SYLLABUS

Genetics and molecular evolution

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 (English)/ Biologist
1.7. Form of education	Full time

2. Information regarding the discipline

2.1. Name of the discipline	Genetics and molecular evolution					Discipline code	BME1115
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. 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	56	of which: 3.5 course	28	3.6 seminar/laborator	28
Time allotment for individual study (ID) and self-study activities (SA)					**hours**
3.5.1. Learning using manual, course support, bibliography, course notes (SA)					42
3.5.2. Additional documentation (in libraries, on electronic platforms, field documentation)					40
3.5.3. Preparation for seminars/labs, homework, papers, portfolios and essays					30
3.5.4. Tutorship					10
3.5.5. Evaluations					4
3.5.6. 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/essential 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	2hrs
2. DNA Replication and Recombination		2hrs
3. DNA transcription. RNA molecules and RNA processing		2hrs
4. The Genetic Code and translation		2hrs
5. Control of Gene Expression in Prokaryotes		2hrs
6. Control of Gene Expression in Eukaryotes		2hrs
7. Gene mutations and DNA repair		2hrs
8. Transposable Elements		2hrs
9. Chromosomal/genomic changes		2hrs
10. Bacterial and viral genetic systems. Bacterial conjugation and transformation.		2hrs
11. Bacterial and viral genetic Systems. Bacteriophage and transduction		2hrs
12. Gene isolation and manipulation. Generating and analysing recombinant molecules		2hrs
13. Gene isolation and manipulation. Genetic engineering		2hrs

14. Evolution of genes and traits		2hrs
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
1. Procedures, equipment use, and safety considerations for molecular biology laboratory.	Interactive exposure Explanation Conversation Didactical demonstration Individual practical work	2hrs
2. DNA isolation - methodology investigation.		2hrs
3. DNA isolation – practical work. Calculation of DNA concentration and purity assessment.		2hrs
4. *In vitro* DNA amplification - PCR technique: the principle and components of the cyclic reaction.		2hrs
5. *In vitro* DNA amplification – practical work.		2hrs
6. Fragment DNA isolation techniques – methodological aspects.		2hrs
7. Fragment DNA isolation techniques – practical work (agarose gel electrophoresis).		2hrs
8. Obtaining recombinant DNA molecules – methodology investigation.		2hrs
9. Obtaining recombinant DNA molecules – practical work.		2hrs
10. Bacterial transformation – methodological aspects.		2hrs
11. Bacterial transformation – practical work.		2hrs
12. Regulation of gene expression in prokaryotes – methodological aspects.		2hrs
13. Regulation of gene expression in prokaryotes – practical work: Blue-white screening.		2hrs
14. Molecular data interpretation and presentation		2hrs
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. 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

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 domain of data mining and knowledge discovery	Exam	50%
10.5 Seminar/laboratory	Apply data mining techniques in real problems	Practical project implementation and presentation	50%
10.6 Minimum standard of performance			
• 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.			

11. Labels ODD (Sustainable Development Goals)

Not applicable

Date:
20.01.2025

Signature of course coordinator

Lect. Dr. Cristina Mircea

Signature of seminar coordinator

Lect. Dr. Cristina Mircea

Date of approval:

Signature of the head of department

Assoc. Prof. Dr. Beatrice Kelemen