DEGREE CURRICULUM

BIOCHEMISTRY

Coordination: ESPINET MESTRE, CARMEN

Academic year 2019-20

BIOCHEMISTRY 2019-20

Subject's general information

<table>
<tr><td>Subject name</td><td>BIOCHEMISTRY</td></tr>
<tr><td>Code</td><td>101607</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biotechnology</td><td>1</td><td>COMMON</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>9</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>1</td><td>2</td><td>6</td></tr>
<tr><td>Number of groups</td><td>3</td><td>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>ESPINET MESTRE, CARMEN</td></tr>
<tr><td>Department</td><td>BASIC MEDICAL SCIENCES</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
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BIOCHEMISTRY 2019-20

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CAMBRAY CARNER, SERAFIN	serafi.cambray@udl.cat	2	
ESPINET MESTRE, CARMEN	carme.espinet@udl.cat	5,9	
FERREZUELO MUÑOZ, FRANCISCO	francisco.ferrezuelo@udl.cat	,8	
HERREROS DANES, JUDIT	judit.herreros@udl.cat	4,3	

Learning objectives

Targets:

What are the chemical structures of the components of living matter.

How these components interact to give rise to organized supramolecular structures.

How living matter draws energy from the environment to maintain its existence.

How exactly an organism stores and transmits the information it needs to grow and reproduce exactly.

How chemical reactions are monitored inside living cells.

Competences

Skills to which it contributes:

Biomolecules

Metabolism

Subject contents

ITEM 1. **Levels of molecular organization in living things**. Differential chemical properties of living matter. Bioelements. Biomolecules Origin, specialization and differentiation of biomolecules.

ITEM 2. **Biological importance of water**. Interaction of water with other biological components. Biological importance of water. Distribution of water in different organisms. Buffer systems in biological environments. Osmosis in living beings.

ITEM 3. **Carbohydrates**. Generalities Classification Monosaccharides: aldoses and ketoses. Disaccharides: the glycosidic link. Polysaccharides: structural, reservoir and gelling agents. Glycosaminoglycans and proteoglycans. Glycoproteins

ITEM 4. **Lipids.** General characteristics. Fatty acids and Acylglycerides. Glycerophospholipids, Sphingolipids, Isoprenoid lipids, Pyrroleic lipids. Prostaglandins. Leucotriens. Tromboxans.

ITEM 5. **Proteins**. Amino acids protein components. Structure and properties of amino acids. Rare and non-protein amino acids. Amino acid reactions. Peptide link Peptides Physical-chemical properties of peptides. Proteins Structural characterization and physical-chemical properties of proteins. Biological functions of proteins. Denaturalization Sequencing of proteins. Synthesis of peptides and proteins.

ITEM 6. **Biocatalysis**. Molecular structure of enzymes. Mechanism of enzymatic reactions. General characteristics, active center, catalytic center and center of union. specificity of enzymes main classes of enzymes Structural characteristics. Isoenzymes Effect of enzymes on the speed and on the equilibrium constant of the catalyzed reaction. Activation energy concept.

ITEM 7. **Kinetics and regulation of enzymatic activity**. Control of enzymatic activity. Influence on the speed of the enzymatic reactions of pH, ionic strength and temperature. Enzymatic reactions with a single substrate and with several substrates. Kinetic Constants: Vmax, Kcat, Km. and S0.5. Alosterism. Mechanism for the activation of proenzymes (zymogens). Vitamins such as cofactors, precursors of cofactors, or prosthetic groups of particular enzymes. Describe and explain the structure, function, activation process, places and mode of action of the vitamins.

ITEM 8. **Introduction to metabolism**. Concept of metabolism and metabolic pathway. Phases of metabolism. Oxidoreductions in biochemical processes. Control and compartmentalisation of metabolic pathways.

ITEM 9. **Central routes of oxidative metabolism**. Production of acetyl-CoA. The piruvate dehydrogenase complex. Cycle of citric acid. Energy performance and regulation. Anaplerotic reactions. Cycle of glioxylate.

ITEM 10. **Electronic transport and oxidative phosphorylation.** Mitochondrial electronic transport chain. Origin and use of reduced substrates. Chemosmotic coupling: ATP synthase and oxidative phosphorylation. Mitochondrial transport systems. Regulation of oxidative phosphorylation. Energy balance of oxidative metabolism.

ITEM 11. **Metabolism of glucose.** Degradation of glucose: glycolysis and of phosphate pentoses pathway. Fermentation. Gluconeogenesis. Synthesis and degradation of glycogen. Use of other glucides. Coordination in the control of the metabolism of glucose and glycogen: importance of the metabolic specialization of the tissues.

ITEM 12. **Photosynthesis**. Basic processes of photosynthesis. Photosynthetic pigments. Absorption of the energy of light. Electronic transport and photophosphorylation. Assimilation of CO2 and photosynthesis in the biosynthesis of glucides: Calvin's cycle. Regulation of photosynthesis. Photorespiration and C4 cycle.

ITEM 13. **Metabolism of lipids.** Lipoproteins: structure and function. Use of triacylglycerol in animals. Oxidation of fatty acids: metabolic route and regulation. Ketogenesis. Biosynthesis of fatty acids: metabolic route and regulation. Biosynthesis of triacylglycerols and phospholipids. Cholesterol metabolism. Synthesis and metabolism of bile salts.

ITEM 14. **Metabolism of nitrogen compounds.** Cycle of nitrogen. Intracellular protein degradation. Basic mechanisms of degradation of amino acids. The transaminases and metabolism of the amino group. Cycle of urea. Destiny of the carbonate skeleton. Biosynthesis of amino acids. Metabolism of the heme group. Proteins containing iron.

ITEM 15. **Nucleotide metabolism**. Degradation of nucleic acids and nucleotides. Recovery of nucleotides and synthesis again. Biomedical applications of nucleotide analogues.

ITEM 16. **Metabolic integration**. Metabolic profile of the most important organs. Mechanisms of metabolic regulation: global vision. Tissue interrelations. Metabolic adaptation to fasting / refeeding. Other examples.

ITEM 17. **Metabolism of xenobiotics**. Overview of biotransformations. Phase I and Phase II reactions. Citocrom P450: nomenclature, global reaction and biological functions. Inhibitors Electronic transport systems of the P450 cytochrome. Other oxygenation reactions.

Practical activities

LABORATORY PRACTICES

PRACTICE 1. Colorimetric determination of the concentration of proteins. Use of standard for qualification. We use control samples. Quantitative determination of the concentration of plasma proteins: Biuret method.

PRACTICE 2. Enzymatic kinetics. Essay of alpha amylase enzymatic activity. Determination of kinetic constants.

PRACTICE 3. Glucose metabolism: Determination of glucose absorption and glycemia curve.

PROBLEMS

The classes of problems will be carried out in parallel with regard to the agenda.

SEMINARS

This is a proposal that can vary depending on the actuality or impact of a particular topic: Bioenergetics. Thermogenesis Metabolism of ethanol The proteasome: specific functions Metabolism of iron Production of monoclonal antibodies Ribonucleotide Reductase: functions and applications

Methodology

The following activities will be programmed to achieve objective goals and acquire the attributed competences:

Part of the course is developed in one-hour theoretical concepts presentation sessions. These concepts are reinforced by one-hour seminar sessions and problems. Laboratory practices allow for a better understanding of theoretical concepts and the acquisition of basic skills in laboratory work. The bibliographic works will be done in groups of 20 students, on topics proposed and related to the subject. The presentation will be oral.

Master classes. (CM) Seminars. (Sem) Virtual activities (Av) Tutorials. (Tut) Computer classroom activities. (To Inf.) Laboratory practices. (PL).

Evaluation

Activity	qualification (%)
Theory exams 1, 2, 3	25, 22, 25
Problems	10
	16
Total	100

With a mark of 4 or more in exams 1 and 2 and 3, you get average with work and tests on seminars and practices. If the result is 5 or more, the corresponding subject part is approved and not required recover. If the exam is less than 4 or the average is less than 5, the subject must be recovered.

Bibliography

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