

**COURSE DATA****Data Subject**

Code	36351
Name	Functional Histology
Cycle	Grade
ECTS Credits	6.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1109 - Degree in Biochemistry and Biomedical Sciences	Faculty of Biological Sciences	2	Second term

Subject-matter

Degree	Subject-matter	Character
1109 - Degree in Biochemistry and Biomedical Sciences	11 - Integración fisiológica y fisiopatológica	Obligatory

Coordination

Name	Department
GARCIA VERDUGO, JOSE MANUEL	21 - Cellular Biology and Parasitology
MORANTE REDOLAT, JOSE MANUEL	21 - Cellular Biology and Parasitology

SUMMARY

Functional Histology course deals with the study of organic tissues (General Histology) and how they are organized into organs and systems (Microscopic Organography). It is based on the observation and description of the tissue components, integrates molecular and morphofunctional aspects (histophysiology), and includes basic principles of histopathology. Embryonic origin, classification, organization and morphofunctional characteristics of epithelial, connective, cartilage, bone, muscle, nervous, haematopoietic and lymphoid tissues. The lectures also include fundamentals of organography, which is complemented during the practical classes with observations, interpretations and diagnosis of tissue samples and organs. The contents of this course will provide the basis for other subjects, such as Regulation of Proliferation and Cell Fate, Human Physiology, Immunology and Immunopathology, and Molecular Neurobiology and Neuropathology.



PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Basic knowledge in biochemistry, genetics, molecular biology, and cell biology.

OUTCOMES

1109 - Degree in Biochemistry and Biomedical Sciences

- Know the usual procedures used by scientists in the area of molecular biosciences and biomedicine to generate, transmit and disseminate scientific information.
- Know the common and differential molecular and cellular elements of the different types of living organisms with special emphasis on the human being and model organisms for their study.
- Understand experimental approaches and their limitations and interpret scientific results in molecular biosciences and biomedicine.
- Know how to design multidisciplinary experimental strategies in the field of molecular biosciences to solve complex biological problems, especially those related to human health.
- Acquire skills to use the methodologies of molecular biosciences and to keep an annotated record of activities.
- Know how to work responsibly and rigorously in the laboratory, considering the safety aspects in experimentation as well as the legal and practical aspects of the handling and disposal of waste.
- Know the biochemical and molecular bases of cell function.
- Have an integrated view of normal and altered cell function, including metabolism and gene expression.
- Have an integrated view of the cellular responses to environmental effectors and changes and the alterations that cause pathologies.
- Have an integrated view of the systems of intercellular communication and cellular physiology that regulate normal and pathological development and function.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.



- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Show initiative and leadership for multidisciplinary teamwork and cooperation.
- Be able to assimilate scientific texts in English.

LEARNING OUTCOMES

Knowledge about the position of histology in the context of biomedical sciences and recognition of its implications.

Understanding the rationale of tissue physiology from its structural organization. Being able to solve issues and design basic experimental approaches in histology.

Developed skills of observation and of integration of structural, molecular, genetic and functional information to achieve an integrated view of the functions of tissues, organs and organ systems.

Understanding and use of the methods for histological analysis, especially microscopy and histochemistry.

Knowledge about and proper use of microscopes as basic tools for the analysis of cells and tissues, and capacity for interpreting three-dimensional microscopic images.

Understanding of the tissue bases of human pathology.

Becoming familiar with the literature in the field of histology and capacity of analysis and synthesis to organize, integrate and present information in a consistent manner.

Capacity for critical analysis of information in the field.

DESCRIPTION OF CONTENTS

1. INTRODUCTION TO HISTOLOGY

The role of histology in Biomedical Sciences. Functional classification of cell types. Concept of tissue. Simple and complex tissues. General organization of tissues. Introduction to methodologies for the study of histology. General aspects of the embryonic development of tissues.

2. EPITHELIAL TISSUE

General characteristics of epithelia: embryonic origin, distribution and morphofunctional organization. Unity and diversity: cytokeratins. Epithelial cell polarity. Morpho-functional domains and membrane specializations. Cell adhesion systems. Basement membrane. Epithelia and glandular epithelia. Exocrine and endocrine glands: types and mechanisms of secretion. Structure of secretory epithelial cells. Histological organization of the glands.



3. CONNECTIVE TISSUE

Cellular and extracellular components. Histogenesis, functions and distribution. Mesenchyme. Morphofunctional characteristics of different connective tissues. Serous membranes. Concept of parenchyma and stroma. Adipose tissue.

4. CARTILAGE TISSUE

General morphology. Cellular and extracellular components. Structure of mature cartilage. Perichondrium. Chondrogenesis, growth and nutrition. Types of cartilage. Hyaline cartilage. Elastic cartilage. Fibrocartilage. Chordoid tissue.

5. BONE TISSUE

General histological structure of bone tissue. Bone cells: osteoprogenitor cells, osteoblasts, osteocytes and osteoclasts. Bone matrix: structure, composition and process of mineralization. Patterns of gross and microscopic organization of bone. Compact bone: concept of osteon. Spongy bone tissue. Bone structure. Periosteum and endosteum. Osteogenesis: endochondral and endomembranous ossification. Immature and lamellar bone. Growth and bone remodeling. Bone dynamics. Joints: general structure.

6. MUSCLE TISSUE

General features of muscle tissue. Histological Organization of skeletal muscle. Skeletal muscle fibers: myofibrils, myofilaments and sarcomere structure. Morphofunctional basis of muscle contraction. Muscle-tendon junction. Myogenesis and regeneration of skeletal muscle. Histological organization of cardiac muscle tissue. Types and structure of myocardial cells. Intercalated disks. Conducting tissues. Purkinje fibers. Histological organization and distribution of smooth muscle. Structure of smooth muscle fibers. Contraction mechanisms. Other contractile cell types: myoepithelial cells, myofibroblasts and pericytes.

7. NERVOUS SYSTEM

General characteristics of the nervous tissue. Cell types: morphology and basic aspects. General organization of the central nervous system and peripheral nervous system. Ependyma. Choroid plexus. Blood brain barrier.

8. HEMATOPOIETIC AND LYMPHOID ORGANS

Blood components. Structure of blood cells. Histological organization of the bone marrow. Hematopoiesis. General structure of the lymphoid system. Histological organization of lymphoid organs.



9. CARDIOVASCULAR SYSTEM

General characteristics of the cardiovascular system. Arteries. Veins. Capillaries. Arteriovenous anastomoses. Lymphatic vessels. Heart. Vasculogenesis and angiogenesis.

10. RESPIRATORY SYSTEM

General organization of the respiratory system. Wall structure of the respiratory tract. Trachea. Lung. Alveolar Histophysiology. Pleura.

11. URINARY SYSTEM

Macroscopic and microscopic organization of the kidney. Uriniferous tubule. Renal corpuscle. Structure of the urinary tract wall.

12. DIGESTIVE SYSTEM

Mouth and mouth organs. General organization of the digestive tract. Esophagus. Stomach. Small and large intestine. Salivary glands. Liver. Pancreas.

13. REPRODUCTIVE SYSTEM

Testis. Epididymis. Prostate. Ovary. Uterus. Placenta.

14. SKIN APPENDAGES

General organization of the skin. Structure of the epidermis, biology and functional alterations. Dermis. Sensory receptors in the skin. Wound healing. Skin tags. Sweat glands. Sebaceous glands. Mammary glands.

15. SENSE ORGANS: SIGHT AND HEARING

General and microscopic structure of the eye. General and microscopic structure of the ear.

16. ENDOCRINE SYSTEM

Special characteristics of endocrine cells and tissues. Histological organization of the thyroid gland, parathyroid glands and adrenal glands.

**17. LABORATORY PRACTICAL CLASSES****INGLÉS**

1. Foundations for the study of microscopic anatomy. Epithelial lining tissue. Connective tissue.
2. Glandular epithelial tissue. Muscle tissue.
3. Mesenchyme. Cartilaginous tissue. Bone tissue.
4. Nervous tissue. Skin.
5. Tissue and lymphoid organs. Respiratory system.
6. Urinary system. Digestive system.
7. Reproductive system

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	40,00	100
Laboratory practices	20,00	100
Development of group work	10,00	0
Development of individual work	7,00	0
Study and independent work	31,00	0
Readings supplementary material	7,00	0
Preparing lectures	23,00	0
Preparation of practical classes and problem	12,00	0
TOTAL	150,00	

TEACHING METHODOLOGY

Lectures. The teacher will present the basics of the subject, devoting more time to highly complex issues, and will guide the students in the integration of the contents with related issues of other subjects. Teaching and bibliographic resources will be available to students in multimedia.

Laboratory practical classes. The program of practical classes will develop coordinated and parallel to the lectures. It will consist of the microscopic analysis of histological, morphological and functional organization of tissues of mammals. The program also includes the descriptive study of the microscopic and macroscopic anatomy of the principal body organ systems, by analyzing using human normal and pathological samples.

Seminars. The participation of students in these mandatory activities consist of the preparation and presentation of a seminar during approximately 30 minutes (in groups of two students). This activity will be organized jointly with other subjects in the second year.



EVALUATION

An **exam** of both parts of the subject: Histology (lessons 1 to 8) and Organography (lessons 9 to 16), including questions with different formats (multiple choice, developmental, problem solving questions) will be used to evaluate the knowledge and understanding acquired by the students as well as their ability to use specific scientific language in an appropriate way. The grade obtained in this test will represent **60 % of the final grade**.

The evaluation of **laboratory practices** will be based on the examination of identification of histological images (25% of the final mark) and the presentation of observation scripts produced in the classroom during practical sessions (10% of the final mark).

Seminars. The participation of students in these mandatory activities consist of the preparation and presentation of a seminar during approximately 30 minutes (in groups of two students). This activity will be organized jointly with other subjects in the second year. The rating of the seminar will represent **5 % of the final grade**.

To pass the subject it will be necessary to obtain a minimum grade of 5 points (out of a total of 10) in both theory and practical examination. The theoretical exam will not be approved if the grade in one of the two parts (Histology or Organogy) is inferior to 3.5 out of 10. Once these exams are approved, the final grade will be calculated taking into account also the grade obtained in the observation scripts and the seminar.

REFERENCES

Basic

- Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2010). *Biología Molecular de la Célula*. 5ª ed. Ediciones Omega.
- Gartner, L.P. and Hiatt, J.L. (2007). *Color Textbook of Histology*. 3rd ed. Saunders Elsevier.
- Gilbert, S.F. (2005). *Biología del desarrollo*. 7ª ed. Ed. Médica Panamericana.
- Junqueira, L.C: y Carneiro, J. (2005). *Histología básica: texto y atlas*. 6ª ed. Masson.
- Kierszenbaum, A.L. y Tres, L.L. (2012). *Histología y Biología Celular. Introducción a la anatomía patológica*. 3ª ed. Elsevier-Saunders.
- Kühnel, W. (2005). *Atlas Color de Citología e Histología*. 11ª ed. Ed. Médica Panamericana.
- Pavelka, M. and Roth J. (2009). *Functional ultrastructure: Atlas of tissue biology and pathology*. Springer.
- Martín-Lacave, I. (2014). *Atlas de Histología Humana*. 1ª ed. Ediciones Díaz de Santos.
- Montuenga Badía, L. (2014) *Técnicas en histología y biología celular*. 2ª ed. Elsevier España.
- Rhodin, J.A. (1974). *Histology: a Text and Atlas*. Oxford Univ. Press.



- Ross, M.H. y Pawlina, W. (2012). Histología. Texto y Atlas color con Biología Celular y Molecular. 6ª ed. Ed. Médica Panamericana.
- Stevens, A. y Lowe, J. (2006). Histología humana. 3ª ed. Elsevier-Mosby.
- Welsch, U. (2013). Sobotta Histología. 3ª ed. Panamericana.
- Young, B., Heath, J.W. y Woodford, P. (2014). Wheater Histología funcional. Texto y Atlas en Color. 6ª ed. Elsevier España.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

1. Contenidos

Se mantienen todos los contenidos pendientes originalmente planteados en la guía docente ajustando la metodología a docencia telemática.

2. Volumen de trabajo

Las metodologías alternativas para la docencia telemática, aunque en gran medida suponen que el alumnado trabaje a su propio ritmo, en neto no implican un cambio en la dedicación originalmente planteada.

3. Metodología docente

TEORÍA

El contenido de estas clases se proporciona al alumnado de dos maneras:

- en forma de presentaciones de diapositivas locutadas que los/as estudiantes pueden trabajar en el horario que les resulte más conveniente.
- mediante clases programadas en vivo por videoconferencia a través de Blackboard Collaborate.

Adicionalmente, se plantea una actividad que se considerará como parte de la evaluación del bloque teórico que consistirá en la resolución de algunas cuestiones a través de una tarea abierta en aula virtual con inicio y finalización acotados.

PRÁCTICAS

Las tres sesiones de prácticas pendientes tras el inicio del estado de alarma se adaptan para trabajo telemático por parte del alumnado. Se sustituye la observación al microscopio de preparaciones histológicas por el estudio de preparaciones equivalentes en microscopios virtuales de libre acceso



seleccionados por el profesorado. Se mantienen las guías de observación para cada práctica, adaptadas a las nuevas preparaciones. Una vez trabajadas todas las preparaciones y cumplimentada la guía de observación de cada práctica, se fotografiará y entregará a través de tareas abiertas en aula virtual según el calendario establecido por el profesorado.

Las dudas que vayan surgiendo se resolverán a través de los foros habilitados en aula virtual y el correo electrónico institucional.

4. Evaluación

Se ajustan los porcentajes de cada una de las partes de la asignatura para acomodar el reajuste realizado en la actividad del seminario interdisciplinar que pasa a tener asignado un 10% de la nota final en lugar de un 5%.

La evaluación de los contenidos del programa teórico se realizará mediante un examen de cada una de las dos partes de la asignatura: Histología (temas 1 al 8) y Organografía (temas 9 a 16), que consistirá exclusivamente en preguntas tipo test/verdadero y falso realizado a través de aula virtual con tiempo de respuesta acotado. Para facilitar el trabajo de los alumnos, las dos partes se evaluarán en fechas diferentes.

La nota máxima del test será de 8,5 a los que se sumarán:

- hasta 0,75 por la actividad realizada a través de aula virtual antes de la declaración del estado de alarma relacionada con los contenidos de la primera parte de la asignatura temas 1-8).
- hasta 0,75 por la actividad que se plantea a través de aula virtual relacionada con los contenidos de la segunda parte de la asignatura temas 9-16).

En la medida de lo posible, el profesorado supervisará el desarrollo del examen mediante videoconferencia múltiple en tiempo real.

La nota obtenida en este examen representará el 60 % de la nota final.

La evaluación de las prácticas de laboratorio se basará en la realización de un examen de identificación de imágenes histológicas (15% de la nota final) y la presentación de guiones de observación elaborados para cada sesión de prácticas (15% de la nota final). El examen de identificación se realizará de manera telemática mediante una plataforma que permita la observación de imágenes en pantalla completa, así como acotar el tiempo de respuesta para cada una de ellas.

En la medida de lo posible, el profesorado supervisará el desarrollo del examen mediante videoconferencia múltiple en tiempo real.

Seminarios (actividad interdisciplinar de segundo curso): 10% de la nota final



5. Bibliografía

Páginas web recomendadas para el estudio de preparaciones histológicas:

Atlas de Histología Vegetal y Animal. Universidad de Vigo

<http://webs.uvigo.es/mmegias/inicio.html>

Michigan Histology and Virtual Microscopy Learning Resources

<https://histology.medicine.umich.edu/full-slide-list>

University of Iowas Virtual Slidebox Histology

<http://www.path.uiowa.edu/virtualslidebox/>

Atlas of Microscopic Anatomy. Ronald A. Bergman, Ph.D., Adel K. Afifi, M.D., Paul M. Heidger, Jr., Ph.D.

<http://www.anatomyatlases.org/MicroscopicAnatomy/MicroscopicAnatomy.shtml#TOC>

UCSD School of Medicine MedPics

<http://medpics.ucsd.edu/index.cfm?curpage=home>

Blue Histology. School of Anatomy and Human Biology. Univ. Western-Australia

<http://www.lab.anhb.uwa.edu.au/mb140/> _