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)			**Proteomics** **Proteomică**				
2.2 Course coordinator			**Prof. Mihășan Marius, PhD**				
2.3 Seminar coordinator			**Lect. Prof. Pătraș Laura Ioana, PhD**				
2.4. Year of study	**1**	2.5 Semeste	**2**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Elective**
2.8. Code of the discipline		**BME1125**					

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	• Statistics, Molecular Biochemistry and Biophysics, Cell and Molecular Biology
4.2. competencies	• Average skills in operating laboratory equipment; • Average computer skills.

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	• Operating with key concepts, principles and working methodologies specific to proteomics. • Identifying the importance of the structure-function relationships and its particularities applied to proteins. • Evaluating the applicability of proteomics-specific molecular analysis methods and techniques in medical, industrial and research laboratories.
Transversal competencies	• Acquiring the information necessary to assimilate the content of the disciplines of Applied Genomics in Human Health, Metabolomics and Individual Bioinformatics Project. • Using specific concepts for data analysis and interpreting the results in solving theoretical and experimental problems related to protein biology.

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

7.1 General objective of the discipline	• Description of the structural-functional relationship of proteins in the cellular context and the general stages of a proteomics experiment, from the processing of the sample to be analyzed to the acquisition and analysis of data.
7.2 Specific objective of the discipline	• To explain why and how the proteins and peptides must be fractionated before de mass-spectrometry analysis; • To describe the main components of a mass-spectrometer and the working principles; • To understand the mechanisms behind mass-fingerprinting and spectral-matching techniques for protein identification; • The students will learn various data analysis techniques and will apply these techniques for solving data mining problems using special software systems and tools.

8. Content

8.1 Course	Teaching methods	Remarks
Brief history and origin of the term proteomics. The significance of omic domains.	• Interactive exposure • Presentation • Explanation • Practical examples • Case-study discussions	
Protein vs. peptide. Structural and functional features of proteins relevant in proteomics studies. The main stages of a proteomics study.		
Protein fractionation by electrophoresis (PAGE, IEF, 2D-PAGE) and chromatography (IEX, HIC, HILIC, SEC, RPLC).		
Protein digestion - why and how? Fractionation of peptides.		
Overview of current proteomic analysis techniques: mass spectrometry, NMR, X-ray crystallography and microarray.		
Mass spectrometry for protein / peptide analysis - general principles and instruments used.		
Protein identification by mass spectrometry - mass fingerprint vs. peptide sequencing		
Analysis of protein-protein interaction networks (interactomics)		
Biomedical and pharmaceutical applications of proteomics		

Bibliography

1. Dunn M.J., From genome to proteome : advances in the practice and application of proteomics. Weinheim, Wiley-VCH, 2000
2. Issaq, H.J., Proteomic and metabolomic approaches to biomarker discovery. Amsterdam : Elsevier/AP, 2013. URL: http://www.sciencedirect.com/science/book/9780123944467 Informaţii minimale. URL: https://portal.anelisplus.ro/ Acces fulltext. URL: http://www.worldcat.org/oclc/847139875 .
3. Kahl G., The dictionary of gene technology: genomics, transcriptomics, proteomics. Weinheim, Wiley-VCH, 2001
4. Rehm H., Protein biochemistry and proteomics. Amsterdam, Academic Press, 2006
5. Tramontano A., The ten most wanted solutions in protein bioinformatics. Boca Raton, Chapman & Hall/CRC, 2005
6. Dupree E.J., Jayathirtha M., Yorkey H., Mihasan M., Petre B.A. & Darie C.C. 2020. A Critical Review of Bottom-Up Proteomics: The Good, the Bad, and the Future of This Field. Proteomes. 8: 14
7. Gu J., Bourne P.E., Structural Bioinformatics, 2nd Edition, Hoboken: Wiley-Blackwell, 2009
8. Lovric Josip, Introducing Proteomics: From Concepts to Sample Separation, Mass Spectrometry and Data Analysis. Oxford: Wiley Blackwell, 2011.

References (1, 3-5) are available in printed form at the libraries of the Faculty of Biology and Geology and at the Central University Library "Lucian Blaga" in Cluj-Napoca. Reference (2) is accessible in electronic format. References (6-8) are available in electronic format to course holders and will be made available to students.

8.2 Seminar / laboratory	Teaching methods	Remarks
Sample preparation in proteomics.	• Interactive exposure • Explanation • Conversation • Practical demonstration	
Electrophoretic separation: IEF and 2D electrophoresis, digestion and MS analysis of peptides.		
Acquisition and processing of MS data. Databases and bioinformatics strategies for proteomic analysis.		
Evaluation of an individual project on proteomics	• Evaluation	

Bibliography

1. Dunn M.J., From genome to proteome : advances in the practice and application of proteomics. Weinheim, Wiley-VCH, 2000
2. Sparkman O.D., Penton, Z., Gas chromatography and mass spectrometry : a practical guide. Amsterdam, Elsevier, 2011. URL: http://www.sciencedirect.com/science/book/9780123736284 Informaţii minimale. URL: https://portal.anelisplus.ro/ Acces fulltext. URL: http://www.worldcat.org/oclc/713322669.
3. Electronic resources, databases and bioinformatics tools available online

Reference (1, 2) are available in electronic and printed formats, respectively, at the Central University Library "Lucian Blaga" in Cluj-Napoca.

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 exam	50%
10.5 Seminar/lab activities	Evaluation of a short individual project on the topic of proteomics	Oral colloquium	50%
10.6Minimum performance standards			
Each student should obtain minimum 5 at the written exam and oral colloquium. 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
10.07.2024	**Prof. Marius Mihășan, PhD**	**Lect. Prof. Laura Pătraș, PhD**

Date of approval	Signature of the head of department
16.07.2024	**Assoc. Prof. Beatrice Kelemen**