

Faculty of Medicine

**BCHM1210 Biochimie générale**

[67.5h+30h exercises] 8 credits

This course is taught in the 1st semester

Teacher(s): Frederik Opperdoes, Emile Van Schaftingen (coord.)
Language: French
Level: First cycle

Aims

To know and understand at the molecular level the functioning of the various principal cellular components, such as : proteins, nucleic acids, carbohydrates, lipids and their interactions. At the end of term the student should be able to understand the repercussions a mutation may have on the structure and functioning of a protein. He or she should also be able to describe the type of enzyme required to catalyze a metabolic reaction and to identify those steps in a pathway most susceptible to metabolic regulation. The student should also be able to explain how the energy liberated in the course of a metabolic pathway can be utilized by the cell and how this energy can be interconverted within the cell.

Practical work and demonstrations in biochemistry [24 h + 6 h] :

To familiarize the student with the laboratory practices of biochemistry, especially with enzymology and the analysis of proteins, with a special emphasis on their quantification.

During the course the student will learn how to measure the activity of an enzyme and to determine its basic kinetic properties, to partially purify a protein and to evaluate its purity by the technique of SDS-PAGE. The student will also learn how to measure the oxygen consumption by isolated mitochondria.

Main themes

The goal of biochemistry is the understanding of the functioning of a cell in terms of chemistry. Genetic information which is encoded in the DNA is being transcribed as messenger RNA, which is then translated into proteins. These proteins, owing to the unlimited number of variations in the sequence of their amino acids, may express an endless number of structures and functions, which allows them to specifically recognize and interact with other biomolecules which then can be transformed (enzymatic catalysis). The purpose of the course is to understand the general principles of the functioning of these biomolecules. Principles which are equally valid for the elephant and the mouse as they are for the bacterium *Escherichia coli*.

Content and teaching methods

Structure of proteins ; Principles of enzyme kinetics ; Classification of enzymes and their cofactors ; Structures of carbohydrates and lipids ; Metabolic pathways of core metabolism (glycolysis, gluconeogenesis, Krebs' cycle, beta-oxidation of fatty acids, formation of ketone bodies, deamination and urea cycle) ; Structure of nucleic acids.

Practical work and demonstrations in biochemistry :

a. Practical work

- Measurement of the activity of alkaline phosphatase (K_m , V_{max} , inhibition by inorganic phosphate; pH curve)
- Purification of lysozyme (using anion- and cation exchangers and gel filtration on Sephadex G50 ; test of biological activity) ; protein determination ; calculation of purification factor and yield ;
- Mitochondrial oxidation (rate measurements , effects of substrate and inhibitors)
- Measurement of a metabolic balance (glycolysis in yeast : measurement of glucose uptake and ethanol formation ; rate of oxygen consumption).
- SDS-PAGE and Western blot ;
- Production and purification of a recombinant protein.

b. Travaux dirigés :

- Demonstration by computer : Starting from a given DNA sequence : identification of an ORF ; its translation into a protein ; BLAST search against a database ; identification of the encoded protein ; elucidation of the three-dimensional structure ; search for the presence of post-translational modifications ; identification of disulphur bridges.
- Exercise on enzyme kinetics : calculation of K_m , V_{max} ; Hill coefficient : détermination of the reaction mechanism from its kinetic data ; Calculation of enzymatic activity using a radioisotope (K_m)
- Visit of research laboratories and large equipment.

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Written exam.

Support: text book (Horton, Principles of biochemistry, 3rd edition or later). Other recommended textbooks will be suggested at the beginning of the course.

Practical work and demonstrations in biochemistry :

Basic knowledge required: Organic chemistry; biology, General biochemistry Bac2

Evaluation : Practical work and interpretation of the results ; general interrogation at the end of term.