

## 28400 - Cytology and histology

### Información del Plan Docente

Academic Year	2017/18
Faculty / School	105 - Facultad de Veterinaria
Degree	451 - Degree in Veterinary Science
ECTS	8.0
Year	1
Semester	Annual
Subject Type	Basic Education
Module	---

### 1.General information

#### 1.1.Introduction

#### 1.2.Recommendations to take this course

Basic knowledge of Anatomy, Biology, Chemistry and Biochemistry.

#### 1.3.Context and importance of this course in the degree

#### 1.4.Activities and key dates

On the website of the Faculty of Veterinary Medicine ( <http://veterinaria.unizar.es/gradovet> ) you are offered detailed information about the different activities programmed for this course and the corresponding deadlines.

### 2.Learning goals

#### 2.1.Learning goals

#### 2.2.Importance of learning goals

### 3.Aims of the course and competences

#### 3.1.Aims of the course

#### 3.2.Competences

### 4.Assessment (1st and 2nd call)

#### 4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

### 5.Methodology, learning tasks, syllabus and resources

#### 5.1.Methodological overview

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The learning process that has been designed for this course is based on the following activities:

- a) Lectures: The topics tackled in this course will be presented, explained and discussed in 50 minute lectures where ppt presentations will be used for image support.
  
- b) Seminars: At the beginning of course a seminar will be held where the Histological Technique will be explained. Students will also observe, comment and discuss electron microscopy images corresponding to the theoretical classes of Cytology.
  
- c) Laboratory practice: Parallel to the theory small-group practical classes will be held, where the student will observe histological preparations of various tissues and organs using optical microscopes. Each student must take 16 practices, 1.5 or 2 hour duration, in the Histology laboratory. The existence of more than 3 unexcused absences from these classes implies that the student will go directly to practical final exam.
  
- d) Works: Students have to complete a lab notebook which is considered mandatory.
  
- e) Tutorials: Students will be able to meet teachers to consult issues related to the subject. Dates and times should be agreed by email in advance.

Selected supporting materials will be provided in the Moodle Digital Platform:

<https://moodle2.unizar.es/>

### 5.2.Learning tasks

The program that is offered to the student to help him to achieve the expected results includes the following activities...

- I) Lectures on the contents shown in the course syllabus.
  
- II) Laboratory practical classes with the following contents:

1. Epithelial tissue (I)

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2. Epithelial tissue (II)
3. Connective tissue
4. Cartilage and bone
5. Muscle tissue
6. Nervous system
7. Cardiovascular system
8. Endocrine system
9. Respiratory system
10. Digestive system (I)
11. Digestive system (II)
12. Lymphoid Organs
13. Urinary system
14. Reproductive system
15. Review (I)
16. Review (II)

In the review practices students will have at their disposal all histological preparations that have been used in previous practices along the course. The teacher responsible for the course will offer support and answers to the questions raised in the review.

### 5.3.Syllabus

#### Course syllabus

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### Introduction

Unit 1. Cytology and Histology concept. Historical perspective. Spanish School of Histology. Histological methods: microscopy, electron microscopy, histochemistry, immunocytochemistry.

### Cytology

Unit 2. Introduction to cell study. Cell Theory. General concepts: prokaryote and eukaryote cells. Observation of fixed and stained cells.

Unit 3. Plasma membrane: structural model and chemical composition. Properties and functions. Molecular transport. Endocytosis and exocytosis.

Unit 4. Ribosomes. Endoplasmic reticulum: ultrastructure and varieties: granular (rough) and agranular (smooth) endoplasmic reticulum. Functions.

Unit 5. The Golgi complex: ultrastructure. Functions. Cellular secretion.

Unit 6. Lysosomes and peroxisomes: ultrastructure. Functions.

Unit 7. The mitochondria: ultrastructure. Functions.

Unit 8. The cytoskeleton: microtubules, microfilaments and intermediate filaments. Ultrastructure and organization. Functions. Cytoplasmic Inclusions. Hyaloplasma.

Unit 9. The nucleus: general characteristics: shape, number, position and general structure. Nuclear envelope. Nuclear pores. Chromatin. Nucleolus. Nucleoplasm.

### General Histology

Unit 10. Animal Tissues: concept. Tissue differentiation and renovation. Tissue classification. Epithelial tissue. Structural and functional characteristics. Cellular polarity: apical, lateral and basal surfaces. Epithelial classification. Lining epithelia types. Glandular epithelia and glands. Epithelial cell renewal.

Unit 11. Connective tissue: structural and functional characteristics. Classification. Cells and extracellular components. Adipose tissue.

Unit 12. Cartilage: structure. Classification. Hyaline cartilage. Elastic cartilage. Fibrous cartilage. Origin and growth of cartilage.

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Unit 13. Bone: general characteristics. Classification. General structure of bones. Cellular and matrix components of bones. Ossification: types. Bone growth, remodelling and repair. Bird bones.

Unit 14. The blood: Study techniques. Erythrocytes, leukocytes, platelets. Morphological variations, structure and chemical composition. Differences in various animal species. The bone marrow. Hematopoiesis.

Unit 15. Muscle tissue: Types. Skeletal muscle. Types of muscle fibers. Muscle-tendon junctions. Cardiac muscle. Smooth muscle. Regeneration of muscle tissues.

Unit 16. Nervous tissue: general characteristics. Neurons: structure and ultrastructure. Classification of neurons. Nerve fiber: myelinated and unmyelinated nerve fibers. Degeneration and regeneration of nerve fibers. Interneuron synapses. Neuroglia.

### Microscopic Anatomy

Unit 17. Nervous system: general organization. Central nervous system: the brain. Structure of isocortex. White matter. Cerebellum. Cellular organization of cerebellar cortex. White matter. Spinal cord: white and gray matter. Meninges. Ependyma. Choroid plexuses. Peripheral nervous system: peripheral nerves. Dorsal root ganglia.

Unit 18. The cardiovascular system: arteries. Arteriolar-venous anastomosis. Capillaries. Chemoreceptors and baroreceptors. Veins. Venous circulation and valves. The heart: cardiac skeleton. Cardiac valves. Lymphatic vessels.

Unit 19. Lymphoid organs: general characteristics. Primary lymphoid organs: the thymus and the bursa of Fabricius. Secondary lymphoid organs: lymph node, the spleen, hemolymph nodes.

Unit 20. The digestive system: the buccal cavity, tongue, teeth, lips and palate. The pharynx. The salivary glands. The digestive tube: general structure: the esophagus, the glandular stomach, the compound stomach, the small intestine, the large intestine. The Peritoneum. The liver and gallbladder. The exocrine pancreas. The avian digestive system.

Unit 21. The Respiratory system: components and structural organization: the nasal cavity, the larynx, the trachea, the lung, the pleura. The Avian respiratory system, and the air

Unit 22. The urinary system: the kidney. Differences among domestic species. General structure. The nephron. Collecting duct system. Juxtaglomerular complex. Blood supply of kidney. Lymphatic vessels. Renal pelvis. The ureters. The urinary bladder. The urethrae.

Unit 23. The Endocrine system: peripheral diffuse endocrine system. Hypophysis and epiphysis cerebri. The thyroid, parathyroid and adrenal glands. The endocrine pancreas.

Unit 24. The male reproductive system: general characteristics. The testes: structure and functions. The epididymis. The ductus deferens. The Accessory glands: vesicular, prostate and bulbourethral glands. The penis.

Unit 25. The female reproductive system: the ovary, the oviduct, the uterus and the vagina. The avian reproductive system. The mammary gland.

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Unit 26. The integumentary system: the skin: epidermis and dermis. Hair follicle. Hair structure.

Unit 27. The eye: structure of eyeball and eyelid. The ear: general structure.

### 5.4.Course planning and calendar

Classroom sessions calendar

In the 2016-2017 course Cytology and Histology classes begin on September 20th. Holiday periods are considered from December 23 rd , 2016 to January 8 th , 2017 (Christmas) and from 10 th to 17 th April, 2017 (Easter). For more detailed information on non-school days go to

<http://wzar.unizar.es/servicios/calendario>

The timetable and schedule of lectures and practical classes can be found at:

[http://veterinaria.unizar.es/gradovet/horarios1.php?COD\\_TITULACION=6](http://veterinaria.unizar.es/gradovet/horarios1.php?COD_TITULACION=6)

The composition of the groups for the practical classes will be published in the unit bulletin board at the beginning of the course.

### 5.5.Bibliography and recommended resources

[BB: Bibliografía básica / BC: Bibliografía complementaria]

- [BB] [Atlas] - Bacha, William J.. Atlas color de histología veterinaria / William J. Bacha, Linda M. Bacha ; [traducción de la ed. en inglés Diana Perriard] . 2a ed. Buenos Aires : Inter-Médica, cop. 2001
- [BB] [Atlas] - Ross, Michael H.. Atlas de histología descriptiva / Michael H. Ross, Wojciech Pawlina, Todd A. Barnash . Buenos Aires ; Madrid [etc.] : Editorial Médica Panamericana, cop. 2012
- [BB] [Atlas] - Young, Barbara. Wheater. Histología funcional : texto y atlas en color / Barbara Young, Phillip Woodford y Geraldine O'Dowd, . 6ª ed. Ámsterdam ; Barcelona ; Madrid [etc.] : Elsevier, D.L. 2014
- [BB] [Citología . Histología] - Ross, Michael H.. Histología : texto y atlas color : correlación con biología celular y molecular / Michael H. Ross, Wojciech Pawlina ; [revisión científica, Roberto Montes de Oca Luna... (et al.) ; traducción, Alejo Alday, Mirta Giacomucci]. 7ª ed. L'Hospitalet de Llobregat, Barcelona : Wolters Kluwer, D.L. 2015
- [BB] [Histología] - Banks, William J. Histología veterinaria aplicada / William J. Banks. 2a ed. México, D.F. : El Manual Moderno, 1996
- [BB] [Histología] - Dellmann, Horst-Dieter. Histología veterinaria / H.-Dieter Dellmann . 2a. ed. Zaragoza : Acribia, [1994]
- [BB] [Histología] - Junqueira, L. C.. Histología básica : texto y atlas / L. C. Junqueira, José Carneiro ; [colaboradores, Paulo Alexandre Abrahamsohn... (et al.)] . 12ª ed. Buenos Aires ; Madrid [etc.] : Editoria Médica Panamericana, D.L. 2015
- [BC] [Atlas] - Gartner, Leslie P.. Atlas en color y texto de histología / Leslie P. Gartner, James L. Hiatt ; [traducción por Jorge Horacio Negrete] . 6ª ed. Buenos Aires ; Madrid [etc.] : Editorial Médica Panamericana, D.L. 2015

Listado de URL

- Animaciones de biología celular [<http://www.johnkyrk.com/index.esp.html>]



## **28400 - Cytology and histology**

- Recorded Histology Lectures y Practical Exercises [<http://www.doctorc.net/>]
- Veterinary Histology [<http://cal.vet.upenn.edu/projects/histo/index.htm>]