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)			**Genetics and molecular evolution** **Genetică şi evoluţie moleculară**				
2.2 Course coordinator			**Lecturer dr. Mircea Cristina**				
2.3 Seminar coordinator			**Lecturer dr. Mircea Cristina**				
2.4. Year of study	**1**	2.5 Semester	**1**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Elective**
2.8 Code of the discipline		**BME1115**					

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	**56**	Of which: 3.5 course	**28**	3.6 seminar/laboratory	**28**

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	42
Additional documentation (in libraries, on electronic platforms, field documentation)	40
Preparation for seminars/labs, homework, papers, portfolios and essays	30
Tutorship	10
Evaluations	4
Other activities:	-

3.7 Total individual study hours	126
3.8 Total hours per semester	182
3.9 Number of ECTS credits	7

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competencies	

5. Conditions (if necessary)

5.1. for the course	• Video projector • Online meeting platform
5.2. for the seminar /lab activities	• Participation in at least 90% of the practical work • Adequate laboratory room

6. Specific competencies acquired

Professional competencies	• Understanding the molecular mechanisms regarding the bases of heredity, the sources of genetic variability, and the evolutionary mechanisms existing in the living world • Developing the ability to use laboratory methods and techniques specific to the study of genetic material
Transversal competencies	• Developing the capacity to use genetics concepts in the interpretation of bioinformatics data in multidisciplinary contexts

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

7.1 General objective of the discipline	• Description of the molecular aspects related to trait transmission, the correlation between the genetic material and phenotype, and the evolutionary mechanisms involved
7.2 Specific objective of the discipline	• Developing the ability to understand the mechanisms underlying the genetic determination of characters • Gaining knowledge about the principles and mechanisms involved in the regulation of gene activity in prokaryotes and eukaryotes • Understanding the importance of genetic variability and its generating factors in an evolutionary context

8. Content

8.1 Course	Teaching methods	Remarks
1. Nucleic acids - structure, types, functions	• Interactive exposure • Presentation • Explanation • Practical examples • Case-study discussions	
2. DNA Replication and Recombination		
3. DNA transcription. RNA molecules and RNA processing		
4. The Genetic Code and translation		
5. Control of Gene Expression in Prokaryotes		
6. Control of Gene Expression in Eukaryotes		
7. Gene mutations and DNA repair		
8. Transposable Elements		
9. Chromosomal/genomic changes		
10. Bacterial and viral genetic systems. Bacterial conjugation and transformation.		
11. Bacterial and viral genetic Systems. Bacteriophage and transduction		
12. Gene isolation and manipulation. Generating and analysing recombinant molecules		
13. Gene isolation and manipulation. Genetic engineering		
14. Evolution of genes and traits		

Bibliography

1.Griffiths, J. F., Griffiths, A. J., Wessler, S. R., Lewontin, R. C., Gelbart, W. M., Suzuki, D. T., & Miller, J. H. (2005). An introduction to genetic analysis. Macmillan.
2.Pierce, B. A. (2012). Genetics: a conceptual approach. Macmillan.
3.Robinson, T. R. (2010). Genetics for dummies. John Wiley & Sons.
4.Watson, J. D. (2004). Molecular biology of the gene. Pearson Education India.
5.Khanna, P. (2010). Essentials of genetics. IK International Pvt Ltd.

8.2 Seminar / laboratory	Teaching methods	Remarks

Practical work: Bacterial conjugation	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
Practical work: *In vitro* DNA amplification – PCR		
Practical work: Obtaining recombinant DNA molecules		
Practical work: Bacterial transformation		
Practical work: Regulation of gene expression in prokaryotes. Blue-white screening		

Bibliography

1. Green, M. R., & Sambrook, J. (2019). Screening bacterial colonies using X-Gal and IPTG: α-Complementation. Cold Spring Harbor Protocols, 2019(12), pdb-prot101329.
2. Birge, E. A. (2000). Conjugation and the Escherichia coli Paradigm. In Bacterial and Bacteriophage Genetics (pp. 341-371). Springer, New York, NY.
3. Innis, M. A., Gelfand, D. H., Sninsky, J. J., & White, T. J. (Eds.). (2012). PCR protocols: a guide to methods and applications. Academic press.
4. Glick, B. R., & Patten, C. L. (2017). Molecular biotechnology: principles and applications of recombinant DNA (Vol. 34). John Wiley & Sons.
5. Chen, I., & Dubnau, D. (2004). DNA uptake during bacterial transformation. Nature Reviews Microbiology, 2(3), 241-249.

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 present in the curriculum of many universities in the world.
- The course allows for developing fundamental knowledge in evolutionary biology theories and laboratory techniques for generating, processing, and understanding genetic and genomic information needed for advanced bioinformatics analysis in pharmaceutical/biotechnology industries or at academic and biomedical research institutes.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.1 Course	Know concepts and methods from the domain of data mining and knowledge discovery	Research report and presentation	50%
10.2 Seminar/lab activities	Apply data mining techniques in real problems	Project implementation and presentation	50%
Minimum performance standards			
Each student should obtain minimum 5 for the research report and for the final grade. In order to obtain the minimum grade 5, the student must demonstrate the mastery of the basic concepts of data preparation in order to analyze them.			

Date Signature of course coordinator Signature of seminar coordinator
10.07.2024 **Lect. Dr. Cristina Mircea** **Lect. Dr. Cristina Mircea**

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