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)	**Bioinformatic methods for microbial genomics and transcriptomics** **Metode bioinformatice pentru genomica și transcriptomica microorganismelor**					
2.2 Course coordinator	**Lecturer Baricz Andreea Ionela, PhD** **Abrudan Monica, PhD**					
2.3 Seminar coordinator	**Lecturer Baricz Andreea Ionela, PhD** **Abrudan Monica, PhD**					
2.4. Year of study	**2**	2.5 Semester	**3**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**Elective**
2.8. Code of the discipline	**BME1135**					

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	24
Additional documentation (in libraries, on electronic platforms, field documentation)	18
Preparation for seminars/labs, homework, papers, portfolios and essays	16
Tutorship	8
Evaluations	4
Other activities:	

3.7 Total individual study hours	70
3.8 Total hours per semester	126
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1. curriculum	• Cell and molecular biology, Genomics and functional genomics
4.2. competencies	• Average computer skills; basic skills in Linux and Unix OS.

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, • Computers, specific development environment

6. Specific competencies acquired

Professional competencies	• Ability to explain the phenotype (including pathogenity), diversity and physiology of microorganisms in an environmental and infectious context; • Ability to analyse and interpret microbial genomics and transcriptomics data using bioinformatics tools. • Skills in querying public genomic databases to perform microbial population-wide data analyses. • Capacity for analysis, synthesis and communication of specialized scientific information.
Transversal competencies	• Acquiring the necessary / complementary information to assimilate the content of the disciplines of Molecular Taxonomy, Biological and System Networks, Applied Genomics in Human Health and Individual Bioinformatics Project. • Using the specific concepts of genomics and transcriptomics for data analysis, interpreting the results in solving theoretical and experimental problems on the diversity, adaption and pathogenicity of microorganisms.

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

7.1 General objective of the discipline	• Description of the structure, organization and functioning of microbial (viral, prokaryotic and eukaryotc) genomes in the cellular context, under the effect of changes in environmental factors, the interaction between microorganisms and between host and host-dependent microorganisms.
7.2 Specific objective of the discipline	• Gaining knowledge of the main characteristics of microbial (viral, prokaryotic, yeast and protists) genomes; • Understanding the microbial diversity through genomic perspective; • Understanding the genomic structure of infectious agents, using relevant examples; • Using genomic next generation sequencing data is to track the outbreaks and spread of bacterial diseases; • Applying genomic analyses in tackling antimicrobial resistance, focusing on the analysis of strains, genes and vehicles; • Applying genomic and transcriptomic analyses to infer the microbial response to environmental stress.

8. Content

8.1 Course	Teaching methods	Remarks
Molecular diversity of viruses, prokaryotes, yeasts and protists. The tree of life.	• Interactive exposure • Presentation • Explanation • Practical examples • Case-study discussions	
Prokaryotic genomes: sequencing, assembly, annotation, molecular phylogeny, comparative genomics and phylogenomics. Metagenomics.		
Next Generation Sequencing data of bacterial genomes. Data gathering, quantity control, data analysis and interpretation. Real-world use cases		
Mechanisms of prokaryotic genome evolution.		
The human microbiome		
Genetic and genomic mechanisms of microbial adaption and resistance –theory and case-studies.		
Pathogen genomics		
Microbial transcriptomics: RNA-Seq, annotation and quantification of microbial transcripts, and gene expression profiling in prokaryotes		

Bibliography
1. Lesk A.M., Introduction to genomics. Oxford : Oxford University Press, 2017
2. Madigan M.T., Martinko J.M., Bender K.S., Brock biology of microorganisms. Boston ; Columbus ; Indianapolis ; [etc.] : Pearson, 2015.
3. McArthur J.V., Microbial ecology : an evolutionary approach. Amsterdam ; Boston ; Heidelberg ; [etc.] : Elsevier : Academic Press, 2006
4. Zhou J., Thompson D.K., Xu Y., Tiedje J.M., Microbial functional genomics. Hoboken, N.J. : Wiley-Liss, 2004

All references listed above are available in printed format at the libraries of the Faculty of Biology and Geology.

8.2 Seminar / laboratory	Teaching methods	Remarks
Molecular identification by taxonomy marker gene analysis	• Interactive exposure • Explanation • Conversation • Practical demonstration • Study cases	
Genomic analysis of non-pathogens: data acquisition, analysis, visualization and interpretation.		
Transcriptomic analysis in prokaryotes.		
Pathogen genomics: UNIX refresher, acquisition, analysis, visualization and interpretation of data. Case studies for genomic investigation of infectious epidemics.		
Final evaluation of an individual project on the topic of the course	• Evaluation	

Bibliography
1. Rochelle P.A., Environmental molecular microbiology : protocols and applications. Norfolk : Horizon Scientific Press, 2001.
2. Electronic resources, databases and bioinformatics tools available online

Reference (1) is available in printed 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 promotes the gaining of theoretical knowledge and practical skills required for teamwork in the field of research and development in academic entities, research medical institutes but also in R&D units in private 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	Knowledge of concepts and methods from the topics of the course	Written colloquium (combined test)	50%

10.5 Seminar/lab activities	Evaluation of a short individual project in the topic of the course	Oral colloquium	50%
10.6Minimum performance standards			
Each student should obtain minimum 5 (out of maximum 10) at the written exam and oral colloquium. In order to obtain the minimum grade 5 (out of maximum 10), the student must demonstrate the mastery of the basic concepts described during the course and practicum classes.			

Date   Signature of course coordinator   Signature of seminar coordinator

16.01.2023   **Lect. Andreea Baricz, PhD**   **Lect. Andreea Baricz, PhD**

                        Monica Abrudan, PhD   **Monica Abrudan, PhD**

Date of approval   Signature of the head of department

20.01.2023   **Assoc. Prof. Beatrice Kelemen**