

Toxicology

Code: 102663
ECTS Credits: 5

Degree	Type	Year	Semester
2502445 Veterinary Medicine	OB	4	2

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

Other comments on languages

Catalan 85%, English 10%, Spanish 5%

Teachers

Núria Giménez Gómez

Prerequisites

It is advisable to have a good knowledge of chemistry, biochemistry, physics, cell biology, physiology, pharmacology and pathology. A good level of English and a critical reading ability of toxicological information (books, review articles, original articles) are 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 Veterinary Medicine.

Objectives and Contextualisation

Toxicology is a fundamental subject in the second semester of the 4th year of the Veterinary Medicine Degree, and part of the subject Pharmacology, Toxicology and Therapeutics. Its objective is to provide the basic knowledge of what is currently the science of toxicology, specifically the fundamental toxicological principles (experimental toxicology, analytical toxicology and regulatory toxicology) and in the important branches of environmental toxicology (= pollutants) and of veterinary clinical toxicology (= diagnosis and treatment of poisonings, including the use of antidotes). The specific study of the main toxic agents that affect or can affect the health of animals, both domestic and wild, or contaminate food, such as gases and volatiles, metals and non-metals, ionizing radiation, pesticides, products for domestic and industrial use, and toxins, is also carried out. The approach is multifaceted, useful for veterinarians who end up dedicating themselves to clinic but also to those who will work on production and animal health, food safety, R & D or biomedical research.

Competences

- Demonstrate knowledge and understanding of the general bases of medical and surgical treatments.

- Draft and present satisfactory professional reports, always maintaining the required confidentiality.
- Perform basic analytical techniques and interpret the clinical, biological and chemical results, and interpret the results of tests generated by other laboratories.
- Perform the most common medical and surgical treatments of animals.
- Prescribe and dispense medicines correctly and responsibly in accordance with legislation, and ensure that the medicines and waste are stored and eliminated properly.
- Work effectively in single or multidisciplinary teams and show respect, appreciation and sensitivity for the work of others.

Learning Outcomes

1. Critically evaluate data on the circumstances of intoxication or poisoning, the signs and symptoms, pathology and others, which should lead to a diagnosis and the establishment of treatment guidelines for the intoxicated patient or patients.
2. Define the general and specific bases for the treatment of intoxications.
3. Describe the fundamental principles that govern experimental and analytical toxicology.
4. Draft and present satisfactory professional reports, always maintaining the required confidentiality.
5. Identify and interpret the legislation affecting medicinal waste in foods.
6. Identify and interpret the phases of drug development and know the bodies involved in their development and authorisation.
7. Recognise and identify the different available antidotes and plan their use in cases of intoxication in domestic and wild animals, as well as decontamination techniques.
8. Recognise and identify the main toxic agents that contaminate, impregnate or intoxicate wild and domesticated animals and, in particular, gaseous and volatile agents, metals and non-metals, pesticides, products for domestic and industrial use and toxins, and their possible accidental or deliberate presence in water or foods.
9. Select, collect and issue samples to perform toxicological analyses and draft the corresponding reports for the receiver laboratory.
10. Use the basic preparatory and analytical techniques of a toxicology laboratory, applying at all times basic safety and risk prevention standards, and draft the corresponding assessment report.
11. Work effectively in single or multidisciplinary teams and show respect, appreciation and sensitivity for the work of others.

Content

THEORY*

SECTION A: GENERAL TOXICOLOGY

UNIT 1.- INTRODUCTION TO TOXICOLOGY. Definition and current concept of Toxicology. Historical perspective: Paracelsus and Orfila. Chemical and biological warfare. Main toxic disasters: the lessons and the consequences.

UNIT 2.- BASIC PRINCIPLES. Toxicological terminology. Genotoxic agents. Carcinogenesis. Teratogeny and allergy. Toxicology branches: medical, analytical, experimental, environmental and regulatory. Classification of toxics.

UNIT 3.- EXPERIMENTAL TOXICOLOGY. General principles Toxicity evaluation. QSAR and retrospective studies. Tests of acute and chronic toxicity. Experimental animals GLP and GMP. Special tests: reproduction, teratogenesis, mutagenicity, carcinogenesis. Ames Test. Safety factors. Hofmann and the LSD.

UNIT 4.- TOXICOKINETICS AND METABOLISM. Exposure and absorption pathways of the poisons. Distribution. Metabolism of xenobiotics. Lethal synthesis. Elimination.

UNIT 5.- ENVIRONMENTAL TOXICOLOGY AND ECOTOXICOLOGY. Contamination and pollution. Sentinel species. Biomarkers. Oil spills and oiled birds.

SECTION B: DIAGNOSTIC AND THERAPY OF POISONINGS

UNIT 6.- DIAGNOSTIC OF POISONINGS. Generalities of the diagnostic protocol. Clinical history. Symptoms and clinical signs. Post-mortem examinations. Analytical toxicology. Collection, transport and storage of samples. Frequency of poisonings: toxicoepidemiological data.

UNIT 7.- TREATMENT OF POISONINGS. General guidelines for the treatment of a poisoned animal. Elimination of the source of the toxic agent. Measures to prevent the absorption. Symptomatic treatment. Antidote treatment. Introduction to antidotes. Useless, dangerous or obsolete antidotes. Classification of antidotes according to their mechanism of action.

SECTION C: TOXICAGENTS

UNIT 8.- TOXIC GASES (+ ACIDS AND BASES). Simple asphyxiating gases. Fluorine. Chlorine. CFCs. Oxygen and ozone. Methylisocyanate. Carbon monoxide. Carbon dioxide. Hydrogen sulphide. Cyanhydric acid and cyanide. Nitrogen and sulfur oxides. Acid rain. Ammonia. Acids and alkalis.

UNIT 9.- NON-METALS AND METALLOIDS. The Periodic Table of the elements. Fluorides. White phosphorus. Arsenic. Selenium.

UNIT 10.- METALS. Sodium and pigs. Aluminum and acid waters. Iron. Copper and sheep. Zinc. Cadmium and Itai-Itai syndrome. Tin and tributyltin (TBT). Mercury. Methylmercury and Minamata. Thallium. Lead. Tetraethyl lead.

UNIT 11.- IONIZING RADIATIONS. Introduction. X-rays and gamma rays. Alpha and beta rays. Radon. Chernobyl and Fukushima. A and H bombs. Strontium-90, cesium-137 and iodine-131.

UNIT 12.- PESTICIDES. Introduction. Chlorophenols, hexachlorobenzene. Chlorates, 2,4-D, 2,4,5-T, paraquat, glyphosate. Nicotine, pyrethrins and pyrethroids, organochlorine insecticides, organophosphorus and carbamic insecticides; delayed neurotoxicity (OPIDN). Amitraz. Metaldehyde. Zinc and aluminum phosphide, red squid, strychnine, cholecalciferol, warfarin and other anticoagulants, fluoroacetate.

UNIT 13.- TOXICS RELATED TO FOOD. Urea Nitrates and nitrites. Nitrosamines. Heterocyclic aromatic amines. The Toxic Oil Syndrome (TOS). Polycyclic aromatic hydrocarbons. Ethanol. Methanol. Drug residues in food. Food additives.

UNIT 14.- MISCELLANEOUS TOXIC AGENTS. Solvents. VOCs. Ethylene glycol. Phenols, cresols and derivatives. Tar. Detergents. Nonsteroidal anti-inflammatory drugs: diclofenac and vultures. Drugs of abuse.

UNIT 15.- TOXINS. Bacterial toxins. Avian botulism. Tetanus. Toxin-producing cyanobacteria. Mycotoxins and mycotoxicosis. Aflatoxins. Ochratoxins. Trichothecenes. Zearalenone. Patulin. Introduction to poisonous plants. Reptile toxins. Marine toxins.

CLASSROOM PRACTICES (PAUL) / SEMINARS*

- Impact of the use of lead in sports: aquatic ecosystems, terrestrial ecosystems, shooting ranges. Lead poisoning in aquatic birds and birds of prey.
- Bioaccumulation, bioconcentration and biomagnification. The case of p,p'-DDT. Rachel Carson and Silent Spring. Polychlorinated and polybrominated biphenyls. Dibenzo-p-dioxins and polychlorinated dibenzofurans. Polybrominated diphenyl ethers. TEF and TEQ.
- Median lethal dose and lethal concentration. Determination of LD50 by probit techniques. Pictograms. Precautionary and Hazard Statements. NOEL and NOAEL, NOEC and NOAEC. ADI and TLV.
- Tutorials and discussion poster performance (presential and non-presential).

LABORATORY PRACTICES (PLAB)*

- Determination of organochlorine residues.
- Determination of acetylcholinesterase activity.

- Identification of poisonous plants (lab and UAB campus).

* Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.

Methodology

Theory*. The teacher will explain much of the contents of the syllabus with the support of visual material that will be available to the students in the Moodle/Virtual Campus. These keynote sessions will deal with the main topics of the subject, which will have to be extended and confronted autonomously by the students as personal work. The teaching material that should be used will basically consist of books and review articles.

PAUL/Seminars*. Complementary to the theory classes, PAUL and seminars will address (with use of ICT) specific topics related to poison and contaminant agents. The active participation of all students will be promoted during the resolution/discussion of the issues/situations/problems/cases that may arise. During the preparation of the work, individual or group tutorials, face-to-face or virtual, will be available, with the objective of solving doubts and guide students on their elaboration.

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

* The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory work	7.5	0.3	1, 3, 8, 9, 10
Lectures	21	0.84	1, 2, 3, 5, 6, 7, 8
Seminars and problems	12.5	0.5	3, 8
Type: Autonomous			
Individual work	56	2.24	1, 3, 5, 6, 7, 8
Preparation, elaboration and evaluation of a work with scientific format	25	1	1, 2, 7, 8, 4, 11
Resolution of cases and problems	1.6	0.06	1, 2, 8, 4

Assessment

Evaluation*

The competences of this subject will be evaluated by:

a) A first mid-term partial exam, where the theory program and the seminars carried out to date will be evaluated. Worth 25% of the final grade.

b) A second exam (2nd partial exam) at the end of the course, where all the content of theory, seminars and laboratory practices will be evaluated. Worth 50% of the final grade.

c) Preparation of a scientific poster, a written summary of ≈1,000 words (references not included) that will be prepared in groups throughout the semester on a topic of toxicology. Worth 20% of the final grade

d) Case resolution and classroom activities. Worth 5% of the final grade

To pass the subject, the weighted average grade of the two exams and the overall grade of the subject (calculated from the weighted average for all activities) must be equal to or greater than 5.0. Therefore, the subject will be considered 'failed' when:

- The weighted average grade of the two exams does not reach a minimum of 5.0. In this case, the final grade will be listed as 'failed' regardless of the grade for the other activities

- The weighted average grade of the two exams is equal to or greater than 5.0 but the overall average of the subject is less than 5.0

When the student does not carry out any of the activities of evaluation these will score 0. The no attendance by unjustified reasons to a laboratory practice or seminar will subtract 0,25 points to the final grade. A student will be considered non-assessable when his/her participation in assessment activities represents $\leq 15\%$ of the final grade. In order to take the reevaluation exam, the student must have previously been assessed in a set of activities that represent a minimum of two thirds of the final grade of the subject. The mark of the reevaluation exam will replace the weighted average mark of the midterm exams.

* Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Cases and class activities	5	0	0	1, 2, 7, 8, 4
First partial test	25	0.6	0.02	1, 2, 3, 5, 7, 8
Scientific poster	20	0	0	1, 2, 3, 6, 7, 8, 11
Second partial test	50	0.8	0.03	1, 2, 3, 5, 6, 7, 8, 9, 10

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Software

None.