



Course syllabus

Faculty of Health and Life Sciences

Department of Chemistry and Biomedical Sciences

1KE014 Farmaceutisk biokemi, 15 högskolepoäng

1KE014 Pharmaceutical Biochemistry, 15 credits

Main field of study

Biomedical Science, Pharmacy, Chemistry

Subject Group

Chemistry

Level of classification

First Level

Progression

G1F

Date of Ratification

Approved 2011-05-02

Revised 2018-06-04 by Faculty of Health and Life Sciences.

The course syllabus is valid from autumn semester 2018

Prerequisites

General entry requirements and 7.5 credits in cell biology and 7.5 credits in general chemistry, or the equivalent.

Objectives

Module 1: Basic biochemistry, 10.5 credits After completing the module, the student should be able to:

- accurately describe the chemical structure of amino acids present in proteins and their side-chain charge at physiological pH
- describe the formation and characteristics of a peptide bond
- explain the structural levels of proteins and identify structure-function relationships
- elaborate on the principle of enzyme catalysis and basic enzyme kinetics (Michaelis-Menten kinetics)
- conduct and evaluate simple enzyme activity studies
- describe some common mechanisms for regulating enzyme activity
- explain how drugs can act as enzyme inhibitors or receptor antagonists
- provide an overview of variations in drug metabolism in relation to variations in enzyme activity, e.g., in phase I reactions

- describe the functions of vitamins and their relation to coenzymes
- explain the breakdown and absorption of carbohydrates in the digestive system
- write structural formulas for the breakdown of glucose in eukaryotes under aerobic and anaerobic conditions and include participating enzymes and coenzymes
- explain the principle behind oxidative phosphorylation and describe in general terms the function, organisation, and physiological regulation of the respiratory chain
- describe glycogen metabolism and its hormonal regulation
- provide an overview of gluconeogenesis and its physiological significance
- present the basic structure of the most common membrane lipids
- describe the breakdown and absorption of dietary lipids in the digestive system
- explain the structure and function of blood lipoprotein complexes
- provide an overview of fatty acid and triglyceride metabolism
- provide an overview of the biosynthesis of cholesterol, bile salts, vitamin D, and steroid hormones, including the regulation of cholesterol synthesis
- describe the formation and function of ketone bodies during fasting and insulin deficiency
- provide an overview of the formation of prostaglandins, thromboxanes, and leukotrienes from essential fatty acids and how drugs can affect these synthesis processes
- provide an overview of the breakdown of dietary protein and the absorption of amino acids in the digestive system
- provide an overview of amino acid metabolism, including the urea cycle
- explain the metabolism of biogenic amines
- provide an overview of the biosynthesis and breakdown of the most common nucleotides and provide their structural formulas
- exemplify how defects in enzymes or vitamin deficiencies can cause metabolic disorders and lead to health problems
- describe the structure, properties, and functions of DNA and RNA
- provide a general explanation of the gene concept and the structure of eukaryotic and prokaryotic genes
- provide an overview of the basic processes of replication and transcription
- provide an overview of translation and targeting of synthesised protein
- identify drugs that act on replication, transcription, or translation.

Module 2: Biochemical methods, 4.5 credits

After completing the module, the student should be able to:

- prepare solutions for biochemical experiments
- explain and apply some common chromatographic and electrophoretic techniques for the separation and detection of biochemical molecules
- perform and explain the principles behind purification of proteins and DNA from biological tissue
- apply some basic molecular biology techniques such as PCR and restriction enzyme cleavage
- conduct basic biochemical information searches
- document laboratory-based biochemical work
- present simple biochemical experiments in speech and writing.

Content

Module 1: Basic biochemistry, 10.5 credits

The module includes the following components:

- biochemical information searches
- amino acids – structural formulas and properties
- structure and functions of polypeptides
- structural composition of proteins and structure-function relationships
- membrane proteins with emphasis on receptors and ion channels, ligand-receptor interactions, and intracellular signaling pathways
- drug binding to membrane proteins and its effects on ion transport or intracellular signaling
- basic enzymology
- regulatory mechanisms of enzyme activity
- vitamins and coenzymes
- breakdown of polysaccharides in the intestinal system and absorption of monosaccharides
- aerobic and anaerobic breakdown of glucose, fructose, and galactose
- glycogen synthesis and breakdown and its hormonal regulation
- gluconeogenesis and its significance under different physiological conditions
- the respiratory chain
- lipids – biochemical structure and function
- breakdown and absorption of lipids in the digestive system and the formation and functions of lipoprotein complexes
- synthesis and breakdown of fatty acids, triglycerides, and steroids
- metabolism of ketone bodies in different physiological states
- breakdown of proteins and absorption of amino acids in the intestinal system
- synthesis and breakdown of amino acids
- the urea cycle
- synthesis and breakdown of biogenic amines
- nucleotides and their metabolism
- regulation of metabolic processes under different physiological conditions
- metabolic disorders
- RNA and DNA – structure and functions
- replication, transcription, and translation, as well as protein targeting
- the impact of drugs on different cellular processes.

Module 2: Biochemical methods, 4.5 credits

The module includes the following components:

- chromatographic and electrophoretic techniques for separation and detection of biochemical molecules
- buffers, fractional salt precipitation, and centrifugation
- PCR and DNA sequencing

Laboratory work:

- preparation of solutions for biochemical experiments
- purification of proteins from biological tissue
- basic spectrophotometric analysis of proteins
- studies of an enzyme's activity in the absence and presence of an inhibitor
- molecular biological methods for manipulating and analysing DNA using PCR, restriction enzyme analysis, and agarose gel electrophoresis.

Type of Instruction

Instruction is delivered in the form of lectures, laboratory work, group discussions, and seminars. Participation in laboratory work, group discussions, and seminars is

mandatory. For distance students, internet access is required.

Examination

The course is assessed with the grades Fail (U), Pass (G) or Pass with Distinction (VG).

Laboratory work is examined through the student's individual lab reports.

The seminar assignment is examined through an individual or group presentation.

Theoretical components are examined through an end-of-course examination. A first resit examination is offered within six academic weeks after the regular examination date.

Each module is graded as Fail, Pass, or Pass with Distinction.

The assessment criteria for a passing grade are based on the Objectives (see above).

For the final course grade, one of the grades Fail, Pass, or Pass with Distinction is used. To receive the grade of Pass with Distinction for the entire course, the student must have been awarded this grade for Module 1, Basic Biochemistry.

Course Evaluation

During or shortly after the course, a written course evaluation should be conducted. The result and analysis of the course evaluation should be promptly communicated to the students who have taken the course. Students who are taking the course when it is offered the next time should be informed of the result at the course introduction. The course evaluation is anonymous.

Required Reading and Additional Study Material

Module 1

Tymoczko, Berg & Stryer. *Biochemistry a short course*. Freedman and Company. The latest edition.

Module 2

Wilson, K. & Walker, J. *Principles and Techniques of Biochemistry and Molecular Biology*. Univ. Press, N.Y. The latest edition.

Laborationskompendium i Biokemi, Linnéuniversitetet. The latest edition.