Toxicology

Code: 101910
ECTS Credits: 3

2025/2026

Degree	Type	Year
Biomedical Sciences	OB	3

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

It is advisable to have a good knowledge of physics, chemistry, biochemistry, cell biology and physiology. A good level of English and a critical reading ability of toxicological information (books, review articles, original articles) is also recommended. In order to be able to attend the sessions of laboratory practices, the student must justify having passed the biosafety and security tests that he/she will find in the Virtual Campus and accept the operation regulations of the laboratories of the Faculty of Biosciences.

Objectives and Contextualisation

Toxicology is a fundamental subject of the second semester of the 3rd year of the Degree in Biomedical Sciences. Its objective is to provide the basic knowledge of what is currently the science of toxicology, paying special attention to the fundamental principles and the areas of experimental, analytical and regulatory toxicology, ecotoxicology (= pollutants) and medical toxicology (= diagnosis and treatment, including the use of antidotes). The specific study of the main toxic agents that affect or can affect humans and animals, and in particular gaseous and volatile agents, metals and non-metals, ionizing radiation, pesticides, domestic and industrial chemicals, and toxins, is also carried out.

Competences

- Display theoretical and practical knowledge of the major molecular and cellular bases of human and animal pathologies.

- Read and critically analyse original and review papers on biomedical issues and assess and choose the appropriate methodological descriptions for biomedical laboratory research work.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Learning Outcomes

1. Describe the branches of ecotoxicology (environmental contaminants) and the elements for diagnosing and treating the main conditions.
2. Describe the principles of experimental and analytical toxicology.
3. Understand and critique scientific articles on pharmacology.
4. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Content

THEORY*

BLOCK A. INTRODUCTION TO TOXICOLOGY

- Introduction to toxicology, basic principles of toxicology. (TE) Concept of toxicity. Historical perspective. Factors that determine toxicity: substance, organism and environment. Fundamental concepts. Epidemiology of poisoning. (Relationship between pharmacology and toxicology)

BLOCK B. PHASES OF TOXICITY: FROM EXPOSURE TO EFFECTS

- Environmental toxicology and ecotoxicology (TE). The compartments of the earth: atmosphere, hydrosphere, lithosphere and biosphere. Mobility of pollutants through the environment. Transport in fluids. Bioaccessibility. Partition coefficients H', Koc and Kow. Bioaccumulation. Biomagnification.
- Toxicokinetics (TE). Dose and internal exposure. Absorption. Routes of exposure. Absorption rates. Distribution. Pre-systemic elimination. Plasma proteins. Accumulation and remobilization. Metabolism. Phases I and II of metabolism. Characteristics of metabolism: specificity, induction and inhibition. Detoxification and metabolic activation. Excretion. Relationship between metabolism and excretion. ADME concept (Absorption, Distribution, Metabolism (biotransformation) and Elimination.
- Toxicodynamics I (TE). Mechanisms. Types of interactions of the toxic with the molecular target: non-covalent bonds, covalent bonds, electron transfer, enzymatic reactions. Concepts of agonist, antagonist, inhibitor.
- Toxicodynamics II (TE). Types of toxic effects. Toxicity at the molecular level. Toxicity in organs and systems. Toxicity on the digestive system and hepatotoxicity, Nephrotoxicity, Toxicity on the respiratory system, Neurotoxicity, Toxicity on the reproductive system, hematopoietic and immune. Other types of effects. Genotoxicity. Carcinogenesis. Teratogenesis. Endocrine disruptors.

BLOCK C. EVALUATION OF TOXICITY

- Toxicological risk assessment. Quantitative toxicology. Dose-response (TE). Dose and concentration concept. Type of response. Acute toxicity index (LD50, CL50). Subchronic toxicity index (NOAEL and LOAEL) and Benchmarkdose(BMD). Maximum exposure limits (ADI, TDI, RfD). Uncertainty factors. Maximum permissible concentrations (MRL). Experimental evaluation of toxicity: for what? How? When? Methodologies useful in the screening phase. Stages of risk assessment. What QR is and how is it interpreted. What is the probability of carcinogenic risk that is considered acceptable? and acceptable?. Dose response curve of non-carcinogenic effects. Dose response curve of carcinogenic effects. Characterization of toxicological risk. Toxicological risk communication. Food toxicology. Toxins present in food and food safety. RASFF alert system.
- Experimental toxicology: methods for determining toxicity (TE). Cause-effect evaluation: epidemiological studies, toxicological studies with experimental animals, *in vitro studies,* QSAR studies. Globally Harmonized System (GHS).

- Analytical toxicology (TE). Phases of chemical monitoring : pre-analytical, analytical and post-analytical. Extraction, purification and determination of an analyte. Chromatography. Calculation of concentrations. Interpretation of toxicological analysis. Chromatographic techniques: gas chromatography. The flame ionization detector (FID) and the electron capture detector (ECD). Mass spectrometry (MS). Biological monitoring. Biomarkers.

BLOCK D. TOXIC SUBSTANCES

- Industrial pollutants and pesticides (TE). Introduction to pollution. Origin and classification of pollutants. Metals. Radioactivity, pesticides: organochlorides (dioxins, PCBs and concepts of TEQ and TEF), anticholinesterasics (organophosphates and carbamates) and neonicotinoids). Microplastics. Acute and chronic effects. Concept PBT, POP. Food safety (European, state and regional). EFSA. RASFF. AESAN. ACSA.
- Treatment of poisonings (TE). Approaches to the diagnosis of poisonings. General aspects and antidotes. General guidelines for the treatment of an intoxicated patient. Local treatment. General treatment. Measures to prevent the absorption of the toxic substance. Main treatment methods: evacuating, neutralizing, antidotic and eliminating. Fundamental and applications. Elimination of the source of the toxic. Activated carbon mechanisms, favoring the elimination or excretion of the substance.
- Toxins present in vegetables, animals and fungi (TE). General introduction to toxins. Phytotoxin poisoning: control and prevention. Variability in the production of phytotoxins. Main groups of phytotoxins. Mycotoxins. Poisoning by ingestion of mushrooms. Marine toxins. Bivalve poisoning. Poisonings from fish consumption. Toxins as drugs (Atropine) and drug modifications.
- Emerging pollutants (TE). Regulation and control. Endocrine disruptors. Mechanisms of action. Epidemiological evidence in animals and humans. Relationship between endocrine disruptors and chronic diseases. Flame retardants (PBDEs). Perfluoroalkyl substances (PFOA and PFOS). Bisphenol A and chemical analogues. Phthalates.

SEMINARS

- S1. Tools for the preparation of a scientific poster I.
- S2. Introduction to databases and search strategies I.
- S3. Clinical cases (data extraction and interpretation).
- S4. Preparation of a scientific poster II.
- S5. Problems I. Health risk assessment.
- S6. Problems II. Health risk assessment
- S7. Scientific poster presentation III.

LABORATORY PRACTICES (PLAB)*

- Determination of acetylcholinesterase activity in pesticide poisoning

- Identification of toxic plants and rapid determinations of phytotoxins

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory work	3	0.12	2, 4
Lectures	16	0.64	2, 1
Seminars and problems	7	0.28	3, 2, 1
Type: Supervised			

Face-to-face and virtual tutoring	2	0.08	3, 4
Type: Autonomous			
Individual work	25	1	4
Preparation and elaboration of a work with scientific format in groups	18.6	0.74	3, 4
Resolution of cases and problems	2	0.08	3, 2, 1

Theory*. The teacher will explain much of the contents of the syllabus with the support of visual material that will be available to students in the Campus Virtual (CV) in advance. In order to follow the explanations, students must bring this material to class as a script. These lectures will deal with the main parts of the subject, which will have to be extended and confronted autonomously by the students as personal work. The teaching material that will be used in these cases will basically consist of books and review articles. Parts of the theory program (specific and well-defined topics) will be explained, by their own entity and interest, in the section of seminars.

Seminars*. Complementary to the theory classes, seminars will address (with use of ICT) specific topics related to poisons and contaminants. The active participation of all students will be promoted during the resolution/discussion of the issues/situations/problems/cases that may arise.

Laboratory practices*. Practical sessions for the observation and execution of procedures, methodologies and techniques that are used in the study of poisons. Group work and active self-learning are promoted.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Cases and class activities	25%	0	0	3, 4
Final test (cumulative)	50 %	1.4	0.06	3, 2, 1
Preparation and elaboration of a scientific work	25 %	0	0	3, 2, 1, 4

The competences of this subject will be evaluated* by:

a) Preparation of a scientific poster that will be prepared in group throughout the semester on a toxicology topic. Weight of the mark on the final total: 25%

d) Classroom activities and case resolution. Weight of the mark on the final total: 25%

b) A final exam where all theory, seminars and laboratory practices will be evaluated. Weight of the mark over the final total: 50%.

To pass the subject, the overall grade of the final exam, the subject must be equal to or greater than 5.0. Therefore, the subject will be considered to be suspended when:

- The grade of the final exam does not reach a minimum of 5.0. In this case, the final grade will appear as 'suspended' regardless of the grade of the rest of the activities.

When the student does not perform any of the evaluation activities, this will score as 0. Non-attendance for unjustified reasons to a laboratory practice or seminar will subtract 0.25 points from the final grade. It will be considered that a student is not evaluable when his participation in evaluation activities represents $\leq$ 15% of the final grade. In order to be able to take the recovery exam the student must have been previously evaluated in a set of activities that represent a minimum of two thirds of the final grade of the subject. The grade of the recovery exam will replace the grade of the final exam.

This subject does not consider the single assessment system.

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Software

None.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	531	Catalan	second semester	morning-mixed

(PAUL) Classroom practices	532	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	531	Catalan	second semester	afternoon
(PLAB) Practical laboratories	532	Catalan	second semester	afternoon
(PLAB) Practical laboratories	533	Catalan	second semester	afternoon
(TE) Theory	53	Catalan	second semester	morning-mixed