

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	297 - Degree in Optics and Optometry
ECTS	6.0
Course	2
Period	Second semester
Subject Type	Basic Education
Module	---

1.Basic info**1.1.Recommendations to take this course****1.2.Activities and key dates for the course****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****5.1.General methodological presentation**

It is intended that students know the basic biological concepts related to their future professional activity and are able to apply them in practice.

To achieve this, the theoretical and practical classes are interleaved to optimize the learning process, reducing the time from students acquire theoretical knowledge until applied in the laboratory. This strategy progressively adapts to solve practical problems involved ultimately more applied part of the course, and a way of bringing students to situations that would confront in a job in the field of Optics and Optometry.

BRIEF SUMMARY OF THE SUBJECT

Biology is concerned with the study of life and living organisms including their structure and function at molecular level. We will study three main areas: Structural Biology of the Cell: from biomolecules to cell structure, Metabolism: chemical reactions in living cells and energy production, and Molecular Genetics.

In addition, it includes the study of ocular infections, and its object is the study of microorganisms that causes these infections in aspects of detection, isolation, identification, mechanisms of colonization and pathogenicity, dissemination and transmission, clinical significance, epidemiology and procedures to control and to treat them and also the biological human response to them. They are considered as microorganisms bacteria, viruses, fungi, protozoa and metazoa.

5.2.Learning activities**SEMINARS**

Laboratory diagnostic of ocular infections.

LABORATORY**Molecular Biology laboratory**

- Proteins: Cellogel serum protein electrophoresis.
- Carbohydrates: Starch hydrolysis and Fehling test for reducing sugars.
- Lipids: Lipid Thin Layer Chromatography.
- Nucleic Acids: Thymus DNA isolation.

Microbiology laboratory

- Methods of microbiological diagnosis of ocular infections. Collection, transport and storage of samples. Safety rules.
- Microbiological analysis of a conjunctival smear. Direct vision. Culture. Culture media. Identification through biochemical tests. Interpretation of results. Identification of microorganisms of the genera *Staphylococcus* spp., *Pseudomonas* spp. from culture. Microscopic description. Gram staining. Learning to recognize ocular pathogens.
- Study of antimicrobial susceptibility: Methods. Preparation and interpretation of susceptibility testing by disc diffusion method. Interpretive reading.

Students must deliver a portfolio at the end of practice, where it appears a summary of the performed practices, schemes and additional documents they deem appropriate to supplement their learning. They must appear schemes and / or drawings representing the observations and experiences.

5.3.Program

PART I: MOLECULAR BIOLOGY

1. The origin and evolution of cells. Chemical evolution. RNA world. The first cell. The evolution of metabolism. Present day prokaryotes. Eukaryotic cells. The origin of eukaryotes. The development of multicellular organisms. Classification of living organisms.

2. Chemical Components of Cells. Chemical bounds. Carbon compounds. Water. Weak interactions in aqueous systems. Biomolecules.

3. Proteins. Amino acids. Peptide bonds. Peptides and proteins. The structure of proteins: primary structure. Protein secondary structure. Protein tertiary and quaternary structures. Protein function.

4. Enzymes. The catalytic activity of enzymes. Mechanisms of enzymatic catalysis. Coenzymes. Regulation of enzyme activity.

5. Carbohydrates. Monosaccharides and Disaccharides. Polysaccharides: structure and function. Glycoconjugates: Proteoglycans, glycoproteins and glycolipids.

6. Lipids. Fatty acids. Triacylglycerols. Structural lipids in membranes: Glycerophospholipids, Sphingolipids. Cholesterol: vitamin D and steroid hormones. Dolichols. Eicosanoids.

7. Nucleic Acids. Nucleotides. Other functions of nucleotides. Nucleic acids structure and function. DNA: the double helix. RNA: types. Ribozymes.

8. Eukaryotic cell: Cell membranes. Cytoplasm. Membrane lipids. Membrane proteins. Cell membrane structure: the phospholipid bilayer. The glycocalix.

26812 - Biology

9. Transport across membranes : Passive diffusion and carrier proteins. Ion channels. Active transport driven by ATP hydrolysis. Active transport driven by ion gradients. Endocytosis.

10. The endoplasmic reticulum, the Golgi apparatus and lysosomes. Protein sorting and transport. The endoplasmic reticulum and protein secretion. The smooth ER and lipid synthesis. Export of proteins and lipids from the ER. Organization of Golgi. Protein glycosylation within the Golgi. Lipid and polysaccharide metabolism in the Golgi. Protein sorting and export from the Golgi. Vesicular transport. Cargo selection, coat proteins and vesicle budding. Vesicle fusion. Lysosomal acid hydrolases. Endocytosis and lysosome formation. Phagocytosis and autophagy.

11. The cytoskeleton and cell movement. Structure and organization of actin filaments. Actin, Myosin and Cell movement. Microtubules. Microtubule motors and movement. Intermediate filaments.

12. The nucleus. The structure of nuclear envelope. Nuclear lamina. The nuclear pore complex. Transport of proteins to and from the nucleus. Transport of RNAs. Chromatin. The nucleolus and rRNA processing.

13. Mitochondria. Peroxisomes. Organization and function of mitochondria. Mitochondrial genetic system. Structure and function of peroxisomes.

14. Bioenergetics and Metabolism. Energy, Catalysis, and Biosynthesis. Free energy and ATP. The generation of ATP from glucose, lipids and amino acids. Krebs cycle. The electron transport chain. Chemiosmotic coupling. Cell Communication.

15. Molecular genetics. Chromosomes: centromeres and telomeres. Genomes. Asexual and sexual reproduction. Mendelian inheritance. Genes. Introns and exons. Genetic variation. Mutations. Repetitive DNA sequences. Gene duplication and pseudogenes.

16. From DNA to proteins. DNA replication. DNA repair. DNA transcription. RNA processing. Translation of mRNA. Genetic code. Control of gene expression.

17. The Cell Cycle and Apoptosis. The eukaryotic cell cycle. Regulators of the cell cycle progression. Mitosis. Meiosis. Cell death: necrosis and apoptosis. Programmed cell death.

18. Light induced molecular changes of vision process. Photoreceptor Cells (Rods and Cones) . Isomerization of

26812 - Biology

Retinal (11- *cis* -Retinal vs. All- *trans* -Retinal) . Protein Conformational Changes Resulting from Retinal Isomerization. Signal Transduction Cascade to Generate a Nerve Impulse. Ion channels. Recovery.

PART II: MICROBIOLOGY AND DIAGNOSTIC OF OCULAR INFECTIONS

19. Introduction to Microbiology and Parasitology . Historical memory. Current concept and content of the discipline. Discovery of ocular infections. Applications of Microbiology for optical/optometrist.

20. General characteristics of bacteria. Structure and composition of the bacterial cell. Capsule, flagella, fimbriae, glycocalyx. Cellular wall. Cytoplasmic membrane. Cytoplasm. Nuclear equivalent. Bacterial division. Sporulation and germination.

21. Nutrition and microbial growth. Nutrition. Aerobic and anaerobic respiration. Fermentation. Growth and reproduction. Bacterial growth curve.

22. Bacterial Genetics. Mutations. Plasmids, insertion sequences, transposons and integrons. Bacterial transfer and recombination. Transformation, transduction, conjugation, transposition.

23. Microbiology applied to the practice of the optical/optometrist. Action of physical and chemical agents on microorganisms. Disinfection and sterilization. Antiseptics and disinfectants. Terms of use. Biofilms: Deposits, adhesion and growth of microorganisms on contact lenses.

24. Antimicrobials. Classification and mechanisms of action. Study methods of antimicrobial susceptibility. MIC and MBC. Antimicrobial resistance mechanisms. Bases of clinical use of antimicrobials.

25. Relations bacteria-host. Epidemiology and prophylaxis. Microbiota of healthy eye. Bacterial ecology. Pathogenicity and virulence. Determinants of microbial pathogenicity and host defense mechanisms. Epidemiology and prevention of infectious diseases. Epidemiological chain. Exposure and disposal prophylaxis.

26. Ocular infections. Overview and main characteristics of microbial infections. Conjunctivitis, keratitis, endophthalmitis and ocular adnexal infections. Microbiological diagnosis of ocular infections.

26812 - Biology

27. Bacteria that cause ocular infections. Study of microbiological characteristics, ocular manifestations, prevention and treatment of infections caused by Gram-positive bacteria (*Staphylococcus aureus* , *Streptococcus pyogenes* and *Streptococcus pneumoniae*) and Gram-negative bacteria (*Pseudomonas aeruginosa* and *Neisseria gonorrhoeae*).

28. Ocular infections caused by Chlamydiae. Study of trachoma. Inclusion conjunctivitis and other eye infections. Prevention and treatment.

29. Viruses that cause ocular infections. Nature of the virus. Characteristics of the virus particle. Microbiological study, Ocular manifestations, prevention and treatment of ocular herpes infections, adenovirus and enterovirus.

30. Fungi that produce ocular infections . The fungi. Growth and reproduction. Classification of fungi. Fungi as etiological agents causing eye infections. Features of ocular mycoses. Prevention and treatment.

31. Parasites that cause ocular infections. Study of some protozoa that produce ocular manifestations: *Toxoplasma* , *Acanthamoeba* , *Onchocerca* and *Toxocara* . Prevention and treatment.

5.4. Planning and scheduling

TIME TABLE

- The lectures will be held on Monday, Tuesday and Wednesday.
- The workshops will be conducted when indicated by the corresponding teacher.

- The laboratory practice will be held on Monday, Tuesday, Wednesday, Thursday and Friday.

- The tutorials will take place in concert with the corresponding teacher appointments.

- Delivery of portfolio on the regulated practices will be agreed upon completion thereof.

- The theoretical examination shall be conducted in the relevant calls:

1 st call: june.

2 nd : september.

26812 - Biology

5.5. Bibliography and recommended resources

- BB** Biología molecular de la célula / Bruce Alberts ... [et al.] ; traducido por Mercé Durfort i Coll, Miquel Llobera i Sande . - 5ª ed. Barcelona : Omega, D.L.2010
- BB** Bioquímica : conceptos esenciales / Elena Feduchi Canosa ... [et al.] ; colaboradora Carlota García-Hoz Jiménez. Madrid [etc] : Editorial Médica Panamericana, D.L. 2010
- BB** Introducción a la biología celular / Bruce Alberts ... [et al.] . - 3ª ed. México : Editorial Médica Panamericana, 2011
- BB** Murray, Patrick R.. Microbiología médica / Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller . - 6ª ed. Barcelona [etc.] : Elsevier, D.L. 2009
- BB** Nelson, David L.. Lehninger Principios de bioquímica / David L. Nelson, Michael M. Cox ; coordinador de la traducción, Claudi M. Cuchillo. 6ª ed. Barcelona : Omega, D.L. 2014
- BB** Nelson, David L.. Lehninger Principios de bioquímica / David L. Nelson, Michael M. Cox ; coordinador de la traducción, Claudi M. Cuchillo. 6ª ed. Barcelona : Omega, D.L. 2014
- BB** Pérez-Santonja, Juan J.. Queratitis infecciosas : fundamentos, técnicas diagnósticas y tratamiento / Juan J. Pérez-Santonja, José M. Hervás-Hernandis . Madrid : Ergon, 2006
- BB** Seal, David V.. Ocular infection / David Seal, Uwe Pleyer ; with contributions from Gregory Booton ... [et al.] . 2nd ed. New York [etc.] : Informa Healthcare, 2007
- BB** Tortora, Gerard J.. Introducción a la microbiología / Gerard J. Tortora, Berdell R. Funke, Christine L. Case . - 9ª ed. Buenos Aires [etc.] : Editorial Médica Panamericana, cop. 2007

26812 - Biology

- BB** Willey, Joanne M.. Microbiología / Joanne M. Willey, Linda M. Serwood, Christopher J. Woolverton. 7^a ed. (3^a ed. en español) Madrid [etc.] : McGraw-Hill, cop. 2009
- BC** Brock : Biología de los microorganismos / Michael T. Madigan, John M. Martinko, Paul V. Dunlap, David P. Clark ; coordinación Ricardo Guerrero. - 12^a ed. Madrid [etc.] : Pearson Education, 2009