ITMO University

Advanced biochemistry

Course Workload		Assessment form (examination/ graded test/ ungraded test)
ECTS	Hours	
3	108	Exam

Students will know how to determine the main nutrients and metabolic ways of their transformation; to reproduce the basics of bioenergy: the processes of energy transformation in living organisms; to explain the mechanisms of regulation of metabolism and cellular homeostasis; to justify the basics of enzymatic catalysis; to formulate the basis for the organization of joint project activities and joint research of biochemical processes of cell structures; to reproduce the basic physico-chemical and biochemical methods of research of animal and plant biological tissues; to describe the methodological foundations of experimental research in biochemistry; to describe current trends in the development of the main sections of biochemistry; to explain the relevance of the chosen research topic.

Course structure:

1. Biogenic substances

1.1. The main nutrients: proteins, carbohydrates, lipids, their structure, properties and biological functions
1.2. Water-and fat-soluble vitamins and their biological role

2. Proteomics

2.1. Structure and properties of proteinogenic amino acids
2.2. Structural hierarchy of proteins
2.3. Formation of a three-dimensional structure and its role in the functioning of proteins
2.4. Physico-chemical properties of proteins and methods of their isolation
2.5. Classification of proteins and their biological functions

3. Enzymology

3.1. Characteristics of enzymes as biological catalysts
3.2. The structure of enzymes
3.3. Isoenzymes

3.4. Mechanism of action of enzymes
3.5. Cofactors and coenzymes
3.6. Kinetics of enzymatic reactions
3.7. Regulation of enzymatic activity
3.8. Classification and nomenclature of enzymes

4. Bioenergy

4.1. The structure of a biological cell
4.2. Biological membranes
4.3. Compartmentalization of biochemical processes
4.4. Mitochondria
4.5. Biological oxidation and oxidative phosphorylation
4.6. Heat generation and ATP synthesis
4.7. Disconnectors and inhibitors of oxidation and phosphorylation

5. Metabolism

5.1. The structure and properties of carbohydrates
5.2. Glucose metabolism pathways
5.3. The pentose phosphate cycle
5.4. Glycolysis and aerobic oxidation
5.5. The cycle of tricarboxylic acids
5.6. Gluconeogenesis
5.7. Synthesis and breakdown of glycogen

6. Regulation of metabolism

6.1. Structure and properties of lipids
6.2. Triglycerides
6.3. Saturated and unsaturated higher fatty acids and their biological role. β-oxidation and its energy value
6.4. Acetyl-coenzyme A is the central link of metabolism
6.5. Synthesis of ketone bodies
6.6. Sterols and steroids