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<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="5">Cellular Regulatory Mechanisms</td></tr>
<tr><td>Code</td><td>PMB264</td><td>Year of study</td><td colspan="4">2.</td></tr>
<tr><td>Course teacher</td><td>Ivica Šamanić, Ph.D., Assistant Professor</td><td>Credits (ECTS)</td><td colspan="4">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Professor Jasna Puizina, PhD
Željana Fredotović, Ph.D., Assistant professor</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>15</td><td>10</td><td>20</td><td></td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="4">10%</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Understanding the cellular signaling mechanisms that control almost all aspects of cellular behavior, such as cell cycle control, programmed cell death, metabolism, movement, proliferation, and differentiation.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Recommended fundamental knowledge of cell biology, biochemistry and molecular biology.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">After successful completion of this course students will be able to:
links the structure and function of the cellular organelles to the mechanisms that modulate cellular response to external or internal stimuli
understanding the molecular basis of cellular regulatory mechanisms due to the fact that many types of cancer are the result of communication disorders between cells
understand the importance of proteolytic systems for the rapid degradation of damaged and abnormal proteins in maintaining cell homeostasis since various neurodegenerative processes, such as Alzheimer's, Parkinson's and Huntington's disease, are caused by the accumulation of non-functional proteins in the cell
describe and carry out basic cell culture and microscopy (optical fluorescence microscopy, image processing and analysis)
present research in a seminar form
the acquired knowledge and skills will form the bases for further research in the field</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">LECTURES (15 hours):
1. INTRODUCTION- Structural and functional organization of cells, cell–cell communication
2. CELL DIVISION – The Cell Cycle, Control of the Cell Cycle: The Role of Protein Kinases, Checkpoints, Cdk Inhibitors; Mitosis and Cytokinesis, Genetic Control of Meiosis
3. CELL SIGNALING AND SIGNAL TRANSDUCTION – The Basic Elements of Cell Signaling, Signal Transduction by G Protein-coupled receptors, The Ras-Map Kinase Pathway, Signaling by the Insulin Receptor, The roles of Calcium and NO as an Intracellular Messengers
4. PROTEOLYSIS (or protein degradation) - Protein Degradation by the Ubiquitin–Proteasome Pathway, Lysosomal Proteolysis
5. CELLULAR RESPONSES TO DNA DAMAGE – DNA damage detection and signaling (Protein-Tyrosine Phosphorylation as a Mechanism for Signal Transduction), Transcriptional Response (Post-transcriptional gene control), DNA Damage Checkpoints, DNA Repair Mechanisms,
6. REGULATION OF PROGRAMMED CELL DEATH PATHWAY- Cellular pathways and complexes controlling caspase activation (Molecular basis of caspase</td></tr>
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<tr><td></td><td colspan="6">activation, Death-inducing signaling complex and the death receptor pathway, Apoptosome and mitochondria pathway)
7. THE ENDOPLASMATIC RETICULUM - The endoplasmic reticulum and protein secretion, Quality control in the ER, the smooth ER and lipid synthesis, Export of proteins and lipids from the ER
8. THE GOLGI COMPLEX - Organization of the Golgi, Protein glycosylation within the Golgi, Lipid and polysaccharide metabolism in the Golgi, Protein sorting and export from the Golgi apparatus
LABORATORY:
Practicum experiences allow the performance of experiments in cell culture related to the process of autophagy and apoptosis, as well as the analysis of the cell cycle. Special attention is given to the practical part in which students acquire the basic skills in fluorescence microscopy.
Experimental Topics;
- cultivation of eukaryotic cells
- microscopy methods for structural analysis of the eukaryotic cell
- organelle isolation
- to confirm autophagy using fluorescent microscopy, acridine orange (AO) can be used to detect acidic vesicular organelle (AVO) formation in live cells
- analysis of cell viability using Propidium Iodide
SEMINARS:
Reading and discussing primary scientific literature, writing a short assay summarizing analyzed articles. Selected articles related to the above topics will be analyzed in 2-hour blocks. Assays will be written at home and submitted to the lecturer for evaluation. The aim is to develop writing skills and presentation skills needed to effectively communicate the purpose, scope, and conclusions of the project.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☒ seminars and workshops
☒ exercises
☐ on line in entirety
☒ partial e-learning
☐ field work</td><td colspan="3">☒ independent assignments
☐ multimedia
☒ laboratory
☒ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attendance at all lectures is strongly recommended.
Students are required to attend laboratory exercises and write lab reports.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1,5</td><td>Research</td><td></td><td>Practical training</td><td>1</td></tr>
<tr><td>Experimental work</td><td>1,5</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Methods of Evaluation
• Lab reports
All lab reports must contain complete and detailed outline of the experimental procedure, description of the results accompanied by analysis and interpretation.
• Practical skills
Hands On: Assessment of flourescence microscopy skills and ability to process and analyze the acquired digital images
• Quizzes</td></tr>
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<tr><td></td><td colspan="3">Quizzes will cover both material from the previous labs as well as material on the experiment for the present lab session (based on theory and protocols found in the lab manual and interpretation of data)
• Research-based class seminar will be elevated.
Students will have to prepare presentation showing background of the problem they are dealing with. The topic can be chosen from a recent scientific publication, popular science article that has strong relevance to cellular regulatory mechanisms. The presentation will be scored according to the content of the presentation (key words, critical review of literature, presentation of scientific results), format, innovativeness and language competence as well.
• Class Participation will also be part of the grade.
Final grades will be based on each student's performance as assessed by points total.</td></tr>
<tr><td rowspan="9">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>1. Geoffrey M. Cooper, 2019: The Cell: A Molecular Approach. 8th Edition, Oxford University Press</td><td></td><td></td></tr>
<tr><td>2. John T. Hancock, 2017: Cell Signalling. Fourth Edition, Oxford University Press</td><td></td><td></td></tr>
<tr><td>3. Metode u molekularnoj biologiji, 2007. Andreja Abramovič Ristov (ur). Institut Ruđer Bošković.</td><td></td><td></td></tr>
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<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">1. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Scott, M.P., Bretscher, A., Ploegh, H.,Amon, A., Martin,K.C., 2016: Molecular Cell Biology. Eight Edition, W.H. Freeman & Co, New York
2. Laboratorijski priručnik: eksperimentalne metode opisane u obliku protokola.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">Student evaluation</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
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