Universitat Autònoma de Barcelona

2022/2023

Animal and Cell Biology

Code: 102652
ECTS Credits: 7

Degree	Type	Year	Semester
2502445 Veterinary Medicine	FB	1	1

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

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Prerequisites

There is no official prerequisite, but in order to take this subject it is convenient that student review the contents related to animal and cell biology of the subject of Biology of the High school.

Objectives and Contextualisation

The objective of this subject is twofold:

- give students a global vision of the structure and organization of the main groups of animals as well as their diversity, from an evolutionary point of view,

- the study of the eukaryotic cell, the knowledge of intracellular molecules and the interactions between cells allowing the construction of multicellular organisms.

On successfully completing this subject, students will be able to:
1. Demonstrate knowledge about basic concepts for the study of Animal Biology.

2. Demonstrate knowledge about the main levels of organization and architectural patterns of non-arthropod invertebrates.

3. Understand the systematics and phylogenetic relationships between the main groups of animals as a result of evolutionary and adaptive processes.

4. Demonstrate knowledge about the morphological characteristics, biological cycles and ecological importance of the main metazoan groups, as well as their interactions with human beings, with specialemphasis on those with more veterinary interest, such as parasites or species of economic interest.

5. Understand the structure ofthe eukaryotic cell and relate it to the operation of its compartments.

6. Acquire the integrated concept of a cell thanks to the knowledge about the ability to interact with other cells and with the external environment.

7. Understand the basic processes of operation of an organism based on the operation of the cell and each of its compartments.

8. Master basic terminology and be able to express the concepts with ownership and correctly describe the cellular structures.

9. Demonstrate knowledge about the diversity of animal cells.

Competences

- Analyse, synthesise and resolve problems and make decisions.
- Demonstrate generic knowledge of animals, their behaviour and the bases of their identification.
- Demonstrate knowledge and understanding of the physical, chemical and molecular bases of the main processes in 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. Analyse, synthesise and resolve problems and make decisions.
2. Apply dissection methods to the observation and analysis of the internal anatomy of representative samples of the main animal groups of veterinary interest.
3. Define the principles and methods of animal classification.
4. Describe and identify the different levels of animal organisation.
5. Describe the molecules, structures and processes involved in a cell's interaction and communication with the external environment and with other cells.
6. Explain the functioning and regulation of the cell cycle and cell division.
7. Identify the basic functioning processes of an organism from the functions of the cell and each of its compartments.
8. Identify the large animal groups and their phylogenetic relationships.
9. Integrate the functions of the different organelles and cell structures with the overall functioning of the cell.
10. Interpret the development, growth and biological cycles of the main animal taxa of veterinary interest.
11. Observe, handle and preserve animal specimens.
12. Recognise the morphology and bionomics of the main animal taxa of veterinary interest.
13. Relate the structure of the different parts of the cell and their functions.
14. Work effectively in single or multidisciplinary teams and show respect, appreciation and sensitivity for the work of others.

Content

ANIMAL BIOLOGY

1. INTRODUCTION. Characteristics of living beings. The kingdoms of organisms and the concept of animal. The concept of species. Classification of organisms: taxonomy and systematics.

2. LEVELS OF ORGANIZATION. Structural organizational levels. Animal organization plan. Concept and type of symmetry.

3. REPRODUCTION. Type of reproduction: asexual and sexual. Parthenogenesis. Adaptive meaning of the different reproductive patterns. DEVELOPMENT: Biological cycles. Larval and metamorphosis development.

4. PROTOZOA. The concept of Protozoa. Shape and function. Representative types. Main parasitic groups.

5. PORIFERA. Cellular elements and structural types. CNIDARIA. Basic organization Biological cycles

6. PLATYHELMINTHES. Basic organization of Turbellaria, Trematoda and Cestoda. Morphological particularities and biological cycles of parasitic platyhelminthes.

7. MOLLUSCS. General characteristics. Gastropoda, Bivalvia and Cephalopoda. Groups of veterinary interest

8. ANNELIDS. General characteristics. Polychaeta, Oligochaeta and Hirudinea.

9. NEMATODES. General characteristics. Biological cycles of parasitic nematodes.

10. ARTHROPODS. General characteristics. Structure and importance of the cuticle. Basic elements of a segment. Chelicerata. Mites

11. CRUSTACEANS. Basic organization. Reproduction and development. Groups of veterinary interest.

12. INSECTS. Basic organization. The flight. Development and metamorphosis. Groups of veterinary interest.

13. EQUINODERMATA. General characteristics.

14. CHORDATA. General characteristics and basic organization. Basic organization of Chephalochordata. General characteristics of the vertebrates. FISH. Agnatha, Condrichtia and Osteichtia. Basic organization Structural and functional adaptations.

15. AMPHIBIANS. General characteristics. Anura and Caudata. REPTILS. Adaptations to the terrestrial environment. The amniota egg. Diversity

16. BIRDS. Morphological and physiological adaptations on flight. Endotherm. MAMMALS. General characteristics. Tegument and derivatives. Patterns of feeding and dental formulas. Diversity

CELL BIOLOGY

1 - TRANSMISSION AND EXPRESSION OF THE GENETIC INFORMATION

1.1 DNA replication. Limitations of DNA polymerases. 1.1.2 Eukaryotic chromosome replication machinery.

1.2 The beginning and the end of the replication of the eukaryotic chromosome. 1.2.1 Origins of replication. 1.2.2 Telomeres and telomerase. 1.2.3 Cellular senescence and aging of organisms. 1.2.4 Telomeric dysfunction and cancer.

1.3 Transcription

1.4 Translation: from DNA to protein. 1.4.1 Chaperones in the folding of cellular proteins. 1.4.2 Degradation of proteins poorly folded in proteasomes in the cytosol. 1.4.3 Accumulation of protein aggregates: Alzheimer's. 1.4.4 Transmission of protein aggregates between organisms and spices: prions as an infectious agent.

2 - NUCLEI, CHROMOSOMS AND GENETIC REGULATION

2.1 Organization of the interfacial core

2.2 Structure of the eukaryotic chromosome 2.2.1 Different levels of packaging of the chromatin. 2.2.2 Eucromatin and heterochromatin. 2.2.3 Inactivation of the X chromosome.

2.3 Regulation of transcription of genes. 2.3.1 Transcriptional control: Promoters and regulatory regions. 2.3.2 Control of gene expression in eukaryotes: Combinatory regulation. 2.3.4 Autonomous specification and conditional specification. 2.3.5 Imprinting of developmental genes.

3 - MEMBRANE STRUCTURE

3.1 The lipid bilayer. 3.1.1 Three types of lipid bilayer lipids. 3.1.2 Behavior of membrane lipids in aqueous solution

3.2 Membrane proteins. 3.2.1 Functions of membrane proteins. 3.2.2 Connection of the proteins to the lipid bilayer. 3.2.3 Folding patterns of membrane proteins

3.3 Fluid membrane. 3.3.1 Movements of lipids and proteins within the membranes. 3.3.2 Adaptations to maintain the fluidity of the membranes.

4 - TRANSPORT THROUGHOUT MEMBRANES

4.1 Simple diffusion.

4.2 Bases of transport mediated by proteins.

4.3 Mediated transport for permeases or conveyors. 4.3.1 Passive transport through permeases. 4.3.2 Active transport by conveyors: Primary active transport (Na + / K + pump, H + pump, Ca2 + pump, MDR pump) and secondary active transport (Na / glucose co-transporter).

4.4 Passive transport for protein channels. 4.4.1 Channels of random opening. 4.4.2 Regulated opening channels: regulated channels by voltage, channels regulated by union to chemical transmitter, channels regulated by stress.

5 - THE CITOESQUELET

5.1 Microtubules. 5.1.1 Structure of the microtubules. 5.1.2 Cell structures formed by microtubules and microtubule organizer centers. 5.1.3 Dynamic instability of microtubules. 5.1.4 Proteins associated with microtubules. 5.1.5 Stable microtubules: cilia and flagella.

5.2 Actin filaments. 5.2.1 Structure of actin filaments. 5.2.2 Dynamics of actin filaments. 5.2.3 Proteins associated with actin filaments: cell cortex, adhesion belts, contractile ring, stress fibers. 5.2.4 Activation of platelets. 5.2.5 Migration of cells.

5.3 Intermediate filaments. 5.3.1 Types of intermediate filaments. 5.3.2 Structureof intermediate filaments. 5.3.3 Functions of the intermediate filaments. 5.3.4 Diseases caused by alteration of intermediate filaments.

6- CELLULAR BANDS AND TRANSPORTATION OF BIOMOLECULES BETWEEN COMPARTMENTS

6.1 Introduction to the intracellular compartments. Membranes delimited by membranes. 6.1.1 Evolutionary origin of cell organelles. 6.1.2 Mechanisms for importing proteins to organelles: proteins entering the nucleus, mitochondria and reticulum endoplasmic 6.1.3 Signal sequences. 6.1.4 Synthesis and transport of lipids

6.2 Basis of the lipid and protein vesicular transport: via biosynthetic-secretory and endocytose pathway. 6.2.1 Deformation of the membrane for the formation of vesicles and charge selection. 6.2.2 Fusion of the vesicle to the appropriate organelle.

7 - BIOSINTETIC-SECRETARY ROUTE

7.1 Endoplasmic reticulum. 7.1.1 protein synthesis in the endoplasmic reticulum. 7.1.2 Sections of lipids in the endoplasmic reticulum. 7.1.3 Glucosylation of proteins in the endoplasmic reticulum. 7.1.4 Control output of the reticle.

7.2 Golgi apparatus. 7.2.1 Return of proteins to endoplasmic reticulum. 7.2.2 Glycosylation of lipids and proteins in the Golgi apparatus. 7.2.3 Transport of proteins to lysosomes. 7.2.4 Transport of proteins and lipids to the cell surface: exocytosis.

8 - ENDOCYTOSIS ROUTES

8.1 Phagocytosis.

8.2 Pinocytosis and endocytosis mediated by receptors.

8.3 Endosomes

8.4 Lysosomes

9 - MITOCONDRIA

9.1 Composition of mitochondrial membranes and compartments

9.2 Obtaining energy from food. 9.2.1 Oxidation of metabolites in mitochondria. 9.2.2 Respiratory chains. 9.2.3 Oxidative phosphorylation. 9.2.4 Transportation of molecules through the internal mitochondrial membrane. 9.2.5 Decoupling of the transport of electrons and oxidative phosphorylation.

9.3 Aerobic and anaerobic metabolism during physical exercise.

9.4 Genetic system of mitochondria. 9.4.1 Mitochondrial diseases. 9.4.2 Identification of individuals through sequencing of mitochondrial DNA.9.4.3 Mitochondrial Eva

10 - CELLULAR COMMUNICATION

10.1 Signal molecules

10.2 Receptors inside the cell

10.3 Receptors on the surface of the cell. 10.3.1 Receivers coupled to ion channels. 10.3.2 Protein-coupled receptors G. 10.3.3 Receptors associated with enzymes

10.4 Integration of signals

11 - CONTROL OF THE CELL CYCLE

11.1 Basis of the cell cycle control: intracellular signals and extracellular signals, control points along the cell cycle, cycles and kinases dependent on ciclines

11.2 Control point at the end of G2 (G2 / M).

11.3 Output control of M

11.4 Control of the cycle at the end of G1

11.5 Molecular brakes of the cycle

11.6 Disobeying the social control of cell proliferation. 11.6.1 Cancer-related genes. 11.6.2 Viruses and cancer. 11.6.3 Cancer diagnosis and treatment

12. CELLULAR DIVISION

12.1 Mitotic cell division. 12.1.1 Molecular mechanism of mitosis: organization and operation of the mitotic axis: prophase, promethase, metaphase, anaphase and thermophase. 12.1.2 Molecular mechanism of the cytokinesis: structure and operation of the fragmoplast and the contractile ring.

12.2 Meiotic cell division. 12.2.1 General characteristics and comparison between mitosis and meiosis. 12.2.2 Pairing of homologous chromosomes and recombination during meiosis. 12.2.3 Segregation of homologous chromosomes during meiosis I 12.2.4 Recombinant molecular mechanism 12.2.5 Meiosis in its context: spermatogenesis and ovogenesis

LABORATORY CLASSES:

1. Practical session 1. Observation and study of non-arthropod protists and invertebrates

2. Practical session 2. Observation and study of Molluscs: anatomy and diversity.

3. Practical session 3. Arthropods: anatomy and diversity. Crustaceans, Chelicerates and Insects.

4. Practical session 4. Chords: Fish: anatomy and diversity.

* The practices of this subject are part of the content of Animal Biology, since the practices of the part of Cell Biology are taught within the subject Integrated Laboratory.

Methodology

The methodology used in this subject is based on facilitating the active participation and construction of the learning process by the student, through different methodological strategies. In this sense, the sessions of the subject will be divided into master classes, seminars and problems, and laboratory practices, which are scheduled in an integrated way so that the student must relate throughout the course the content and activities scheduled for achieve the indicated competencies. In this sense, the role of the teacher is to give students the necessary information or indicate where they can get it and help and tutored so that the learning process can be done effectively.
To achieve this goal, the subject is based on the following activities:
-Master classes: Master classes will be lectures and flipped classes. Students will have the videos of the contents of each class to see at home before each face-to-face class. In class, there will be activities to work on the contents of the videos. These activities will consist of individual questionnaires from the Moodle classroom to monitor the viewing of videos by students, group questionnaires on different platforms to stimulate the approach and resolution of doubts, and raising problems or questions to work and solve in the classroom. The master classes will be complemented with the visualization of animations and videos related to the treated subjects. Visual aids used in class will be available on the Virtual Campus. It is recommended that students view and bring this materialto class to use as a support when taking notes. Although it is not essential to expand the contents of the classes taught by the teacher, unless the teacher expressly requests it, students are advised to regularly consult the books recommended in the Bibliography section to consolidate and clarify, if it is necessary, the contents explained in class. With these classes the student acquires the basic scientific-technical knowledge of the subject that must complement with the personal study of the topics explained.

Seminars

The seminars of this subject will be given in a face-to-face format, if the health and university authorities allow it. They will consist of directed work classes, with videos in some sessions and problem classes.

1. Directed work classes:

In each seminar sessionstudents will work on a glossary of scientific terms, with different methodology,corresponding to the theme / topics that are worked on in the corresponding session and / or related questions. In most cases, the subject / will have previously explained at theoretical classes. The list of the glossary by subjects will be available from the beginning of the course in the CV.

Different activities will be alternated:

- Discussion and correction about the terms of the glossary and exercises / problems delivered in previous sessions and about the questions of the evaluation test carried out in the previous session.

- Group discussion of the resolution of the questions by the students, with the participation of the teacher.

- Preparation by each group of a list of questionsV / F on the subject or topics that has been explained intheory. Discussion and correction of the questions.

- Projection of a video. Analysis and discussion of the video. The student can consult on the web of the subject the transcription of the videos (original in English) that are projected.

- The last quarter of an hour is allocated to an individual assessment test: answering about 10 V / F questions about the subject worked in the seminar or about the video.

The goal of the seminars is to promote the capacity for analysis and synthesis, critical reasoning and the capacity to solve problems.

2. Classes of problems:

The resolution of scientific problems allows a very interesting deduction and integration exercise for the scientific training of the students. The theoretical knowledge is complemented with the resolution of problems related to the topics covered in the theory classes. The compilation of the problems will also be found in the virtual campus in / pdf format. In each problem session each student individually will have to take and deliver the solved problems corresponding to the theme / s that are worked in the corresponding session.

The teacher will ask a student randomly to present theresolution of a problem and explain it to the rest of the classmates with the helpof the teacher.

The goal of the problem classes is to guide the student regarding their level of learning, approaching it to the scientific method and helping the integration of concepts and knowledge.

Practical sessions

During the practical sessions students will work with zoological material in the laboratory (observation of preparations and specimens, study of anatomy and morphology of groups, dissections, identification of specimens, etc.) and will complement it with the study and the questions posed to the corresponding practice scripts.

The objective of the practical sessions is to complete andreinforce the zoological knowledge acquired in the theoretical classes and seminars. Practical sessions will be stimulated and developed in the student empirical skills such as the ability to observe, analyse and recognize zoological diversity.

At the end of all the practices the students will do an on-line questionnaire about the practical sessions.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory practices	8	0.32	1, 2, 4, 8, 11, 12, 14
Seminars	2	0.08	1, 5, 6, 7, 9, 13, 14
Seminars (supervised work)	6	0.24	3, 4, 8, 10, 12, 14
Theorical lessons	35	1.4	3, 4, 5, 6, 8, 7, 9, 10, 12, 13
Type: Supervised			
Tutorials for preparing work and solving problems	5.5	0.22	3, 4, 5, 6, 8, 7, 9, 10, 12, 13
Type: Autonomous			
Preparation of work, resolution of questions and problems	35	1.4	1, 3, 4, 5, 6, 8, 7, 9, 10, 12, 13, 14
Study and self-learning assay	73	2.92	1, 3, 4, 5, 6, 8, 7, 9, 10, 12, 13, 14

Assessment

The assessment of this subject will be carried out continuously:

Assessment of the master classes:

The assessment of the master classes has a global weight of 76% of the final mark. By this part the knowledge acquired by the student in the subject will be assessed individually, as well as the capacity for analysis and synthesis, and critical reasoning.

This 76% is distributed as follows:

- The part of Animal Biology has a weight of 33%, of which at least 23% will be obtained from the partial exam and up to a maximum of the remaining 10% will derive from the questionnaires that the student does at the classroom (depending on the number of face-to-face lessons that can be done during the course).

- The part of Cell Biology has a weight of 43%, of which at least 28% will be obtained from the partial exam and up to a maximum of the remaining 15% will derive from the questionnaires that the student does in the classroom. (depending on the number of face-to-face lessons that can be done during the course).

Therefore, in addition to the evaluation activities throughout the master classes, there will be 2 partial exams. A mark of at least 4.5 out of 10 is required to successfully pass the partial exam.

Second-chance exam: Students who do not pass (with a 4.5) any of the 2 partial exams must be reassessed. Students who, having reached the minimum score to pass the subject, want to upload a mark will also be able to submit to the Second-chance exam. In this case, the note that will prevail will be that of the last exam.

To make the average with the other activities (seminars / problems, practices) it is necessary to reach at least a 4 in the Second-chance exam or have successfully passed the two partial exams.

Assessment of seminars / problems:

The assessment of this part consists on both: small works (issues / problems) that should be presented on seminar day and the participation and the assessment tests (by groups or individually) that will be developed throughout the seminar.

This part has a global weight of 10% of the final mark (which is divided into 7.5% of the Animal Biology seminars and 2.5% of the Cell Biology problem classes).

To make the average with the other activities (exams, practices) it is necessary to have a mark of at least 4.

Evaluation of the practical sessions:

Atthe end of all practical sessions the student will answer an on-line test individually that assesses the use and achievement of the specific skills of each practice. Participation and behaviour in the laboratory classes will also be taken into account.

This part has a global weight of 14% of the final mark.

To make the average with the other activities (seminars / problems, exams it is necessary to have a mark of at least 4.

Not assessable:

A student is considered not assessable if he participates in assessment activities that represent less than 15% of the total mark.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes

Laboratory sessions	14%	2	0.08	2, 8, 11, 12, 14
Partial exams	76% (of which up to 25% will correspond to the marks of the activities in the theorical sessions)	6	0.24	1, 3, 4, 5, 6, 8, 7, 9, 10, 12, 13
Seminars	10%	2.5	0.1	1, 2, 3, 4, 5, 6, 8, 7, 9, 10, 12, 13, 14

Bibliography

Animal Biology

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HISTÒRIA NATURAL dels Països Catalans. Vol. 8, 9, 10, 11, 12, 13. Ed. Enciclopèdia Catalana.

Cell Biology

ALBERTS B, BRAY D, HOPKIN K, JOHNSON A, LEWISs J, RAFF M, ROBERTS K, WALTER P (2011). Introducción a la Biología Celular. Ed. Médica Panamericana. Madrid.

ALBERTS B, JOHNSON A, LEWIS J, MORGAN D, RAFF M, ROBERTS K, WALTER P. (2015). Molecular Biology of the Cell. Garland Science. Sixth edition.

BECKER WM, KLEINSMITH LJ, HARDIN J. (2007). El mundo de la célula. Pearson Educación SA. Madrid.Sexta edición.

COOPER GM, HAUSMAN RE. (2009). La Célula. Editorial Marbán. Quinta edición

KARP G (2009). Biología Celular y Molecular. McGrawn Hill. Quinta edición

On-line Books: http://www.ncbi.nlm.nih.gov/sites/entrez?db=Books&itool=toolbar

Websides:

Aula Virtual de l'Autònoma Interactiva: https://e-aules.uab.cat/2020-21

Animal Diversity Web: http://animaldiversity.ummz.umich.edu/

Adena/World Wildlife Found: http://www.wwf.es/

Biodidac: http://biodidac.bio.uottawa.ca

Comissió Internacional de Nomenclatura Zoològica: http://www.iczn.org/

Museu Nacional de Ciències Naturals de Madrid (CSIC): http://www.mncn.csic.es/

Natural History Museum, Londres: http://www.nhm.ac.uk/

Tree of Life Project: http://phylogeny.arizona.edu/tree/phylogeny.html

Software

No special software will be used.