

## SYLLABUS

### 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</b>
1.6 Study programme / Qualification	<b>Bioinformatics applied in life sciences</b>

### 2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)	<b>Metabolomics</b> <b>Metabolomică</b>		
2.2 Course coordinator	<b>Lecturer Sesărman Viorica Alina, PhD</b>		
2.3 Seminar coordinator	<b>Lecturer Licărete Emilia, PhD</b>		
2.4. Year of study	<b>2</b>	2.5 Semester	<b>3</b>
2.6. Type of evaluation	<b>C</b>	2.7 Type of discipline	<b>Elective</b>
2.8. Code of the discipline	<b>BME1134</b>		

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

3.1 Hours per week	<b>4</b>	Of which: 3.2 course	<b>2</b>	3.3 seminar/laboratory	<b>2</b>
3.4 Total hours in the curriculum	<b>56</b>	Of which: 3.5 course	<b>28</b>	3.6 seminar/laboratory	<b>28</b>
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"> <li>Statistics, Biochemistry, Genomics and functional genomics</li> </ul>
4.2. competencies	<ul style="list-style-type: none"> <li>Average computer skills</li> </ul>

### 5. Conditions (if necessary)

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

### 6. Specific competencies acquired

<b>Professional competencies</b>	<ul style="list-style-type: none"> <li>• Development of the ability to use concepts and terms that are specific to metabolomic techniques and data processing;</li> <li>• Knowledge of using techniques for targeted and untargeted metabolite discovery and downstream data processing and visualization;</li> <li>• Development of the capacity for analysis, synthesis and communication of specialized scientific information</li> </ul>
<b>Transversal competencies</b>	<ul style="list-style-type: none"> <li>• Acquiring the information required for the assimilation of the content of the Proteomics, Transcriptomics, Applied genomics in human health, Individual bioinformatics project disciplines.</li> <li>• Using the specific concepts of metabolomic analysis to interpret the results or solve theoretical and experimental problems of metabolite discovery and characterization.</li> </ul>

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

7.1 General objective of the discipline	<ul style="list-style-type: none"> <li>• Description of analytical methods and downstream data processing, integration and visualization for quantitation and identification of metabolites from living cells and tissues.</li> </ul>
7.2 Specific objective of the discipline	<ul style="list-style-type: none"> <li>• Description of main metabolomics techniques, data acquisition and processing strategies;</li> <li>• Understanding the principles underlying the metabolic fluxes and metabolic networks in living cells;</li> <li>• Knowledge of main databases for metabolomics;</li> <li>• Applying bioinformatics tools for targeted and untargeted metabolomic data processing and visualization.</li> </ul>

## 8. Content

8.1 Course	Teaching methods	Remarks
Metabolomics definition, aims and applications	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Presentation</li> <li>• Explanation</li> <li>• Practical examples</li> <li>• Case-study discussions</li> </ul>	
Targeted metabolomics (lipidomics, glycomics, and metabolite identification). Databases.		
Untargeted metabolomics. Aims and approaches.		
Overview of metabolic fluxes in microbial, plant and animal cells.		
Genome-scale metabolic networks		
Metabolomics for metabolite discovery, pre-clinical tests and clinical diagnostics –case studies		
Multi-omics data integration		

### Bibliography

1. Issaq, H. J, Proteomic and metabolomic approaches to biomarker discovery. Amsterdam : Elsevier/AP, 2013. URL: <http://www.sciencedirect.com/science/book/9780123944467> Informații minimale. URL: <https://portal.anelisplus.ro/> Acces fulltext. URL: <http://www.worldcat.org/oclc/847139875>.
2. Patrinos, G.P, Molecular diagnostics. Amsterdam : Elsevier/Academic Press, 2010. URL: <http://www.sciencedirect.com/science/book/9780123745378> Informații minimale. URL: <https://portal.anelisplus.ro/> Acces fulltext. URL: <http://www.worldcat.org/oclc/528609449>.

### Optional references:

3. Sussulini, A. (Ed.). (2017). Metabolomics: from fundamentals to clinical applications (Vol. 965). Springer. <https://www.springer.com/gp/book/9783319476551>

4. Lindon, J. C., Nicholson, J. K., & Holmes, E. (Eds.). (2007). The handbook of metabonomics and metabolomics, 1st Edition. Elsevier. <https://www.sciencedirect.com/book/9780444528414/the-handbook-of-metabonomics-and-metabolomics>

References (1, 2) are available in electronic or printed format at the „Lucian Blaga” Academic Library and libraries of the Faculty of Biology and Geology. References (3, 4) are recommended (optional) resources made available upon request.

8.2 Seminar / laboratory	Teaching methods	Remarks
Analytical methods for targeted and untargeted metabolomics. Mass and NMR spectrometry.	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Practical demonstration</li> </ul>	
Experimental design and sample preparation of biological materials.		
Databases and data acquisition for metabolomics		
Mass spectrometry data processing for metabolomics by univariate and multivariate statistical analyses.		
Data sharing, integration and visualization for metabolomics: study cases and exercises		
Genome-scale metabolic models - examples		
Evaluation of a short individual project	<ul style="list-style-type: none"> <li>• Evaluation</li> </ul>	

### Bibliography

1. Fanali, S., Liquid chromatography : applications. Burlington : Elsevier Science, 2013. URL: <http://www.sciencedirect.com/science/book/9780124158061> Informații minimale. URL: <https://portal.anelisplus.ro/> Acces fulltext. URL: <http://www.worldcat.org/oclc/827208184>.
2. Niessen W.M.A., Liquid chromatography-mass spectrometry. Boca Raton ; London ; New York : Taylor & Francis, 2006
3. Nyman S., NMR spectroscopic applications to biomedicine. Turku : Turun Yliopisto, 2001
4. Sparkman, O.D., Penton, Z., Gas chromatography and mass spectrometry : a practical guide. Amsterdam : Elsevier, 2011. URL: <http://www.sciencedirect.com/science/book/9780123736284> Informații minimale. URL: <https://portal.anelisplus.ro/> Acces fulltext. URL: <http://www.worldcat.org/oclc/713322669> .
5. Stagg, C., Magnetic resonance spectroscopy : tools for neuroscience research and emerging clinical applications. Amsterdam : Academic Press, 2013. URL: <http://www.sciencedirect.com/science/book/9780124016880> Informații minimale. URL: <https://portal.anelisplus.ro/> Acces fulltext. URL: <http://www.worldcat.org/oclc/865647250>
6. . Electronic resources, databases and bioinformatics tools available online

References (1, 4, 5) are available in electronic format at the libraries of the Faculty of Biology and Geology.

Reference (2) is available in printed format at the library of the Faculty of Chemistry and Chemical Engineering.

Reference (3) is available in printed format at the library of the Faculty of Physics

## 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, but also in R&D units in private companies;
- The course is listed 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 on the topic of metabolomics	Oral colloquium	50%
<b>10.6 Minimum performance standards</b>			
Each student should obtain minimum 5 at the written colloquium and oral colloquium. In order to obtain the minimum grade 5, 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
<b>16.01.2023</b>	<b>Lecturer Viorica Alina Sesărman, PhD</b>	<b>Lecturer Emilia Licărete, PhD</b>

Date of approval	Signature of the head of department
<b>20.01.2023</b>	<b>Assoc. Prof. Beatrice Kelemen</b>