SYLLABUS

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**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			**Molecular Biochemistry and Biophysics** **Biochimie și biofizică moleculară**				
2.2 Course coordinator			**Lecturer Toma Vlad, PhD**				
2.3 Seminar coordinator			**Lecturer Toma Vlad, PhD**				
2.4. Year of study	**1**	2.5 Semester	**I**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Elective**
2.8. Code of the discipline		**BME1113**					

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	**4**
3.4 Total hours in the curriculum	**56**	Of which: 3.5 course	**28**	3.6 seminar/laboratory	**28**
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					30
Additional documentation (in libraries, on electronic platforms, field documentation)					30
Preparation for seminars/labs, homework, papers, portfolios and essays					26
Tutorship					8
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	• Basic algebra calculation skills
4.2. competencies	• Average computer skills

5. Conditions (if necessary)

5.1. for the course	• Beamer • Online meeting platform
5.2. for the seminar /lab activities	• Attendance of a minimum of 90% of practical/ seminar classes, • Laboratory room with biophysics and biochemistry dedicated equipment; • Computers, specific development environment

6. Specific competencies acquired

Professional competencies	• Development of the ability to explain fundamental biological phenomena as a consequence of the functioning of the laws of physics and chemistry within the context of structural complexity of living systems • Ability to use essential laboratory techniques in the study of living and designing experiments, obtaining data, analysing / interpreting them and formulating conclusions • Development of the capacity for analysis, synthesis and communication of specialized scientific information.
Transversal competencies	• Gaining the complementary information to assimilate the content of Genomics and functional genomics, Structural Bioinformatics and Proteomics courses; • Use of concepts specific to the molecular / cellular level of life organization in new contexts (in vitro, cellular, tissue) .

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

7.1 General objective of the discipline	• Description of basic physical and physico-chemical phenomena in living matter and interpretation of fundamental aspects of life through the prism of the laws of physics; the formation of a rational conception about the functioning of living systems on a natural basis.
7.2 Specific objective of the discipline	• Understanding cellular functions as the purpose of physico-chemical interactions between biomacromolecules, cellular organelles and cells. • Knowledge of physical and chemical phenomena promoting the structure and functions of the cell. • Understanding the operation and application of laboratory instruments for the study of biomolecular and cellular structures.

8. Content

8.1 Course	Teaching methods	Remarks
Atom and molecule. Atomic and molecular orbitals. Strong chemical bonds.	• Interactive exposure • Presentation • Explanation • Practical examples • Case-study discussions	
Secondary (weak) chemical bonds. Building of supramolecular structures.		
Carbohydrates and lipids. Structures and roles.		
Amino acids and proteins. Peptide bond, protein structure levels. Protein functions.		
Enzymes and coenzymes. Enzyme catalysis.		
Nucleotides and nucleic acids (DNA, RNA), nucleic acid structure and roles		
Protein-protein, protein-nucleic acids and protein-ligands interactions		
Principles of biophysical methods and techniques for investigating the cell, nucleic acids and protein structure		
Cell metabolism: principles and types of metabolic pathways		

Bibliography

1. Alberts B., Johnson A., Lewis J., Molecular biology of the cell. New York ; Abingdon : Garland Science, Taylor & Francis Group, 2008.
2. Frauenfelder H., Chan S. S., The physics of proteins : an introduction to biological physics and molecular biophysics. New York : Springer, 2010.
3. Glaser, Roland. Biophysics, 2005.
4. Lesk A. M., Introduction to protein architecture : the structural biology of proteins. New York ; Oxford University Press, 2003.
5. Nelson P. C. si colab., Biological physics : energy, information, life. New York : W. H. Freeman, 2008.
6. Papachristodoulou D., Snape A., Elliott W.H., Elliott D.C., Biochemistry and molecular biology. Oxford : Oxford University Press, 2014.
7. Phillips R., Kondev J., Theriot J., Garcia H.G., Orme N., Physical biology of the cell. London ; New York : Garland Science, 2013

All references are available in hard print format at the libraries of the Faculty of Biology and Geology.

8.2 Seminar / laboratory	Teaching methods	Remarks
Seminar: Methods of investigation of biological compounds: separation (centrifugation, electrophoresis, chromatography)	• Interactive exposure • Explanation • Conversation • Practical demonstration	
Seminar: Methods for investigating biological compounds: qualitative methods (electron microscopy, X-ray diffraction, FTIR, Raman spectrometry)		
Seminar: Methods of investigation of biological compounds: quantitative methods (spectrometry - spectrophotometry, spectrofluorimetry, mass spectrometry)		
Practical work: separation by centrifugation of biological samples and electrophoresis of nucleic acids and proteins		
Practical work: spectrophotometric and spectrofluorimetric dosing of nucleic acids and proteins		
Practical work: electron microscopy (demonstration)		
Practical work: mass spectrometry (demonstrative)		
Final evaluation		

Bibliography

1. Copeland R. A., Enzymes : a practical introduction to structure, mechanism and data analysis. New York : VCH, 1996.
2. Davidovits, P. Physics in biology and medicine, 2008.
3. Glusker J. P., Lewis M., Crystal structure analysis for chemists and biologists. New York ; Weinheim ; Cambridge : VCH Publishers, 1994.
4. Mason W.T., Fluorescent and luminescent probes for biological activity : a practical guide to technology for quantitative real-time analysis. London , Academic Press, 1993.
5. Wilson K., Principles and techniques of biochemistry and molecular biology. Cambridge : Cambridge University Press, 2010.

All references are available in hard print format at the libraries of the Faculty of Biology and Geology.

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 course is applicable and allows the acquisition of practical skills needed to work in laboratories for analysis and interpretation of biological and theoretical data needed for advanced bioinformatics analysis in research institutes or in R & D units at pharma and biotech companies.
- The course is present in the curriculum of similar specializations at Romanian and foreign Universities.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Know concepts and methods from the topics of the course	Written exam (combined test)	50%
10.5 Seminar/lab activities	Apply qualitative and quantitative techniques in real-life problems	Oral colloquium	50%
10.6Minimum performance standards			
Each student should obtain minimum 5 (five) at the written exam and oral colloquium. In order to obtain the minimum grade 5 (five) , the student must demonstrate the mastery of the basic concepts described during the course.			

Date	Signature of course coordinator	Signature of seminar coordinator
10.07.2024	**Toma Vlad, PhD**	**Toma Vlad, PhD**

Date of approval	Signature of the head of department
16.07.2024	**Assoc. Prof. Beatrice Kelemen, PhD**