| Clinical biochemistry (4 CFU; 44 hours: 36 di lezione e 8 di esercitazione) | | | |
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| **Learning objectives: The student acquires the language and knowledge necessary to appreciate the role of major biomolecules involved in the metabolic pathways underlying pathophysiological processes** | | | |
| **Theory lessons (36 hs)** | | | |
| **Topics and skill acquired** | **Topics** | **Specific contents** | **Hours** |
| ***1. INTRODUCTION (2 HOURS)*** | ***Introduction*** | Presentation of the syllabus, explanation of the methods of ascertaining knowledge and skills. Textbooks and teaching materials. Knowledge self-assessment test and discussion of results | 2 |
| ***2. NUCLEIC ACIDS (10 HOURS)*** *To be able to describe structure, function and metabolism of nucleic acids* | ***DNA structure and functions*** | General outline of the flow of information contained in DNA from the nucleus to protein synthesis. Nucleosomes and chromatin organization | 2 |
| | ***DNA duplication*** | DNA polymerase, fast and slow duplication of polynucleotide chains. Okazaki fragments. Telomeres and telomerase. Cancer and telomerase (hint) | 3 |
| | ***Transcription and RNA molecular anatomy*** | RNA polymerase, transcription and maturation of RNAm. RNAr, RNAm, RNAt, microRNA | 2 |
| | ***Genetic code and protein synthesis*** | Universality of the genetic code and biochemical importance. Start codons and stop codons. | 1 |
| | | Amino acid activation and aminoacyl-tRNA synthetase. Initiation, elongation, and termination. Antibiotics and protein synthesis (hint) | 2 |
| ***3.GENE EXPRESSION REGULATION (4 HOURS)*** *to be able to describe the molecular mechanisms that regulate gene expression in prokaryotes and eukaryotes* | ***Molecular anatomy of the gene*** | Gene organization and differences between eucaryotes and procaryotes | 1 |
| | ***Gene expression regulation*** | Lac operon in prokaryotes. Regulation of metallothionein expression as an example in eukaryotes. Translational regulation of transferrin | 3 |
| ***4. METABOLISM (16 HOURS)*** *To be able to describe the main metabolic pathways of carbohydrate, lipid and amino acid metabolism* | ***Carbohydrate metabolism*** | Glycolysis and regulation | 2 |
| | | Gluconeogenesis and regulation | 1 |
| | | Glycogenolysis and glycogenosynthesis and regulation, pentose cycle | 1 |
| | | Life without oxygen, including ruminal fermentations | 2 |

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| | ***Lipid metabolism*** | Beta-oxidation of fatty acids | 1 |
| | | Ketogenesis, ketosis in fasting and ketosis in lactating cow | 1 |
| | | Fatty acid synthase complex and fatty acid biosynthesis | 1 |
| | ***Intermediate metabolism*** | Molecular structure of Pyruvate dehydrogenase complex, enzymatic mechanism and regulation. Metabolic role of Krebs cycle and its regulation | 2 |
| | | Hints of bioenergetics, molecular structure of respiratory chain complexes, and oxidative phosphorylation | 3 |
| | ***Aminoacid catabolism and urea synthesis*** | Transdeamination, transaminases | 1 |
| | | Urea synthesis | 1 |
| ***5. METABOLISM INTEGRATION AND TISSUE BIOCHEMISTRY (4 HOURS)***<br>*To be able to describe the main mechanisms of signal transduction and integration.*<br>*and to recognize the main metabolic differences that characterize tissues/organs* | ***Signal transduction*** | G proteins and signal transduction by AMPc and protein kinase. Other transduction pathways | 1 |
| | ***Metabolic interconnections*** | Metabolic networks and the role of some key intermediates, particularly glucose-6-P, acetyl-CoA and pyruvate | 1 |
| | ***Tissue biochemistry*** | Specific metabolic adaptations of organs and tissues, particularly liver, muscle and erythrocytes. It should be noted that this cross-cutting topic will not be treated independently, but included at the appropriate time in the lectures on metabolism | 2 |

| Practical activities (8 hs) | | | |
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| **Topics and skill acquired** | **Topics** | **Specific contents** | **hours** |
| ***6. ABILITY TO PERFORM BASIC ANALYTICAL PROCEDURES IN THE BIOCHEMISTRY LABORATORY (8 HOURS)***<br>*(a) acquisition of the ability to use basic laboratory techniques;*<br>*(b) acquisition of the ability to report experimental data correctly and to evaluate them critically*<br>*(c) ability to work in groups* | ***Correct use of micropipettes*** | Dilution of a concentrated solution and verification of linearity by colorimetric measurement | 2 |
| | ***Determination of analytical precision and accuracy*** | Concept of analytical variability. Measurement of the precision by laboratory determination of the coefficient of variation. Discussion on the concept of accuracy | 2 |
| | ***Extraction and analysis of biomolecules*** | Separation of erythrocytes from whole blood.<br>Extraction of hemoglobin by osmotic lysis.<br>Differential centrifugation.<br>Basic concepts of uv-vis spectrophotometry.<br>Construction of the absorption spectrum of hemoglobin absorption | 2 |
| | ***Construction of metabolic maps*** | Metabolic connections developed through group work supervised by the teacher | 2 |