

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 bioinformaticice pentru genomica și transcriptomica microorganismelor						
2.2 Course coordinator	Prof. Banciu Horia, PhD Abrudan Monica, PhD						
2.3 Seminar coordinator	Abrudan Monica, PhD						
2.4. Year of study	2	2.5 Semester	3	2.6. Type of evaluation	E	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	<ul style="list-style-type: none"> Cell and molecular biology, Genomics and functional genomics
4.2. competencies	<ul style="list-style-type: none"> Average computer skills; basic skills in Linux and Unix OS.

5. Conditions (if necessary)

5.1. for the course	<ul style="list-style-type: none"> Beamer Online meeting platform
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5.2. for the seminar /lab activities	<ul style="list-style-type: none"> • Attendance of a minimum of 90% of practical/ seminar classes, • Computers, specific development environment
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6. Specific competencies acquired

Professional competencies	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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 <ol style="list-style-type: none"> 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 <p>All references listed above are available in printed format at the libraries of the Faculty of Biology and Geology.</p>		
8.2 Seminar / laboratory	Teaching methods	Remarks
Introduction to the seminar: organization and tasks	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Practical demonstration • Study cases 	
Exercises on: Introduction to Sequencing; Sequencing QC; Read Alignment; Genome Assembly; Assembly method comparison; Genome visualisation tools Typing, AMR databases Genome Annotation, PathogenWatch Phylogenetics, Surveillance		
Study cases (for example, genomes of <i>S. aureus</i> ; analysis tools like Galaxy or Jupyter notebooks)		
Final evaluation of an individual project on the topic of the course	<ul style="list-style-type: none"> • Evaluation 	
Bibliography <ol style="list-style-type: none"> 1. Rochelle P.A., Environmental molecular microbiology : protocols and applications. Norfolk : Horizon Scientific Press, 2001. 2. Electronic resources, databases and bioinformatics tools available online <p>Reference (1) is available in printed format at the libraries of the Faculty of Biology and Geology.</p>		

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

<ul style="list-style-type: none"> • 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.
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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 exam (combined test)	50%
10.5 Seminar/lab activities	Knowledge on analyzing and interpreting biological data	Evaluation of individual assignment	50%
10.6 Minimum 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

16.07.2024

Prof. Banciu Horia, PhD

Monica Abrudan, PhD

Monica Abrudan, PhD

Date of approval

Signature of the head of department

16.07.2024

Assoc. Prof. Beatrice Kelemen, PhD