Universitat Autònoma de Barcelona

2017/2018

Ecotoxicology and Pollution

Code: 100818
ECTS Credits: 10

Degree	Type	Year	Semester
2500251 Environmental Biology	OB	3	1

Contact

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Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Eva Castells Caballé

Prerequisites

Although there are no official prerequisites, the student would require a background in the following subjects: Chemistry, Cell Biology and Histology, Ecology, Plant Physiology and Animal Physiology. A significant proportion of the recommended bibliography, readings and materials worked in class will be in English, so it is recommended that students have minimal skills in this language.

Objectives and Contextualisation

Pollution and its harmful effects on living organisms, including man, is one of the main current environmental problems. The scope of this problem is global due to transport processes between environmental compartments, seriously affecting the health of ecosystems and therefore of humanity. In this subject, the student will identify the pollution processes and their effects, while being able to decide and use the most appropriate laboratory and field techniques to evaluate them in each case.

The objectives of the subject are the student to be trained in the following skills:

A) Knowledge: to identify the environmental chemistry of the main environmental pollutants, as well as the indices that allow either the prospective or retrospective risk assessment of the potential impacts of pollution, from the effects at the molecular level to the ecosystem level.

B) Procedures: be familiar with laboratory and field techniques for assessing the impacts of pollution, solving problems and making decisions.

C) Attitudes: raise awareness and adopt critical positions regarding pollution issues.

Skills

- Adapt to new situations.
- Catalogue, assess and manage natural biological resources.

- Communicate efficiently, orally and in writing.
- Develop a sensibility towards environmental issues.
- Develop bioassays and apply biotechnological processes.
- Develop strategies of analysis, synthesis and communication in order to teach biology and environmental studies.
- Diagnose and solve environmental problems regarding the biological environment.
- Identify and use bioindicators.
- Make decisions.
- Manage, conserve and restore populations and ecosystems.
- Perform biological diagnoses.
- Sample, characterise and manipulate populations and communities.
- Solve problems.

Learning outcomes

1. Adapt to new situations.
2. Apply knowledge of the functioning of aquatic (lakes and oceans) and aerial environments to diagnosing and solving problems caused by pollution in living beings.
3. Collect and analyse biological samples, as bioindicators.
4. Communicate efficiently, orally and in writing.
5. Develop a sensibility towards environmental issues.
6. Identify the principal mechanisms of spreading, transformation and accumulation of the principal contaminants in the natural environment and in the biota.
7. Identify the principal types of contaminants in the aquatic and atmospheric environments.
8. Know the principal techniques for identifying the state of contamination of an ecosystem.
9. Make decisions.
10. Manage the different techniques for identifying the impacts that different types of pollution have at the level of organisms, towns, communities and ecosystem.
11. Recognise the basic principles of biology that must be conveyed in the field of secondary education.
12. Solve problems.
13. Use indices to determine the state of conservation of an ecosystem.

Content

Theoretical classes

BLOCK A. ENVIRONMENTAL CHEMISTRY

Chapter 1. From the pollution sources to the effects to ecosystems.

Chapter 2. Pollution sources and main pollutants.

Chapter 3. Pollution transportation and transference between environmental compartments.

Chapter 4. Abiotic and biotic transformation of pollutants.

BLOCK B. TOXICOLOGIA: INDIVIDUO

Chapter 5. Basic concepts in toxicology.

Chapter 6. Dose-reponse relationship and toxicity indices.

Chapter 7. Toxicokinetics.

Chapter 8. Toxicodynamics: the toxic effects.

BLOCK C. ECOTOXICOLOGIA: DEL INDIVIDU AL ECOSISTEMA

Chapter 9. Introduction to ecotoxicology.

Chapter 10. Effects on populations.

Chapter 11. Effects on communities.

Chapter 12. Effects on ecosystems.

BLOCK D. METODOLOGIAS DE ESTUDIO EN ECOTOXICOLOGIA

Chapter 13. Chemical monitoring: assessment of pollution concentrations.

Chapter 14. Biological monitoring: biomarkers, bioindicators and ecological indicators.

Chapter 15. Ecological risk assessment of pollution.

Chapter 16. Remediation of polluted sites.

Laboratory and field practices

Practice 1. Laboratory indicators: ecotoxicological tests and pollutants analysis.

Practice 2. Aquatic macroinvertebrates as field bioindicators (field trip+laboratory).

Methodology

The guided sessions will consist of lecture sessions supplemented with individual or group practical exercises or case studies, a field trip, and two blocks of laboratory practices. At the end of the semester, students will prepare a written report in small groups on any topic of ecotoxicology and contamination from published scientific literature (seminar). The seminar activity will consist of two compulsory tutoring sessions (seminars 1 and 2) where the teacher will guide the students in the preparation of the work. After the presentation of the written report, a face-to-face session will be carried out to assess the oral and written evaluation of the report done (seminar 3). The schedule of the seminar sessions (seminars 1, 2 and 3) will be specified by the corresponding professor.

The student should spend time to autonomous activities such as the preparation of the seminar, the problem solving and study cases raised in class, as well as the study of the subject.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Case studies and problems	18	0.72	4, 9, 12
Field trip	5	0.2	3, 13
Laboratory practices	21	0.84	10, 9, 12, 5, 13

Master classes	36	1.44	2, 8, 6, 10, 7
Type: Supervised			
Seminar session 3	4	0.16	1, 4, 6, 9, 12, 5
Seminar sessions 1+2	4	0.16	1, 2, 4, 8, 6, 9, 11, 12, 5
Type: Autonomous			
Case studies and problem solving	20	0.8	9, 12
Personal study	100	4	2, 8, 6, 10, 7, 13
Seminar preparation	30	1.2	4, 8, 6, 9, 5

Evaluation

The evaluation will be based on two midterm exams, a seminar presented at the end of the semester, and the case studies and problems raised in class.

In the first half of the subject, the theoretical blocks A and B and the practice 1 will be evaluated. In the second half, blocks C and D and the practice 2 will be the one evaluated. Each of the two partial exams will weight a 35% of the final mark. The rest of the final mark will be obtained from the seminar (20%) and the case studies and problems raised during the course (10%).

A student will be only considered as 'not-passed' when the weighted average mark of the two midterm exams is less than 4.5 regardless of the marks in the other activities. The subject will be passed with an overall weighted average mark of 5 or more.

When the mean mark in the two midterm exams is below 4.5 or when the weighted average of all the activities of the subject is less than 5 ('failed'), the student will have the possibility to do a recovery examination of the previous exams. This examination will include the entire syllabus of the subject (the two midterm exams) and the obtained mark substitute that of the midterm exams, hence weighting a 70% of the global mark of the subject.

The student will only be considered as 'not evaluable' if not attending to any of the exams.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Case studies and problems	10%	2.5	0.1	9, 12, 5
Midterm exam 1	35%	3	0.12	1, 2, 4, 6, 10, 7, 9, 12
Midterm exam 2	35%	3	0.12	4, 8, 10, 9, 3, 12, 13
Referral exam	70% (replace the marks of the two midterm exams)	3	0.12	1, 2, 4, 10, 7, 9, 12
Seminar	20%	0.5	0.02	4, 9, 11, 12, 13

Bibliography

Recommended literature

Forbes VE, Forbes TL. 1994. Ecotoxicology in theory and practice. Chapman & Hall. London, UK (Ciència i Tecnologia 504.05 For).

Gestel CAM, Brummelen TC. 1996. Incorporation of the biomarker concept in ecotoxicology calls for a redefinition of terms. Ecotoxicology 5: 217-225 (http://www.springerlink.com/content/hq48823852176k14/)

Hoffman DJ, Rattner BA, Burton GA, Cairns J. 1995. Handbook of ecotoxicology. First Edition. Lewis Publishers, Boca Raton, USA (Ciència i Tecnologia 504.05 Han).

Klaassen CD, Watkins JB. 2005. Fundamentos de Toxicología. McGraw-Hill (Ciència i Tecnologia 615.9 Kla)

Moriarty F. 1999. Ecotoxicology. Third Edition. Academic Press. London, UK (Ciència i Tecnologia 504.05 Mor)

Newman MC, Clements WH. 2007. Ecotoxicology: A comprehensive treatment. First Edition. CRC Press. BocaRaton, USA

Newman MC, Unger MA. 2002. Fundamentals of ecotoxicology. Second Edition. Lewis Publishers, CRC Press, BocaRaton, USA (Ciència i Tecnologia 504.05 New)

Pepper IL, Gerba CP, Brusseau ML, Brendecke JW. 1996. Pollution Science. Academic Press. San Diego, USA (Ciència i Tecnologia 504.05 Pol).

Repetto M, Repetto G. Toxicología Fundamental. Ed. Díaz de Santos, 2009 (Ciència i Tecnologia 615.9 Rep)

Van Straalen N. 2003. Ecotoxicology becomes stress ecology. Environmental Science and Technology 37: 324A-330A (http://pubs.acs.org/doi/abs/10.1021/es0325720).

Walker CH, Hopkin SP, Sibly RM, Peakall DB. 2005. Principles of ecotoxicology. Third Edition. Taylor & Francis, London, UK. (Ciència i Tecnologia 504.05 Pri 574 Pri).

Webpages

Toxicology Basic Principles (http://sis.nlm.nih.gov/enviro/toxtutor/Tox1/index.html)