



## Teaching Guide

Identifying Data					2021/22
<b>Subject (*)</b>	Ecotoxicology		<b>Code</b>	610G02042	
<b>Study programme</b>	Grao en Bioloxía				
Descriptors					
Cycle	Period	Year	Type	Credits	
Graduate	1st four-month period	Fourth	Optional	6	
<b>Language</b>	Spanish				
<b>Teaching method</b>	Face-to-face				
<b>Prerequisites</b>					
<b>Department</b>	Bioloxía				
<b>Coordinador</b>	Barreiro Lozano, Rodolfo	<b>E-mail</b>	rodolfo.barreiro@udc.es		
<b>Lecturers</b>	Barreiro Lozano, Rodolfo Piñeiro Corbeira, Cristina	<b>E-mail</b>	rodolfo.barreiro@udc.es cpcorbeira@udc.es		
<b>Web</b>					
<b>General description</b>	This subject studies the effects of pollutants on organisms. This study includes (i) the analysis and detection of these effects and (ii) the prediction of the possible damage that pollutants may cause. A substantial portion of the contents is devoted to biomonitoring (i.e. using the organisms themselves to detect pollution), a tool that has become increasingly important for environmental protection and management.				



<b>Contingency plan</b>	<p>Adaptations to be made in the event of unexpected non-attendance due to outbreaks of the disease:</p> <ol style="list-style-type: none"><li>1. Modifications to the contents<ul style="list-style-type: none"><li>-None</li></ul></li><li>2. Methodologies<ul style="list-style-type: none"><li>*Teaching methodologies that are maintained<ul style="list-style-type: none"><li>-Everything but lab work. The only change will be that all students will be in Teams.</li></ul></li><li>*Teaching methodologies that are modified<ul style="list-style-type: none"><li>-Lab work. Lab work will be replaced by equivalent exercises with ITs through Teams.</li></ul></li></ul></li><li>3. Mechanisms of personalized attention to students<ul style="list-style-type: none"><li>-Moodle. Attention to student demand when raising questions in the forum.</li><li>- Email. Attention to student demand when they ask questions by email.</li><li>-Teams. Attention to student demand when they ask questions in the subject channel.</li></ul></li><li>4. Modifications in the evaluation.<ul style="list-style-type: none"><li>- There are no changes. The only change will be that the multiple choice test will be with an on-line assessment tool instead of in the classroom and the exposure of students' bibliographic works will be through Teams instead of in the classroom.</li></ul></li></ol> <p>*Evaluation observations:</p> <ol style="list-style-type: none"><li>5. Modifications of the bibliography or webgraphy.<ul style="list-style-type: none"><li>- Not applicable.</li></ul></li></ol> <p>Adaptations foreseen in the centre for cases in which the capacity of the classroom assigned for the subject is exceeded:</p> <ul style="list-style-type: none"><li>- Allocation of two or more classrooms for the subject and the teaching of the class via TEAMS for students who are not in the classroom with the teacher.</li></ul>
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Study programme competences	
Code	Study programme competences
A9	Identificar e utilizar bioindicadores.
A17	Realizar bioensaios e diagnósticos biolóxicos.
A21	Deseñar modelos de procesos biolóxicos.
A23	Avaliar o impacto ambiental. Diagnosticar e solucionar problemas ambientais.
B1	Aprender a aprender.
B4	Traballar de forma autónoma con iniciativa.
B6	Organizar e planificar o traballo.
B7	Comunicarse de maneira efectiva nunha contorna de traballo.
B8	Sintetizar a información.
B9	Formarse unha opinión propia.
B10	Exercer a crítica científica.
B11	Debater en público.

Learning outcomes
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Learning outcomes	Study programme competences		
Distinguir e identificar as técnicas de ecotoxicología retrospectiva e prospectiva		B9	
Describir os efectos habituais da contaminación en individuos, poboacións e comunidades	A9 A17 A23		
Valorar as vantaxes e limitacións de cada nivel de organización para detectar o impacto contaminante		B9 B10	
Comprender os resultados de técnicas básicas de ensaio de toxicidade, estudos de acumulación-depuración, biomarcadores	A9 A17 A21		
Describir os mecanismos polos que un organismo fai fronte aos contaminantes.	A21	B1 B4	
Valorar críticamente a relevancia da información derivada de ensaios de toxicidade	A17	B9 B10	
Valorar críticamente as predicións de modelos de distribución e efectos de contaminantes	A23	B9 B10	
Realizar unha procura bibliográfica dun tóxico ecotoxicolóxico e resumir a información obtida		B1 B4 B6 B7 B8 B9 B10 B11	
Enfrontarse á literatura especializada podendo encadrala nun tóxico concreto da ecotoxicología		B1 B4 B8 B9 B10	

Contents	
Topic	Sub-topic
Introduction	Human population growth. Major environmental problems in Europe. Ecotoxicology.
Pollutants	Major types and features Inorganic pollutants: metals and anions Organic pollutants Organometals Gases
Toxicokinetics	Mechanisms for pollutant accumulations. Uptake. Biotransformation and detoxification of metals and metaloids. Biotransformation of organic pollutants. Excretion. Bioaccumulation Factor (BAF), Bioconcentration Factor (BCF), and Accumulation Factor. Kinetics.



Bioamplification along the trophic chain	Bioamplification. Trophic transfer and Bioamplification factor. Examples of bioamplification in metals and organic pollutants.
Bioaccumulation and pollutant detection (Retrospective Ecotoxicology I)	Bioavailability. Factors of pollutant bioavailability. Use of bioaccumulators. Requisites of a good bioaccumulator.
Toxicodynamics: biochemical and histological effects	Protective and non protective biochemical changes. Molecular toxicity mechanisms. Modes of toxic actions in organic pollutants. Examples of molecular mechanisms. Cytotoxicity and necrosis. Damage to genes and chromosomes.
Physiological effects	Sublethal effects. Effects on growth, development, reproduction, physiology and behaviour. Trade-off between detoxification and production.
Biomarkers (Retrospective Ecotoxicology II).	Classification, especificity and relationship with damaging effects. Requisites of a good biomarker. Examples of biomarkers. Use of biomarkers.
Toxicity assays (Prospective Ecotoxicology I).	Dose-response relationship. Types of assays. Data analyses. Toxicity curves, mean lethal time and threshold LC50. Data analyses in chronic assays: NOEC, LOEC y MATC. Application Factor.
Prediction (Prospective Ecotoxicology II)	Prediction at individual level: QSAR. Prediction at ecosystem level: SSR.
Changes in community composition (Retrospective Ecotoxicology III).	Indicator species. Relative abundance. Saprobic systema and biotic indexes. Diversity. Comparisson with reference communities.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A9 A23 B8 B9	24	84	108
Seminar	B1 B4 B6 B7 B8 B9 B10 B11	7	17.5	24.5
Laboratory practice	A17	5	0	5
ICT practicals	A21 A23	10	0	10
Multiple-choice questions	A9 A17 A21 A23	1	0	1
Personalized attention		1.5	0	1.5

(\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	Lectures supported by graphic information available to students through Moodle.



Seminar	Problem solving and bibliographic review.
Laboratory practice	Lab work under the guidance of the teacher and with a protocol that comprehensively details the exercises to be performed (also available in Moodle)
ICT practicals	IT work under the guidance of the teacher and with a protocol that comprehensively details the exercises to be performed (also available in Moodle)
Multiple-choice questions	Test of theory and practice contents.

### Personalized attention

Methodologies	Description
Seminar	<p>The personalized attention will consist of solving doubts in the corresponding tutorial schedules.</p> <p>Part-time students and students with attendance dispensation: resolution of doubts through official tools for teledocency and telecommunication (virtual campus, Teams, e-mail).</p>

### Assessment

Methodologies	Competencies	Description	Qualification
Guest lecture / keynote speech	A9 A23 B8 B9	In some lectures, questions will be asked (orally and/or in writing) to the students on aspects dealt with in the session, which they will have to answer on the spot in order to assess the individual performance of the session.	5
Laboratory practice	A17	Attendance is mandatory. Each day of unexcused absence will mean 0.5 points less in the final grade.	0
Multiple-choice questions	A9 A17 A21 A23	Knowledge acquired in theory and practice sessions is assessed with a multi-option test.	65
Seminar	B1 B4 B6 B7 B8 B9 B10 B11	<p>First chance: Presenting a bibliographic review paper at the last seminar session.</p> <p>Second chance: Students who have not presented a paper at the first opportunity may submit their paper in WRITING on the date of the second opportunity test (detailed guidelines for submitting a paper are available in Moodle). SECOND CHANCE PAPERS MAY GET A MAXIMUM GRADE OF 5 (passed).</p>	30
ICT practicals	A21 A23	Attendance is mandatory. Each day of unexcused absence will mean 0.5 points less in the final grade.	0

### Assessment comments

<p>In order to pass the course it is REQUIRED to pass the theory exam with a grade of at least 4. Otherwise, the course will be suspended regardless of the remaining grades and the lowest numerical grade will be placed (i) the average grade with the above percentages or (ii) the grade of the theory exam).</p> <p>Failure to attend the theory exam will result in no final grade ("No presentado").</p> <p>Students with dispensation from attendance: it will be possible to take the tests using teledocency tools.</p> <p>Cheating in the assessment tests or in any assessment activity will directly imply the qualification of failing '0' in the subject, thus invalidating any qualification obtained in all the assessment activities for the extraordinary exam session.</p>
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### Sources of information

<b>Basic</b>	<ul style="list-style-type: none"> <li>- Walker, C. H., S. P. Hopkin, R. M. Sibly, and D. B. Peakall. (2006). Principles of Ecotoxicology, 3rd edition. Taylor &amp; Francis, London</li> <li>- Newman, M. C. (2010). Fundamentals of Ecotoxicology, 3 edition. CRC Press</li> <li>- Newman, M. C.; Clements, W.H. (2008). Ecotoxicology: A Comprehensive Treatment. CRC Press</li> </ul>
<b>Complementary</b>	La bibliografía básica es suficiente para una asignatura de licenciatura. Además, el alumno debe buscar trabajos científicos para realizar el trabajo tutelado; los trabajos concretos varían para cada alumno.



## Recommendations

Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

## Other comments

Students are encouraged to use the tutorials to resolve questions with the teacher. Green Campus Programme Faculty of Science: to contribute to achieving an immediate sustainable environment and to comply with point 6 of the "Environmental Declaration of the Faculty of Science (2020)", the written assignments will be mainly requested in electronic format.

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.