natural environment. Knowledge of the functioning of soils is essential to understand how soils act as sinks for pollutants.

Effects of pollution on plants and plant ecosystems

Air pollution is a problem that manifests itself at local, regional, continental and global scales. It results from rare natural processes, such as volcanic emissions or fires, and from anthropogenic processes such as industrial activity or combustion. The effects of pollutants on the emission of pollutants into the atmosphere affect living beings directly, and indirectly through their impact on the climate, by modulating their response to other stressful situations.

The presence of organic and inorganic pollutants in soil and water can alter the correct development of plants, which can present mechanisms to correct this alteration. Some species have the ability to detoxify and accumulate pollutants in tissues or organs to limit physiological damage. These mechanisms can be used through phytoremediation biotechnology.

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 apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- 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 communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- 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 transmitir ideas, problemas y soluciones y de comunicarlas a una audiencia profesional y no profesional.
- Capacidad para el trabajo multidisciplinar en equipo y la cooperación.
- 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.
- Saber utilizar las diferentes fuentes bibliográficas y bases de datos biológicos y usar las herramientas bioinformáticas.
- Desarrollo de un compromiso ético y capacidad de participación en el debate social.
- Reconocimiento, respeto y promoción de los derechos humanos fundamentales, especialmente los de igualdad, de los valores democráticos y de los valores propios de una cultura de paz.
- Comprender los mecanismos de toxicidad de contaminantes.
- Diseñar bioensayos de ecotoxicidad en suelos y aguas.
- Valorar integralmente del estado de salud del medio ambiente.
- Saber catalogar y evaluar recursos biológicos.
- Conocer la estructura y dinámica de las poblaciones.
- Evaluar riesgos para la salud humana.



- Interpretar el paisaje y restaurar hábitats.

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 Toxicology and Environmental pollution
- 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. EFECTOS DE LA CONTAMINACIÓN SOBRE ANIMALES

Organismo y ambiente. Adaptación: Variación adaptativa. Tipos de adaptación. Tolerancia y resistencia. Mecanismos reguladores.

Respuestas Fisiológicas ante cambios en el ambiente: Escalas temporal, espacial y funcional.- Cambios a corto y medio plazo: Plasticidad fenotípica. Respuestas a los cambios ambientales crónicos: Aclimataciones.

Contaminación ambiental. Concepto de estrés ambiental. Estrés tóxico. Síndrome general de adaptación al estrés.

Alteraciones producidas por tóxicos en diversos procesos fisiológicos en animales. Efectos sobre la respiración: hipoxia. efectos sobre la conducción nerviosa. Alteraciones producidas en la regulación endocrina. Alteraciones sobre la osmorregulación.

Mecanismos moleculares de la toxicidad: relación entre las interacciones moleculares iniciales con los



efectos a niveles de organización superiores. Dianas moleculares. Ataque covalente a las proteínas y a los ácidos nucleicos. Estrés oxidativo. Tóxicos que ejercen su acción mediante inhibición enzimática.

2. EFECTOS SOBRE SALUD HUMANA

-Evaluación de la exposición ambiental e implicación en la Salud Pública
-Método de investigación y evaluación en la promoción de la salud en relación con el Medio Ambiente.
-Vigilancia de la Salud Pública y Medio Ambiente.
Contaminación, Medio Ambiente Laboral y efectos sobre la salud.

3. EFECTOS DE LA CONTAMINACIÓN EN ECOSISTEMAS ACUÁTICOS

Principales impactos antrópicos en los ecosistemas acuáticos
Tipos de contaminantes acuáticos y sus efectos sobre las comunidades biológicas
Eutrofización. Acidificación. Metales pesados. Xenobióticos. Contaminación biológica. Otros contaminantes
Indicadores de calidad
Introducción a la Directiva Marco del Agua
Modelización en el estudio de los contaminantes acuáticos
Ecotoxicología acuática aplicada al estudio en: Microcosmos. Mesocosmos. Macrocosmos
8. Pollutants Risk assessment. Fundamentals of pollution risk assessment. Prospective and retrospective risk assessment. Methods for exposure characterisation. Methods for effects characterisation. Deterministic and probabilistic methods for risk characterisation. Communication of results
9. Effects of pollutants on populations and communities. Concepts of sensitivity and vulnerability Direct and indirect effects of pollutants. Recovery and resilience. Structural and functional response of communities. Mesocosm and field studies

4. EFFECT ON SOIL

Introduction and generalities. Types of pollution, sources of pollution
sources of pollution and pollutants. Processes, distribution and forms of contaminants in soil. Effects of human activities on soil contamination. Impact of agricultural, industrial, extractive and mining activities. Assessment of the effects of soil contamination. Legal framework on soil pollution. Methods of soil disposal, decontamination and remediation.

5. POLLUTION EFFECTS ON PLANTS AND PLANT ECOSYSTEMS

Brief introduction to air pollution, pollutants, measurement techniques, and passive dosimeters. Experimental techniques for the assessment of the effects of air pollution.
Effects of pollution on plants. Absorption and accumulation of pollutants, effects at molecular, anatomical and physiological level and visible symptoms.
Elimination of pollutants by plants

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	57,00	100
Laboratory practices	33,00	100
Attendance at events and external activities	5,00	0
Study and independent work	80,00	0
Preparation of evaluation activities	30,00	0
Preparation of practical classes and problem	15,00	0
TOTAL	220,00	

TEACHING METHODOLOGY

- Master class for acquiring the fundamental knowledge on air pollution, including methodological aspects.
- Practice class on the evaluation of pollution effects.
- Students will work in groups (of 2 or 3 people; optional) on specific subjects proposed by the lecturer, finally showing their results in an oral presentation to the rest of the class.
- A tutorship of 1.5 hours will be carry out in the class. On the other hand, other tutored sessions will be available by e-mail or using the “aula virtual” tool.
- All activities and master classes are reinforced with documentation and information exchanges between lecturers and students using the “aula virtual” tool of the Universitat de València webpage.

EVALUATION

SE1 - Continuous student evaluation in theory classes, laboratory and seminars: participatory assistance, manipulation of the material and equipment, organisation of work, understanding and use of the training script, carrying out calculations, work on equipment, etc.

SE2 - Evaluation of non-presential activities related to laboratory classes: reports and/or dedicated internships.

SE3 - Written examinations on theoretical and/or practical lessons: based on learning outcomes and objectives specific to each subject.

SE4 - Attendance at tutorials to carry out the work and/or participative attendance at programmed course(s) to promote transversal skills.

SE5 - Preparation of a report on the activities carried out to promote transversal competences



The Pollution Effects exam will take place in January of the current course and will consist of FIVE parts*. The value of each is also indicated below.

Pollution on plants (15%)

Public Health (10%)

Aquatic ecosystems (25%). Of this subject only the 2 official exams will be taken (1st and 2nd call), there will be no make-up exams for those students failed or not presented in the official calls.

Animal physiology (35%)

Soils (15%)

*In order to be able to average the grades of the different subjects, at least a 4/10 must be obtained in each of them. The course is passed with a 5 out of 10.

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