

BASIC DETAILS:

Subject:	TOXICOLOGÍA		
Id.:	33362		
Programme:	DOBLE GRADO EN FARMACIA Y BIOINFORMÁTICA. PLAN 2018		
Module:	MEDICINA Y FARMACOLOGÍA		
Subject type:	OBLIGATORIA		
Year:	5	Teaching period:	Primer Cuatrimestre
Credits:	6	Total hours:	150
Classroom activities:	64	Individual study:	86
Main teaching language:	Inglés	Secondary teaching language:	Castellano
Lecturer:	FLORES SERRANO, DAVID (T)	Email:	dflores@usj.es

PRESENTATION:

Toxicology is critical for pharmaceutical sciences in that it could be defined as the science branch dealing with toxic substances which are defined as those causing an adverse effect in a living organism when they reach this by accident or by means of an inadequate administration. According to international standards, this science also includes physic phenomena such as radiation and noise pollution. The study of toxicants helps society in a variety of ways and not only protecting human beings and environment from their adverse effects but also facilitating the development of more specific toxicants which could be beneficial in chemotherapy and other chemicals such as pesticides. Its impact on forensic and legal issues is also relevant.

La toxicología es muy relevante para las ciencias farmacológicas ya que puede definirse como la rama de la ciencia que se ocupa de las sustancias tóxicas, las cuales se definen como aquellas que causan un efecto perjudicial en los seres vivos al ser administradas, bien por accidente o de forma inadecuada, a un organismo vivo. Por acuerdo internacional, la toxicología también incluye fenómenos físicos tales como la radiación y el ruido. El estudio de los tóxicos sirve a la sociedad de formas variadas, no solo para proteger a los humanos y al medio ambiente de sus efectos perniciosos sino también para facilitar el desarrollo de tóxicos más selectivos que puedan tener efectos beneficiosos tales como sustancias para quimioterapia y otras drogas de uso clínico, así como pesticidas. Su influencia en aspectos forenses y periciales es también destacable.

PROFESSIONAL COMPETENCES ACQUIRED IN THE SUBJECT:

General programme competences	G01	Ability to express opinions and propose arguments effectively both orally and in writing. Effectively use language skills to express views and formulate arguments both orally and in writing.
	G02	Troubleshooting and decision-making.
	G03	Ability for autonomous learning and self-criticism.
	G04	Ability to effectively use new information and communications technology to improve written and oral presentations and to facilitate data analysis.
	G05	Ability for teamwork, actively contributing to the objectives and the organisation of a team.
	G06	Ability to transfer the knowledge acquired in practical work and skills to the field of work.
	G07	Demonstrate creativity, independence of thought, autonomy.
	G08	Demonstrate critical and analytical ability to conventional approaches of the discipline.
	G09	Demonstrate capacity for innovation, creativity and initiative.
	G11	Knowledge of the English language for use in professional environments.
	Specific programme competences	E03
E04		Assess the risks associated with the use of chemicals substances and laboratory processes.
E17		Conocer las estructuras de las biomoléculas y sus transformaciones en la célula.
E20		Comprender la relación entre el ciclo de vida de los agentes infecciosos y las propiedades de los principios activos.

	E23	Conocer las propiedades de las membranas celulares y la distribución de fármacos.
	E25	Conocer las principales rutas metabólicas que intervienen en la degradación de fármacos.
	E29	Knowledge of the processes of liberation, absorption, distribution, metabolism and excretion of drugs, and factors that influence the absorption and disposition depending on their routes of administration.
	E35	Utilizar de forma segura los medicamentos teniendo en cuenta sus propiedades físicas y químicas incluyendo cualquier riesgo asociado a su uso.
	E36	Conocer y comprender los fundamentos básicos de los análisis clínicos y las características y contenidos de los dictámenes del diagnóstico de laboratorio.
	E37	Develop health and hygiene analysis (biochemical, food science, microbiological, parasitological) related to general health and with food and environment in particular.
	E38	Evaluar los efectos de sustancias con actividad farmacológica.
	E39	Conocer y comprender las técnicas utilizadas en el diseño y evaluación de los ensayos preclínicos y clínicos.
	E40	Llevar a cabo las actividades de farmacia clínica y social, siguiendo el ciclo de atención farmacéutica.
	E41	Promote the rational use of medication and healthcare products.
	E42	Adquirir las habilidades necesarias para poder prestar consejo terapéutico en farmacoterapia y dietoterapia, así como consejo nutricional y alimentario a los usuarios de los establecimientos en los que presten servicio.
	E43	Comprender la relación existente entre alimentación y salud, y la importancia de la dieta en el tratamiento y prevención de las enfermedades.
	E44	Understand the management and the characteristics of pharmaceutical assistance in Primary and Specialised Care structures in the Healthcare System.
	E45	Assess the toxicological effects of the substance and design and implement appropriate tests and analysis.
	E46	Conocer las propiedades y mecanismos de acción de los fármacos.
	E47	Understand the structure and function of the human body as well as the general mechanisms of disease, molecular, structural and functional alterations, syndromic expression and therapeutic tools for restoring health.
	E48	Learn about the nature, mechanism of action and effect of toxins and resources in case of intoxication.
	E49	Conocer las técnicas analíticas relacionadas con diagnóstico de laboratorio, tóxicos, alimentos y medioambiente.
	E50	Understand the management and characteristics of pharmaceutical assistance in an office environment and in the pharmaceutical industry.
	E54	Use efficiently information retrieval techniques for primary and secondary sources of information (including databases using computer).
	E58	Learn the techniques of oral and written communication skills in order to be able to inform users of pharmaceutical establishments in terms that are understandable and appropriate for different cultural levels and social environments.
	E64	Proporcionar atención farmacéutica a los pacientes.
	E65	Realizar farmacovigilancia.
Regulated profession competences	P02	Evaluate the therapeutic and toxic effects of substances with pharmacological activity.
	P03	Know how to apply the scientific method and acquire skills in handling legislation, sources, bibliography, developing protocols and other aspects considered necessary for the critical design and evaluation of preclinical and clinical trials.
	P05	Prestar consejo terapéutico en farmacoterapia y dietoterapia, así como en el ámbito nutricional y alimentario en los establecimientos en los que presten servicios.
	P06	Promote rational use of medicines and healthcare products, and acquire basic knowledge in clinical management, health economics and efficient use of healthcare resources.
	P07	Identify, evaluate and assess the problems related to drugs and medication as well as participate in pharmacovigilance activities.
	P08	Llevar a cabo las actividades de farmacia clínica y social, siguiendo el ciclo de atención farmacéutica.
	P09	Intervenir en las actividades de promoción de la salud, prevención de enfermedad, en el ámbito individual, familiar y comunitario; con una visión integral y multiprofesional del proceso salud-enfermedad.
	P10	Diseñar, aplicar y evaluar reactivos, métodos y técnicas analíticas clínicas, conociendo los fundamentos básicos de los análisis clínicos y las características y contenidos de los dictámenes de diagnóstico de laboratorio.
	P11	Assess the toxicological effects of the substance and design and implement appropriate tests and analysis.
	P12	Desarrollar análisis higiénico-sanitarios, especialmente los relacionados con los alimentos y

		medioambiente.
	P13	Develop information and communication skills, both oral and written, to deal with patients and users of the centre where the professional activity is conducted.
	P15	Recognise the limitations and the need to maintain and update professional skills, with particular emphasis on self-learning of new knowledge based on the available scientific evidence.

PRE-REQUISITES:

Toxicology is a multidisciplinary science using concepts and methodologies from many other basic disciplines in order to solve issues of its own. To be more precise, the adequate understanding of toxicologic problems require a solid base in Chemistry, Biochemistry, Physiology, Pharmacokinetics and Pharmacology. The strategic location of this subject in the final year of the Pharmacy degree guarantees that alumni have received a previous development in those disciplines in order to embed the contents of this course. On the top of the specific aspects refereing to Toxicology Science, this subject will give the students the chance to use and integrate the tools and knowledge encountered in the previous courses of the degree with a view to grasp toxicologic problems in a critical way using to this end all the knowledge acquired in the previous years.

La Toxicología es una ciencia multidisciplinar que utiliza conceptos y métodos de otras muchas disciplinas básicas para resolver los problemas que le son propios. En concreto la correcta comprensión de los problemas toxicológicos requiere una base sólida en Química, Bioquímica, Fisiología y Farmacología. La ubicación estratégica de la asignatura en el 5º curso del grado garantiza que el alumno haya recibido la formación previa necesaria, para asimilar correctamente los contenidos de la materia. Esta asignatura, además de los aspectos y conocimientos específicos referentes a la toxicología, brindará al alumno la oportunidad de comenzar a utilizar e integrar las herramientas y conocimientos adquiridos en los cuatro cursos anteriores con la finalidad de analizar problemas toxicológicos de una forma crítica y selectiva utilizando para ello todos los recursos proporcionados y adquiridos con anterioridad.

SUBJECT PROGRAMME:

Subject contents:

1 - Introduction to Toxicology
1.1 - Definition of Toxicology
1.2 - Historic overview of Toxicology
1.3 - Current objectives of Toxicology
1.4 - Multidiscipline nature of Toxicology
1.5 - Scope of modern Toxicology
1.6 - Main applied branches: forensic toxicology, clinical toxicology, occupational toxicology, environmental toxicology and food poisonings
2 - Qualitative and quantitative aspects of Toxicology
2.1 - Definition of Toxic
2.2 - Clasification of toxic agents
2.3 - Definition of poisoning
2.4 - Types of poisonings
2.5 - Definition of toxicity
2.6 - Applied criteria to the study of toxicity
2.7 - Effect-dose-time relationship
2.8 - Selectivity, Sensitivity and safety range
2.9 - Molecular aspects impacting a given substance toxicity
3 - Stages in the toxic process: Exposition and Absorption
3.1 - General Principles
3.2 - Exposition phase: Physical availability and toxic absorption
3.3 - Processes involved in the toxicokinetic phase
4 - Toxicokinetic phase. Distribution and Retention
4.1 - Concept of Biological availability. Compartmental models
4.2 - Elements impacting on the toxic distribution

4.3 - Elements impacting retention of a toxic compound
4.4 - Biologic and environmental elements impacting on the biotransformation kinetics
5 - Toxicokinetic phase. Biotransformation and elimination
5.1 - General Principles
5.2 - Phase I Reactions
5.3 - Phase II Reactions
5.4 - Consequences of the biotransformation process
6 - Toxicodynamic phase
6.1 - Characteristics of the toxicodynamic phase
6.2 - Main determinants involved in the toxic effects of xenobiotics
6.3 - Main cellular damage caused by xenobiotics. Mechanisms of toxic effect
7 - Genetic Toxicology
7.1 - General Principles
7.3 - Mutagenesis. Mechanisms of induction of genetic alterations
7.4 - Types of mutagenic effects
7.5 - Molecular mechanisms
7.6 - Impact on human health
7.7 - Assessment of genetic alterations
7.8 - Transgenic Models
8 - Chemical Carcinogenesis
8.1 - Overview
8.3 - Definition of carcinogenic agent
8.4 - Mechanisms and stages of carcinogenesis
8.5 - Types of carcinogens
9 - Developmental toxicology. Teratogenesis
9.1 - Scope of problem-The human experience
9.3 - Principles of developmental toxicology
9.4 - Mechanisms and Pathogenesis of developmental toxicology
9.7 - Modern Safety Assessment
10 - Toxic responses of the liver
10.1 - Overview
10.2 - Liver physiology. An overview
10.3 - Hepatotoxic agents
10.4 - Mechanisms and types of Toxin-induced liver injury
10.7 - Critical factors in toxicant-induced liver injury
11 - Toxic responses of the immune system
11.1 - The immune system
11.2 - Immunomodulation by xenobiotics
11.3 - Xenobiotic-induced hypersensitivity and autoimmunity
12 - Antitoxic therapy
12.2 - Definition of antagonist and antidote
12.3 - Foundations of antitoxic therapy
12.4 - Therapies based on toxicant absorption obstruction
12.5 - Therapies based on increased elimination rates
12.6 - Therapies based on an increased toxicity threshold
12.7 - Diagnosis of poisonings
13 - Toxic effects of pesticides
13.1 - Overview
13.2 - Economics and Public Health
13.3 - Insecticides
13.4 - Herbicides
13.5 - Fungicides
13.6 - Rodenticides
14 - Toxic effects of Heavy Metals
14.1 - Overview
14.2 - Major Toxic Metals
14.3 - Essential Metals with potential for toxicity
14.4 - Metals related to medical therapy

Subject planning could be modified due unforeseen circumstances (group performance, availability of resources, changes to academic calendar etc.) and should not, therefore, be considered to be definitive.

TEACHING AND LEARNING METHODOLOGIES AND ACTIVITIES:

Teaching and learning methodologies and activities applied:

COVID19. Due to the amount of delegates in each classroom, it is anticipated that ALL lectures would be "in-class"

The student will acquire the desired knowledge and skills through the study of the teaching programme subjects. To this end we will provide the following tools:

- **Lectures** in which the most important subjects will be presented and some **practical exercises** will be offered in order to facilitate the understanding of some aspects. All power point presentations will be provided to the students.
- A **basic text** in which the lectures are based and that the student will be able to use to consolidate and expand knowledge. Also some **extra bibliography and web sites** will be provided to alumni to compare the information received in class and also to expand knowledge for those students willing to investigate further.
- **Seminars** carried out by experts will be arranged during the semester. The dates are unknown at the time of producing this guide and the timeframe provided above is merely orientative. These seminars will have associated some assignments that will be marked individually.
- In order to enhance the communication skills and team working abilities a joint **team assignment** will be proposed at the beginning of the term which will be presented by the students and will also be marked. This assignment will be handed at least one week in advance of the presentation.

This plan will potentially be subject of changes depending on unpredicted events such as group progress, resources availability, calendar changes and accommodation of other subject needs and therefore should not be considered as closed and final.

El alumno adquirirá los conocimientos necesarios para superar la asignatura a través del estudio de los temas del programa. Para ello se proporcionarán las siguientes herramientas:

- **Clases teóricas** en las que se expondrán los temas más importantes y se realizarán algunos **ejercicios prácticos** que faciliten la comprensión de ciertos aspectos. Todas las presentaciones se pondrán a disposición de los alumnos.
- Un **libro de texto base** en el que se fundamenta la asignatura y que el alumno podrá usar para consolidar o ampliar conocimientos. También se pondrán a disposición del alumno **libros de consulta y páginas web** para contrastar la información recibida en clase y para que aquellos alumnos interesados puedan ampliar conocimientos en temas específicos.
- Adicionalmente se propondrán **seminarios** a lo largo del semestre realizados por profesionales expertos en las materias sobre las que los alumnos deberán realizar un cuestionario que será evaluable. LAS FECHAS ESTÁN SIN CONFIRMAR A LA REALIZACIÓN DE ESTA GUÍA DOCENTE Y EL CALENDARIO PROPUESTO ES MERAMENTE ORIENTATIVO.
- Con la finalidad de potenciar los aspectos relacionados con la comunicación y el trabajo en equipo se propondrá a los alumnos un **trabajo en grupo** que deberá ser presentado en público y entregado al menos una semana antes de dicha presentación. Este trabajo será evaluable.

Esta planificación queda sujeta a posibles cambios y podrán verse modificados por motivos imprevistos (rendimiento del grupo, disponibilidad de recursos, modificaciones del calendario,

necesidades de otras asignaturas) y por tanto no deben considerarse como cerrados y definitivos.

Student work load:

Teaching mode	Teaching methods	Estimated hours
Classroom activities	Master classes	46
	Practical work, exercises, problem-solving etc.	6
	Coursework presentations	4
	Films, videos, documentaries etc.	4
	Participation in seminars, conferences etc.	2
	Assessment activities	2
Individual study	Tutorials	1
	Individual study	35
	Individual coursework preparation	10
	Group coursework preparation	23
	Project work	10
	Recommended reading	7
Total hours:		150

ASSESSMENT SCHEME:

Calculation of final mark:

Individual coursework:	45 %
Group coursework:	15 %
Final exam:	40 %
TOTAL	100 %

*Las observaciones específicas sobre el sistema de evaluación serán comunicadas por escrito a los alumnos al inicio de la materia.

BIBLIOGRAPHY AND DOCUMENTATION:

Basic bibliography:

KLAASEN, Curtis. Essentials of Toxicology. 2nd edition. McGraw Hill 2010
REPETTO, M. Toxicología fundamental. Ed. Diaz de Santos.

Recommended bibliography:

Hodgson, E. A textbook of modern toxicology. Editorial Wiley (disponible en pdf)
Olson Kent, R. Poison and Drug overdose. Appleton
Ellenhom, M. Diagnosis and Treatment of Human Poisoning. Williams and Wilkins. 2ª edición. 1996
Gossel, T.A. Principles of Clinical Toxicology. New York: Raven Press. 3ª ed. 1994
Marruecos, L. Toxicología clínica. Barcelona: Springer-Verlag Iberica. 1993
Dreisbach, H. Manual de Intoxicaciones: Prevención, Diagnóstico y Tratamiento. Appleton and Lange 1987

Recommended websites:

AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY	http://www.atsdr.cdc.gov
BUSCADOR DE INFORMACION TOXICOLOGICA Y AMBIENTAL	http://busca-tox.com
CHEMICAL SAFETY INFORMATION FROM INTERGOVERNMENTAL ORGANIZATIONS	http://www.inchem.org
INTEGRATED RISK INFORMATION	http://www.epa.gov

SYSTEM	
PROGRAMA DE INFORMACION Y FORMACION EN TOXICOLOGIA CLINICA	http://wzar.unizar.es/stc/toxicologianet/index.htm
TOXIPEDIA	http://toxipedia.org
TOXNET (toxicology data network)	http://toxnet.nlm.nih.gov
VARIOUS TYPES OF PESTICIDE TOXICOLOGY AND ENVIRONMENTAL CHEMISTRY INFORMATION	http://extoxnet.orst.edu
INSTITUTO NACIONAL DE TOXICOLOGIA Y CIENCIAS FORENSES	http://institutodetoxicologia.justicia.es
EUROPEAN SOCIETY OF TOXICOLOGY	http://www.eurotox.com
FEDERACION INTERNACIONAL DE LA INDUSTRIA DEL MEDICAMENTO	http://www.ifpma.org
INSTITUTO DE FARMACOLOGIA Y TOXICOLOGIA CSIC/UCM	http://www.ucm.es/info/farmamed/html/instituto.htm
INTERNATIONAL SOCIETY OF REGULATORY TOXICOLOGY AND PHARMACOLOGY	http://www.isrtp.org
INTERNATIONAL UNION OF TOXICOLOGY	http://www.toxicology.org/intox/