Universitat Autònoma de Barcelona

2017/2018

Biochemistry

Code: 101967
ECTS Credits: 6

Degree	Type	Year	Semester
2500890 Genetics	FB	1	2

Contact

Name: Maria Plana Coll
Email: Maria.Plana@uab.cat

Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Maria Carme Espunya Prat

Prerequisites

There are no official prerequisites, but it is assumed that the student has previously acquired enough solid knowledge on subjects like Chemistry or Celular Biology

Much of the literature is in the English language, which is also used in the figures used in theory classes.

Objectives and Contextualisation

In the Biochemistry course, the structural and functional characteristics of biomolecules from a basic and general point of view, focusing on proteins, and especially on enzymes, are studied in the first part. In a second part the concepts will be applied dynamically to understand the bioenergetics, the biosignalisation and the main routes of the metabolism. The general objective of the subject is to provide the basics of the molecular and metabolic aspects and concepts necessary for the monitoring of many subjects of the Degree of Genetics.

Specific objectives of the subject:

- Understand the fundamental structural features of biological molecules, knowing how to draw conclusions about their stability, their functionality and their capacity for replication of structures.
- Understand the kinetic concepts of enzymatic action in the context of the study of biological reactions and their regulation.
- Describe the general mechanisms through which living things get and transform the energy of the environment.
- To know the main molecular mechanisms of signal transduction.
- Describe the main routes of intermediate metabolism of glucids, lipids and nitrogen compounds, their regulation and coordination.
- Learn how to apply the knowledge studied to solve qualitative and quantitative problems.

Content

THEORY

Topic 1. Basic concepts

General concept of biochemistry. Chemical elements present to living beings. Levels of structural organization of biomolecules. Types of links between molecules. Biological importance of water. Concept of pH and pK.

Topic 2. Proteins: functions and primary structure

Types of proteins and functions. Structure and properties of amino acids. Peptides and peptide link. Composition and sequence of amino acids of proteins.

Topic 3. Three-dimensional structure of proteins

Structuring levels of proteins. Description of alpha helix and beta pleated sheet. Fibrous and globular proteins. Folding of proteins. Quaternary structure.

Topic 4. Function and evolution of proteins: oxygen transport proteins.

Storage and transport of oxygen: myoglobin and hemoglobin as examples of protein evolution. Allosterism and cooperativity of hemoglobin. Different forms of hemoglobin: physiological adaptation and molecular pathology.

Topic 5. Enzymes, enzymatic kinetics and regulation.

Nature and function. Classification and nomenclature of enzymes. Effects of catalysts on chemical reactions. Enzymatic mechanisms. Enzymatic kinetics: Michaelis-Menten model. Enzymatic cofactors. Enzymatic inhibition. Regulation of enzymatic activity: allosterics, covalent modification and changes in enzyme concentration. Biomedical and biotechnological applications.

Topic 6. Glucids.

Types of glucose and functions. Monosaccharides, description and properties. Glycosidic link Oligosaccharides. Polysaccharides Glycoproteins, proteoglycans and glycolipids.

Topic 7. Nucleic acids.

Nature and function. Nucleotides. Primary structure of nucleic acids. Secondary structure: Watson and Crick model and alternative structures. Tertiary structure: DNA transfer and super-proliferation RNA. Complex DNA-proteins: organization of chromosomes.

Topic 8. Lipids.

Types of lipids and functions. Storage pumps

Topic 9. Introduction to metabolism.

Concept of metabolism Biochemical and thermodynamic reactions: free energy in biological processes. Role of ATP and other phosphorylated compounds. Biological reactions of oxidation-reduction. Regulation of metabolic processes.

Topic 10. Biosignaling.

Extracellular chemical signals: hormones, neurotransmitters and growth factors. Properties of the signal transduction mechanisms. Signal transduction main systems: membrane and intracellular receptors.

Topic 11. Metabolism of glucose.

Degradation of glucose: glycolysis and pentoses phosphate pathway. Fermentation Gluconeogenesis. Synthesis and degradation of glycogen.

Topic 12. Central routes of oxidative metabolism.

Production of acetyl-CoA. Cycle of citric acid. Energy performance and regulation. Anaplerotic reactions.

Topic 13. Energy transitions: oxidative phosphorylation and photosynthesis.

Mitochondrial chain electron transport and oxidative phosphorylation. Respiratory control Chain of photosynthetic electron transport chain and photophosphorylation. Biosynthesis of glucides (Calvin cycle). Regulation of photosynthesis.

Topic 14. Lipid Metabolism.

Metabolism of fatty acids. Regulation of the metabolism of fatty acids. Ketogenesis. Cholesterol and lipoprotein metabolism.

Topic 15. Metabolism of nitrogen compounds.

Catabolism of amino acids. Excretion of nitrogen and urea cycle. Nitrogen fixation. Metabolism of nucleotides.

Topic 16. Integration of metabolism.

Specific tissue metabolism. Coordination between the metabolisms of the liver, muscle (skeletal and cardiac), adipose tissue and brain. Main regulatory hormones. Stress and adaptation of metabolism.

PROBLEMS

The problems refer to some aspects of the Theory program, such as chemical equilibrium and amortizing systems, enzymatic kinetics, Lambert-Beer law, free energy and constant equilibrium, reduction potential and redox reactions. The collection of statements will be presented at the beginning of the semester through the Virtual Campus of the subject.