

<i>Study course title</i>	Practical Biochemistry
<i>Study course code (DUIS)</i>	Ķimi1026
<i>Credits</i>	2
<i>European credit transfer and accumulation system credits</i>	3
<i>Total number of contact hours</i>	32
<i>Number of lecture hours</i>	Click or tap here to enter text.
<i>Number of hours for seminars</i>	Click or tap here to enter text.
<i>Number of hours for practical assignments</i>	Click or tap here to enter text.
<i>Number of hours for laboratory assignments</i>	32
<i>Independent study hours</i>	Click or tap here to enter text.
<i>Course developer (-s)</i>	
Dr. biol., prof. Natalja Škute, Dr. chem., doc. Jelena Kirilova	
<i>Prerequisite knowledge</i>	
basic knowledge in General Chemistry and Organic Chemistry	
<i>Study course abstract</i>	
<p>Aim of the course: To develop students' active and creative attitude to learning, to provide a modern concept of research methods in the field of biochemistry. Practical research skills and abilities are developed during laboratory works.</p> <p>Course objectives: 1) to introduce students to main methods for investigations of bioorganic compounds, their structure and properties; 2) to allow students to gain practical experience of key techniques used in modern biochemistry laboratories; 3) to develop skills including research results presentations.</p>	
<i>Course plan</i>	
<p>(Reflected in the course content, structure and calendar)</p> <p>Course structure: Laboratory works - 32 h.</p> <p>Laboratorijas work topics:</p> <ol style="list-style-type: none"> 1. Isolation of proteins by various biochemical methods (salvation, centrifugation, gel-filtration, electrophoresis). 2. Spectroscopic identification of proteins. 3. Extraction and purification of chlorophylls by various methods. 4. Characterization of chlorophylls by chromatographic and spectrometric methods. 5. Extraction and characterization of nucleic acids by various methods. 6. Fluorescence technics for fluorescent substances (dyes, labels, fluorescent proteins). 7. Isolation of living cell (bacterias, plant). 8. Biochemical analysis of living cell (bacterias, plant). 	
<i>Learning outcomes</i>	
<p>Academic competences: the course gives an understanding of the practice underlying many biochemical, molecular, and biophysical topics; give a experience in key techniques used in modern biochemistry laboratories.</p> <p>Professional competences: after the execution of the course students will have acquired skills in purification and isolation of biochemical compounds, biochemical research methods, etc. for their application for characterization of biologically important substances and living organisms components.</p>	

After successful completion of the course, students gain understanding of research methods of biologically important classes of compounds and their properties, as well as advanced skills on characterization and analysis of bioorganic substances.
<i>Requirements for awarding credits</i>
Successful execution of laboratory work (20%), presentation (20%); exam at the end of the course (60%)
<i>Course content</i>
<p>Basic steps of biochemical analysis and its use in various investigations in medicine, ecology, agriculture etc.</p> <p>Centrifugation: the basic theory of centrifugation and the mathematical expression of sedimentation rate. The different types of centrifuge and rotor commonly used in biochemical studies. The principles of differential, zonal and isopycnic centrifugation, and their applications.</p> <p>Chromatography: the basic principles of chromatography, a partition process in which molecules distribute between two different phases. The various chromatographic techniques particularly useful in protein purification, including ion-exchange chromatography, gel filtration and affinity chromatography.</p> <p>Photobiological processes in biochemistry. VIS, UV, Rt and others. Quantum absorption and energy. Light quantum interaction with chromophore groups in peptides, nucleic acids, chlorophylls and others. Spectrophotometry basics and types of spectrophotometers. Absorption spectra of peptides, nucleic acids, chlorophylls, haemoglobins. Their qualitative and quantitative analysis.</p> <p>Fluorescence Technology: main principles of fluorescence and its applications for biochemistry and cell biology research. Phosphorescence and chemiluminescence in biology. Design and application of fluorescence probes, fluorescence measurements, special techniques and recent advances in fluorescence technology: emission and excitation spectra, fluorescence lifetime, quantum yield determination, and fluorescence resonance energy transfer (FRET) theory.</p> <p>Vibrational spectroscopy and its use in molecular analysis.</p> <p>Charge of biological molecules and the electrophoretic methods, The types of electrophoreses types: zone, polyacrylamide (PAGE), capillary (CE), isoelectric focusing (IEF), immunofixation, pulsed field, two-dimensional. Electrophoretic analysis of proteins, nucleic acids and visualization of it.</p>
<i>Compulsory reading list</i>
<p>Nelson, D. L. & Cox, M. M. Lehninger Principles of Biochemistry. Freeman, 7th ed., 2017.</p> <p>Voet, Donald. Biochemistry / Donald Voet, Judith G. Voet. 4th ed. Hoboken, NY: John Wiley & Sons, 2011.</p> <p>Hames, David. Biochemistry / David Hames & Nigel Hooper. 3rd ed. - New York: Taylor & Francis, 2006.</p> <p>Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and James Darnell, J. Molecular Cell Biology, Freeman, 7th ed. 2013.</p> <p>Wilson, K. & Walker, J. Principles and Techniques of Biochemistry and Molecular Biology. CUP, 7th ed, 2010.</p>
<i>Further reading list</i>
<ol style="list-style-type: none"> 1. Ferdmans, D. Bioķīmija: māc. grāmata / D. Ferdmans. - Rīga : Zvaigzne, 1971. 2. Cēdere, D., Logins J. Organiskā ķīmija ar ievirzi bioķīmijā. – Rīga, 1996 3. Crowe, J. Chemistry for the Biosciences. OUP, 3rd edition, 2014. 4. Bettelheim, Frederick. Laboratory manual for general, organic & biochemistry / Frederick Bettelheim, Joseph Landesberg. - Fort Worth : Harcourt Brace Jovanovich College Publishers, 1991. 5. Белясова, Н.А. Биохимия и молекулярная биология. - Минск: Книжный Дом, 2004 6. Алексеев, В. И. Прикладная молекулярная биология / В.И. Алексеев, В.А.Каминский. - 2-е изд.,испр. - Москва: КомКнига, 2004.
<i>Periodicals and other sources</i>

1. Clinical Biochemistry
2. The Biochemical Journal <http://www.biochemj.org/bj/tocprev/toc2001.htm>
3. Histochem. Cytochem. <http://freemedicaljournals.com/link3.php?id=2447>
4. Journal of Bioorganic Chemistry

5. Nature Methods

Notes

The course addresses major practical aspects of modern biochemical and biophysical methods for analysis of biomolecules. Laboratory experiments include UV-VIS spectrophotometry, thin-layer chromatography and high-performance liquid chromatography with mass-spectrometry, ultra-centrifugation; isolation, purification and characterization of proteins, nucleic acids and cells, molecular vibrational (raman, resonance raman and infrared), fluorescence spectroscopies (emission and excitation spectra, fluorescence lifetime, quantum yield determination, and Fluorescence resonance energy transfer (FRET) theory).