UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Biochimica Generale

2526-1-H4103D156

Aims

The course main objective is to provide students with the concepts necessary for understanding biological phenomena and the energetic variation associated with them. The course will focus on how to place the molecular basis for understanding the complex processes underlying the metabolism of living creatures

Contents

Introduction to biochemistry.
Bioenergetics.
Enzymology. Diagnostic use of enzymes and isoenzymes. Bioenergetics: respiratory chain and oxidative phosphorylation. Glucose metabolism: digestion, absorption. Aerobic and anaerobic glycolysis. Regulation of glycolysis. Glycogen synthesis and glycogenolysis and regulation. Galactose and fructose metabolism.
Lipid metabolism: digestion and absorption. Catabolism of lipids. Citric acid cycle. Lipogenesis. Regulation of lipolysis and lipogenesis. Metabolism of cholesterol and its derivatives. Metabolism of ketone bodies. Lipoprotein metabolism of plasma lipoproteins.
Protein metabolism: digestion, absorption, and transport of amino acids. General metabolism of amino acids. Urea cycle. Gluconeogenesis and its regulation.
Purine and pyrimidine metabolism.

Detailed program

Bioenergetics - Respiratory chain and oxidative phosphorylation. Use of the energy released in biological oxidation-reductions for the formation of molecules with high energy content. Main control mechanisms. The P/O ratio. The production of ATP. ATP reactions. The energetic charge. Inhibitors and uncouplers of oxidative phosphorylation.

Mitochondrial dysfunctions.

Enzymology - Enzymatic catalysis. Enzyme kinetics. Meaning of Vmax and Km. Factors that influence enzymatic activity. Inhibitors. Metabolic inhibition. Feedback inhibition. Product inhibition and regulation of metabolic pathways. Drugs as enzyme inhibitors. Criteria and techniques for measuring enzymatic activity. Isoenzymes. Diagnostic use of enzymes and isoenzymes.

Carbohydrates Metabolism - Digestion, absorption and transport of carbohydrates. Role of dietary fiber and notes of the microbiota. Aerobic and lactacid glycolysis. Metabolic and hormonal regulation of glycolysis. ATP yield. Metabolism of 2,3 diphosphoglycerate. Hexosomonophosphate shunt. Glucose 6-P dehydrogenase. Ribose production. Interconversion of sugars. Galactose and fructose metabolism. Galactosemia. Blood sugar regulation. Glycogen metabolism. Glycogen synthesis and glycogenolysis. Liver and muscle glycogen. Glycogen storage diseases. Metabolic and hormonal regulation of glycogen metabolism and glycemia and diabetes mellitus.

Lipid metabolism - Digestion and absorption of lipids. Catabolism of lipids. Lipolysis. Lipases. ?-oxidation of fatty acids. Role of carnitine. ATP yield. Krebs cycle. Reactions of the citric acid cycle. ATP yield and relationships with the respiratory chain. Lipid anabolism; Lipogenesis: biosynthesis of fatty acids; synthesis of unsaturated and polyunsaturated fatty acids; biosynthesis of triglycerides. Regulation of lipolysis and lipogenesis. Metabolism of cholesterol and its derivatives. Food-derived cholesterol. Cholesterol biosynthesis. Regulation of cholesterol synthesis. Conversion of cholesterol into neutral sterols and bile salts. Metabolism of complex lipids. Metabolism of glycerophospholipids and sphingolipids. Ketogenesis and its regulation. Metabolism of ketone bodies. Plasma lipoproteins and lipid transport. Lipoprotein metabolism. Apolipoproteins. Transport of exogenous lipids via chylomicrons. Transport of endogenous lipids by VLDL, IDL and LDL. HDL and reverse cholesterol transport. Lipoprotein receptors. Dyslipidemias.

Protein metabolism - Digestion of proteins, absorption and transport of amino acids. General metabolism of amino acids. Transaminases. Deamination. Glutamate dehydrogenase. Glucogenic and ketogenic amino acids. Metabolism of branched-chain amino acids. Phenylketonuria. Urea cycle reactions. Adjustment. Extrahepatic elimination of ammonia. Glutamate and glutamine - Gluconeogenesis and its regulation.

Metabolism of pyrimidine and purine nucleotides - Biosynthesis of pyrimidines and purines. Biosynthesis of deoxyribonucleotides. Synthesis of thymidylate and tetrahydrofolate cycle. Purine catabolism. Purine nucleotide recovery pathways. Antimetabolites. Regulation of nucleotide metabolism. Formation and elimination of uric acid and related clinical aspects.

Oxidative stress and free radicals; cellular effects and their implication in pathologies.

Prerequisites

To take the Biochemistry exam, it is necessary to pass the Chemistry and Biochemistry Propaedeutics

Teaching form

DE- 29 lessons of 2 hours carried out in presence mode
DI- 7 lessons of 2 hours carried out in presence by the teacher/tutor for the entire class or a subgroup. Discussion of the topics covered in class, additional explanations, simulation of the exam

Textbook and teaching resource

1. La Biochimica di TM DEVLIN- VI ed. (2024) EDISES Università
2. Biochimica Medica- Siliprandi and Tettamanti V ed. Piccin
3. Le Basi della Biochimica- Ermine Ercikan Abali III ed. Zanichelli

Semester

first year, II semester

Assessment method

The final exam will be written and structured as follows:

- 13 multiple-choice questions with 5 answers (each correct answer is worth 2 points; blank or incorrect answers will not be counted); the student must provide the correct answer to at least 9 questions.
- 1 guided open-ended question on a biochemistry topic covered in class (from -3 points to 5 points).

Office hours

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Sustainable Development Goals

ZERO HUNGER | GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION