

**Morphology I**

Code: 102679  
ECTS Credits: 9

Degree	Type	Year	Semester
2502445 Veterinary Medicine	FB	1	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: No  
Some groups entirely in Spanish: No

**Teachers**

Ana Carretero Romay  
María Dolores Fondevila Palau  
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Enrique María Mateu de Antonio  
Marc Navarro Beltrán  
Martí Pumarola Batlle  
Rosa Maria Rabanal Prados  
Jesús Ruberte París  
Víctor Nacher García  
Pedro Ginés Mayor Aparicio

**Prerequisites**

There are no prerequisites for taking this course. However, in order to ensure the proper achievement of the learning aims, it is recommended that students have passed the subject of Animal and Cell Biology in the first semester of the first year of the Degree. Also, the consistency in daily work and the ability to observe is important.

**Objectives and Contextualisation**

Morphology I is a basic subject in the first year of the Degree that helps to make the student know the structure and organization of domestic animals to understand the function of the organs, tracts and systems that composes the animal organism, during the individual development and during the adult stage. In particular, Morphology I focuses on the study of general embryology, the basic tissues that composes the body and the Locomotor apparatus. The subjects Structure and function of the nervous system, Morphology II and Physiology complement the contents related to the structure and the function of the organ systems of the animal body.

The formative objectives of the subject are:

- To understand the origin and organization of the structures of animals during their development, the basic concepts of the mechanisms that control their development, as well as the etiology and meaning of development anomalies.
- To understand the microscopic structure of cells and tissues as the basis for studying the organs that compose the domestic animals.
- To understand the shape, structure, disposition and function of the organs that make up the Locomotor apparatus in the different species of veterinary interest.
- To use the embryological, histological and anatomical terminology correctly and appropriately.
- To know how to use the embryological, anatomical and histological knowledge as a basis for the study of other preclinical and clinical subjects.
- To access and to use critically information sources on embryology, anatomy and histology in an autonomous and adequate manner.

## Competences

- Comunicar la informació obtinguda durant l'exercici professional de manera fluïda, oralment i per escrit, amb altres col·legues, autoritats i la societat en general.
- Demonstrate knowledge and understanding of structural and functional disorders of the animal organism.
- Demonstrate knowledge and understanding of the structure and functions of healthy animals.
- Work effectively in single or multidisciplinary teams and show respect, appreciation and sensitivity for the work of others.

## Learning Outcomes

1. Apply the different types of tissue processing and histological techniques.
2. Communicate information obtained during professional exercise in a fluid manner, orally and in writing, with other colleagues, authorities and society in general.
3. Define the structural components of basic tissues.
4. Describe changes to tissue components of organs and relate them with the functionality of the organ.
5. Explain the basic concepts of the mechanisms that control the embryonic processes.
6. Explain the etiology and meaning of developmental anomalies.
7. Microscopically identify animal tissues and organs.
8. Recognise and explain the form, structure, layout and relationships of the organs, apparatus and systems of animals of veterinary interest.
9. Recognise and explain the origin and organisation of the structure of animals during their development.
10. Relate the composition and the structure of tissues with their functions.
11. Use anatomical and embryologic knowledge to solve problems of a veterinary nature.
12. Use the correct and suitable embryologic and anatomical terminology.
13. Work effectively in single or multidisciplinary teams and show respect, appreciation and sensitivity for the work of others.

## Content

The learning process of the contents of the subject needs an integrated boarding throughout the attendance to master classes and practical sessions. The subject is divided into three main parts, the contents of which are detailed below.

Schedule of the course

## PART 1. GENERAL EMBRIOLOGY (2,5 ECTS)

### Concept of Embryology.

Stages of the ontogenic development. Gametes: oogenesis and spermatogenesis. Fertilization. Applied aspects on "in vitro" fertilization. Nuclear reprogramming of the oocyte, and therapeutic and reproductive cloning.

### Germinal stage.

- Segmentation. Morulation. Blastulation. Cell fate determination and differentiation. Notions about the embryo transfer. Preimplantation genetic diagnosis. Gastrulation.

### Embryo or organogenesis.

- Maternal recognition of pregnancy. Embryonic implantation.
- Formation and derivatives of the three germ layers. Neurulation and formation of primary organs. Phenomena involved in the appearance of the embryonic form.
- Other biological processes occurring during the ontogenic development: growth, migration, cell apoptosis, cell lines, embryonic induction, etc.
- Control and regulation of the ontogenic development. Gene expression during the development.
- Extra-embryo annexes. Disposition and formation in mammals and birds.
- Extra-embryo circulation. Placentation. Umbilical cord. The chorionic sack in different of domestic mammal species. Morphological and histological classification of the placenta.

### Fetal stage.

- Fetal growth. Stages of the fetal development. Pregnancy stages. Changes during birth.
- Observation of the fetal development and extra-embryo annexes in mammals. Morphological identification at different fetal stages.

### Notions on Teratology

- Anomalies during the gastrulation stage. The double monsters. Malformations during the acquisition of the embryonic form. General causes of congenital malformations.

## PART 2. HISTOLOGY (2 ECTS)

### Introduction

- Concept of Histology. Basic tissues. Microscopically anatomy.
- Processing of animal cells and tissues for the histological study: Staining and histological techniques.

### Basis tissues

- Epithelial tissue. Coating epithelium tissue: concept and classification criteria. Coating epithelium and glandular exocrine and endocrine epithelium.
- Connective tissue. Concept and general structure. Components. The extracellular matrix (MEC): fundamental substance, fibres and cells.
- Specialized connective tissue. Adipose tissue: components and types. Cartilaginous tissue: components, structure and types. Bone tissue: components and structure. The spongy and the compact bone tissue. Intramembranous and endochondral ossification. The bone growth.
- Blood. Components: plasma and cell fraction. Erythrocyte: morphology and functions. Leukocytes: concept and type. Morphology and functions. Haematopoiesis.
- Muscle tissue. Skeletal striated muscular. Striated heart muscle. Smooth muscle.

## PART 3. LOCOMOTOR APPARATUS (4,5 ECTS)

### Generalities

- Ontogenic and phylogenic development of the Locomotor apparatus. Congenital malformations. Osteology and bone biomechanics. Arthrology. Classification and constituent elements of the joints. Joint biomechanics. Myology. Anatomical classification of muscles. Structural organization of skeletal muscles.

### Thoracic limb

- Bones of the thoracic limb. Descriptive and comparative anatomy. Ossification centers. Radiological anatomy. Keratinized structures of the limb.
- Joints and muscles of the thoracic limb. Biomechanics of the limb. Vascularization. Lymph nodes. Innervation. Brachial plexus. Areas of cutaneous innervation.
- Surface anatomy: Identification of regions of the limb and palpable bone points. General principles of the anatomic dissection.
- Dissection and anatomical preparation of limb regions, identifying and studying muscles, joints, blood vessels and nerves.

### Cervical, dorsal, thoracic and abdominal regions

- Ontogenic development of the vertebral column. Congenital malformations. Vertebral column. Cervical, thoracic, lumbar, sacral and caudal vertebrae. Ribs and sternum. Descriptive and comparative anatomy. Ossification centers. Radiological anatomy.
- Joints of the vertebral column. Ligaments. Epaxial and hypoaxial muscles. Thoracic joints and muscles. Diaphragm: ontogeny, description and anatomical relations. Biomechanics of respiration. Muscles and fascia in the abdominal region. Inguinal canal. Muscles of the tail. Arterial and venous vascularization of the neck, trunk and tail. Lymph nodes and vessels. Innervation of the neck, trunk and tail. Areas of cutaneous innervation.
- Dissection and anatomical preparation of the cervical region, the thoracic and the abdominal wall, and tail, identifying and studying muscles, joints, blood vessels and nerves.

### Pelvic limb

- Bones of the pelvic limb. Descriptive and comparative anatomy. Ossification centers. Radiological anatomy. Keratinized structures of the limb.
- Joints and muscles of the pelvic limb. Biomechanics of the limb. Vascularization. Lymph nodes. Innervation. Lumbosacral plexus. Areas of cutaneous innervation.
- Surface anatomy: Identification of regions of the limb and palpable bone points. General principles of the anatomic dissection.
- Dissection and anatomical preparation of limb regions, identifying and studying muscles, joints, blood vessels and nerves.

## **Methodology**

The methodology used during the teaching and learning process is based on the student efficiency analyzing the information that our team made available through different means. The main role of the teacher is to help the student, not only giving information, but also directing and supervising the learning process. The course is based on the following activities:

**Master classes:** The student acquires the scientific knowledge of the discipline. The student must complete this knowledge with the personal and autonomous study of the topics explained.

**Practical sessions:** Practical sessions approach the theoretical models to reality and reinforce, complete and allow to apply the knowledge acquired in master classes. At the beginning of the course, the student will receive a practical guide describing the contents studied in each session. In practical sessions, the students grouped in small groups will study dissections, bones, preparations of isolated organs, models, x-rays, histological preparations, etc. Throughout the observation of these specimens, the student will acquire a three-dimensional concept of the structural disposition, required to understand, for example, the movement of joints, the muscular biomechanics, the distribution of vessels and nerves, or the juxtaposition of adjacent structures. In practical sessions, the student will also develop manual dexterity and skills, such as curiosity and observation. The attendance to the practical sessions will be controlled.

The student's learning will be monitored through different evaluative tests in continuous assessment, including dissection and microscopy. These tests will evaluate the understanding of practical sessions and the integration of theoretical contents acquired in master classes. The student will also be examined in 3 synthesis tests during the semester.

The materials used in the subject will be available on the Moodle platform.

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratorial sessions	77.5	3.1	1, 2, 4, 5, 7, 9, 8, 13, 11, 12
Master classes	38	1.52	3, 5, 6, 9, 8, 10, 12
Type: Autonomous			
Autonomous learning	103.5	4.14	1, 3, 5, 7, 9, 8, 10, 12

## Assessment

The evaluation will be performed continuous along the course, for the better monitoring of the teaching and learning processes, encourage the continuous effort during the semester and verify the compliance of competences assigned.

Evaluation of practical sessions: There will be 6 controls or tests of continuous evaluation during the course; 3 tests corresponding to the histology block and 3 tests corresponding to the locomotor block. The collaborative work and the quality of the dissection realized by the students will also be evaluated. Qualifications obtained will worth 10% of the final grade (also for students repeating the course). In addition, for the better integration of practical contents of different blocks, one evaluation will be performed at the end of each block. The evaluation of the practical contents of Block 1 (Embryology) will be included in the corresponding written exam. Practical contents of Block 2 (Basic Tissues) will be assessed through a microscope examination, and will worth 12% of the final grade of the course. Practical contents of Block 3 (Locomotor apparatus) will be assessed through an oral examination performed in the dissection room, using the specimens dissected during the anatomy practical sessions. The oral practical examination of Block 3 (Locomotor apparatus) will worth 30% of the final grade of the course. A minimum grade of 4.5 points out of 10 will be required in the practical examinations of Blocks 2 and 3 in order to average with other qualifications and, consequently, to pass the course.

Written evaluations: Two partial examinations will be conducted: the first one corresponding to the Block 1 (General Embryology) and the second one including contents of Block 2 (Basic Tissues) and Block 3 (Locomotive apparatus). These examinations will evaluate both theoretical and practical concepts corresponding to each Block. Overall, written exams will worth 48% of the final grade. A minimum grade of 4.5 out of 10 will be required in each examination to average with other qualifications and to pass the course. In the second partial examination, the contents of Block 2 (Basic tissues) and Block 3 (Locomotive apparatus) must be approved separately with a minimum of 4.5 out of 10. Theoretical examinations allow to evaluate the integration of theoretical knowledge with those acquired in practical sessions, the ability to relate and analyze concepts, and overall knowledge and skills of the student.

The following table shows the weight of each examination on the final grade:

Respect to the 100 total grade in Morphology I

	Weight ETCS	Weight %	% Controls	% Practical exam	% Theoretical exam	TOTAL (100%)
Embryology	2,50	27,8%	0	0	27,8	27,8
Basic tissues	2,00	22,2%	3	12	7,2	22,2
Locomotor	4,50	50,0%	7	30	13	50
TOTAL	9,00	100,0%	10	42	48	100

The student's final grade will be calculated from the average of all his partial grades. The course will be approved with a final grade of 5 or higher

Students with a minor grade than 4.5 out of 10 in the practical exam of Basic tissues or oral exam of the Locomotive apparatus or any one of the three partial written examinations will have the opportunity to recover them at the end of the semester. The continuous assessment of practices won't be recoverable.

The student who has not been made any partial exam, including theoretical or practical ones, will be considered as Not Presented. The student who made one partial exam but not further exams will be considered Failed. If the student failed the course, the grades corresponding to overcome blocks (Embryology, Basic Tissues and Locomotives) can be saved.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final practical exam of Block 2 in the Microscope room	12	0.5	0.02	1, 2, 3, 7, 10
Individuals controls along the course on microscopy and dissection, and collaborative work.	10	0	0	1, 7, 8, 13, 11, 12
Oral practical exam of Block 3 in the Dissection room	30	0.5	0.02	1, 2, 7, 8, 11, 12
Written examinations (2 partials)	48	5	0.2	3, 4, 5, 6, 9, 8, 10, 12

## Bibliography

### Textbooks of Anatomy

- Dyce, Sack & Wensing (1999). Anatomía veterinaria. Ed. McGrawHill Interamericana
- König & Liebich (2004). Anatomía de los animales domésticos. Tomo1: Aparato Locomotor. Ed. Médica Panamericana.
- Schaller (1996). Nomenclatura anatómica veterinaria ilustrada. Ed. Acribia S.A., Zaragoza.

- Evans, H.E. & de Lahunta, A. (2013). Miller's Anatomy of the Dog. Ed. Elsevier Saunders. St. Louis, Missouri.

#### Textbooks of Embryology

- Gilbert, S.F. (2013). Developmental Biology. 10th Edition. 719 pages. Sinauer Associates, Inc. ISBN: 978-0-87893-978-7.
- Hyttel, P., Sinowatz F., Vejlsted, M. & Betteridge, K. (2010). Essentials of Domestic Animal Embryology. 472 pages. Ed. Saunders Ltd. Title. ISBN: 978-0-7020-2899-1.
- McGeady, T.A., Quinn, P.J. & FitzPatrick, E.S. (2006). Veterinary Embryology. 377 pages. Blackwell Publishing Ed. ISBN-10: 140511147X.
- Noden, D.M. & A. de Lahunta (1990). Embriología de los animales domésticos. Ed. Acibia, Zaragoza.

#### Textbooks of Histology

- Banks (1993). Applied Veterinary Histology. 2nd ed. Williams and Wilkins. London.
- Eurell & Frappier (2006). Dellmann's textbook of Veterinary Histology. 6th ed.
- Kierszenbaum A.L. (2015). Histology and Cell Biology. An introduction to Pathology. Mosby Elsevier Ed.
- Kristic (1989): Los tejidos del hombre y de los mamíferos. Ed. Interamericana. Madrid
- Samuelson, D.N. Textbook of Veterinary Histology (2007) Saunders/Elsevier Ed.

#### Atlas of Anatomy

- Done, Goody, Evans & Stickland (2010). Atlas en color de Anatomía Veterinaria. El perro y el gato, 2ª edición. Ed. Elsevier Mosby.
- Ruberte, Sautet, Navarro, Carretero & Pons (1995). Atlas de Anatomía del perro y del gato. Vol. 1: Cabeza y Cuello. Multimédica, Sant Cugat del Vallès, Barcelona.
- Ruberte, Sautet, Navarro, Carretero & Espelt (1996). Atlas de Anatomía del perro y del gato: Vol. 2: Tórax y Miembro torácico. Multimédica. Sant Cugat del Vallès, Barcelona.
- Ruberte, Sautet, Navarro, Carretero, Manesse & Pérez-Aparicio (1998). Atlas de Anatomía del perro y del gato: Vol. 3: Abdomen, pelvis y Miembro pelviano. Multimédica. Sant Cugat del Vallès, Barcelona.

#### Atlas of Histology

- Bacha & Bacha (2000). Color atlas of Veterinary Histology. 2nd. Ed. Lippincott Williams & Williams. London
- Young, B. & Heath, J.W. (Eds) (2013). Wheater's Functional Histology: A Text and Colour Atlas (Book with CD-ROM) 6ª ed. Elsevier Saunders. St. Louis, Missouri.

#### Cd's of Histology

- Weather's Functional Histology, 4a ed. (B. Young i J.H. Heath)
- Texto Atlas de Histología, 2a ed., (L.P. Gartner & J.L. Hiatt)
- Color Textbook of Histology 3ª ed. (Gartner L.P. & Hiatt J.L. Saunders/Elsevier Ed.
- El microscopi virtual a Histología sobre bases biomoleculares, (Genesser)
- Di Fiore's Atlas of Histology, 10a ed. (V.P. Eroschenko, Lippincott Williams & Wilkins)

#### Link to webs of Embryology

- Atles del desenvolupament embrionari preimplantacional dels mamífers domèstics.  
<http://videodigitals.uab.es/cr-vet/www/21197/atlas/inicio.html>
- <http://placentation.ucsd.edu/>. Web del Prof. Kurt Benirschke sobre la placentació comparativa de diverses espècies animals.
- [http://php.med.unsw.edu.au/embryology/index.php?title=Main\\_Page](http://php.med.unsw.edu.au/embryology/index.php?title=Main_Page). Web interactiva sobre embriologia creada pel Dr Mark Hill, Cell Biology Lab, Department of Anatomy, School of Medical Sciences, Faculty of Medicine, The University of New South Wales, Sydney, Australia.

#### Link to webs of Anatomy

- Atlas de los músculos del perro I: Miembros torácico y pelviano.

[http://veterinariavirtual.uab.es/anatomia/musculosperrol/Atlas\\_virtual/primer.html](http://veterinariavirtual.uab.es/anatomia/musculosperrol/Atlas_virtual/primer.html)

- Atlas de los músculos del perro II: Cuello, tronco y cola. Cabeza.

[http://veterinariavirtual.uab.es/anatomia/musculosperrol/Atlas\\_virtual/primer.html](http://veterinariavirtual.uab.es/anatomia/musculosperrol/Atlas_virtual/primer.html)

- Inervación y vascularización de los miembros del perro.

[http://veterinariavirtual.uab.es/anatomia/nerviosyvasosperro/Atlas\\_virtual/primer.html](http://veterinariavirtual.uab.es/anatomia/nerviosyvasosperro/Atlas_virtual/primer.html)

- Atlas de osteología de los mamíferos domésticos.

[http://veterinariavirtual.uab.es/anatomia/osteologia/Atlas\\_Virtual/primer.html](http://veterinariavirtual.uab.es/anatomia/osteologia/Atlas_Virtual/primer.html)

- Atlas de Anatomía seccional en el perro.

<http://veterinariavirtual.uab.es/anatomia/anatseccional/primer.html>

#### Link to webs of Histology

- <http://www.med.umich.edu/histology/digMicro.html>. Col·lecció de preparacions histològiques.
- <http://zyx.freesevers.com/histo/histo.htm>. Histology World és un web on podeu trobar tot tipus d'informació relacionada amb la Histologia: llibres, revistes, publicacions, col·leccions, laboratoris etc. així com links amb tots els altres webs.
- <http://www3.usal.es/histologia/>. Web de la Universitat de Salamanca. Col·lecció de preparacions histològiques. Inclou autoavaluació i jocs.