



COURSE DESCRIPTION Biochemistry

SSD: BIOCHIMICA (BIO/10)

DEGREE PROGRAMME: BIOINGEGNERIA INDUSTRIALE (P16)
ACADEMIC YEAR 2024/2025

COURSE DESCRIPTION

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: U1582 - BIOCHEMISTRY, CELL AND MOLECULAR BIOLOGY
MODULE: U1098 - Biochemistry
TEACHING LANGUAGE: INGLESE
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 6

REQUIRED PRELIMINARY COURSES

Chemistry

PREREQUISITES

main subjects of basic disciplines such as mathematics, physics and chemistry

LEARNING GOALS

The course will provide students with structural features of the most relevant macromolecules, i.e. proteins, carbohydrates, lipids and nucleic acids, to understand macromolecule's structure-function relationships. It will describe key principles of enzyme structure, kinetics, and regulation. It will illustrate the stages in anabolism and catabolism. Principal pathways for carbohydrates, lipids and amino acids metabolism will be detailed. Bioenergetics, energy transformation in living system and biological oxidation reduction reactions will be explained. Molecular mechanisms of biological recognition will be illustrated

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate knowledge and understanding of the biochemical/molecular mechanisms of metabolism. He/she must demonstrate the ability to elaborate discussions concerning metabolic regulation from the knowledge of biochemical processes. The course aims to provide students with the basic knowledge and methodological tools required to analyse cell metabolism.

Applying knowledge and understanding

The student must demonstrate the ability to elaborate discussions concerning metabolic regulation from the knowledge of biochemical processes.

COURSE CONTENT/SYLLABUS

Structure of proteins 1. Primary, secondary, tertiary and quaternary structure 2. Native state, folding and unfolding 3. Post-translational modifications *Carbohydrates and glycobiology* 1. Monosaccharides and disaccharides 2. Polysaccharides 3. Glycoconjugates: proteoglycans, glycoproteins, glycosphingolipids *Lipids*

1. Storage lipids

2. Structural lipids in membranes

Enzymes 1. General properties of enzymes 2. Enzyme kinetics 3. Examples of enzymatic reactions 4. Regulatory enzymes *Oxygen-binding proteins*

1. Protein-ligand interaction

2. Globins

3. Myoglobin

4. Hemoglobin

Bioenergetics and metabolism

1. Bioenergetics and thermodynamics

2. Chemical logic and common biochemical relations

3. Phosphoryl group transfers and ATP

4. Biological oxidation-reduction reactions

Carbohydrate metabolism 1. Glycolysis 2. Fates of pyruvate under anaerobic conditions: fermentation 3. Gluconeogenesis 4. Pentose phosphate pathway of glucose oxidation 5. Coordinated regulation of glycolysis and gluconeogenesis 6. The metabolism of glycogen 7. Coordinated regulation of Glycogen synthesis and breakdown *The Citric Acid Cycle*

1. Production of acetyl-CoA

2. Reactions of the Citric Acid Cycle

3. Regulation of the Citric Acid Cycle

Fatty Acid metabolism

1. Digestion, mobilization and transport of fats

2. Beta oxidation of fatty acids

3. Keton Bodies

4. Biosynthesis of fatty acids

Amino Acid Oxidation and the production of Urea

1. Metabolic fates of amino groups

2. Nitrogen excretion and the urea cycle

Oxidative Phosphorylation

1. Electron-Transfer Reactions in mitochondria

2. ATP Synthesis

3. Regulation of Oxidative Phosphorylation

READINGS/BIBLIOGRAPHY

text book: Principles of Biochemistry Lehninger David L. Nelson, Michael M. Cox Freeman and notes provided by the professor and available on the professor's website

TEACHING METHODS OF THE COURSE (OR MODULE)

multiple choice tests and oral examination

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- Written
- Oral
- Project discussion
- Other

In case of a written exam, questions refer to

- Multiple choice answers
- Open answers
- Numerical exercises

b) Evaluation pattern

multiple choice tests on specific topics will be performed during the course