SYLLABUS

Structure and evolution of genome

Academic 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, 4 semesters
1.6. Study programme/Qualification	Molecuar Biotechnology/ Biologist
1.7. Form of education	Full-time

2. Information regarding the discipline

2.1. Name of the discipline	**Structure and evolution of genome**					Discipline code	**BME1202**
2.2. Course coordinator					Prof. Horia Leonard Banciu, PhD		
2.3. Seminar coordinator					Lect. Laura Ioana Pîtraş, PhD		
2.4. Year of study	1	2.5. Semester	2	2.6. Type of evaluation	E	2.7. Discipline regime	Mandatory

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

3.1. Hours per week	**4**	of which: 3.2 course	**4**	3.3 seminar/laboratory	**4**
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**
Learning using manual, course support, bibliography, course notes (SA)					28
Additional documentation (in libraries, on electronic platforms, field documentation)					24
Preparation for seminars/labs, homework, papers, portfolios and essays					24
Tutorship					16
Evaluations					4
Other activities: two-way communication with the course holder / tutor					2
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	Genetics, Bioinformatics
4.2. competencies	Basic understanding of using biological data bases and bioinformatic tools; Interpretation of biological data

5. Conditions (if necessary)

5.1. for the course	Online meeting platform Beamer, projection screen, blackboard
5.2. for the seminar /lab activities	Attendance of a minimum of 90% of seminar classes is mandatory for granting the participation at the written exam.

6.1. Specific competencies acquired [1]

Professional/essential competencies	• Ability to analyze, communicate and solve problems derived from the study of genomes; • Obtaining practical skills in the use of genomic databases and genomic analysis, applied in the investigation of different groups of organisms, including the investigation of evolutionary processes; • Ability to organize and carry out the complex laboratory activities, as researchers in laboratories/research units in the field of biotechnologies, biochemistry, cell and molecular biology, genetics.
Transversal competencies	• Ability to clearly and convincingly communicate scientific results appropriate to the level of understanding of the audience (specialists, the general public or decision-makers); • Use of theoretical notions in solving practical problems. • Ability to analyze and interpret scientific data and formulate pertinent conclusions; • Understanding the ethical implications of biological and biomedical research.

6.2. Learning outcomes

Knowledge	The student knows: • the fundamental principles of the organization and evolution of viral, prokaryotic, and eukaryotic genomes, including organellar genomes. • modern strategies for sequencing, annotation, and functional investigation of genomes, with an emphasis on applications in biotechnology and biomedicine.
Skills	The student is able to: • analyze and interpret genomic results using biological databases and bioinformatics tools for the study of genome evolution. • apply experimental and computational methods to investigate the structure, variability, and expression of genomes in different biological systems.
Responsibility and autonomy:	The student has the ability to work independently to obtain: • developing and presenting scientific presentations on topics of evolutionary genomics, based on specialized literature and case studies. • developing research projects on the evolutionary mechanisms of genomes, integrating sequencing methods and the interpretation of integrated analyses of molecular biology and bioinformatics.

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

7.1 General objective of the discipline	• In-depth understanding of the technologies, principles, and fundamental concepts underlying the investigation, organization, function, and evolution of viral, prokaryotic, and eukaryotic genomes (organellar and nuclear).
7.2 Specific objective of the discipline	• Knowledge of sequencing strategies and functional investigation of genomes. • Understanding the role of genomics in biomedical, environmental, medical, and biotechnological scientific research. • Understanding the general structural characteristics and natural evolutionary mechanisms of viral, prokaryotic, and eukaryotic genomes.

8. Content

8.1 Course	Teaching methods	Remarks
Genes and genomes: the evolution of concepts and their current meaning.	Frontal lecture; discussion.	2 hrs

[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.

Principles of genomic analysis; genome projects and genome databases; Sequencing strategies for genes and whole genome: principles, applications and limitations	Frontal lecture; discussion; problem solving.	4 hrs
Functional genomics by transcriptomics, proteomics, and epigenomics	Frontal lecture; discussion; case study.	2 hrs
Structure and evolution of viral genomes	Frontal lecture; discussion; case study.	4 hrs
Structure and evolution of prokaryotic genomes	Frontal lecture; discussion; problem solving.	4 hrs
Structure and evolution of organellar (mitochondrial and plastid) genomes	Frontal lecture; discussion; problem solving.	4 hrs
Structure, evolution and characteristics of nuclear genomes in eukaryotes	Frontal lecture; discussion; problem solving.	4 hrs
The human genome compared to other vertebrate genomes. Evolution of eukaryotic genomes	Frontal lecture; discussion; case study.	4 hrs
Bibliography Bernardi, G. Structural and Evolutionary Genomics. Natural Selection in Genome Evolution, Elsevier, Amsterdam, 2005. Caetano-Anolles Gustavo, Evolutionary genomics and systems biology. Hoboken, N. J. : Wiley-Blackwell, 2010. Craig N.L., Cohen-Fix O., Green R., Molecular biology : principles of genome function. Oxford University Press, 2010. Gregory T. R., The evolution of the genome. Elsevier Academic Press, Amsterdam, 2005. Lesk A.M., Introduction to genomics. Oxford : Oxford University Press, 2017 Lynch, M. The origins of Genome Architecture, Sinauer Assoc., Sunderland, 2007. Mülhardt, Cornel, Molecular biology and genomics. Academic Press, Amsterdam, 2007 Watson J.D., Baker T.A., Bell S.P., Molecular biology of the gene. Cold Spring Harbor Laboratory Press, 2008 Slides (pdf / pptx) are provided to the students through the dedicated team channel within MS Teams application.		
8.2 Seminar / laboratory	Teaching methods	Remarks
Organizing and introducing seminar tasks	Discussion	2 hrs
Presenting an individually assigned topic (case study, methodologies, evolutionary mechanisms of the viral, prokaryotic, fungal, plant and animals genomes).	Eurystic conversation; discussion, problem solving.	22 hrs
Session for making up missed activities (week 11 or 13)		2 hrs
Evaluation of an essay written based on the gained knowledge during seminars	Evaluation	2 hrs
Bibliography Scientific papers (as pdf) available through the University librairies as open access or paid online subscription to main publishers.		

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 has a similar contents to the courses in other European universities and takes into account the level of training of the students;
- The course is fundamental for the development of work skills in research laboratories and/or in biotechnological research units.

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	Knowledge of information from the topics of the course	Written exam	40 %
	Accuracy, coherence, and organization of responses. The ability to analyze and interpret.		

10.5 Seminar/laboratory	Skills to understand and synthesize scientific information.	Written colloquium	20%
	Accuracy, coherence, and organization of responses.		20%
	Skills for presenting/ communicating scientific information		20%
10.6 Minimum standard of performance			
• A minimum grade of 5 (five) on the written exam and at least 5 (five) for the overall course average. • Completion of at least one essay on an individually assigned topic. • Completion of at least one presentation on an individually assigned topic.			

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

	General label for Sustainable Development							
								
								

Date:
08.01.2025

Signature of course coordinator

Prof. Horia Banciu, PhD

Signature of seminar coordinator

Lect. Ioana Pătraș, PhD

Date of approval:
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Signature of the head of department

Assoc. 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.*”.