27103 - General Biology

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	446 - Degree in Biotechnology
ECTS	12.0
Course	1
Period	Annual
Subject Type	Basic Education
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

For students enrolled in the subject, places, times and dates of lectures and practical sessions will be public via Bulletin Board advertisements of the grade on the platform Moodle at the University of Zaragoza , https://moodle2.unizar.es/add/, and in the moodle page for the course. These routes will be also used to communicate enrolled students their distribution by groups of practical sessions, which will be organized by the coordination of degree. Provisional dates will be available on the website of the Faculty of Sciences in the corresponding section of the Degree in Biotechnology : https://ciencias.unizar.es/grado-en-biotecnologia .

In this web there will be also available the dates of exams.

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

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5.1.General methodological presentation

Participatory master classes

Classes of problems and seminars.

Laboratory practices

5.2.Learning activities

Learning activity 1: Master classes. Acquisition of basic knowledge of biology (9 ECTS).

Methodology:

1) Participatory lectures. The basic material will be provide by the professors to the students through the UNIZAR learning platform, on the website: http://add.unizar.es:800/newweb/web/index.html.

2) Tutorials.

Learning activity 2 : training of working with biological materials (2 ECTS).

Methodology:

1) Practices in the laboratory.

2) Individual work.

3) Elaboration of a report.

Learning activity 3 : seminars (1 ECTS).

Methodology:

1) Problem-based learning.

2) Work in group and individual.

5.3.Program

Master classes

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1st part: CELL BIOLOGY (**1st semester)**

1. Origin and overall view of cells . Introduction to Cell Biology. Origin and evolution of cells. Eukaryotic cells and cell diversity. Cells as experimental models.

2. Techniques to study cells . Light microscopy. Fluorescence microscopy. Electron microscopy: SEM, TEM. Physical methods for cell separation. Subcellular fractionation.

3. Chemical components of cells. Basic cell molecules and macromolecules. Cell localization and function of sugars lipids, proteins and nucleic acids. Basic relationships between chemical structure and cell function.

4. Enzymes in cells. Basic features and actions of enzymes. Cofactors. Active site. Enzyme kinetics. Effect of pH, temperature and inhibitors on enzyme activity.

5. The cell membranes . General functions of biomembranes. Structure of plasma membrane. Asymmetry of membrane lipids. Types of membrane proteins. Membrane dynamics. Lipid rafts and membrane domains.

6. Mermbrane transport . Overview of membrane transport. Simple diffusion and facilitated diffusion. Protein-mediated transport: channels, permeases. Cotransport. Active transport: ionic pumps, ABC transporters.

7. Endocytosis . Phagocytosis and pinocytosis. Receptor-mediated endocytosis. The endocytic route: ligands and receptors sorting.

8. The Endoplasmic Reticulum. Protein intracellular traffic: overview and mechanism of protein sorting to organelles. Sorting signals. Rough and smooth endoplasmic reticulum (RER, SER). Secretory protein synthesis. Membrane protein synthesis. Protein glycosylation. Quality control in endoplasmic reticulum. Chaperones. Membrane lipid synthesis.

9. The Golgi Apparatus. Export of proteins from ER: the ERGIC. Structure and dynamics of Golgi apparatus. Golgi biogenesis models. Glycoprotein and glycolipid synthesis. Protein transport and the Golgi. Constitutive and regulated secretion. Lysosomes.

10. The Nucleus. Structure of interphase nucleus: nuclear membrane, nuclear lamina, chromatin, nucleolus. Chromosomes. Nucleus during mitosis: assembly and disassembly of nuclear membrane. The nuclear pore complex and nuclear-cytoplasmic traffic. Protein import and export. Control of nuclear transport.

11. Mitochondria and peroxysomes. Structure and phylogeny of mitochondria. Mitochondrial DNA. Mitochondrial biogenesis. Useful energy generation in mitochondria. Electron transport protein complexes. ATP synthase functioning. Structure, function and biogenesis of peroxysomes.

12. The cytoskeleton. General characteristics and composition. Actin filaments: molecular turnover *in vitro* and *in vivo* . Actin-binding proteins: assembly of bundles and networks. Microtubules: structure and properties. Dynamic instability *in vitro* and *in viv* o. Microtubule-organizing centers and centrosome. Microtubules and cell division. Microtubules, microfilaments and cell motility. Transport of vesicles organelles and cell structures on microtubules and microfilaments:

motor proteins. Intermediate filaments: structure and functions.

13. The cell cycle . The life destiny of a cell: proliferation, differentiation and apoptosis. Cell cycle phases. Cell cycle checkpoints. Regulators of cell cycle progression: cyclins and cyclin-dependent kinases (cdk). Types of cyclins and cdk. Regulation of cyclin activity: cyclin inhibitors. Mitosis and meiosis.

2nd part: HISTOLOGY

15. Introduction to animal histology.

Definition of histology and tissue. Determining factors for the maintenance of the cellular organization in the tissues. Overview of the basic tissues types. Basic Histological Techniques: fixation, embedding, sectioning, mounting, staining and observation.

16. Epithelial tissue. Definition and common types of epithelial tissues.Epithelial: types and descriptions, proprieties, localizations and cell junctions. Functions of the epithelial. Basement membrane. Introduction to glandular tissue. Development of epithelial tissues.

17. Connective proper tissue. Definition and classification. Connective tissue proper: cells, and extracellular matrix (ground substance and fibers). Types of connective tissue proper: loose connective tissue, dense connective tissue (regular and irregular) and reticular connective. The functions of connective tissues proper. .

18. Cartilage tissue. Definition and classification. Hyaline cartilage: structure, growth and remodelling, cartilage matrix and cells (chondroblasts and chondrocytes). Fibrocartilage and elastic cartilage

19. Adipose tissue. White adipose tissue: structure, distribution, adipocytes and functions. Brown adipose tissue: structure, distribution, adipocytes and functions.

20. Blood. Components of blood: plasma and blood cells. Description and function of blood cells: erythrocytes, thrombocytes and leucocytes Functions of blood tissues.

21. Bone tissue . Definition, classification and structure of bone tissues. Extracellular matrix of bone tissue. Bone cells: osteocytes, osteoblasts, osteoclasts. Functions of the bone tissues.

22. Muscle tissue. Types of muscle tissue: smooth muscle, cardiac muscle and skeletal muscle. Smooth muscle: cellular organization. Skeletal muscle: cellular organization, striations, the sarcomeres. Cardiac muscle: cellular organization and intercalated discs.

23. Nervous tissue. Structure: components and classification of tissue.Neurons: structure, functions and types. Neuroglia cells: functions and types

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3rd part: Ecology and evolution

24. Bases & development

The nature and logic of Science. Scientific principles. Natural causality. Uniformity. Common perception. Scientific method. Observation. Hypothesis. Experimentation. Conclusions. Life's origin by chemosynthesis. Geological Scale. Historical overview. Evolution Thought. Darwin's early background. Lamarck's hypothesis of Evolution. The origin of species through natural selection. Descent with Modification: a darwinian view of life. What is fitness? Evolution: scientific evidence. DNA and evolution. Darwinian revolution

25. Mechanisms of evolution

Neo-darwinism. Populations. Genes. Alleles. Genetic reservoir. Fitness. Hardy-Weinberg principle. Change's agents. Natural selection. Mutation. Migration. Emigration. Immigration. Sampling errors. Founder effect. Bottleneck. Random mating.

26. Varibility

Amplitude. Unnatural Selection: Dogs, Pigeons, Drosophila. Quantification: electrophoresis, genome sequence. Amplitude theories and maintenance Selectionist. Neutralist. Maintenance and promotion. Mutation. Moving parts. Migration. Sexual reproduction. Independent distribution. Crosslinking recombination. Exogamy. Diploidy. Natural selection polymorphisms. Heterozygous superiority. Geographic variations: cline, ecotype.

27. Natural selection mechanism

The results of natural selection. Stabilizing selection. Directional selection. Disruptive selection. Genetic adaptative complex. Supergenes. Evolution and progress. "Red-queen" effect. Sexual selection. Assessing the Costs of Adaptations

Maintaining Genetic Variation. Coevolution. Mimetic evolution.

28. Species and their formation

Species, Breed and subspecies. How do new species arise? Allopatric speciation. Sympatric speciation. Hybridization. Disruptive Selection. Maintenance of genetic isolation. Completing speciation. Reproductive isolating mechanisms. Sexual chaos

Macroevolution-Fossil evidence of registration. Anagenesis, cladogenesis, adaptive radiation. Extinction. Theory of punctuated equilibrium. Selfish gene theory.

29. Ecology and environment

Ecology and evolutionary biology. Subfields of ecology. Environmental basics. Biogeography. Dispersion and distribution. Expansion. Transplanted species. Conduct and habitat selection. Biotic and abiotic factors. Ecological study levels.

30. Population ecology

Population, community, ecosystem. Population properties. Growth pattern. Density: Factors, Fluctuations. Loading capacity. Mortality patterns. Age structure. Life strategies. Populations control and applications

31. Community ecology

Loose Assemblages of Species. Competition. Principle of Competitive Exclusion. Ecological niche. Fundamental niche. Realized niche. Moving the niche. Family rivalry - Winners. Predation / Coevolution / Deaths-Age / Life Strategies. Predation / Individuals Number Population. Predation / Load Capacity. "Escape Predation". Camouflage, Temporary strategies, Coevolution. Predation / Diversity. Paine - Pisaster Lubchenco - Littorina, Grasses-Rabbits-Wildflowers. Symbiosis. Parasitism. Mutualism. Commensalism. Herbivory disease. Diversity - Number of species.

32. Ecosystem ecology

Energy flow. Flow of matter. Biogeochemical cycles. Climatology. Outstanding energy productivity. Trophic levels. Primary producers. Primary, secondary and tertiary consumers. Detritivorous. Energy transfer efficiency. Trophic pyramides. Chemiosmotic ecosystems.

33. Behavior-ecology

Basic Concepts-History. Ethology: Nico Tinbergen, Konrad Lorenz & Karl Von Frisch. Discrete sensory inputs can stimulate both simple and complex behaviours. Fixed action patterns. Oriented movement. Behavioural rhythms. Animal signals and communication. Links between experience and behaviour. Habituation. Imprinting. Spatial learning. Cognitive maps. Associated learning. Development of learned behaviour. Experience and behaviour. Genetic makeup and environment contribute to behaviour development. Regulatory genes and behaviour. Genetically based behavioural variation in natural populations. Variation in prey selection

Selection for individual survival and reproductive success can explain most behaviours. Foraging behaviour and its evolution. Optimal foraging model. Mating behaviour and mate choice. Mating systems and parental care. Sexual selection and mate choice. Male choice by females. Male competition for mates. Applying game theory. Evolution of altruistic social behaviour. Social learning. Evolution and human culture

34. Environmental assessment and conservation biology

Basic Concepts. Environment: the total of our surroundings. Natural resources: vital to human survival. Renewable resources. Perpetually available: sunlight, wind, wave energy. Renew themselves over short periods: timber, water, soil. Nonrenewable resources: oil, coal, minerals. Global human population growth. Brainstorm. What is an "environmental

problem"? Environmental science is not environmentalism. Conservation biology. Crisis of Biodiversity. The causes of "vulnerability"and extinction. Preserving genes, species, communities and ecosystems. Concepts of pollution, emission, immission, release, waste, reuse, recycling, recovery, disposal. Sustainable development. Greenhouse effect and CO 2 emission sources temperature increase. Environmental audit. National Wild Life Federation index. Reiquan index.

35. Reconstructing and using phylogenies

Taxonomy, phylogeny and systematics. Homologous traits are inherited from a common ancestor. Phylogenetic groups. Phylogenetic trees. Definition and interpretation. Construction of phylogenetic trees. Information sources. Homology and analogy, ancestral and derived traits, synapomorphias and homoplasias. Parsimony and likelihood. Application of phylogeny and systematics. Biological classification and evolutionary relationships. Many uses of phylogenetic trees.

Seminars and laboratory

Seminars are intended to develop the practice of tissue recognition from microscopic slide viewing

Laboratory classes are intended to teach the student the microscopic anatomy of prokaryotic and eukaryotic cells.

5.4.Planning and scheduling

Schedules of lectures and problems will coincide with the officially established and will be available at: https://ciencias.unizar.es/grado-en-biotecnologia .

The places, calendar and groups for training and practical sessions will be established in coordination with the rest of maters at beginning of course. The Coordinator will produce the groups of students for these activities at beginning of course to avoid overlaps with other subjects.

5.5.Bibliography and recomended resources

- Cooper, Geoffrey M.. La célula / Geoffrey M. Cooper, Robert E. Hausman . 5ª ed. Madrid : Marbán, cop.2009
- Introducción a la biología celular / Bruce Alberts ... [et al.] . - 3ª ed. México : Editorial Médica Panamericana, 2011
- Campbell, Neil A.. Biología / Neil A. Campbell, Jane B. Reece ; colaboradores y consultores : Lisa Urry ... [et al.] . - 7ª ed. Madrid [etc] : Ed. Médica Panamericana, 2007
- Vida : la ciencia de la biología / William K. Purves ... [et al.] . - 8a ed. Buenos Aires [etc.] : Editorial Médica Panamericana, 2009
- Cooper, Geoffrey M.. La célula / Geoffrey M. Cooper, Robert E. Hausman. - 6ª ed. Madrid : Marbán, cop. 2014
- Bryson, Bill. Una breve historia de casi todo / Bill Bryson ; traducción de José Manuel Alvarez Flórez . 1ª ed. en esta colección Barcelona : RBA, 2014
- Angier, Natalie. El canon : un viaje alucinante por el maravilloso mundo de la ciencia / Natalie Angier ; [traducción de Isabel Febrián] Barcelona : Paidós, 2008