UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biochemistry

2425-1-H4601D004

Aims

GENERAL BIOCHEMISTRY
The form main objective is to provide students with the concepts necessary for understanding biological phenomena and changes in energy associated with them. The course will focuses on how place the molecular basis for understanding the complex processes underlying the metabolism of living creatures.

SYSTEMATIC HUMAN BIOCHEMISTRY
The form aims to describe the biochemical and molecular language, the complex patterns of communication, interaction and control of cell and tissue functions.

CLINICAL BIOCHEMISTRY AND CLINICAL MOLECULAR BIOLOGY
Students' skills:

- to describe the role, the limitations and the aims of BC tests;
- to illustrate the causes of biological, analytical and post-analytical variability;
- to illustrate the meaning of quality control in BC;
- to describe the concept of analytical goal, reference intervals, desirable, decisional levels, sensibility, specificity and predictive value of BC tests;
- to illustrate the concept of function and lesion marker applied to hepatic and cardiac diagnostics;
- to describe the main lab tests used in the assessment of glucidic metabolism, plasmatic protein alterations, coagulopathies, hemoglobinopathies, dyslipidemias, and bone diseases;
- to describe the use of tumor markers.

Contents

GENERAL BIOCHEMISTRY AND SYSTEMATIC HUMAN BIOCHEMISTRY
The course aims to educate students to reason, in molecular terms, the main cellular metabolisms, understand and

explain at the molecular level cellular functions and tissue control systems, in particular connective, bone and tooth tissues. In addition, the course aims to provide students with fundamental knowledge about the biochemical and clinical investigations related to major alterations of organs/tissues relevant in dentistry.

CLINICAL BIOCHEMISTRY AND CLINICAL MOLECULAR BIOLOGY
To provide the students with the basic knowledge about clinical biochemistry tests to be used in the main organ/tissue alteration relevant for the dentists.

Detailed program

GENERAL BIOCHEMISTRY

Enzymology: enzyme kinetics and catalysis. Significance of Vmax and Km. factors influencing enzyme activity. Inhibitors. Allosteric enzymes. Isoenzymes. Diagnostic use of enzymes and isoenzymes.

Bioenergetics: Respiratory chain and oxidative phosphorylation. High-energy molecules. The production of ATP. Oxidative phosphorylation. Inhibitors and uncoupling factors.

Glucose metabolism: Digestion, absorption and carbohydrates transport. Aerobic and anaerobic glycolysis. Hormonal and metabolic regulation of glycolysis. Glycogen synthesis and glycogenolysis. Metabolic and hormonal regulation of glycogen metabolism. Sugars interconversion. Galactose and fructose metabolism Lipid metabolism: Lipids. digestion and absorption. Catabolism of lipids. Beta-oxidation of fatty acids. Role of carnitine. Citric acid cycle.

Lipogenesis: biosynthesis of fatty acids, biosynthesis of triglycerides. Regulation of lipolysis and lipogenesis. Metabolism of cholesterol and its derivatives. Conversion of cholesterol to steroid hormones and bile salts. Metabolism of ketone bodies. Lipoprotein metabolism of plasma lipoproteins. Lipoprotein receptors.

Protein metabolism: Protein Digestion. Absorption and transport of amino acids. General metabolism of amino acids. Gluconeo genesis and its regulation. Purine and pyrimidine metabolism: Biosynthesis of purines and pyrimidines. Purine nucleotides recovery pathway.

HUMAN BIOCHEMICAL SYSTEMATICS

Metabolic regulation of blood glucose: liver and muscle glycogen. Hormonal regulation of blood glucose. Gastro entero pancreatic hormones: insulin, glucagon.

Hormones: Hormones and hypothalamic pituitary. Hormones release. GH. Prolactin. ACTH. Vasopressin. Oxytocin. Thyroid hormones. Hormones in the adrenal cortex. Sex hormones. Hormones regulation hunger and satiety.

Nervous tissue biochemistry: Biosynthesis and catabolism of neurotransmitters. Neurotoxins. Blood biochemistry and coagulation of the blood elements and plasma proteins. Hemoglobin and myoglobin oxygen transport. The blood coagulation cascade. Anticoagulants and fibrinolysis.

Biochemistry of the liver: Role of gluconeo genesis in the liver. Urea cycle and extra-hepatic mechanisms of elimination of ammonia. Reactions of the urea cycle. Extra hepatic elimination of ammonia. Glutamate and glutamine. Mechanisms of liver detoxification. Degradation of hemoglobin. The metabolism of ethanol. Oxidative stress and free radicals.

Biochemistry of skeletal muscle and myocardium: Structure and muscle protein. Mechanism of contraction. Muscle energy metabolism. Biochemistry of connective tissue proteoglycans, glycoproteins, collagen, elastin.

Homeostasis and the regulatory role of Calcium and Phosphorus: Calcitonin, Vitamin D, Parathyroid hormone.

Biochemistry of bone and tooth: Macromolecules of the organic matrix. Mineralization of bone and tooth. Bone resorption. Growth factors and hormones that act on cells of the bone. Biochemistry of saliva. Biochemistry of nutrition: biochemical aspects of digestion and absorption of nutrients. Basal metabolic rate. Principles of power. And fat soluble vitamins. Homeostasis of carbohydrates, lipids and proteins. The fasting-feeding cycle.

CLINICAL BIOCHEMISTRY AND CLINICAL MOLECULAR BIOLOGY

Role, limitations and the aims of BC tests; Biological, analytical and post-analytical variability; Analytical goals, and control quality in BC. How to interpret lab results: reference intervals, desirable, decisional levels, sensibility, specificity and predictive value of BC tests; Clinical biochemical assessment of glucidic metabolism, plasmatic protein alterations, coagulopathies, hemoglobin opathies, Function and lesion markers in the hepatic and cardiac diagnostics; dyslipidemias, and bone diseases. Use of biochemical tumor markers.

Prerequisites

Aims of Preparatory Sciences course.

Teaching form

All lectures are conducted in face-to-face delivery mode:

- 30 (2-hour) lectures conducted in the in-presence delivery mode.

Textbook and teaching resource

GENERAL AND SYSTEMATIC HUMAN BIOCHEMISTRY BOOKS:

Siliprandi/Tettamanti: Biochimica Medica. Piccin
Devlin T.M.: Biochimica (con aspetti clinici). Idelson-Gnocchi
Ferrier D.: Le basi della biochimica. Zanichelli
Nelson D.L. et al.: Introduzione alla biochimica di Lehninger. Zanichelli
Ferguson D.B.: Biologia del cavo orale. Zanichelli/CEA
Maccarrone M.: Fondamenti di Biochimica Umana ed Zanichelli

CLINICAL BIOCHEMISTRY AND CLINICAL MOLECULAR BIOLOGY BOOKS:
Federici Giorgio: Medicina di laboratorio. Publishing house: McGraw-Hill

Semester

First year of course, second semester.

Assessment method

All students have access to a written test followed by an oral interview. The written test consists of 27 closed-ended tests, (20 single-answer and the remaining multiple-choice). 20 questions assess the student's preparation on the topics of GENERAL BIOCHEMISTRY and HUMAN SYSTEMATIC BIOCHEMISTRY, the remaining 7 focus on topics of CLINICAL BIOCHEMISTRY. A time of one hour for the written test is assigned. The student is admitted to the oral exam if the answers score reaches a minimum of 17; The oral is carried out the same day, after the correction of the writing and takes about 20-30 minutes for each candidate. The questions proposed in the written test aim at evaluating the comprehension of the topics covered in lesson, with particular reference to the acquisition of knowledge concerning cell and organ metabolism and to the correct use of laboratory tests in the various diagnostic fields.
In the oral examination, taking into account the written test, the student is asked to explain / deepen some of the answers provided (both those provided wrong and correct), in order to verify the correct interpretation of the question and the reasoning that led to the answer. It also evaluates the knowledge of the main metabolic pathways, and of the biochemical interactions between the cells or in the different organs / tissues and of the dysfunctions that determine alterations of the main hematochemical parameters.

Office hours

Reception upon appointment.
Bulbarelli Tel. Ufficio 026448 8221
alessandra.bulbarelli@unimib.it

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING