Universitat Autònoma de Barcelona

2019/2020

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

For those students who request it in writing in advance, there will be a Spanish version of the exams

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, paying special attention to what are the fundamental 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, 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: TOXIC AGENTS

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 tributiltin (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).

- Public poster defense.

LABORATORY PRACTICES (PLAB)

- Determination of organochlorine residues.

- Determination of acetylcholinesterase activity.

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

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 (VC) in advance. In order to follow the explanations, students must bring this material to class as a script. 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 teacher will indicate which topics should be studied in this deeper way. 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.

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, in groups of 4, of a work with scientific format	25	1	1, 2, 7, 8, 4, 11
Resolution of cases and problems	1.6	0.06	1

Assessment

Evaluation

The competences of this subject will be evaluated by:

a) A first mid-term partial exam, where Section A of the theory program and the seminars given until then will be evaluated. The exam will consist of a test with 60 T/F questions, with 36 minutes to complete it. Worth 30 % of the final grade.

b) A second examination (2^{nd} partial exam) at the end of the course, where sections B and C of theory, the corresponding seminars and PLAB practices will be evaluated with approximately 60 T/F questions, plus about 5 more questions about the posters (based on your proposals) and about 15 of the first partial (continuous and

cumulative evaluation), with a total of 80 questions and with 48 minutes of time to do it. Worth 50 % of the final grade.

c) Preparation of a scientific poster, a written summary of ≈1,000 words (references not included) and 10 questions T/F about it, which will be prepared in groups of four students throughout the semester, on a toxicological topic that it will be specified, and that will have to be sent to the teaching staff in the periods that will be conveniently indicated. Worth 20 % (10 % put by the teacher on the quality of the work -collective note to all the members of the team, unless in writing some of them state that not all members have done a comparable job and there has not been a good capacity to collaborate as a team-, 10 % from the notes that you will put to the work of your peers, according to a system that will be specified in a timely manner, in which your critical capacity to assess the work of the others will be trained and evaluated).

A student will be considered as "failing grade" when the final marks does not allow him/her to reach a global grade equal to or greater than 5.00. If a student does not show up for any of the evaluation activities, this will score as zero (0.00). The non-attendance for non-justified reasons to a PLAB subtract 0.25 points to the final grade. It will only be considered as "not gradable" in the case that the student does not appear in two or more evaluations. In this subject a final second chance exam will be held for students with a final grade of <5.00, with the requirement that they must have attended all the lab practices and have presented, defended and approved the work (poster + summary + questions). This exam is only for failing grade students and cannot be used to improve a grade that is> 5.00. In this exam the whole course will be evaluated (theory + PAUL/seminars + PLAB) through 80 T/F test questions, and the resulting final grade will be 80 % of the score obtained in it and 20 % of that achieved in the work. It should be noted that the second chance exam will have a degree of difficulty equal to or greater than that of the partial exams.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
First partial test	30	0.6	0.02	1, 2, 3, 5, 7, 8
Poster+summary score	10	0	0	1, 2, 3, 6, 7, 8
Preparation, drafting and public defense of a scientific work	10	0	0	1, 2, 3, 6, 7, 8, 4, 11
Second partial test	50	0.8	0.03	1, 2, 3, 5, 6, 7, 8, 9, 10

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