SYLLABUS

Cell and molecular biology

University year 2025-2026

1. Information regarding the programme

1.1. Higher education institution	Babeş Bolyai University
1.2. Faculty	Faculty of Biology and Geology
1.3. Department	Department of Molecular Biology and Biotechnology
1.4. Field of study	Biology
1.5. Study cycle	Master
1.6. Study programme/Qualification	Bioinformatics applied in life sciences
1.7. Form of education	Full time

2. Information regarding the discipline

2.1. Name of the discipline	**Cell and molecular biology**					Discipline code	**BME1114**
2.2. Course coordinator	Lecturer Ioana Drăghici, PhD						
2.3. Seminar coordinator	Lecturer Ioana Drăghici, PhD						
2.4. Year of study	1	2.5. Semester	1	2.6. Type of evaluation	E	2.7. Discipline regime	Elective

3. Total estimated time (hours/semester of didactic activities)

3.1. Hours per week	**4**	of which: 3.2 course	**2**	3.3 seminar/laboratory	**2**
3.4. Total hours in the curriculum	154	of which: 3.5 course	28	3.6 seminar/laborator	**28**
Time allotment for individual study (ID) and self-study activities (SA)					**hours**
Learning using manual, course support, bibliography, course notes (SA)					34
Additional documentation (in libraries, on electronic platforms, field documentation)					30
Preparation for seminars/labs, homework, papers, portfolios and essays					20
Tutorship					10
Evaluations					4
Other activities:					
3.7. Total individual study hours	**98**				
3.8. Total hours per semester	**154**				
3.9. Number of ECTS credits	**6**				

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competencies	

5. Conditions (if necessary)

5.1. for the course	• Classroom with a video projector and internet access.
5.2. for the seminar /lab activities	• Video logistic support and access to the MS Teams online communication platform. • A minimum attendance rate of 90% for practical activities (seminars and laboratory sessions) is required to qualify for the exam.

6.1. Specific competencies acquired [1]

[1] One can choose either competences or learning outcomes, or both. If only one option is chosen, the row related to the other option will be deleted, and the kept one will be numbered 6.

Professional/essential competencies	• Develop the ability to explain essential biological processes by correlating the structure and function of cellular components, with a focus on the molecular mechanisms involved. • Enhance the ability to select, utilize, and adapt experimental and bioinformatics techniques for collecting, organizing, and analyzing molecular data for research and diagnostic purposes. • Cultivate the capacity to design and execute rigorous experimental frameworks using advanced methods to address relevant scientific questions, with an emphasis on molecular interactions and their impact on cellular function. • Develop the skills to analyze and interpret experimental results, integrating theoretical and practical knowledge to generate scientifically grounded conclusions.
Transversal competencies	• Build the ability to correlate biological information from the cellular to the organismal level, employing an integrated approach that leverages computational and bioinformatics methods to solve complex life science challenges. • Strengthen the aptitude for applying and adapting molecular and cellular concepts in research, diagnostics, and the resolution of interdisciplinary challenges in modern biology.

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Gain a comprehensive understanding of the structural and functional aspects of eukaryotic cells and their subcellular components, along with the basic principles of how the genome orchestrates cellular behavior, including macromolecule synthesis.
7.2 Specific objective of the discipline	• Describe different types of cells, especially eukaryotic cells; functional and structural similarities and dissimilarities between them • Describe the structure, function and dynamics of important biomolecules, organelles and other cellular components • Understand fundamental facts about cellular processes such as intracellular transports, cellular growth and division, and energy transformation • Explain how the growth, development, and behavior of organisms are activated through the expression of genetic information in context • Cultivate a rational perspective on the importance of cellular biology research in advancing modern biology and medical science.

8. Content

8.1 Course	Teaching methods	Remarks
Cell as a basic unit of life. Cell diversity.		
Origin of life and the cells. Cell organization of prokaryotic and eukaryotic cells.	Interactive exposure Presentation Explanation Practical examples Case-study discussions	
Membrane structure. Transport across cell membranes.		
Intracellular compartments and protein transport.		
Energy generation in mitochondria and chloroplasts.		
The cytoskeleton and cell movement.		
Cell cycle, cell division - mitosis and meiosis		
Organization of the genome: DNA and chromosomes.		
DNA replication.		
Flow of genetic information, from DNA to protein: Transcription and Translation.		
Bibliography		

1. Alberts, B., Bray, D., & Hopkin, K. (2014). Essential cell biology. New York: Garland Science.
2. Campbell, N. A., Reece, J. B., & Urry, L. A. (2015). Biology: A global approach. Boston, MA: Pearson
3. Watson, J. D., Baker, T. A., & Bell, S. P. (2008). Molecular biology of the gene. Boston: Pearson.
4. Lodish, H. F., Berk, A., & Kaiser, C. A. (2013). Molecular cell biology. New York: W.H. Freeman and Company.
5. Cooper, G. M., & Hausman, R. E. (2009). The cell: A molecular approach. Washington, D.C: ASM Press.

Pierce, B. A. (2017). Genetics: A conceptual approach. New York: Macmillan Education

8.2 Seminar / laboratory	Teaching methods	Remarks
Presentation of the workflow and organization of the group activities. Assignment of topics for mini-projects.		
Introductory Concepts. Exploring online resources in molecular biology.	Hands-on activity	
Mutations (classification, molecular basis, repair, phenotypic consequence)	Explanation	Seminar
Unique features of organelle DNA (mitochondrial genome and chloroplast genome)	Explanation	Seminar
Isolation of genomic DNA from different cell types/environments	Hands-on activity	Laboratory
DNA quantification (UV absorbance, Agarose gel electrophoresis).	Hands-on activity	Laboratory
PCR amplification of certain genes.	Hands-on activity	Laboratory
Nucleotide sequence analysis and results interpretation.	Didactical demonstration	
Presentation of student mini-projects (scientific article/methodology and results obtained during practical activities).	Feedback	

Bibliography

1. Wink, M. (Ed.). (2020). *An introduction to molecular biotechnology: Fundamentals, methods and applications*. John Wiley & Sons.
2. Alberts, B., Johnson, A., Lewis, J., Wilson, J. H., & Hunt, T. (2015). Molecular biology of the cell. Abingdon: Garland Science, Taylor & Francis Group.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The Cell and Molecular Biology course aligns with international academic and professional standards, being an integral part of study programs at prestigious universities in Romania and abroad. It contributes to developing core competencies in molecular biology, encompassing both theoretical knowledge of cellular processes and practical skills in modern laboratory techniques.
- The course facilitates the acquisition of fundamental competencies in molecular biology theories and associated laboratory techniques. These skills enable the generation, processing, and interpretation of biological data, essential for advanced bioinformatics analyses in the pharmaceutical/biotechnology industries or within academic and medical fields.

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	Know concepts and methods from the topics of the course	Written exam	50%

10.5 Seminar/laboratory	Apply tools and concepts of molecular cell biology in real-life problems	Individual mini-project (implementation and presentation of the project). Active participation in practical activities.	50%
10.6 Minimum standard of performance			
• Each student should obtain minimum 5 for the written exam and for the final grade. In order to obtain the minimum grade 5, the student must demonstrate the mastery of the basic concepts described during the course.			

11. Labels ODD (Sustainable Development Goals)[2]

It does not apply.	

Date:
05.12.2024

Signature of course coordinator

Lecturer Ioana Drăghici, PhD

Signature of seminar coordinator

Lecturer Ioana Drăghici, PhD

Date of approval:
09.12.2024

Signature of the head of department

Associate prof. Beatrice Kelemen, PhD

[2] Keep only the labels that, according to the *Procedure for applying ODD labels in the academic process*, suit the discipline and delete the others, including the general one for *Sustainable Development* – if not applicable. If no label describes the discipline, delete them all and write „*Not applicable*.”.