CONTENT

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ IG/04	**Course name:** Acquirement of Internal Grant
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 10	
Recommended semester/trimester of the course: 6., 8.	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 141	

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SAVBVK/17	**Course name:** Analysis of biophysical properties of ion channels

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 15 **Per study period:** 15s / 210
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
During semester there will be two oral examinations/presentations for 40 points. If student gains less than 20 points, she/he will not earn any credit.

Learning outcomes:
Absolvent will receive relevant knowledge about biophysical properties of single ion channels with the focus on the pharmacological applications. She/he will master modern methods for analysis and will be able to adequately apply them for obtaining detail information about conductive characteristics and the gating behaviour of single ion channels. She/he will be able to assess benefits and risks of using the specific analysis strategy in practice.

Brief outline of the course:
Analysis of ion channel gating kinetics, fitting methods for the description of open and closed time distributions, analysis of burst gating kinetics, the channel selectivity and ion conductance, current theoretical models of conductive and permeation properties of ion channels.

Recommended literature:
B. Hille: Ionic channels of excitable membranes, Sinauer Associates, 1992
B. Sakmann, E. Neher: Single-channel recording, Springer Science + Business Media, 2009

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 6

N	P
0.0	100.0

Provides: RNDr. Marta Gaburjáková, PhD., Ing. Alexandra Zahradníková, DrSc., RNDr. Jana Gaburjáková, PhD.

Date of last modification: 24.02.2017

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/PVS/04	**Course name:** Author's patents, discoveries, software

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: present

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Patent filed, invention, software product created.

Learning outcomes:
The PhD student demonstrates the ability to create an innovative product in a given scientific field, or with impact on an interdisciplinary scale or in technical practice.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 46

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SAVZSLP/17	**Course name:** Basics of the good laboratory practices
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week: Per study period:** 15s / 15s **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course: 1.	
Course level: III.	
Prerequisities:	
Conditions for course completion: Independent work on a project. Preparation of three standard operating procedures for the project.	
Learning outcomes: The aim of the course is to introduce students to the principles of the good laboratory practice and their application in research, and to instil laboratory habits compatible with the GLP system.	
Brief outline of the course: 1. Introduction to the Good laboratory practice The purpose of Good Laboratory Practice (GLP) in the securing of the quality of laboratory studies. The position of GLP in the processes leading from basic research to the manufacture/production. 2. GLP principles and their application in basic and applied research. Acquisition, handling and processing of samples. Chain of operations. Standard operating procedures. Testing and model systems. Equipment, meters, reagents. Labelling, storage and archivation. Evaluation of analysis results. 3. Examples of utilization of the GLP principles in basic biomedical research Examples of sample and solution labelling, design of unique identifiers, naming of the files, following safety measures. Randomisation and blinding. Application of the GLP principles in the specific circumstances of the student.	
Recommended literature: WHO: Handbook: Good Laboratory Practice (GLP). Second Edition, WHO, 2006 Huber L.: Good laboratory practice and current good manufacturing practice, Agilent Technologies Deutschland GmbH, 2002 http://ec.europa.eu/growth/sectors/chemicals/good-laboratory-practice_en http://www.oecd.org/env/ehs/testing/goodlaboratorypracticeglp.htm	
Course language: Slovak and English	
Notes:	

Course assessment Total number of assessed students: 3	
N	P
0.0	100.0
Provides: RNDr. Alexandra Zahradníková, PhD.	
Date of last modification: 21.11.2021	
Approved: prof. RNDr. Pavol Miškovský, DrSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ BIOE2/14	**Course name:** Bioenergetics II

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 17s / 15s
Course method: present

Number of ECTS credits: 6

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Individual work on a project.
Exam and completed individual project
During an exam, a student shoulb be able to demonstrtae his/her deep knowledge from the parts of the Bioenergetics which are involved in the brief description of the subject and moreover, to present results of the mini-project from the selected field of the bioenergetics research.

Learning outcomes:
The main goal of the course is to provide a comprehensive review about principles and the up-to-date knowledge in Bioenergetics. The focus will be given on the complex description of the components of the respiratory chain in mitochondria, the mechanism of the oxidative phosphorylation, and the role of mitochondria in health, diseases and aging. The practices allow :
(1) obtain skills in the isolation and purification of cytochrome c oxidase, terminal complex of the respiratory chain in mitochondria, and will investigate the catalytic properties of this enzyme or alternatively
(2) achieve the ability to study formation and dissipation of mitochondrial membrane potential, as well as production of reactive oxygen species in situ using confocal microscopy techniques. Moreover, the student will gain practical experience in measuring mitochondrial respiratory chain activity using high-resolution respirometry.

Brief outline of the course:
Lectures:
1. Introduction to bioenergetics
Areas of interest of bioenergetics and its importance and position in science. Central concept of bioenergetics - chemiosmotic theory. The main sources of energy in living organisms. Processes in biological systems in which energy is consumed. Gibbs free energy. Structure and significance of adenosine triphosphate (ATP). Change in Gibbs energy during ATP hydrolysis. Reasons why ATP plays an important role in bioenergetics. Oxidation-reduction (redox) potential. Determination of redox potential. Influence of pH on redox potential. Relationship between Gibbs energy and redox potential. Ion electrochemical gradient. Proton motive force. Equilibrium distribution of ions on the membrane. Nernst potential. Donnan's equilibrium.
2. Mitochondria and oxidative phosphorylation

Mitochondria - structure and functions. Mitochondrial genome. Origin of mitochondria. Respiratory chain in mitochondria. Respiratory chain components. Mechanism of electron transport in the respiratory chain. Proton transport across the inner mitochondrial membrane. Chemiosmotic proton circuit. Utilization of proton electrochemical potential for ATP synthesis. Production of oxygen radicals in the respiratory chain. Respiratory chain in bacteria.

3. Respiratory chain and ATP synthesis

NADH dehydrogenase (complex I) - structure and mechanism of functioning. Mechanism of proton pumping in NADH dehydrogenase. NADH dehydrogenase inhibitors. Succinate dehydrogenase (complex II) - structure and catalytic mechanism. Cytochrome c reductase (complex III) - structure. Mechanism of proton pumping in complex III - Q cycle. Cytochrome c oxidase (complex IV) - structure and basic functions. Catalytic mechanism of cytochrome c oxidase. Pumping protons in cytochrome c oxidase. ATP synthesis in mitochondria. ATP synthase (F1F0-ATPase) - structure and basic functions. Mechanism of ATP synthesis. Control and regulation of ATP synthesis - thermodynamic aspect and kinetic aspect. Disconnection of electron transport from ATP formation. ATP synthase inhibitors. Proton transport in other ATPases.

4. Regulation of oxidative phosphorylation

Supramolecular organization of the respiratory chain. Structure of the respiratory supercomplex. Factors that affect the supramolecular association of the respiratory chain. - Mechanisms of proton leakage on the inner mitochondrial membrane. Passive and active proton leakage. Slipping mechanism. Oxidative phosphorylation uncoupling proteins. Flux control analysis. Types of respiratory control in mitochondria – role of $\Delta\psi m$. Regulation of oxidative phosphorylation by cytochrome c oxidase phosphorylation. Allosteric inhibition of cytochrome c oxidase by ATP molecules.

5. The role of mitochondria in the development of diseases and aging

Monitoring of mitochondrial membrane potential. Ca2+ homeostasis in mitochondria. Initiation of apoptosis in mitochondria. Mitochondria and necrosis. Mutations in the mitochondrial genome. Medical aspect of mitochondrial research. Diseases associated with defects and disorders of mitochondria. Diagnosis and therapy of mitochondrial-related diseases. Mitochondrial aging theory. History of mitochondrial aging theory. Generation of oxygen radicals and oxidative stress in mitochondria. Testable predictions of mitochondrial aging theory. The possibility of extending the lifespan of biological organisms.

6. Photosynthesis

Photosynthesis - basic terms and definitions. Chloroplasts - sites of photosynthesis. Photosystem I and photosystem II - structure and properties. Light phase of photosynthesis. Dark phase of photosynthesis. Calvin cycle. CO2 fixation. Photosynthesis and ATP production. Evolutionary consequences of photosynthesis for the existence of life - the formation of molecular oxygen. Photosynthesis in bacteria.

7. Pumps and other transport systems in mitochondria

Alternative ways of using the transmembrane proton gradient. Heat generation. Uncoupling proteins. Mechanical movement of cell parts. Movement of bacterial cells. Active transport of molecules. Transporters of ions and metabolites in mitochondria. Alternative methods of creating a transmembrane proton gradient. Proton pumps. Bacteriorodopsin - structure and basic mechanisms of function. Primary sodium pumps. Classification of ion transport in biological membranes. ATP-controlled ion pumps.

Recommended literature:

1. D. Nicholls and S. Fergusson. Bioenergetics 3, Academic Press, 2002.
2. M. Wikström (Ed.). Biophysical and Structural Aspects of Bioenergetics, The Royal Society of Chemistry, 2005.
3. D. Harris. Bioenergetics at a Glance, Blackwell Science Ltd., 1995.

4. S. Pappa, F. Guerrini, J. Tager (Eds.). Frontiers of Cellular Bioenergetics, Kluwer Academic, 1999.
5. V. Saks (Ed.). Molecular System Bioenergetics, Wiley-VCH Verlag GmbH & Co., 2007.
6. I. Scheffer. Mitochondria (2nd Edition), John Wiley & Sons, Inc., 2008.
7. A.D.N.J. de Grey. The Mitochondrial Free Radical Theory of Aging, R.G. Landis Company, 1999.
8. V. Smil. Energy in Nature and Society, Massachusetts Insitute of Technology, 2008.

Course language:
English language

Notes:

Course assessment
Total number of assessed students: 14

N	P
0.0	100.0

Provides: doc. Mgr. Daniel Jancura, PhD., RNDr. Gabriela Fabriciová, PhD., RNDr. Marián Fabián, CSc., MUDr. Andrey Musatov, DrSc.

Date of last modification: 17.09.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ BTD/14	**Course name:** Biological thermodynamics

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 15s / 15s
Course method: present

Number of ECTS credits: 6

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Individual work on a project.
Exam and completed individual project.
During an exam, a student shoulb be able to demonstrtae his/her deep knowledge from the parts of the Bioenergetics which are involved in the brief outline of the course and moreover, to present results of the mini-project from the selected field of the research. in biological thermodynamics.

Learning outcomes:
The main goal of the course is to provide a comprehensive review about principles and the up-to-date knowledge in Biological thermodynamics. The focus will be given on the description of thermodynamical characteristics of the interactions between biomacromolecules and low-molecular ligands and the influence these interactions and various physical and chemical parameters on the stability of biopolymers. The practices will allow the students to gain experience and skills in the study of the thermodynamic characteristics of the interactions of biomacromolecule-ligand by methods isothermal titration calorimetry and differential scanning calorimetry.

Brief outline of the course:
Lectures:
1. Basics of thermodynamics
1st law of thermodynamics. Internal energy, work, heat. Enthalpy. Heat capacity. Reaction enthalpy. Temperature dependence of reaction enthalpies - Kirchhoff's law. 2nd law of thermodynamics. Thermodynamic definition of entropy. Changes in entropy in specific processes. Dependence of entropy on temperature. Statistical interpretation of entropy. Boltzman's equation. 3rd law of thermodynamics. Nernst's heat theorem. Helmholtz and Gibbs free energy. Standard Gibbs energy of a chemical reaction. Dependence of Gibbs energy on temperature - Gibbs-Helmholtz equation. Dependence of Gibbs energy on pressure for solids, liquids and gases. Partial molar Gibbs energy, chemical potential. Chemical equilibrium. Gibbs energy of a chemical reaction. Equilibrium constant of chemical reaction. Influence of temperature on the equilibrium constant - van‘t Hoff's equation.
2. Thermodynamics of molecular associations
Examples of molecular associations and their significance for biological systems. Physical nature of interactions between macromolecules and low molecular weight ligands and between

macromolecules themselves. Binding sites in proteins and nucleic acids. Dissociation and association binding constants. Determination of dissociation binding constant - Langmuir isotherm. Cooperativity in ligand-macromolecule interactions. Cooperativity - simultaneous ligand binding, Hill's equation. Cooperativity - gradual binding of ligands. Allosteric interactions. Allosteric transition in macromolecules with one binding site. Qualitative description of the Monod-Wyman-Changeaux model for cooperative binding of ligands to macromolecules. Sequential Koshland-Nemethy-Filmer model of ligand binding cooperativity to macromolecules. Aggregation and cooperativity. Receptor aggregation as a source of cooperativity. Negative cooperativity. Binding of ligands to binding sites with a lattice structure. McGhee-von Hippel model. Binding of ligands into two-dimensional lattices - Stankovsky model. Experimental methods used to study the ligand-macromolecule interaction. Determination of ligand-macromolecule interaction parameters by spectroscopic methods. Statistical analysis of binding data.

3. Thermodynamic stability of biomacromolecules and biological structures

Stability of protein structure. Thermal denaturation of proteins. Calorimetric and van‘t Hoff enthalpy of protein denaturation. Chemical denaturation of proteins. Physiological consequences of incorrectly folded proteins. Nucleic acid denaturation. The helix-coil transition in DNA. Methods for determining the thermodynamic parameters of the helix-coil transition. Renaturation and hybridization of nucleic acids. Phase transitions in biological membranes. Use of calorimetric techniques in the study of phase transitions in membranes. Physiological aspects of phase transitions in biological membranes.

4. Experimental methods of biological thermodynamics

Differential scanning calorimetry (DSC) - basic principles. Differential scanning calorimeter - description of experimental equipment. Application of DSC in the study of the stability of biological macromolecules. Isothermal titration calorimetry (ITC) - basic principles. Isothermal titration calorimeter - description of experimental equipment. Application of ITC in the study of thermodynamic parameters of interactions of biomacromolecules with low molecular weight ligands.

Recommended literature:

1. P. Atkins and J. de Paula. Physical Chemistry (9th Edition), Oxford University Press, 2010.
2. R.Chang. Physical Chemistry for the Biosciences, University Science Book, 2006.
3. D.T. Haynie. Biological Thermodynamics (2nd Edition), Cambridge University Press, 2008.
4. Ch.P. Woodbury. Macromolecular Binding Equilibria, CRC Press, 2008.
5. D.A. Beard and H. Qian. Chemical Biophysics, Cambridge University Press, 2008.
6. A. Ben-Naim. A Farewell to Entropy: Statistical Thermodynamics Based on Information, World Scientific Publishing Co.Pte. Ttd., 2008.
7. T.E. Creighton (Ed.). Protein folding, W.H. Freeman and Company, 1992.
8. P. Nelson. Biological Physics, W.H. Freeman and Company, 2008.
9. I.N. Serdyuk, N.R. Zaccai and J. Zaccai. Methods in modern biophysics, Cambridge University Press, 2007.

Course language:

English language

Notes:

Course assessment
Total number of assessed students: 20

N	P
0.0	100.0

Provides: doc. RNDr. Erik Sedlák, DrSc., doc. Mgr. Daniel Jancura, PhD., RNDr. Diana Fedunová, PhD., Mgr. Zuzana Tomášková, PhD.

Date of last modification: 17.09.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ BFT/14	**Course name:** Biophotonics

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 24s / 26s
Course method: present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Individual work on a project.
Exam and completed individual project.

Learning outcomes:
The course aim is to improve theoretical as well as practical knowledge of doctoral students in advanced methods of biophotonics. The course will offer students to reach knowledge on recent advances in biophotonic research which open new possibilities of non-contact, high-speed, multidimensional measurement of living cells under physiological conditions, in particular.

Brief outline of the course:
Brief outline of the course:
Theoretical courses
Introduction (repetitorium in optics and spectroscopy), Principles of optical experiments, Fluorescence spectroscopy and imaging , Advanced laser spectroscopy techniques, Advanced laser microscopy techniques, Biomedical applications, Cultural Heritage and Environmental applications.
Practical training
1. Steady-state absorption and fluorescence spectroscopy and imaging
2. Time resolved fluorescence spectroscopy and imaging or advanced methods of confocal microscopy
3. Raman macro- and micro spectroscopy and imaging or confocal microscopy with superresolution (STED/STORM)
Individual projects
Individual research problems will be proposed to students for independent individual work in using a set of available experimental methods.

Recommended literature:
1. E. Hecht: Optics, fourth edition, Addison Wesley, 2002
2. B. E. A. Saleh, M. C. Teich: Fundamentals of Biophotonics, second edition, Wiley 2007
3. Paras N. Prasad: Introduction to Biophotonics, Wiley 2003
4. Joseph R. Lakowicz: Principles of Fluorescence Spectroscopy, Third edition, Springer 2006
5. W. Demtroder: Laser Spectroscopy, Volume 1 and 2, fourth edition, Springer 2008

6. W. J. Smith: Modern optical engeneering, Fourth edition, Spie Press, McGraw Hill 2008
7. Peter Atkins, Julio de Paula: Physical Chemistry, Oxford 2010
8. M. Schreiner, M. Strlič, R. Salimbeni: Handbook on the Use of Lasers in Conservation and Conservation Science, COST office, Brussels, Belgium (2008) http://conservationresearch.blogspot.com/2008/11/use-of-lasers-in-conservation-2008.html.
9. (Sackler NAS Colloquium) Scientific Examination of Art: Modern Techniques in Conservation and Analysis, Proc. of the National Academy of Science, pp. 254, The National Academies Press, Washington D.C. (2005), http://www.nap.edu/catalog/11413.html.
10. J.S. Mills and R. White: The Organic Chemistry of Museum Objects, 2nd edition, pp. 206, Butterworth-Heinemann Ltd, Oxford 2003
11. Domingo, C.; Cañamares, M.V.; Jurasekova, Z.; del Puerto, E.; Sánchez-Cortés, S.; García-Ramos, J.V.: Aplicaciones de la espectroscopía SERS (Surface-Enhanced Raman Scattering) a la detección de pigmentos orgánicos naturales en objetos del Patrimonio Cultural. Plasmónica: detección sobre nanoestructuras metálicas, pp. 197-230, P. Sevilla Ed., Comité de Espectroscopía, Sociedad Española de Óptica, Madrid (2010),
12. R. Aroca: Surface-Enhanced Vibrational Spectroscopy, pp. 233, John Wiley & Sons, Ltd, Chichester (2006)

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 57

N	P
0.0	100.0

Provides: prof. RNDr. Pavol Miškovský, DrSc., RNDr. Alexandra Zahradníková, PhD., RNDr. Michal Cagalinec, PhD.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BFSb/14	**Course name:** Biophysical seminar II

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 1 **Per study period:** 14
Course method: present

Number of ECTS credits: 1

Recommended semester/trimester of the course: 4.

Course level: III.

Prerequisities:

Conditions for course completion:
Presentation of a scientific article regarding the PhD work topics, critical evaluation of the results and their presentation in the article. Active participation in discussion regarding the presented results, attendance at the seminar.

Learning outcomes:
Students will be able independently work in scientific databases, analyze and interpret results published in the literature.

Brief outline of the course:
Scientific seminar in the field of Biophysics.

Recommended literature:
Publications from top level journals published within last three years. Publications should contain topics regarding the focus of the research in the Department of Biophysics, and also a new approaches or methods.

Course language:
Slovak and English.

Notes:

Course assessment
Total number of assessed students: 6

N	P
0.0	100.0

Provides: doc. RNDr. Katarína Štroffeková, PhD., RNDr. Ivan Zahradník, CSc.

Date of last modification: 15.12.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BFSc/14	**Course name:** Biophysical seminar III

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 1 **Per study period:** 14
Course method: present

Number of ECTS credits: 1

Recommended semester/trimester of the course: 5.

Course level: III.

Prerequisities:

Conditions for course completion:
Presentation of a scientific article regarding the PhD work topics, critical evaluation of the results and their presentation in the article. Active participation in discussion regarding the presented results, attendance at the seminar.

Learning outcomes:
Students will be able independently work in scientific databases, analyze and interpret results published in the literature.

Brief outline of the course:
Scientific seminar in the field of Biophysics.

Recommended literature:
Publications from top level journals published within last three years. Publications should contain topics regarding the focus of the research in the Department of Biophysics, and also a new approaches or methods.

Course language:
Slovak and English.

Notes:

Course assessment
Total number of assessed students: 4

N	P
0.0	100.0

Provides: doc. RNDr. Katarína Štroffeková, PhD., RNDr. Ivan Zahradník, CSc.

Date of last modification: 15.12.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BFSd/14	**Course name:** Biophysical seminar IV

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 1 **Per study period:** 14
Course method: present

Number of ECTS credits: 1

Recommended semester/trimester of the course: 6.

Course level: III.

Prerequisities:

Conditions for course completion:
Presentation of a scientific article regarding the PhD work topics, critical evaluation of the results and their presentation in the article. Active participation in discussion regarding the presented results, attendance at the seminar.

Learning outcomes:
Students will be able independently work in scientific databases, analyze and interpret results published in the literature.

Brief outline of the course:
Scientific seminar in the field of Biophysics.

Recommended literature:
Publications from top level journals published within last three years. Publications should contain topics regarding the focus of the research in the Department of Biophysics, and also a new approaches or methods.

Course language:
Slovak and English.

Notes:

Course assessment
Total number of assessed students: 4

N	P
0.0	100.0

Provides: doc. RNDr. Katarína Štroffeková, PhD., RNDr. Ivan Zahradník, CSc.

Date of last modification: 15.12.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BFSa/14	**Course name:** Biophysical seminary I

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 1 **Per study period:** 14
Course method: present

Number of ECTS credits: 1

Recommended semester/trimester of the course: 3.

Course level: III.

Prerequisities:

Conditions for course completion:
Presentation of a scientific article regarding the PhD work topics, critical evaluation of the results and their presentation in the article. Active participation in discussion regarding the presented results, attendance at the seminar.

Learning outcomes:
Students will be able independently work in scientific databases, analyze and interpret results published in the literature.

Brief outline of the course:
Scientific seminar in the field of Biophysics.

Recommended literature:
Publications from top level journals published within last three years. Publications should contain topics regarding the focus of the research in the Department of Biophysics, and also a new approaches or methods.

Course language:
Slovak and English.

Notes:

Course assessment
Total number of assessed students: 7

N	P
0.0	100.0

Provides: doc. RNDr. Katarína Štroffeková, PhD., RNDr. Ivan Zahradník, CSc.

Date of last modification: 15.12.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BFP/16	**Course name:** Biophysics of proteins and supramolecular complexes

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 28s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
To complete the course, a student should demonstrate his / her deep knowledge of the topics specified in the outline of the course. Individual work on a project comprising experimental work oriented on the biophysics of proteins and supramolecular complexes. Presentation and project defense.

Learning outcomes:
The main goal is to provide a comprehensive overview of state of the art in the field of molecular biophysics with a focus on the biophysics of proteins and supramolecular complexes.

Brief outline of the course:
1. Characterization of amino acids, protein-incorporated and non-protein amino acids, classification and properties, peptide synthesis – peptide bond, classes of peptides – dipeptides, cyclic and acyclic oligopeptide, polypeptides.
2. The role of amino acids in chemistry and life sciences. Function of amino acids and poly/peptides.
3. Physico-chemical properties and reactions of amino acids and peptides – acid-base properties, reactions of amino- and carboxyl groups. Interactions between amino acids.
4. Synthesis of poly/peptides – chemical synthesis, biosynthesis of proteins – translation. Post-translation modification of amino acid residues in proteins.
5. Conformations of amino acids and oligo/peptides – native state of proteins, primary, secondary, tertiary structure. Quaternary structure, formation of protein's and supramolecular complexes. Intrinsically disordered poly/peptides.
6. Protein folding and unfolding, conformational transitions of proteins. Stability of proteins and their complexes, protein-protein interactions, intra- and intermolecular interactions, protein-ligand interactions.
7. Metal ion-binding proteins, conjugation with various compounds.
8. Natural fibrillar protein complexes – structure, formation and applications.
9. Amyloid protein complexes – origin, structure, properties – functional and pathological amyloid aggregates, potential technological applications.
10. Fabrication of peptide- and protein-based nanomaterials.

Recommended literature:
1. Introduction to Protein Science, Oxford University Press, 2016, Ed. A. M. Lesk.

2. Fundaments of Protein Structure and Function, E. Buxbaum, Springer International Publishing, 2015.
3. Exploring Protein Structure: Principles and Practice, T. Skern, Springer International Publishing 2018.
4. Structural Aspects of Protein Synthesis, A. Liljas, M. Ehrenberg, 2013, World Scientific.
5. Advances in Protein Chemistry and Structural Biology – Book series, Vol 123 – 127, 2021, Elsevier, Ed. R. Donev, T. Karabencheva-Christova.
6. Amyloid proteins, Vol. 1 a Vol. 2, Wiley-VCH, 2005, Ed. Jean D. Sipe
Protein and peptide folding, misfolding, and non-folding, Wiley-VCH, 2012, Ed. By Reihard Scheitzer-Stenner.
7. Misbehaving Proteins – Protein (Mis)Folding, Aggregation, and Stability, Springer, 2006, Ed. By Regina M. Murphy and Amos M. Tsai
8. Protein Aggregation and Fibrillogenesis in Cerebral and Systemic Amyloid Disease, Springer, 2012, Ed. J. R. Harris.
9. Other high-impact scientific journals and review papers related to the topic of PhD thesis

Course language:

Notes:

Course assessment
Total number of assessed students: 4

N	P
0.0	100.0

Provides: doc. RNDr. Zuzana Gažová, CSc.

Date of last modification: 28.11.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ CB/14	**Course name:** Cell biology

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 30s / 15s
Course method: present

Number of ECTS credits: 7

Recommended semester/trimester of the course: 3.

Course level: III.

Prerequisities:

Conditions for course completion:
Individual work on the project.
60 min lecture/presentation of a project related to the topic of the dissertation with emphasis on molecular processes in cells.

Learning outcomes:
The aim of course is to enhance knowledge of doctoral students in biological processes underlying cellular and subcellular signalization and regulation. Furthermore, course goal is to introduce students to advanced multidisciplinary methods used to track cell signaling such as immunocytochemistry, flow cytometry, isolation and identification of proteins in combination with fluorescent microscopy.

Brief outline of the course:
1. Cell structure, function and signaling
Introduction (repetitorium in cell biology)
• Structure and function of membranes and organelles
Cell signaling related with cell survival and programmed cell death
2. Theoretical basics of cell cultivation and cell/proteins imaging methods
Routine methods in cell cultivation
Flow cytometry
Fluorescence Microscopy Fluorescence Microscopy
Proteins and Immunoassays
B) Practical training
• Cell cultivation
• Flow cytometry
• Fluorescence microscopy
• Protein isolation and imaging methods
C) Individual projects:
Individual research problems will be proposed to students for independent individual work in using a set of available experimental methods.

Recommended literature:

1. B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Raff, K. Roberts and P. Walter: Essental Cell Biology, Garland Publishing, New York, USA, 1998, Czech translation: Základy bunečné biologie, Espero publishing, Ústi nad Labem
2. B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Raff, K. Roberts and P. Walter: Molecular Biology of the Cell, fifth Edition, Garland Science 2008
3. Alice L. Givan: Flow Cytometry, first principles, second edition, Wiley, 2001
4. E. Newsholme and T. Leech: Functional biochemistry in Health and Disease, Wiley, 2009
5. Joseph R. Lakowicz: Principles of Fluorescence Spectroscopy, Third edition, Springer 2006
6. Otto S. Wolfbeis: Fluorescence methods and applications. Annals of NY Acad.Sciences 2008
7. Ewa M. Goldys: Fluorescence Applications in Biotechnology and the Life Sciences, 2009, Wiley-Blackwell
8. Sean R. Gallagher and Emily A. Wiley" Current Protocols Essential Laboratory Techniques. 2008, Wiley
9. Short Protocols in Molecular Biology Vol 1, 2, Fifth Edition 2002, Wiley

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 36

N	P
0.0	100.0

Provides: prof. RNDr. Pavol Miškovský, DrSc., RNDr. Zuzana Naďová, PhD., RNDr. Veronika Huntošová, PhD., RNDr. Michal Cagalinec, PhD., RNDr. Alexandra Zahradníková, PhD.

Date of last modification: 21.09.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ BFB2/14	**Course name:** Cell biophysics II
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week: Per study period:** 28s **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course: 1.	
Course level: III.	
Prerequisities:	
Conditions for course completion: Participation in problem solution (PBL); participation at the lectures. Exam.	
Learning outcomes: Introduction of students to basic knowledge regarding cell physiology and biophysics and their mechanisms.	
Brief outline of the course: 1. Homeostasis & main regulatory principles 2. Chemical components of cell. 3. Cell metabolism and bioenergetics. 4. Cell structure and function. 5. Cell membrane – function, membrane transport. Role of proteins in membrane transport. 6. Excitable cells – membrane potential, action potential. 7. Cell organelles and their functions – Compartmentalization and protein transport within cell; intracellular transport of vesicles. 7. Intercellular communication – autocrine and paracrine regulatory pathways; hormonal signaling pathways. 8. Intracellular communication – intracellular signal and regulatory pathways 9. Mitochondria 10. Mitochondria and cell death 11. Cell cycle & apoptosis, signaling pathways	
Recommended literature: B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter: Molecular Biology of the Cell, Garland Science 2002 D.U. Silverthorn: Human Physiology – An Integrated Approach, Pearson/Benjamin Cummings 2010 R.M.J. Cotterill: Biophysics – An Introduction, J.Wiley & Sons,Ltd. 2002 G. Krauss: Biochemistry of Signal Transduction and Regulation, Wiley/VCH 2003 M.B. Jackson: Molecular and Cellular Biophysics, Cambridge Univ. Press 2006	

Course language:
Slovak and English.

Notes:

Course assessment
Total number of assessed students: 76

N	P
0.0	100.0

Provides: doc. RNDr. Katarína Štroffeková, PhD., RNDr. Ivan Zahradník, CSc., Ing. Alexandra Zahradníková, DrSc.

Date of last modification: 21.09.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ CM/04	**Course name:** Citation in monograph
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 20	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 1

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ CZC/04	**Course name:** Citation in scientific journal published abroad
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 10	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment

Total number of assessed students: 74

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ CDC/04	**Course name:** Citation in scientific journal published in the country of residence
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 4

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SCI/04	**Course name:** Citation registered in Science Citation Index
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 20	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment

Total number of assessed students: 298

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SMPR/04	**Course name:** Co-worker of project supported by international grant schemes
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 15	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Membership in the research team of an international project.	
Learning outcomes: Active involvement by solving a specific task within a team of international project solvers. The PhD student demonstrates the ability to work in a team, take responsibility for the assigned task, adhere to the time schedule and fulfill the project outputs. The PhD student gains personal experience from the implementation of an international project, participation in its key stages, creation of measurable outputs, grant funding of science	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 113	

abs	n
100.0	0.0

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SDPR/04	**Course name:** Co-worker of project supported by national grant schemes
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 616

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ ASD/14	**Course name:** Data analysis and statistical approaches to high dimensional data
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week: Per study period:** 28s **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Student is obliged to complete hardcopy of the project according to teacher's request. For this project he obtains maximum 50 points, while another 50 points will be awarded for oral test. The minumum number of points needed to obtan mark A is 75. Credits are not granted to a student who obtains less than 30 points.	
Learning outcomes: Student obtaines the knowledge about the advanced methods of treatment of high dimensional data which can be met as outputs of the various physical experiments.	
Brief outline of the course: 1.The purpose of exploratíve analysis. High dimensional data and their format, the methods of data pre-processing, data standardizations. Theoretical and practical applications . The notion of dimension and metrics. 2.Cluster analysis.: k-means clustering, hierarchical clustering, fuzzy clustering. 3.The techniques of manifold learning – dimensionality reduction for the purpose of data visualisation and formulation of the scientific hypothesis.. Clarifying principles and methods of implementation of the method of principal components (PCA), factor analysis, dimensional scaling, locally linear embedding, Isomap, SOM networks. 4.Time series analysis.	
Recommended literature: 1. Y.Ma, Y.Fu, Manifold Learning Theory and Applications, CRC Press, 2011 2. J.A. Lee, M. Verleysen, Nonlinear Dimensionality Reduction, 2007 3. scientific papers	
Course language: slovak language and english language	
Notes:	

Course assessment Total number of assessed students: 9	
N	P
0.0	100.0
Provides: doc. RNDr. Denis Horváth, CSc.	
Date of last modification: 03.05.2015	
Approved: prof. RNDr. Pavol Miškovský, DrSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ODZP/14	**Course name:** Defence of Doctoral Thesis

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: present

Number of ECTS credits: 30

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
The Dissertation thesis is the result of the student's own scientific research. It must not show elements of academic fraud and must meet the criteria of correct research practice defined in the Rector's Decision no. 21/2021, which lays down the rules for assessing plagiarism at Pavel Jozef Šafárik University in Košice and its constituents. Fulfillment of the criteria is verified mainly in the process of supervising and in the process of the thesis defense. Failure to do so is grounds for disciplinary action.

Learning outcomes:
The Dissertation thesis has elements of a scientific work and the student demonstrates extensive mastery of the theory and professional terminology of the field of study, acquisition of knowledge, skills and competences in accordance with the declared profile of the graduate of the field of study, as well as the ability to apply them in an original way in solving selected problems of the field of study. The student demonstrates the ability of independent scientific work in terms of content, formal and ethical aspects. Further details of the Dissertation thesis are determined by Directive no. 1/2011 on the essential prerequisites of final theses and by the Study Rules of Procedure at UPJŠ in Košice for doctoral studies.
The doctoral student demonstrated the ability and readiness for independent scientific and creative activity in the field of study of philology in accordance with the expectations of the relevant qualification framework and the profile of the graduate.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 104

N	P
0.96	99.04

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ DZS/14	**Course name:** Dissertation examination

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: present

Number of ECTS credits: 20

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Obtaining required number of credits as given by the study plan.

Learning outcomes:
Evaluation of competences of the student according to his/her scientific profile.

Brief outline of the course:
Presentation of the results in the thesis for disertation exam, responding to referee´s comments, answering questions of exam committee. Two questions are selected subsequently from one compulsory and one optional subject, respectively. The subjects are selected by guarantee of the program according to the study plan and scientific profile of the student. The third question addresses the current state of work on dissertation thesis.

Recommended literature:

Course language:
english

Notes:

Course assessment
Total number of assessed students: 133

N	P
0.0	100.0

Provides:

Date of last modification: 03.05.2015

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ VPBP/04	**Course name:** Elaboration of reviewer report
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 23	

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SAVEK/14	**Course name:** Electronics of Surfaces, Colloids and Biomolecules

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 14s
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Each student will prepare and present a presentation on a given topic (5 points) and take an oral examination in a form of discussion (5 points). If student gains less than 2 points in one part of the exam, she/he will not earn any credits.

Learning outcomes:
The graduate student will learn the state-of-the-art knowledge and methods of biophysics in the field of electrokinetic processes on membrane surfaces, colloids and biologically active molecules. The student will learn physico-chemical principles determining interactions at surfaces of biologically important systems, especially cell membranes. He/she will gain skills with processing and dissemination of complex knowledge in an expert community. He/she will be able to use this knowledge while working on the theme of dissertation.

Brief outline of the course:
Electric double layer at interfaces of solutions and surfaces. Surface charge and surface potential. Guy-Chapman-Stern theory. Electrokinetics and polarization of particles, colloids and membranes. Dielectrophoretic effects of solid particles and bioparticles. Monolayers, bilayers and micelles. Adsorption, solvation and dispersion.

Recommended literature:
1. AG Marschall: Biophysical Chemistry - vybrané kapitoly
2. D Myers: Surfaces, Interfaces, and Colloids

Course language:
Slovak, English

Notes:

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: RNDr. Ivan Zahradník, CSc.

Date of last modification: 03.05.2015
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: CJP/ AJD1/07	**Course name:** English Language for PhD Students 1

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 2

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
Completion of e-course English for PhD Students (lms.upjs.sk), consultations (1-3).
Written assignments - Professional/Academic CV, Short Academic Biography.

Learning outcomes:
The development of students´ language skills - reading, writing, listening, speaking, improvement of their linguistic competence - students acquire knowledge of selected phonological, lexical and syntactic aspects, development of pragmatic competence - students can efectively use the language for a given purpose, with focus on Academic English and English for specific/professional purposes, level B2.

Brief outline of the course:
Specific aspects of academic and professional English with focus on correct pronunciation, vocabulary development (noun and verb collocations, phrasal verbs, prepositional phrases, word-formation, formal/informal language, etc.), selected aspects of English grammar (prepositions, grammar tenses, passive voice, etc.), academic writing (professional/academic CV, Short Academic Biography).

Recommended literature:
Moore, J.: Oxford Academic Vocabulary Practice. OUP, 2017.
Kolaříková, Z., Petruňová, H., Timková, R.: Angličtina v akademickom prostredí – cvičebnica. Košice, Vydavateľstvo ŠafárikPress, 2021.
Tomaščíková, S., Rozenfeld, J. Developing Academic English in Speaking and Writing. Vydavateľstvo ŠafárikPress, 2021.
McCarthy, M., O´Dell, F.: Academic Vocabulary in Use. CUP, 2008.
Štepánek, L., J. De Haff a kol.: Academic English-Akademická angličtina. Grada Publishing, a.s., 2011.
Armer, T.: Cambridge English for Scientists. CUP, 2011.
lms.upjs.sk

Course language:
English, level B2 according to CEFR

Notes:

Course assessment
Total number of assessed students: 738

N	Ne	P	Pr	abs	neabs
0.0	0.0	48.1	0.0	51.9	0.0

Provides: PhDr. Helena Petruňová, CSc., Mgr. Zuzana Kolaříková, PhD.

Date of last modification: 16.09.2022

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: CJP/AJD2/07	**Course name:** English Language for PhD Students 2

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Test, oral exam in accordance with the exam requirements (https://www.upjs.sk/filozoficka-fakulta/cjp/doktorandi-upjs/)

Learning outcomes:
The development of students´ language skills - reading, writing, listening, speaking, improvement of their linguistic competence - students acquire knowledge of selected phonological, lexical and syntactic aspects, development of pragmatic competence - students can efectively use the language for a given purpose, with focus on Academic English and English for specific/professional purposes, level B2.

Brief outline of the course:
Academic communication (self-presentation, presenting at scientific meetings and conferences). Specific aspects of academic and professional English with focus on vocabulary development (formality, academic word-list), English grammar (passive voice, nominalisatio), language functions (expressing opinion, cause/effect, presenting arguments, giving examples, describing graphs/charts/schemes, etc.). Cross-language interference.

Recommended literature:
Moore, J.: Oxford Academic Vocabulary Practice. OUP, 2017.
Kolaříková, Z., Petruňová, H., Timková, R.: Angličtina v akademickom prostredí (cvičebnica). UPJŠ Košice, 2021.
Tomaščíková, S., Rozenfeld, J. Developing Academic English in Speaking and Writing. Vydavateľstvo ŠafárikPress, 2021.
McCarthy, M., O´Dell, F.: Academic Vocabulary in Use. CUP, 2008.
Štepánek, L., J. De Haff a kol.: Academic English-Akademická angličtina. Grada Publishing, a.s., 2011.
Armer, T.: Cambridge English for Scientists. CUP, 2011.

Course language:
B2 level according to CEFR

Notes:

Course assessment
Total number of assessed students: 729

N	Ne	P	Pr	abs	neabs
0.27	0.0	93.83	1.1	4.8	0.0

Provides: PhDr. Helena Petruňová, CSc., Mgr. Zuzana Kolaříková, PhD.

Date of last modification: 10.03.2022

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SAVZVE/17	**Course name:** Ethical standards for scientists

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 28s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
During semester there will be three oral examinations for 30 points. If student gains less than 20 points from any examination, she/he will not earn any credit.

Learning outcomes:
The aim of the course is to provide students with an overview of different aspects of ethics in scientific research which they meet or will meet at the different levels of scientific training/ career development. The gained knowledge would direct students to avoid knowing/unknowing violation of ethical principles in scientific research and systematically follow widely excepted ethical standards for scientists.

Brief outline of the course:
1. Good research practice as a tool for prevention of non-ethical behavior in science and research (scientific integrity).
Code of ethics developed by domestic and international scientific institutions. Data management: back-upping, storing, sharing, unbiased interpretation. Authorship of research publications: responsibility of authors, guidelines on authorship, author order, defining roles of the first author, equally-contributed authors, a corresponding author. Conflict of interest: guidelines on identification, disclosure, elimination. Submitting manuscripts: writing a cover letter, rules for proper communication with editors, reasons for a manuscript withdrawal. Reviewing process: rights and responsibilities of reviewers, how to become a competent and responsible reviewer, rules for responding reviewers` comments. Plagiarism: types, guidelines on recognition, causes, ways to eliminate it. Predatory journals and publishers: definition, ways to recognize them, reasons to avoid submitting to predatory journals and publishers, comparison to traditional journals and publishers.
2. Ethical aspects in scientific training and mentoring.
Freedom of scientific research. Motivation for scientific work. Moral standards for scientists. Rules for effective communication and problem solving in a scientific research team. Rights and responsibilities of students. Rights and responsibilities of supervisors. Ways to manage and resolve student-supervisor conflicts.
3. Copyright law

Copyright law of the Slovak Republic: personal rights, property rights. International copyright law. Publishing in scientific journals: copyright, open access (green and gold models), plan S, sharing copyright and open access publications.

Recommended literature:

1. B. B. Martinson, M. S. Anderson, R. de Vries: Scientists behaving badly. Nature 435 (2005) 737–378.
2. J.D. Bowman: Predatory Publishing, Questionable Peer Review, and Fraudulent Conferences. Am J Pharm Educ. 2014 78(10), 176.
3. M. Roig: Avoiding Plagiarism, Self-plagiarism, and Other Questionable Writing Practices: A Guide to Ethical Writing, 2015, U.S. Department of Health and Human Services, the Office of reseach integrity
4. Resnik, D. B. (2012). Plagiarism: Words and ideas. Accountability in Research, 19, 269–272.
5. Autorský zákon SR č. 185/2015 Z.z.

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 4

N	P
0.0	100.0

Provides: RNDr. Marta Gaburjáková, PhD.

Date of last modification: 23.09.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SAVEMB/14	**Course name:** Excitability and Motility of Cells
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week: Per study period:** 14s **Course method:** present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course: 3.	
Course level: III.	
Prerequisities:	
Conditions for course completion: Each student will prepare and present a presentation on a given topic (5 points) and take an oral examination in a form of discussion (5 points). If student gains less than 2 points in one part of the exam, she/he will not earn any credits.	
Learning outcomes: The graduate student will learn the state-of-the-art knowledge and methods of biophysics in the field of cellular excitability and motility. The student will learn principles of the initiation and spreading of the excitation and of the movement activity at the membrane/molecular level and their phylogenesis at the cellular level. He/she will gain working skills with processing and dissemination of complex knowledge in an expert community. He/she will be able to use this knowledge while working on the theme of dissertation.	
Brief outline of the course: Permeability of membranes for ions and solutes, Nernst equation, Goldman - Hodgkin – Katz equation. Types of membrane transport: passive and facilitated diffusion, channels, transporters, active transport, pumps, exchangers. Initiation and spreading of nerve impulse, Hodgkin-Huxley model, nerve synapse, neuro-muscular endplate. Contractile proteins and microtubules, myosin motor, muscle cells, myofibrils, contraction-relaxation cycle, calcium signaling and energetics of contraction.	
Recommended literature: 1. DM Bers: Excitation-Contraction Coupling and Cardiac Contractile Force 2. AG Marschall: Biophysical Chemistry 3. N Sperelakis: Cell Physiology	
Course language: Slovak, English	
Notes:	

Course assessment Total number of assessed students: 4	
N	P
0.0	100.0
Provides: RNDr. Ivan Zahradník, CSc.	
Date of last modification: 03.05.2015	
Approved: prof. RNDr. Pavol Miškovský, DrSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ AEDBF/18	**Course name:** Experimental Data Analysis in Biophysics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 28s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
1. Semestral work.
2. Test.

Learning outcomes:
Provide basic knowledge on experimental data analysis.

Brief outline of the course:
1. Experimental data analysis: models, residual graph, correlations
Random error analysis, random and systematic errors, mean and standard deviation, standard error, normal distribution, histograms, distribution, limit distribution, standard deviation and 68% interval, measured value acceptance, rejection of some data, Chauvenet criterion, weighted average, experimental examples. Graphical verification of the relationship between values, relative measurement errors, number of valid digits for relative errors, multiplication of two measured values and determination of experimental uncertainty of the resulting value, errors in direct measurements, square root rule for repeated measurements, indirect measurement errors, addition, subtraction of two experimental values , product and quotients, addition of independent errors, error for single - variable functions, experimental examples.
2. Analysis of ligand binding reactions data: 1: 1 binding, partition function, competitive titration
Definition of partition function, microscopic and macroscopic constants, total, free ligand concentration, difference, alternative definitions of partial reactions, competition, types of competition, practical aspects of competitive titration
3. Data analysis of complex ligand binding reactions I .: cooperativity and allosteric models
Allosteric regulation as an extended mechanism for controlling protein function; how effectors bind to regulatory sites different from the active site, how effectors induce conformational changes, and how they affect activity. Types of allosteric effectors, structural similarity / difference with the substrate of their target protein. Heterotropism / homotopism An example is the binding of oxygen molecules to hemoglobin, where oxygen is both a substrate and an effector. An allosteric or "other" site is the active site of an adjacent protein subunit.
4. Data analysis of complex ligand binding reactions II .: binding of intercalators to DNA
How do intercalators interact with DNA? How do intercalators interact with DNA? How do intercalating agents cause mutations, what is an intercalating agent, what is DNA groove binding,

what is DNA groove binding, what is DNA groove binding, is intercalation reversible Is intercalation reversible?
5. Protein folding kinetics: Chevron imaging
Thermodynamics of protein folding, stability measurements, structural changes of protein, measurements in the presence of a denaturing agent, measurements using spectroscopic or calorimetric techniques. What is the enthalpy of protein folding? Why is protein folding spontaneous? How is protein folding? Is the change in protein folding entropy positive? Analysis of the kinetic course of folding.
6. Protein-drug binding kinetics, selected examples, How does protein binding affect drug kinetics? What is a drug binding protein? What three types of proteins do drugs bind to? Why is plasma protein binding important?
7. Selected examples of protein-protein and protein-receptor interactions
As drugs bind to their receptors, from the initial association, through drug entry into the binding pocket, to the acceptance of the final bound conformation, GPCR G-protein coupled receptor modulators, GPCRs as target proteins, make up one-third of all drugs sold.
8. Analysis of enzyme kinetics, selected examples
The analysis of kinetic data of enzymes to obtain validated parameters requires attention to two details, which are often given less attention than necessary. The first is experimental design, which ensures that variables considered independent are truly independent, that different interpretations can be distinguished, and that parameter values can be estimated. The second is that the experimenter should be aware of the statistical assumptions that are included in the analysis using commercial software tools. In this lecture we will deal with the mentioned detail.
9. Stability of biomacromolecules I .: equilibrium two-state model
Many of the single-domain proteins are "two-state systems", i. j. proteins that fold directly from the denatured state to the native state, without the population of metastable intermediates - states separated by a barrier, the problem of conformational space of the unfolded state.
10. Stability of biomacromolecules II .: equilibrium multistate models
Partially folded protein intermediates can be very difficult to detect
and study, although they may be important for both kinetic and equilibrium properties. Here are some examples of how cryptic intermediates can affect classical protein stability analysis. Classical heat denaturation analysis provides a major method for measuring the stabilizing free energy of protein molecules and changes in stability induced by mutations and other perturbations. Use of double integration method, partition function, solution stability and obtained parameters.
11. Stability of biomacromolecules III. Non-equilibrium models
Influence of scanning speed on calorimetric records, influence of instrument response time, signal convolution, influence of unfolding kinetics on calorimetric record, analysis of reversibility , physical and chemical processes during thermal unfolding
12. Behavior analysis of individual molecules
Time trajectories of individual molecules, methods of tracking individual molecules of proteins and nucleic acids, preparation of samples for measurement, chemical and biochemical conjugation reactions, analysis of experiments, Markov models, autocorrelation analysis

Recommended literature:

[1] Wyman and Gill, 1990, Binding and Linkage: Functional Chemistry of Biological Macromolecules, University science books
[2] H. Gutfreund, 1995, Kinetics for the life sciences, Cambridge University Press
[3] reprints from scientific journals.

Course language:

slovak, english

Notes:	
Course assessment Total number of assessed students: 9	
N	P
0.0	100.0
Provides: doc. RNDr. Gabriel Žoldák, PhD.	
Date of last modification: 16.12.2021	
Approved: prof. RNDr. Pavol Miškovský, DrSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ EMSP/16	**Course name:** Experimental methods for the study of the proteins

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 14s / 14s
Course method: present

Number of ECTS credits: 6

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
To complete the course, a student should demonstrate his / her deep knowledge of the topics specified in the outline of the course. Individual work on a project comprising experimental work oriented on the protein properties – utilization of several experimental techniques, experimental data analysis. Presentation and project defense.

Learning outcomes:
The main goal is to provide a comprehensive overview of the principles, challenges and opportunities of biophysical experimental techniques for studying of properties of proteins and protein complexes. The focus is also on classical techniques for studying of the structure and conformational states of proteins, and advanced techniques for studying the formation of protein-ligand or protein supramolecular complexes.
Practices will provide skills to prepare amyloid fibrils and to study of the effects of environmental conditions and ligands on the formation of amyloid fibrils, as well as the influence of protein-ligand interactions on the structure and stability of proteins. The practices will also allow the students to gain experience and skills in characterizing protein properties using spectroscopic, microscopic, optical and calorimetric techniques.
Experiment: Individual experimental work and analysis of obtained data.

Brief outline of the course:
Lectures:
1. Spectroscopic methods for protein study (UV-VIS absorption spectroscopy, fluorescence and FTIR spectroscopy, circular dichroism).
2. Determination of thermodynamic parameters from stability measurements of proteins and their complexes – differential scanning calorimetry and isothermal titration calorimetry.
3. Imaging methods – atomic force microscopy, transmission electron microscopy, fluorescence microscopy.
4. Study of protein-ligand interactions using surface plasmon resonance.
5. Determination of surface tenstion of proteins in various environmental conditions.
6. Separation methods for protein oligomers – electrophoresis, HPLC.
Practices:

Characterization of the properties of protein-ligand complexes using various experimental techniques. Preparation of amyloid fibrils in different conditions and determination of the influence of small molecules on their formation.
Project:
Individual work oriented on the topics specified in the outline.

Recommended literature:

1. Methods in Protien Biochemistry, De Gruyter, 2012, Ed. H. Tschesche
2. Ulrich Kubitscheck (ed) Fluorescence microscopy, Wiley-Blackwell, 2013
3. Greg Haugstadt, Atomic Force microscopy, Wiley, 2012
4. J. Nadeau. Introduction to Experimental biophysics, CRC Press 2012
5. N. Matubayasi: Surface tension and related thermodynamic quantities of aqueous electrolyte solutions, CRC Press 2014
6. Stefan S. Sarge, Gunther W. H. Hohne and Wolfgang Hemminger, Calorimetry, Wiley-VCH, 2014
7. Laurence Barron, Molecular Light Scattering and Optical Activity, Cambridge University Press, 2004
8. Mark C. Leake, Single-Molecule Cellular Biophysics, Cambridge Unoversity Press, 2013
9. V. Uversky, S. Longhi: Instrumentalanalysis of intrinsically disordered proteins, Wiley 2010
7. Other high-impact scientific journals and review papers related to the topic of PhD thesis

Course language:

Notes:

Course assessment

Total number of assessed students: 3

N	P
0.0	100.0

Provides: doc. RNDr. Zuzana Gažová, CSc., RNDr. Diana Fedunová, PhD.

Date of last modification: 28.11.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ DKZU/04	**Course name:** Home Conference with Foreign Participation
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 320	

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ ZSOM/16	**Course name:** Image acquisition and processing in microscopy.

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 14s
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active solving of given problems, lectures attendance, final exam.

Learning outcomes:
The image acquisition and processing software is inseparable part of the modern microscopes. The primary goal of the education is to provide basic information for students allowing correct usage of the software in different tasks of the acquired image analysis. The lectures continue with algorithms principles in the form of the tasks after successfully reaching the goal. Solving the tasks and their defense are terms of the final exam.

Brief outline of the course:
Brief outline of course:
1) Introduction to image processing.
Image, its acquisition and representation in a computer. Pinhole camera model. How to get an image to a computer. Properties of digital images. Data structures used in image processing. Discrete linear integral transformations. Linearity and convolution. Linear integral transformations, Fourier transform.
2) Image preprocessing.
Division of preprocessing methods. Point brightness transformations. Brightness correction. Histogram equalization and cumulative histogram. Brightness scale modification. Geometric transformations. Coordinate transformation. Approximation of brightness function. Preprocessing using local operators. Image filtering. Image sharpening.
3) Image segmentation methods.
Thresholding. Segmentation by edge detection. Finding of edges by searching the graph. Searching for boundaries by Hough transformation. Segmentation based on merging and splitting of regions. Segmentation by template matching. MeanShift algorithm. Graph cut method. Features and recognition. Scalar descriptors. Moments. Classification of microscopic cells.
4) The third dimension in images.
Basics of projection geometry, camera model. Types of projection transformations. Camera calibration, intrinsic and extrinsic matrix. Acquisition by two cameras - stereo vision. Epipolar geometry and fundamental matrix. Capturing objects in 3D. Model-based vision, model types.
5) Mathematical morphology (for binary images).

Fundamentals of mathematical morphology. Dilation. Erosion. Combining dilation and erosion. Opening and closing properties. Hit-or-miss transformation. Top hat transformation. Skeleton, topological properties. Distance function.
6) Textures and their properties.
Definition of textures. Properties of textures and their distribution. Methods for describing textures. Methods based on determination of areas frequencies. Coocurrence matrix. Criteria derived from the coocurrence matrix. Number of edges in the texture. Length of primitives.
7) Motion analysis.
Differential method. Background modeling. Detection of points of mutual correspondence. Optical flow. Objects trajectories and Kalman filter.

Recommended literature:

[1] M. Sonka, et al., Image processing, analysis, and machine vision, 3rd ed. Toronto: Thomson, 2008.
[2] G. R. Bradski and A. Kaehler, Learning OpenCV, 1st ed. Beijing ; Sebastopol, CA: O'Reilly, 2008.

Course language:

Notes:

Course assessment

Total number of assessed students: 0

N	P
0.0	0.0

Provides: doc. Ing. Zoltán Tomori, CSc.

Date of last modification: 24.09.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ NEM/04	**Course name:** Implementation of new experimental methodology
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 15	
Recommended semester/trimester of the course: 8.	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 91	

abs	n
100.0	0.0

Provides:	
Date of last modification:	
Approved: prof. RNDr. Pavol Miškovský, DrSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ MK/04	**Course name:** International Conference
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 6	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 485	

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ ZKC/04	**Course name:** Journals Registered by Current Contets Database
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 20	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 537

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ ZNC/04	**Course name:** Journals not registered in the Current Contents Connect database and published abroad

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 69

abs	n
100.0	0.0

Provides:

Date of last modification:

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ DNC/04	**Course name:** Journals not registered in the Current Contents Connect database and published in the country of residence
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment

Total number of assessed students: 25

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ DKC/04	**Course name:** Journals registered in the Current Contents Connect database and published in the country of residence
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 15	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 9

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MMB/14	**Course name:** Methods of molecular biology

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 28s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Six written and electronic exercises regarding course work within duration of the course

Learning outcomes:
Students will be able to analyze DNA and protein sequences. Further, they will be able to compare and predict protein characteristics at the level of primary and secondary structure. Students will be able to design primers and mutations for protein cDNA.

Brief outline of the course:
Analysis of recombinant DNA molecules, electrophoresis, antibody protein detection, description and techniques of gene manipulation (mutations and genetic diseases).
Week 1 - Complete coding sequence (CDS) of a gene or protein.
Week 2 - BLAST search and sequence comparison.
Week 3 - Calculation of protein properties.
Week 4 - Assignment - analysis of selected protein - comparison of sequences from different animal or plant species.
Week 5 - PCR.
Week 6 - Designing basic primers.
Week 7 - Recombinant DNA.
Week 8 - Assignment - design of own primers for targeted mutation in protein.
Week 9 - Protein visualization.
Week 10 - RasMol and protein animation.
Week 11 - Individual assignments

Recommended literature:
B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter: Molecular Biology of the Cell, Garland Science 2008 (Fifth Ed.)
Current Protocols in Molecular Biology, Wiley publishers.
Mac Vector 11.0 softwer Manual
http://www.ncbi.nlm.nih.gov
http://www.ncbi.nlm.nih.gov/pubmed
http://www.ncbi.nlm.nih.gov/sites/gquery
http://blast.ncbi.nlm.nih.gov/Blast.cgi

http://www.cybertory.org/exercises/primerDesign/index.html
http://www.fermentas.com/templates/files/tiny_mce/media_pdf/3_PCR_Troubleshooting.pdf
http://igene.invitrogen.com/products/selector/vectors
http://www.genomics.agilent.com
http://www.origene.com/cdna/
http://www.rcsb.org/pdb/home/home.do
http://www.rasmol.org/software/RasMol_2.7.4/

Course language:
Slovak and English.

Notes:

Course assessment
Total number of assessed students: 25

N	P
0.0	100.0

Provides: doc. RNDr. Erik Sedlák, DrSc., doc. RNDr. Katarína Štroffeková, PhD., RNDr. Alexandra Zahradníková, PhD.

Date of last modification: 21.09.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SAVMB/17	**Course name:** Molecular Biophysics of Cells

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: Per study period: 14s
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
During the semester the student will prepare a written thesis/presentation (40 points) and take an oral examination (40 points). If student gains less than 20 points, she/he will not earn any credits.

Learning outcomes:
The graduate student will gather knowledge on novel findings and methods of molecular biophysics with accent on ion channels, calcium homeostasis and cell energetics. The student will learn the biophysical principles of ion homeostasis, ion transport, and of function of selected enzymes. He/she will learn to work actively with scientific literature. He/she will be able to actively use this knowledge in research relating to the topic of his/her PhD thesis/

Brief outline of the course:
Types of ion channels in the cell: voltage-dependent K+, Na+, Ca2+, Cl- channels, methods of measuring the activity of ion channels; the patch clamp technique;, Ca2+-dependent ion channels: ryanodine receptor, IP3R channel; excitation-contraction coupling in the cell; mitochondrial membrane and its ion channels; apoptosis.

Recommended literature:
B. Hille: Ionic channels of excitable membranes, Sinauer Associates, 2001
B. Sakmann, E. Neher: Single-channel recording, Springer, 2009
Kolektív: Biomembrány. Ústav molekulárnej fyziológie a genetiky SAV, 2010
B. Alberts: Molecular Biology of the Cell

Course language:
English, Slovak

Notes:

Course assessment
Total number of assessed students: 7

N	P
0.0	100.0

Provides: Ing. Alexandra Zahradníková, DrSc.

Date of last modification: 24.02.2017
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MBF2/14	**Course name:** Molecular biophysics II

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 28s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:

Learning outcomes:
The aim of the course is deepen and actualize the knowledge from the molecular biophysics with emphasis on the structure and dynamics of the most important biomacromolecules (nucleic acids, proteins, biomembranes) as well as the processes of molecular associations and recognition.

Brief outline of the course:
Intra- and inter-molecular interactions in biological systems. Conformations of biomacromolecules. Theoretical approaches to the study of biomolecular conformations. Function and structure of nucleic acids. Polymorphism and flexibility of DNA. Conformations of proteins. Analysis of the secondary, tertiary and quaternary structures of polypeptides. Dynamics of the biopolymers. The conformational transitions-helix-coil transition in DNA, denaturation of proteins, phase transitions in biomembranes. Kinetics of the conformational changes. Hydratation of nucleic acids and proteins. Biopolymers as polyelectrolytes. Polyelectrolytic solutions and Debye-Huckel theory. Models in molecular biophysics (Poisson-Boltzman equation, Tanford-Kirkwood model, the Monte Carlo method). Intermolecular associations. Allosteric interactions. Mechanisms and specificity of molecular recognition. Formation of subcellular structures.

Recommended literature:

1. M.B. Jackson, Molecular and cellular biophysics, Cambridge University Press, 2006.
2. M. Daune, Molecular biophysics - Structures in motion, Oxford University Press, 2004.
3. R. Glaser, Biophysics, Springer Verlag, 2001.
4. C.R. Cantor and P.R. Schimmel, Biophysical chemistry I-III, Freeman and Co., 1980.
5. W. Hoppe and W. Lohmann, Biophysics, Springer Verlag, 1986.
6. M.V. Volkenstein, Biofizika, Nauka, Moskva, 1988.
7. R.M.J. Cotterill, Biophysics, John Wiley & Sons Ltd, 2002.
8. P. Atkins and J. de Paula, Physical chemistry (7th Edition, Oxford University Press, 2002.
9. R. Chang, Physical chemistry for the biosciences, University Science Book, 2005.

Course language:
English language

Notes:

Course assessment
Total number of assessed students: 72

N	P
0.0	100.0

Provides: doc. Mgr. Daniel Jancura, PhD., Ing. Alexandra Zahradníková, DrSc., RNDr. Marta Gaburjáková, PhD.

Date of last modification: 17.09.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ MMS/16	**Course name:** Molecular mechanisms of oxidative stress in cells

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 28s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active problem solving; attendance at lectures; an exam.

Learning outcomes:
The main goal of the course is to provide a comprehensive review of up-to-date knowledge and the interplay between cellular metabolism, bioenergetics, and oxidative stress. The focus is given to the mechanisms of oxidative stress generation, the origin, and characterization of individual reactive species, as well as the individual mechanisms and components of cellular defense against the effects of oxidative stress. The course will allow the students to gain experience and skills in the direct and indirect methods of detection of both, reactive species and oxidatively damaged biomacromolecules.

Brief outline of the course:
Lectures:
1. Oxidative stress – general introduction
On the history of oxidative stress. Theories of aging. The mitochondrial free radical theory of aging. Oxygen. Oxygen and its derivative. Reactive oxygen species (ROS). Free radicals. Sources of ROS. The chemistry of free radicals and non-radical reactive species. Oxidative damage to biomolecules Oxidative nuclear and mitochondrial DNA damage. Lipid peroxidation. Products of lipid peroxidation. Oxidative modifications of proteins
2. The role of mitochondria in the development of oxidative stress
Introduction in mitochondrial structure and function. Mitochondrial electron transport chain. Monitoring of mitochondrial membrane potential. Description of individual electron transport complexes and their role in oxidative stress. Generation of oxygen radicals and oxidative stress in mitochondria. Initiation of apoptosis in mitochondria.
3. Cellular redox status: free radicals and oxidative stress
Generation and characterization of the reactive species: Singlet Oxygen. Superoxide Radical. Hydrogen Peroxide. Hydroxyl Radical. Peroxyl Radicals. Reactive Nitrogen Species (RNS). The chemistry of free radicals and related “reactive species”. How do radicals react? Radical chemistry, thermodynamics and kinetics. Chemistry of biologically important radicals and non-radicals. Detection of free radicals and other reactive species.
4. Oxidative stress in pathogenesis

Neurodegenerative Diseases: Parkinson's and Alzheimer's Diseases. Role of Oxidative Stress in Pathogenesis of AD and PD. Cascades Leading to Dopamine Cell Degeneration. Antioxidants Link in Neurodegenerative Disorders. Cardiovascular Diseases. Hypoxia and Stroke. ROS and Myocardial Infarction. Reproductive Systems Disorders (Male and Female). Autoimmune Diseases Oxidative Stress in Metabolic Disorders/Diseases. Oxidative Stress and Carcinogenesis. Physiological Significance of Oxidative Stress
5. Managing oxidative stress/targeting ROS
Antioxidant defenses - Definitions and classifications. Mechanism of action of antioxidants Endogenous: Cellular Antioxidant defense System - Exogenous: Essential Trace Elements, Vitamins,
Dietary supplements, and their modes of action
Oxidative stress-scavenging strategies/targeting: endogenous and exogenous - molecular network and modes of actions of antioxidants in transcriptional regulation of ROS and oxidative stress
6. Detection of free radicals other reactive species
ESR and spin trapping. Detection of superoxide – histochemical method. Detection of nitric oxide. Nitration assay – detection of peroxynitrite. Direct and indirect detection of hydrogen peroxide and singlet oxygen. Lipid peroxidation detection. Analysis of total antioxidant activity.

Recommended literature:

1. B. Halliwell and J.M.C. Gutteridge: Free Radicals in Biology and Medicine, Oxford Science Publications, 2000
2. M.B. Jackson: Molecular and Cellular Biophysics, Cambridge Univ. Press 2006
3. R.M.J. Cotterill: Biophysics – An Introduction, J.Wiley & Sons,Ltd. 2002
4. G. Krauss: Biochemistry of Signal Transduction and Regulation, Wiley/VCH 2003

Course language:

Notes:

Course assessment

Total number of assessed students: 13

N	P
0.0	100.0

Provides: MUDr. Andrey Musatov, DrSc.

Date of last modification: 27.09.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MSIM/14	**Course name:** Molecular simulations

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 30s / 20s
Course method: present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Individual work on a project.
Exam and completed individual project.
Should quarantine persist, written report and answers to posed questions suffice.

Learning outcomes:
The aim of the course is to refresh the theoretical knowledge as well as to provide the frequentant practical experience with the advanced theoretical and computational methods of characterization of complex biological systems. The course will provide a glimpse into the current progress in the filed, which opens new possibilities of detailed characterization of molecules and events within living cells, especially under physiological conditions. The course is aimed especially toward students specializing on more traditional, atomistic levels of description of biological systems, and is built gradually from ab initio principles up to phenomenological descriptions. Theoretical lectures will be accompanied by extensive hands-on exercises.
corona-virus update: for distance learning the volume and composition of practical exercises will be adapted to allow for remote work on computers and/or work using tools and programs availlable for students at their home computers.

Brief outline of the course:
Lectures:
Molecular quantum chemistry – repetitorium. Computational estimations of experimental observables.
Molecular mechanics and modeling.
Mezoscopic approaches.
Exercises:
1. Molecular quantum chemistry
2. Molecular mechanics and modeling
Project:
Project on given microtheme.

Recommended literature:
1. Andrew Leach, Molecular Modelling: Principles and Applications, 2nd ed. (Prentice Hall, 2001).

2. Alan Hinchliffe, Molecular Modelling for Beginners, 2nd ed. (Wiley, 2008).
3. M. P. Allen and D. J. Tildesley, Computer Simulation of Liquids (Oxford University Press, USA, 1989).
4. Scientific papers for actual methods not covered in textbooks.
5. practical exercises: manuals (software suite Schrödinger - Maestro, Jaguar, Desmond; Gaussian 03; MDynaMix etc.)

Course language:

Notes:

Course assessment
Total number of assessed students: 41

N	P
0.0	100.0

Provides: doc. RNDr. Jozef Uličný, CSc., RNDr. Magdaléna Májeková, PhD.

Date of last modification: 27.03.2020

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/DK/04	**Course name:** National Conference

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: present

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in the home conference.

Learning outcomes:
By actively participating in the national scientific conference, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology in his scientific field. He demonstrates the ability to reflect on a specific scientific problem by using the latest approaches and applying them critically. Demonstrates competence in using existing theories and concepts in an innovative way, as well as generating new original scientific knowledge and communicating research results to a wider audience using adequate means and through the Slovak language.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 168

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ NZ/04	**Course name:** Non-reviewed collections of papers and monographs published abroad or in the country of residence
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 114	

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ NTD/16	**Course name:** Nonequilibrium termodynamics

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 14s / 14s
Course method: present

Number of ECTS credits: 6

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Independent work on the project, defense of the project and exam.

Learning outcomes:
PhD student will become familiar with the latest knowledge and approaches in the study of termodynamics and statistical mechanics. The student will be able to compute kinetic constants and derive kinetic equations which describe different biological processes.

Brief outline of the course:
Brownian motion and Langevin equation,reaction rates,kinetic models, linear respond theory, projective operators, nonlinear problems.
Derivation of general master equation for some problems in biophysics.

Recommended literature:
1. R.Zwanzig, Nonequilibrium Statistical Mechanics, Oxford University Press,2001.

Course language:

Notes:

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: RNDr. Michal Pudlák, CSc.

Date of last modification: 15.03.2017

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: KPE/ PgVU/17	**Course name:** Pedagogy for University Teachers

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 28s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
1. Development of a teaching diary—100%
2. Compulsory active participation and attendance in accordance with the Study Regulations.

Learning outcomes:
Students will be able to:
Apply didactic principles, methods, forms, and tools in the teaching of a specialised subject. Specify the educational procedures of a university teacher in subject teaching, pedagogical diagnostics, evaluation of learning outcomes, and self-reflection. Present rationalisation and streamlining possibilities in the teaching of specialised subjects. Apply educational competencies of university teachers taking into account the peculiarities of educating university students.

Brief outline of the course:
The personality of a university teacher. Teaching styles. Student in university education. Student learning styles. Possibilities of adapting teaching styles and student learning styles. University teacher–student interaction and communication in the teaching process. Pedagogical competencies of a university teacher. Didactic analysis of the curriculum; teaching materials and textbooks. Forms of university teaching. Methods of university teaching. Verification methods and student assessment. Creation of a didactic test. Designing university teaching process. University teacher self-reflection.

Recommended literature:
Čapek, R. (2015). Moderní didaktika. Lexikon výukových a hodnoticích metod. Praha, Grada Publishing, a.s.
Danek, J. (2014). Pedagogická komunikácia na vysokej škole. Trnava, Univerzita sv.Cyrila a Metoda v Trnave.
Dargová, J. (2001). Tvorivé kompetencie učiteľa. Prešov, Privat Press.
Dvořáček, J. (2014). Základy pedagogiky. Praha, Oeconomica.
Hupková, M., Petlák, E. (2004). Sebareflexia a kompetencie v práci učiteľa. Bratislava, IRIS.
Kyriacou, CH. (1996). Klíčové dovednosti učitele. Praha, Portál.
Mertin, V. a kol. (2012). Metody a postupy poznávaní žáka: pedagogická diagnostika. Praha, Wolters Kluwer.
Petty,G. (2013). Moderní vyučování. Praha, Portál.

Prucha, J. (2013). Moderní pedagogika. Praha, Portál.
Sirotová, M. (2014). Vysokoškolský učiteľ v edukačnom procese. Trnava, Univerzita sv.Cyrila a Metoda v Trnave.
Slávik, M. a kol. (2012). Vysokoškolská pedagogika. Praha, Grada.
Šebeň Zaťková, T. (2014). Úvod do vysokoškolskej pedagogiky. Trnava, Univerzita sv.Cyrila a Metoda v Trnave.
Turek, I. (2014). Didaktika. Bratislava, Wolters Kluwer, s.r.o.
Zormanová, L. (2014). Obecná didaktika. Praha, Grada.

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 78

abs	n	neabs
98.72	0.0	1.28

Provides: doc. PaedDr. Renáta Orosová, PhD.

Date of last modification: 07.09.2022

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ FZL/14	**Course name:** Physiology

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 30s / 12s
Course method: present

Number of ECTS credits: 7

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Individual work on a project.
Exam and completed individual project

Learning outcomes:
The aim of course is to enhance knowledge of doctoral students in biophysical processes underlying cellular and subcellular signalization and regulation. Furthermore, course goal is to introduce students to advanced multidisciplinary methods used to track cell signaling such as immuno-cytochemistry and electrophysiology in combination with fluorescent microscopy to track proteins of interest.

Brief outline of the course:
Introduction (repetitorium in cell physiology and biophysics). Signal transduction. Excitability and mobility of cell. Apoptosis.
B) Practical training
LAB1: Physiological responses to apoptotic signals in cells.
Methods: Cell cultures, Immunocytochemistry, Confocal microscopy
LAB2: Changes in ion channel functions as a result of apoptotic signal.
Methods: Cell cultures, electrophysiology – whole cell patch clamp, fluorescence microscopy
C) Individual projects:
Individual research problems will be proposed to students for independent individual work in using a set of available experimental methods.

Recommended literature:
1. Alberts B. et al. (2008) Molecular Biology of the Cell. (Fifth Ed.)
2. Silverthon et al. (2010) Human Physiology - An Integrated Approach (Fifth Ed.).
3. Newsholme E.A. & Leech T.R. (2009) Functional Biochemistry in Health and Disease.
4. Reed S. (2009) Essential Physiological Biochemistry
5. Nelson J. (2008) Structure and Function in Cell Signaling
6. Hille B. (2001) Ion Channels of Excitable Membranes (3rd Ed.)
7. Diederich M. (2009) Natural Compounds and Their Role in Apoptotic Cell Signaling Pathways

Course language:

Notes:	
Course assessment Total number of assessed students: 2	
N	P
0.0	100.0
Provides: Ing. Alexandra Zahradníková, DrSc., doc. RNDr. Katarína Štroffeková, PhD., RNDr. Ivan Zahradník, CSc.	
Date of last modification: 21.09.2021	
Approved: prof. RNDr. Pavol Miškovský, DrSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ VYS/04	**Course name:** Presentation in Seminar
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 383

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ PING/14	**Course name:** Protein engineering

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 28s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
seminar work, test

Learning outcomes:
Provide basic knowledge about protein engineering.

Brief outline of the course:
1. DNA: Structure and function; Basic techniques in gene analysis
2. Vectors; Polymerase chain reaction
3. Creating mutations
4. Structure of proteins
5. Posttranslation modifications of proteins; Glycosylation
6. Protein production and purification
7. Preparative refolding
8. Evolution methods
9. Expression of proteins in eukaryotic cells

Recommended literature:
Analysis of genes and genomes, Richard j. Reece, 2004, John Wiley & Sons Ltd
…and reprints from scientific journals

Course language:
Slovak, English

Notes:

Course assessment
Total number of assessed students: 18

N	P
0.0	100.0

Provides: doc. RNDr. Erik Sedlák, DrSc., doc. RNDr. Gabriel Žoldák, PhD.

Date of last modification: 03.05.2015

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: KPPaPZ/PsVU/17	**Course name:** Psychology for University Lecturers

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 28s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Case study, micro-output, its analysis
Current modifications of the course are listed in the electronic bulletin board of the course.

Learning outcomes:
After completing the course, students can:
and Understand, summarize and explain selected psychological knowledge from cognitive psychology, emotion and motivation psychology, personality psychology, developmental, social, educational psychology and health psychology.
b) apply the above psychological knowledge necessary for the professional, competent performance of university teaching practice of doctoral students
c) to create and implement the teaching of a professional topic with applied psychological knowledge
d) evaluate their performance and the performance of their classmates, provide feedback

Brief outline of the course:
The content of the course is based on selected psychological knowledge of cognitive psychology, psychology of emotions and motivation, personality psychology, developmental, social, educational psychology and health psychology. Teaching is realized by a combination of lectures with interactive, experiential methods, discussion, open communication with mutual respect, support of independence, activity and motivation of students. Syllabus: University teacher and his work in the teaching process with a focus on: teachers in relation to themselves (cognitive, personal, social and competencies in the use of methods), in relation to students and as part of the teacher-student relationship on the basis of selected areas of cognitive psychology, psychology of emotions and motivation, developmental psychology, social psychology, educational psychology and health psychology with application to the university environment

Recommended literature:
Alexitch, L. R. (2005). Applying social psychology to education. Social Psychology.–Ed.: Schneider F., Gruman J., Coutts L.–Sage Publications, Inc, 205-228.
Fry, H., Ketteridge, S., & Marshall, S. (2008). A handbook for teaching and learning in higher education: Enhancing academic practice. Routledge.
Mareš, J.: Pedagogická psychologie. Portál, 2013.

Kniha psychologie. Universum, 2014
Čáp, J., Mareš, J.: Psychologie pro učitele. Praha: Portál 2007.
Vágnerová, M.: Školní poradenská psychológie pro pedagogy. Praha: Karolínum 2005.

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 70

abs	n	neabs
100.0	0.0	0.0

Provides: PhDr. Anna Janovská, PhD.

Date of last modification: 24.06.2022

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ RZ/04	**Course name:** Reviewed International or National Proceedings
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 280	

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ KPP/16	**Course name:** Selected chapters from biophysics - protein conformational disorders

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 14s
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Individual work on a project. Exam and completed individual project.
To complete the course, a student should demonstrate his / her deep knowledge of the topics specified in the outline of the course. In addition, a individual project results concerning topics concerning the protein conformational disorders needs to be developed, presented and defended.

Learning outcomes:
The main goal is to provide a comprehensive overview of the state of the art in the field of conformational disorders of proteins and related diseases. The focus will be oriented on a detailed characterization of the diverse protein structures and interactions responsible for the conformational dynamics of proteins. Another goal is to understand the principles of amyloid aggregation of globular and intrinsically disordered proteins.

Brief outline of the course:
1. General principles of protein structure and function.
Native conformation of proteins, conformational stability and protein function relationship. Globular proteins – primary, secondary, tertiary and quaternary structure. Intrinsically disordered proteins – composition and function in organisms.
2. Detailed characteristics of the 3D protein structures.
Secondary structure motifs - α-helixes, β-sheets and turns, supersecondary structures. Ramachandran distribution of amino acids. Tertiary structure – interactions (hydrophobic, H-bonds, S-S bonds, van der Waals, Coulombic). Quarternary structure – structural domains, homo- and hetero-dimerization, oligomerization.
3. Protein structure assembly – protein folding, misfolding and aggregation.
Protein folding thermodynamics – folding funnel. Levinthal's paradox. The role of intracellular environment in protein folding and self-assembly. Chaperons. Protein misfolding. Non-native protein conformations, formation of supramolecular complexes, aggregation. Cellular processes associated with protein aggregation.
4. Amyloid aggregation of proteins and peptides.
The characterization of amyloid aggregation. Basic principles of amyloid aggregation of proteins and peptides. Factors determining the formation of amyloid aggregates. Physiological function of amyloid aggregates.

5. Protein databases – useful tools for protein study.
Protein data bank – PDB. DisProt – database of intrinsically disordered proteins. Predictors of amyloidogenic regions of protein structures. AlphaFold – predictor of 3D protein structures.
6. Relationship between non-native protein conformations and diseases.
Basic characterization of amyloid aggregation-based diseases – sporadic, familiar, hereditary, systemic, transmissible. Toxicity of amyloid aggregates.
7. Therapeutic strategy for conformational diseases.
Identification of inhibitors of amyloid aggregation – small molecules, peptides, nanoparticles. Detailed characterization of organic inhibitors – structural parameters. Characterization of nanoparticles. Multi-target inhibitors. Antibodies.

Recommended literature:

1. Peter Tompa, Structure and Function of Intrinsically Disordered proteins, CRC Press, 2010
2. Peter Jomo Walla, Modern Biophysical Chemistry, Wiley-VCH, 2014
3. Patric F. Dillon, Biophysics – a physiological approach, Cambridge University Press, 2012
4. V. Uversky, A Fink, Protein Misfolding, Aggregation and Conformational Diseases: Part B: Molecular Mechanisms of Conformational Diseases, Springer, 2010
5. E. Sigurson et al., Amyloid proteins.Springer, 2012
6. Other high-impact scientific journals and papers

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 4

N	P
0.0	100.0

Provides: doc. RNDr. Zuzana Gažová, CSc., RNDr. Diana Fedunová, PhD.

Date of last modification: 28.11.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SSOL/04	**Course name:** Self-motivated Study on Scientific Literature
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 195

N	P
0.0	100.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SSNM/17	**Course name:** Self-motivated Study on new Methods
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 25

N	P
0.0	100.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ CSIM/14	**Course name:** Simulations and optimizations of complex biosystems

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 30s / 20s
Course method: present

Number of ECTS credits: 7

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Individual work on a project.
Exam and completed individual project. Written report and Q/A if quarantine persists.

Learning outcomes:
The aim of the course is to provide fresh theoretical knowledge, as well as practical experience with advanced theoretical and computational methods applied to complex biological systems. The course will refresh existing knowledge and provide an overview of the recent development in the area, providing new possibilities of characterization of biological processes, especially under physiological conditions. The core of the course is based on top-down characterization, based on high-throughput experimental data and effective computational treatment based on phenomenological approaches. Theoretical lectures will be accompanied by extensive hands-on exercises.
coronavirus update: distant learning by selfstudy of materials accompanied by videoconferencing (skype) on demand.

Brief outline of the course:
Lectures:
Simulation and optimization techniques
Stochastic processes in physics, chemistry and biology. Statistical description of the features of complex systems. Modeling and simulation of complex systems. Stochastic optimization techniques.
Modeling in systems biology
Essentials of molecular biology, genomics, proteomics and bioinformatics (experimental data sources). Molecura reaction networks. High-throughput experiments and data (mass spectrometry, microarrays). Modeling of complex systems, methods of artificial intelligence, datamining.
Exercises:
1. Computer implementation of cellular automata
2. Parallel implementation of genetic algorithms
3. Construction and simulation of molecular reaction networks
Project:
Individual project on given microtheme.

Recommended literature:

1. van Kampen, N.G, Stochastic processes in physics and chemistry, Elsevier, 2001
2. Binder, K, and Heermann, D. W. Monte Carlo simulation in statistical physics, Springer, 2002
3. Barabasi, A.L, and Stanley, H.E, Fractal concepts in surface growth, Cambridge University Press, 199
4. Morrison, R. W, Designing evolutionary algorithms for dynamic environments, Springer, 2004
5. Ilachinski, A, Cellular automata, World Scientific, 2002
6. Uri Alon, An Introduction to Systems Biology: Design Principles of Biological Circuits, 1st ed. (Chapman and Hall/CRC, 2006).
7. A. Malcolm Campbell and Laurie J. Heyer, Discovering Genomics, Proteomics and Bioinformatics, 2nd ed. (Benjamin Cummings, 2006).
8. Scientific papers for actual methods not covered in textbooks.

Course language:

Notes:

Course assessment

Total number of assessed students: 4

N	P
0.0	100.0

Provides: doc. RNDr. Jozef Uličný, CSc., RNDr. Branislav Brutovský, CSc.

Date of last modification: 27.03.2020

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SAVSMB/17	**Course name:** Special methods of biophysics I

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 15s / 15s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
During semester there will be two written examinations for 30 points. If student gains less than 20 points from any examination, she/he will not earn any credit.

Learning outcomes:
The main aim of the course is to provide students with basic principles of electrophysiological methods in biomedical research. Students will gain a broader overview about experimental methods currently used for studying molecular mechanisms of various cell processes. The course includes also practical training in laboratories equipped with modern electrophysiological techniques.

Brief outline of the course:
1. Cellular electrophysiology
Basic principles of electrophysiological techniques. Principles and methods of maintaining a constant membrane potential and membrane current. Cells suitable for electrophysiological measurements. Basics of cell culture and isolation of cardiac myocytes. Passive and active electrical properties of the cell. Membrane resistance, series resistance, leak resistance, membrane potential. Electrical and computer passive cell models. Techniques of voltage clamp and current clamp. Patch clamp method, configurations on-cell, whole-cell, inside-out, outside-out. Measurement of single ion channels and whole-cell ion currents. Amplifiers for patch clamp, voltage clamp and current clamp. Compensation of passive electrical properties of the cell. Prediction-correction method. Consequences of incomplete series resistance compensation. Consequences of insufficient clamping of the membrane potential. Recording of ion currents and membrane potentials. Aliasing, filtering, types of analogue filters, Nyquist frequency, digitization of current records, sampling frequency. Stimulation protocols, current-voltage curve, voltage-dependent activation, voltage-dependent inactivation, calcium-dependent inactivation, calcium release-dependent inactivation. Protocols for distinguishing types of inactivation. Return from inactivation, deactivation. Analysis of ionic currents through the cell membrane. Programs Clampex and Clampfit. Determination of activation and inactivation time constants. Fitting of voltage dependence of activation and inactivation and current-voltage curve by model equations. Models of electrophysiological properties of cells.
2. Reconstituition of ion channels in planar lipid membranes (BLMs)

Components of a classical BLM setup and their roles. Miniaturized BLM setups (advantages and disadvantages). Isolation of membrane fractions from biological tissues (differential centrifugation, k factor of a rotor, RPM to RCF conversion, properties of centrifugation tubes). Biochemical testing for identification of ion channels in a sample. Biochemical testing for ion channel properties (phosphorylation, oxidation). Preparation of lipid solutions and their properties (lipid phases, temperature of phase transition). Determination and compensation for liquid junction potentials. Properties of BLMs (mechanical and electrical stability, the presence of solvent, horizontal BLM, vertical BLM, properties and role of torus, BLM thickness, fluidity). Formation of BLMs: Mueller`s method, Montal-Mueller`s method, tip-dip method, double-drop method. Properties of materials used for fabrication of cups with a septum for BLM formation. Characteristics of the septum for BLM (size, shape, depth and their relations). BLMs on chips. Physico-chemical processes involved in BLM formation. Incorporation of ion channels into BLMs (KCl gradient, CsCl gradient, manual insertion of a sample into the BLM). Recording ion channel activities (current-voltage characteristics, dose-response curves, recording low-activity ion channels, competition experiments). Analysis of channel activity records (open probability, distribution of open and closed times, ion conductance, ion selectivity, reversal potential, rectification)

Recommended literature:

1. A.J. Williams: An introduction to the methods available for ion channel reconstitution. Microelectrode Techniques: The Plymouth Workshop Handbook, Ed: D.C. Ogden, Company of Biologists, Cambridge, UK, 1994,
2. D. Uhríková a kol., Biofyzika - Vybrané kapitoly: Učebnica pre vysoké školy. - Bratislava: Univerzita Komenského v Bratislave, 2015, ISBN 978-80-223-3800-4
3. Ľ. Lacinová a kol., Kurz: Elektrofyziologické metódy monitorovania iónových kanálov, 2008, učebné texty, Ústav molekulárnej fyziológie a genetiky SAV, ISBN 978-8-970028-5-5
4. R Sherman-Gold (ed.): The Axon Guide for electrophysiology & biophysics laboratory techniques

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 2

N	P
0.0	100.0

Provides: RNDr. Ivan Zahradník, CSc., RNDr. Marta Gaburjáková, PhD., RNDr. Jana Gaburjáková, PhD., Ing. Alexandra Zahradníková, DrSc.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SAVSMB2/17	**Course name:** Special methods of biophysics II

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 15s / 15s
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 3.

Course level: III.

Prerequisities:

Conditions for course completion:
Independent work on project, defense of the project and exam.

Learning outcomes:
The main aim of the course is to provide students with basic principles of imaging methods in biomedical research. Students will gain a broader overview of experimental methods currently used for studying molecular mechanisms of various cell processes. The course includes also practical training in laboratories equipped with modern imaging techniques.

Brief outline of the course:
1. Principles of fluorescence
Interaction of light with matter. Absorption, emission, Jablonsky diagram, non-radiative transitions, triplet states. Photobleaching, autofluorescence
2. Fluorescence probes and their use in biology.
Fluorescent ion indicators. Ratiometric indicators with double excitation and with double emission. Dependence of excitation and emission properties of indicators on their structure. Dependence of affinity (Kd) of indicators on their structure. Probes for membrane staining and membrane potential indicators - fast, slow, proportional. Calibration of fluorescent indicators. Fluorescent probes for monitoring the redox state of cells and the formation of free radicals. Probes for labelling cell organelles. Fluorescent proteins. AM-esters of fluorescent dyes.
3. Fluorescence spectroscopy and microscopy.
Excitation-emission spectra, quantum yield, FRAP, FRET, FLIM techniques. Gating of signal collection, measurement of fluorescence lifetime. CCD and sCMOS cameras.
4. Confocal microscopy
Optical principles of confocal microscopy, scanning confocal microscopy and Nipkow disk microscopy. Confocal scanner, detectors, photomultipliers, hybrid detectors, avalanche photodiodes, photon counting. Acousto-optical tunable filter (AOTF) and acousto-optical beam splitter (AOBS) vs. optical separation and filtering of light. FRAP, FRET and FLIM techniques in confocal microscopy.
5. Super-resolution microscopy

The principle of stimulated emission and its use to improve resolution. STED microscopy. Continuous wave lasers and pulsed lasers - use for excitation and depletion of photons. PALM and STORM techniques. Structured illumination. MINFLUX technology.
6. Optogenetics
Fluorescent protein probes for measuring the concentration of calcium, ATP, GTP and cAMP based on FRET, photo-switchable and photo-convertible fluorescent proteins, optically switchable ion channels for light regulation of membrane potential.
7. Image analysis.
Image thresholding, deconvolution, filtering, Fourier transform, wavelet transform, segmentation methods, active contour methods, automatic particle tracking, co-localization.

Recommended literature:

1. The Molecular Probes Handbook. Invitrogen 2010
2. Pawley J (ed.): Handbook of biological confocal microscopy.
3. Lambert DG (ed.): Calcium imaging protocols. Humana Press, 1999
4. Leica TCS SP8 STED laboratory manual

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 2

N	P
0.0	100.0

Provides: RNDr. Ivan Zahradník, CSc., RNDr. Marta Gaburjáková, PhD., RNDr. Michal Cagalinec, PhD., Ing. Alexandra Zahradníková, DrSc.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: Dek. PF UPJŠ/JSD/14	**Course name:** Spring School for PhD Students

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 4d
Course method: present

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in the Spring School of PhD students of UPJŠ.

Learning outcomes:
By actively participating in the Spring School of PhD Students of UPJŠ, the PhD student demonstrates a high level of ability to process the issues of his dissertation for a multidisciplinary audience with an emphasis on clarifying the motivation, scientific problem, processing methodology and own contribution to the solution of the selected topic. The PhD student demonstrates the ability to professionally discuss various research topics, present his own positions and accept a plurality of opinions. Demonstrates the ability to communicate research results to a wider professional audience with adequate means and through the Slovak language.

Brief outline of the course:
1. Interdisciplinary lectures from the fields of medicine, natural sciences, law, public affairs, humanities. Lecturers - top foreign or national experts from the mentioned fields.
2. Scientific lectures in sections created within related disciplines. Lecturers - top experts from UPJŠ from the mentioned fields.
3. Scientific contributions of PhD students in sections of related fields.
4. Panel discussions on the issue of PhD studies and current trends in the development of scientific disciplines at UPJŠ.

Recommended literature:
Proceedings of the Spring School of Doctoral Students.

Course language:

Notes:

Course assessment
Total number of assessed students: 187

abs	n
100.0	0.0

Provides: doc. RNDr. Marián Kireš, PhD.

Date of last modification: 08.11.2022
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ ZSP/04	**Course name:** Study Stay Abroad
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course: 6., 8.	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 265	
abs	n
100.0	0.0
Provides:	
Date of last modification:	
Approved: prof. RNDr. Pavol Miškovský, DrSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ VPSV/04	**Course name:** Supervision of Student's Scientific Activity
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 6	
Recommended semester/trimester of the course: 6., 8.	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 19	

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ VBP/04	**Course name:** Supervisor/consultant of bacelor thesis
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 6	
Recommended semester/trimester of the course: 6., 8.	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 44	

abs	n
100.0	0.0

Provides:	
Date of last modification:	
Approved: prof. RNDr. Pavol Miškovský, DrSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ PZS/14	**Course name:** Surface enhanced spectroscopy

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 15s / 20s
Course method: present

Number of ECTS credits: 6

Recommended semester/trimester of the course:

Course level: III.

Prerequisities: ÚFV/MOS/14

Conditions for course completion:
Individual work on a project. Exam and completed individual project.

Learning outcomes:
Completing the course doctoral students will get knowledge about advanced techniques of vibrational spectroscopy and fluorescence.

Brief outline of the course:
Introduction to vibrational spectroscopy: Raman and infrared spectroscopy. Fluorescence. SERS – Surface-enhanced Raman spectroscopy (mechanisms, surfaces, applications). SEIRA – surface-enhanced infrared absorption (theory, experiment and applications). SEF – surface-enhanced fluorescence (theory, experiment and applications).
Syllabus/timetable:
Week 1
Light-matter interaction. Spectroscopic methods. Optical spectroscopy methods. Vibrational spectroscopy. Fluorescence. Jablonski diagram.
Week 2
Raman and infrared spectroscopy: Theory, selection rules, experiment/instrumentation, vibration analysis - interpretation of spectra, applications.
Week 3
Macro- and micro-Raman spectroscopy and Raman imaging. CARS microscopy.
Week 4
Surface-enhanced Raman spectroscopy (SERS): SERS effect, mechanisms, SERS spectrum, SERS substrates, hot-spots.
Week 5
Nanoparticles: preparation, characterization and applications. Colloids. Functionalization of nanoparticles. Selective detection. SERS with improved sensitivity. Detection limit.
Week 6
SERS and Plasmonics: plasmon, surface plasmon polaritons (SPPs), localized surface plasmons (LSPs). Plasmon-enhanced Raman spectroscopy (PERS).
Week 7

Brief history, the current status of SERS and some applications of SERS spectroscopy. SERS as an analytical tool. Single molecule detection. SERRS, TERS (TERS-AFM, TERS-STM). SERS commercialization.
Week 8
Surface-enhanced Infrared spectroscopy (SEIRA): theoretical model, SEIRA-active substrates, interpretation of the observed SEIRA spectra, applications.
Week 9
Surface-enhanced fluorescence (SEF): basic principles, fluorescence quenching and enhancement, SEF and metal nanoparticles, SEF and LSPs, similarities and differences between SEF and SERS, applications.
Week 10 – Week 12
Training and individual research project.

Recommended literature:

1. Smith, W.E. and Dent, G.: Modern Raman Spectroscopy: A Practical Approach, John Wiley & Sons (2005), ISBN: 978-0471497943
2. Lakowicz, J. R.: Principles of Fluorescence Spectroscopy, 3rd ed., Springer Science + Business Media, LLC (2006), ISBN: 978-0-387-46312-4
3. Schlücker, S.: Surface Enhanced Raman Spectroscopy: Analytical, Biophysical and Life Science Applications, John Wiley & Sons (2013), ISBN: 978-3-527-63276-3
4. Le Ru, E. C. and Etchegoin, P. G.: Principles of Surface-Enhanced Raman Spectroscopy and related plasmonic effects, Elsevier (2009), ISBN: 978-0-444-52779-0
5. Aroca R.: Surface-Enhanced Vibrational Spectroscopy, John Wiley & Sons (2006), ISBN: 978-0-471-60731-1
6. Scientific manuscripts/papers.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 2

N	P
0.0	100.0

Provides: prof. RNDr. Pavol Miškovský, DrSc., RNDr. Gabriela Fabriciová, PhD., RNDr. Zuzana Jurašeková, PhD.

Date of last modification: 22.09.2021

Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SSB/14	**Course name:** Systems and synthetic biology

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: Per study period: 30s / 20s
Course method: present

Number of ECTS credits: 7

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Presence at lectures and practical exercises, successful completion of given tasks

Learning outcomes:
The course will provide the student an overview of the fundamental assumptions, principles and tools of systems biology, relations to systems medicine as well as get glimpse of the actual state in this rapidly developing discipline.

Brief outline of the course:
Biopolymers as linear sequences. Sequence comparision, scoring matrix BLAS, FASTA and their use in bioinformatics. Sequence databases and illustrations of their use. Physical structure of biopolymers. Foldamers. Anfinsens principle and Levinthals paradox. Protein folding. Molecular dynamics and coarse-grain approaches. Molecular interaction networks and modeling of reaction kinetics. Application of graph approaches. Stochastic and deterministic modeling. High-throughput experiments and databases of results. Perspectives. Synthetic biology - actual state.

Recommended literature:
Actual literature recommended by lecturer.
Kitano, Hiroaki. Foundations of Systems Biology. Cambridge Mass.: MIT Press, 2001.
Campbell, A Malcolm - Heyer, Laurie J.. Discovering Genomics, Proteomics & Bioinformatics (2nd, 07) by Benjamin Cumings,
Alon, Uri. An Introduction to Systems Biology: Design Principles of Biological Circuits. Boca Raton, FL: Chapman & Hall/CRC, 2007.

Course language:

Notes:

Course assessment
Total number of assessed students: 2

N	P
0.0	100.0

Provides: doc. RNDr. Jozef Uličný, CSc.

Date of last modification: 03.05.2015
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ PPC/04	**Course name:** Teaching activities
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 1	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 268

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ PPC/04	**Course name:** Teaching activities
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 1	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 268

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ POVK/04	**Course name:** Work in Organizing Committee of Conference
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 100	

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ PDS/18	**Course name:** Writing Dissertation Work
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 0	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 22	

N	P
0.0	100.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Miškovský, DrSc.