

**SUBJECT OUTLINE**

**Subject: Molecular Biology of the Cell**

**Course coordinator: Dr. Habil. Norica-Beatrice Nichita**

**Academic Year: 2023-2024**

Number of hours per semester /Examination /Credits		
Course and laboratory	Examination	Credits
28 hours/semester	Exam	15

**A. COURSE OBJECTIVES** (in terms of acquired professional competences) :

General objective of the course	The course aims to give a general understanding of eukaryotic cells with focus on subcellular structures and regulatory mechanisms at molecular level
Specific objectives	Application of theoretical knowledge of cellular and molecular biology in practical experiments of doctoral research projects.

**B. COURSE RESOURCES** (where the case)

Course	Adequate room, blackboard, PP presentation, interactive discussions, course support in electronic format
Laboratory	Students will have access to cell culture and molecular biology laboratories, specific research infrastructure, equipment and experimental procedures.

**C. PROFESSIONAL COMPETENCES AQUIRED**

Professional skills	Understanding eukaryotic cell structure and physiological processes; Understanding the biochemical and imaging methods of eukaryotic cell investigation; Understanding the use of specific equipment in experimental applications. Organization of the laboratory experiments and data interpretation.
Transversal skills	Development of individual and transdisciplinary study abilities. Development of interpersonal communication skills and understanding of specific roles within a work team. Understanding research ethics and development of professional values.

**D. COURSE CONTENT**

*a) Course*

Chapter	Content	Number of hours
1. General organization of the cell	Cell types. Cellular organelles, general structure and function. Mechanisms of cellular transport at plasma membrane.	2
2. Extracellular signaling	Molecular mechanisms of cell adhesion. Cytoskeleton: structure, organisation, associated pathologies. Cell- extracellular matrix interactions under physiological and pathological conditions.	2

	Molecular methods to investigate cell- extracellular matrix interactions.	
3.Fundamental mechanisms at cellular level	Transmission of genetic information within cells. Synthesis of proteins and nucleic acids. Protein structure and post-translational modifications. The structure-function relationship, examples of relevant pathologies.	2
4. Imagistic methods for investigation of cell structures	Electronic microscopy. Fluorescence microscopy. Fluorophores, principles, structure and applications.	2
5. Analytical methods for investigation of cell functions	Molecular markers. Cell fractionation. Protein electrophoresis. Production of mono- and polyclonal antibodies. Quantitative and semi-quantitative protein assays based on antigen-antibody interaction: Western blot, ELISA, immunoprecipitation.	4
6. Investigation of cell function by genetic modulation of protein expression.	Genetic editing, silencing and overexpression. Methods for nucleic acids investigations: hybridization, Southern-, Northern-Blot, PCR.	2
<b>Total hours</b>		<b>14</b>

**b) Laboratory**

<b>Chapter</b>	<b>Content</b>	<b>Nr. ore</b>
1. Experimental design	Experimental planning: working hypothesis, objectives, experimental activities. Data interpretation.	2
2.Cell culture	Work safety and biosecurity. Primary and tumour cell lines. Cell passaging. Cell media and culture dishes.	2
3.Monitoring of eukaryotic cell cultures	Inverted microscopy. Morphology of cells of different origins. Detection of bacterial and fungal contamination. Quantitative cell counting assays. Cell viability evaluation using Tripan-blue. Cell viability evaluation using quantitative assays (MTT, MTS).	2
5. Protein analysis	Determination of protein concentration in biological samples using BCA. Standard curves, concentrations and serial dilutions. Molecular markers. Protein electrophoresis under native/denaturing conditions; Western blot; autoradiography; ELISA; immunoprecipitation. Statistic analysis of data and result interpretation.	4
6. Nucleic acid analysis	DNA and RNA purification, determination of nucleic acid concentration using spectrophotometric assays. Reverse transcription, quantitative and semi-quantitative PCR.	4
<b>Total hours</b>		<b>14</b>

**E. EVALUATION** (methods, types of evaluation and their weight in the final grade. Minimum performance standards in relation to the competences defined in **A. COURSE OBJECTIVES**)

<b>Activity</b>	<b>Evaluation criteria</b>	<b>Evaluation methods</b>	<b>Weight in the final grade</b>
Course	Acquirement of the knowledge taught in the course.	Written examination	50%
Laboratory	Understanding of experimental protocols, ability to organize and carry out experiments independently and	Oral assessment during the semester, written examination	50%

	acquisition of good laboratory practices.		
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The assessment results are indicated by grades on a scale from 1 to 10. Grades from 6 to 10 allow the doctoral student to obtain the course credits.

**F. METHODOLOGICAL REMARKS**

Lecture combined with dialogue. Use of modern teaching aids (ppt). Course support provided.

**G. CORROBRATION OF THE CONTENT OF THE COURSE WITH THE EXPECTATIONS OF THE REPRESENTATIVES OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATIONS AND REPRESENTATIVE EMPLOYERS FROM THE FIELD RELATED TO THE PROGRAM**

During the course, the doctoral students will acquire advanced notions in the field of cell biology, on the structure and organization of the cell and subcellular components, at the molecular level. The PhD students will acquire concrete practical knowledge, they will learn to work under sterile and biosafety conditions, will be able to manipulate specific equipment for the study of the cell (optical/fluorescence microscopes, spectrophotometers, sterile hoods, etc). Students will be able to recognize microscopy images, electrophoretic patterns of proteins, isolate and evaluate proteins and nucleic acids from cells, will know how to organize and carry out an experiment independently, interpret the results obtained and integrate them in the context of current knowledge in the field. The discussion sessions will challenge the students' abilities to objectively analyse and propose practical solutions in concrete experimental situations.

**H. References**

Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, Andreas Hofmann, Samuel Clokie (Ed), Cambridge University Press, 2018;

Molecular Biology of the Cell, Alberts Bruce, W W Norton & Co (Ed), 7<sup>th</sup> Edition.

**Course coordinator**

**Dr. Habil. Norica-Beatrice Nichita**

**Director of Doctoral School**

**Dr. Felicia Antohe**

