

**SYLLABUS**  
**GENOME STRUCTURE AND EVOLUTION**  
**ACADEMIC YEAR 2024-2025**

**1. Information regarding the programme**

1.1 Higher education institution	<b>Babeş-Bolyai University</b>
1.2 Faculty	<b>Faculty of Biology and Geology</b>
1.3 Department	<b>Department of Molecular Biology and Biotechnology</b>
1.4 Field of study	<b>Biology</b>
1.5 Study cycle	<b>Master, 4 semesters</b>
1.6 Study programme / Qualification	<b>Molecular Biotechnology/ Biologist</b>

**2. Information regarding the discipline**

2.1 Name of the discipline (En) (Ro)	<b>Genome Structure and Evolution</b> <b>Structura și evoluția genomului</b>						
2.2 Course coordinator	<b>Prof. Horia BANCIU, PhD</b>						
2.3 Seminar coordinator	<b>Lecturer Ioana PĂTRAȘ, PhD</b>						
2.4 Year of study	1	2.5 Semester	2	2.6. Type of evaluation	E	2.7 Type of discipline	C
2.5. Code of the discipline	<b>BME1202</b>						

*E – Written exam; C – Compulsory.*

**3. Total estimated time** (hours/semester of teaching 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					30
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: .....					
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	<ul style="list-style-type: none"> <li>• Molecular genetics, Molecular and cell biology, Microbiology.</li> </ul>
4.2 competencies	<ul style="list-style-type: none"> <li>• Basic understanding of using biological data bases and bioinformatic tools;</li> <li>• Interpretation of biological data</li> </ul>

**5. Conditions** (if necessary)

5.1. for the course	<ul style="list-style-type: none"> <li>• Online meeting platform</li> <li>• Beamer, projection screen, blackboard</li> </ul>
5.2. for the seminar /lab activities	<ul style="list-style-type: none"> <li>• Attendance of a minimum of 90% of seminar classes is mandatory for granting the participation at the written exam.</li> </ul>

## 6. Acquired specific competencies

<b>Professional competencies</b>	<ul style="list-style-type: none"> <li>• Ability to analyze, communicate and solve problems derived from the study of genomes;</li> <li>• 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;</li> <li>• 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.</li> </ul>
<b>Transversal competencie</b> SS	<ul style="list-style-type: none"> <li>• Ability to clearly and convincingly communicate scientific results appropriate to the level of understanding of the audience (specialists, the general public or decision-makers);</li> <li>• Use of theoretical notions in solving practical problems.</li> <li>• Ability to analyze and interpret scientific data and formulate pertinent conclusions;</li> <li>• Understanding the ethical implications of biological and biomedical research.</li> </ul>

## 7. Objectives of the discipline (resulting from the table of acquired competencies)

7.1 General objective of the discipline	<ul style="list-style-type: none"> <li>• The course aims to provide master students with an in-depth understanding of the fundamental principles and concepts underlying the organization, function, and evolution of prokaryotic, eukaryotic and organelle genomes.</li> </ul>
7.2 Specific objectives	<ul style="list-style-type: none"> <li>• Understanding the organization and structure of genomes: Students should be able to describe the different levels of organization of genomes, from nucleotide sequences to chromosomes,</li> <li>• Learning about genome sequencing and annotation: Students should be able to describe the techniques used for genome sequencing and annotation and understand challenges and limitations of these approaches;</li> <li>• Understanding genome evolution: Students should be able to describe the mechanisms of genome evolution, including mutations, recombination, horizontal gene transfer, gene duplication, exon-shuffling, etc., and understand how these mechanisms contribute to genome diversity and adaptation;</li> <li>• Learning about comparative genomics: Students should be able to compare and analyze genomes across different species, and understand how comparative genomics can provide insights into genome function, evolution, and biodiversity.</li> <li>• Understanding the role of genomics in medicine and biotechnology: Students should be able to describe the applications of genomics in medicine, including genomic medicine and personalized medicine, and in biotechnology, including genetic engineering and synthetic biology</li> </ul>

## 8. Contents

8.1 Curs	Teaching methods	Observations
Genes and genomes: the evolution of concepts and their current meaning.	Frontal lecture; discussion.	2 hrs
Principles of genomic analysis; genome projects and	Frontal lecture; discussion;	6 hrs

genome databases; Sequencing strategies for genes and whole genome: principles, applications and limitations	problem solving.	
Functional genomics by transcriptomics and proteomics	Frontal lecture; discussion; case study.	4 hrs
Epigenetics: causes and mechanisms of epigenetic changes; epigenomic approaches	Frontal lecture; discussion; case study.	2 hrs
Structure and evolution of viral genomes	Frontal lecture; discussion; case study.	2 hrs
Structure and evolution of prokaryotic genomes	Frontal lecture; discussion; problem solving.	4 hrs
Structure and evolution of mitochondrial and plastid genomes	Frontal lecture; discussion; problem solving.	2 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.	2 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.

<b>8.2 Seminars / laboratory</b>	Teaching methods	Observations
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**

(1) Scientific papers (as pdf) available through the University libraries 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

Tip activitate	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Pshare in the final grade (%)
10.1 Course	Knowledge of information from the topics of the course	Written exam	40 %
10.2 Seminars/laboratory	Skills to understand and synthesize scientific information.	Conceiving and writing an essay on the topic of the course	30 %
	Skills for presenting/communicating scientific information	Oral presentation of a scientific paper by Powerpoint or similar presentation app	30%
10.3 Minimum performance standards			
<ul style="list-style-type: none"> <li>• A minimum grade of 5 (five) on the written exam and at least 5 (five) for the overall course average.</li> <li>• Completion of at least one essay on an individually assigned topic.</li> <li>• Completion of at least one presentation on an individually assigned topic.</li> </ul>			

Date

**12.07.2024**

Signature of course coordinator

**Prof. Horia BANCIU, PhD**

Signature of seminar coordinator

**Lecturer Laura PĂTRAȘ, PhD**

Date of approval by Department

**16.07.2024**

Signature of Head of Department

**Assoc. Prof. Beatrice KELEMEN, PhD**