SYLLABUS

1. Information regarding the program

1.1 Higher education institution	**"Babeș-Bolyai" University Cluj-Napoca**
1.2 Faculty	**Faculty of Biology and Geology**
1.3 Department	**Biology and Ecology Department of Hungarian Line**
1.4 Field of study	**Biology**
1.5 Study cycle	**2 years, with frequency**
1.6 Study programme / Qualification	**Medical Biology/Master of Medical Biology**

2. Information regarding the discipline

2.1 Name of the discipline	**BME6203 Medical Molecular Biology (in English)**						
2.2 Course coordinator	**dr. Jakab Endre, assistant professor**						
2.3 Seminar coordinator	**dr. Jakab Endre, assistant professor**						
2.4. Year of study	**I.**	2.5 Semester	**2.**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Ob.**

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	154	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					40
Additional documentation (in libraries, on electronic platforms, field documentation)					30
Preparation for seminars/labs, homework, papers, portfolios and essays					24
Tutorship					2
Evaluations					2
Other activities:					0

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	
4.2. competencies	

5. Conditions (if necessary)

5.1. for the course	Course room with laptop, with video projector and with necessary software (Power Point, Word), multimedia appliances, Internet.
5.2. for the seminar /lab activities	Laboratory room - mounted properly: laboratory apparatus and materials (centrifuges, thermostat, electrophoretic apparatus, spectrophotometer, thermocycler), or online, according to the legislation in force. The laboratory equipment and material are ensured for use by the Faculty of Biology and Geology.

6. Specific competencies acquired

Professional competencies	• Cognition, understanding and acquirement of the advanced concepts, theories and methods of biology as well as the adequate use of them in the professional communication.
Transversal competencies	• Ability of working in groups of life sciences researchers, ability of resolving problems and making decisions, organization of activities in a group.

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

7.1 General objective of the discipline	• The course follows the concepts, principles and methods of molecular biology while familiarizing the students with the use of these in clinical laboratories
7.2 Specific objective of the discipline	• Development of the capacity to understand the principles of the methods used in molecular biology laboratories and the currently used technologies of molecular diagnostics. • Formation of the ability of using the molecular biology technologies applied in clinic and diagnostic laboratories

8. Content

8.1 Course	Teaching methods	Remarks
• Introduction into the Molecular Biology. Definition. Basic Concepts. The Brief History of the Molecular Biology. The Structure and Functions of the Nucleic Acids. (1: 1-48, 2: 51-73, 4: 1-12, 23-37)	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours
• Isolation and Purification of Nucleic Acids. Isolation of DNA and RNA. Organic and Inorganic Isolation Methods. Solid Phase Extraction. Determination of the Purity and Concentration of the Nucleic Acids. Electrophoresis. Spectrophotometry. Fluorometry. (2: 567-570, 4: 69-86)	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours
• Separation of Nucleic Acids with Electrophoresis. Pulsed Field Gel Electrophoresis (PFGE). Polyacrylamide Gel Electrophoresis. Capillary Gel Electrophoresis. Buffer Systems. Nucleic Acid Dyes. (2: 570-574, 582-588, 4: 87-101).	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours
• Nucleic Acid Modifying Enzymes. Nucleases. Secondary Modifying Enzymes. Ligases. Restriction Endonucleases. Polymerases. Tertiary Modifying Enzymes.	• Interactive exposure • Explanation • Conversation • Didactical	2 hours

(1: 50-74, 2: 600-610).	demonstration	
• Molecular Cloning of the DNA. Creating of Recombinant DNA. Cloning, Transcription and Expression Vectors. Amplification of the Recombinant DNA. (1: 50-74, 2: 610-631)	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours
• Nucleic Acid and Proteine Hybridization Technologies. Southern Blot. Northern Blot. Western Blot. Eastern Blot. Nucleic Acid Probes. Protein Probes. Classical and Modern Detection Methods. Interpretation of the Results. (1: 50-74, 2: 590-595, 4:102-122).	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours
• Modern Hybridization Methods. Dot/Slot – Blot. Macroarray and Microarray Technologies. DNA Chip. Karyotyping. Fluorescence in situ Hybridization (FISH). Interphase and Metaphase FISH. (2: 595-598, 709-716, 4:122-127,175-183)	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours
• DNA Amplification Technologies. Polymerase Chain Reaction (PCR). Simple PCR Technology. Components of a Typical PCR Reaction. PCR Programs. Primers. Thermocyclers. PCR Modifications: multiplex-PCR, reverse transcriptase PCR, nested PCR, real time PCR. (2: 634-661, 4: 130-151).	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours
• Classical and Modern DNA Sequencing Methods. Direct Sequencing: Maxam-Gilbert and Sanger Methods. Pyrosequencing. Bisulfite Sequencing. Emulsion and Bridge PCR. Next Generation Sequencing. NGS Systems. (1:50-74, 2: 662-680, 686-690, 4:222-238).	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours
• Genomics and Proteomics. Basic Concepts. Genome Projects. Human Genome Project. Clinic Genome and Exome Sequencing. Human Proteome Project. Omics. (1: 759-826, 2: 680-686, 690-693, 4:240-244).	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours
• Isolation and Purification of Proteins. Identification and Sequencing of Proteins. (2: 717-744).	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours
• Molecular Diagnostics in Human Identification, Genetics and Oncology. Single- nucleotide Mutations (SNP). Polynucleotide Polymorphisms. RFLP Technology. STR Typing by PCR. FBI CODIS Database. Epigenetic Alterations. Single-gene Diseases: Leiden Mutation, Hemochromatosis, Cystic Fibrosis. Molecular Oncology. EGFR, K-ras, BRCA1 and BRCA2 (1: 759-826, 493-	• Interactive exposure • Explanation • Conversation • Didactical demonstration	2 hours

498, 4:249-255, 342-355).		
• Molecular Diagnostics in Bacteriology and Virusology. The Importance of Molecular Diagnostics of the Microorganisms. Sampling and Preparation of Samples. Control Processes and Quality Assurance. Melting Point. Infection Diagnostics in the Respiratory and Urinary tracts. (1: 759-826, 4:289-305)	• Interactive exposure • Conversation • Explanation • Didactical demonstration	2 hours
• Gene Therapy. Gene Attenuation and Knock-out Technologies. (1: 759-826).	• Interactive exposure • Conversation • Explanation • Didactical demonstration	2 hours

Bibliography

Obligatory bibliography:

1.Weaver, R. F.: Molecular biology, McGraw-Hill, New York, 2012 – Zoological Library, code: 18399

2. Clark, D. P.: Molecular biology, Elsevier Academic Press, New York, 2005 – Animal Physiology Library, code: 1391, Zoological Library, code: 17878

3. Sambrook, J.: Molecular cloning: a laboratory manual, Cold Spring Harbor Laboratory Press, Plainview, 1989 – Zoological Library, code: 16255

4. Buckingham, L.: Molecular Diagnostics: Fundamentals, Methods and Clinical Applications, F.A. Davis Company, Philadelphia, 2012 – Animal Physiology Library, code:1542

Optional bibliography:

1. McPherson, R. A., Pincus, M. R.: Henry's clinical diagnosis and management by laboratory methods, Elsevier Saunders, Philadelphia, 2011 – Animal Physiology Library, code: 1580

2. Weaver, R. F., Hedrick, Ph. W.: Genetika, Panem, Budapest, 2000 – Zoological Library, code: 17084.

8.2 Seminar / laboratory	Teaching methods	Remarks
Molecular Biology Laboratory Organization. Work Protection Rules and Risk Management. 1: A1.1; 2: 1).	Interactive exposure. Conversation.	2 hours
Isolation and Purification of DNA from Clinic Probes. Determination of DNA Concentration and Purity (1: 5.1, 6.1; 2: 2, 3).	Interactive exposure. Explanation Conversation. Experimental Demonstration.	8 hours
DNA Amplification Methods. PCR. Separation of DNA Fragments Using Gel electrophoresis (1: 5.1; 2: 4,5).	Interactive exposure. Explanation Conversation. Experimental Demonstration.	8 hours
Oligonucleotide Primer Design (2: 6).	Interactive exposure. Explanation Conversation. Experimental	2 hours

	Demonstration.	
Analysis of DNA Sequences. Visualization, Assembling and Identification of DNA fragments. (1: A11.1; 2: 7).	Interactive exposure. Explanation Conversation. Experimental Demonstration.	2 hours
Molecular diagnostics Seminary I.	Interactive exposure. Explanation Conversation.	2 hours
Molecular diagnostics Seminary II.	Interactive exposure. Explanation Conversation.	2 hours
Make up session/Review session.	Interactive exposure. Explanation Conversation.	2 hours

Bibliography

1. Sambrook, J.: Molecular cloning: a laboratory manual, Cold Spring Harbor Laboratory Press, Plainview, 1989 – Zoological Library, code: 16255
2. Jakab, E.: Medical Molecular Biology – Laboratory Practices, 2019

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 content of the discipline is in accordance with the contents thought in other Romanian universities and in foreign countries.

10. Evaluation

Activity type	Evaluation criteria	Evaluation Methods	Portion in the final note
Course	Verification of the theoretical knowledge	Written exam at the end of the semester	80%
Seminar/Laboratory	Verification of the practical knowledge	Written exam at the end of the semester	10%
	Evaluation of the presentations	Evaluation of the presentations during the seminary sessions.	10%
Minimal standard of the performance			
• Cognition of the basic concepts and principles, the minimal note is 5.			

Date	Signature of course coordinator	Signature of seminar coordinator
July 11, 2024	JAKAB Endre, PhD	JAKAB Endre, PhD
	Assistant Professor	Assistant Professor

Date of approval	Signature of the head of department
July 23, 2024	KERESZTES Lujza, PhD
	Associated Professor