<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="5">Molecular-Cytogenetic Chromosome Analysis</td></tr>
<tr><td>Code</td><td>PMB732</td><td>Year of study</td><td colspan="4">2</td></tr>
<tr><td>Course teacher</td><td>Ivica Šamanić, PhD, Assistant Professor</td><td>Credits (ECTS)</td><td colspan="4">3,0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Željana Fredotović, PhD, 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>10</td><td>5</td><td>15</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">Insight into the molecular and structural dynamics of mitotic and meiotic chromosomes.
Theoretical and practical introduction of students with the classical and molecular cytogenetic techniques.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">None</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Student will be able to:
• Integrate and implement of the knowledge acquired during the various courses (primarily Cell biology, Genetics and Molecular biology) for studying genomes at the level of chromosomes and chromatin.
• Explain the importance of cytogenetics in the area of basic research as well as its applications in medical genetics, biotechnology and agriculture
• Perform in situ hybridization and other molecular techniques needed to work in the Molecular and Cytogenetic laboratories (employment of cytogenetic technologists or clinical laboratory technicians).
• Use the acquired knowledge and skills 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:
1. Cytogenetics methods:
molecular cytogenetic techniques;
in situ hybridization (fish, gish, fluorescence in situ hybridization on extended dna fibers: fiber-fish), in situ pcr, prins (primed in situ labeling), flow cytometry (karyotyping and sorting of
chromosomes by flow cytometry), chromosome microdissection.
classical cytogenetic techniques; chromosome preparations, karyotyping, g-(giemsa), r-(reverse), c-(centromere) and q-(quinacrine) banding, chromosome labeling.
2. Structural analyses of chromosomes and their constituent proteins:
histones, dna, nucleosome morphology and higher-level organisation; heterochromatin and euchromatin, position effect variegation; functional states of chromatin and alternation in chromatin organization.
3. Chromosome organization:
metaphase chromosome; centromere and kinetochore, telomere and its maintenance; telomeres and aging.
4. Chromosome territories: the arrangement of chromosomes in the nucleus:
chromosomal domains (matrix, loop domains) and their functional significance; dynamics of ct arrangements during postmitotic cell differentiation and in terminally</td></tr>
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	differentiated cells. 5. Chromosomal abnormalities: numerical (polyploidy, aneuploidy) and structural alterations (chromosomal rearrangements; deletion, duplication, inversion and translocation; structural abnormality: ring chromosomes and isochromosomes). **Laboratory exercise:** Telomere length analysis directly on chromosomes derived from primary cultured human skin fibroblasts and / or peripheral blood cells using quantitative fluorescence *in situ* hybridization, q-pna-fish; application of molecular cytogenetic techniques (pcr, gel electrophoresis, immunofluorescence staining); optical fluorescence microscopy, image processing and analysis. **Seminars:** *Seminar* is one of the *course* requirements. Students will have to prepare presentation on topics of the *original research paper related to the science unit they are studying.* the aim is to develop writing skills and presentation skills needed to effectively communicate the purpose, scope, and conclusions of the project.

Format of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☐ *on line* in entirety ☒ partial e-learning ☐ field work	☒ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	Attending lectures and practical exercises, prepare presentation.	

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)*						
	Class attendance	0,5	Research		Practical training	
	Experimental work	1,5	Report		(Other)	
	Essay		Seminar essay	1,0	(Other)	
	Tests		Oral exam		(Other)	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	Research-based class seminar will be elevated. Students will have to prepare presentation showing background of the problem they are dealing with. 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.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	1. Cooper, G.M. The Cell – A Mollecular Approach, 8th ed. Sinauer Associates, Oxford University Press, 2019.	1-3	
	2. Metode u molekularnoj biologiji, 2007. Andreja Abramovič Ristov (ur). Institut Ruđer Bošković.		
Optional literature (at the time of	1. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick - Molecular Biology of the Gene-Benjamin Cummings, 2013.		

submission of study programme proposal)	2. Practical *In Situ* Hybridisation, Schwarcher T, Heslop Harrison P, Bios, Scientific Publisher Ltd. 2000. 3. Ram J. Singh - Plant cytogenetics-CRC Press, 2017. 4. Species Evolution: The Role of Chromsome Change, Max King, Cambridge University Press, 1995. 5. Thomas Liehr - Fluorescence *In Situ* Hybridization (FISH)_ Application Guide-Springer, 2016
Quality assurance methods that ensure the acquisition of exit competences	Student evaluation.
Other (as the proposer wishes to add)	