



Nr. \_\_\_\_\_ din \_\_\_\_\_

Formular USAMV 0307010101

## SUBJECT OUTLINE

### 1. General data

|                                    |   |
|------------------------------------|---|
| 1.1. Higher Education Institution  | University of Agricultural Sciences and Veterinary Medicine |
| 1.2. Faculty                       | Faculty of Animal Science and Biotechnologies               |
| 1.3. Department                    | Department I: Fundamental sciences - Biotechnologies        |
| 1.4. Study field                   | Biotechnology   |
| 1.5. Study level <sup>1)</sup>     | Master  |
| 1.6. Specialization/ Study Program | Applied biotechnologies                                     |
| 1.7. Teaching Form                 | Full time   |

### 2. Course characteristics

|   |   |               |   |                         |              |                    |                                  |     |
|---|---|---------------|---|-------------------------|--------------|--------------------|----------------------------------|-----|
| 2.1. Name of the course                             | Multi-omics applications in biotechnology |               |   |                         |              |                    |                                  |     |
| 2.2. Course leader                                  |   |               |   |                         |              |                    | Lecturer Dr. Florina Copaciu     |     |
| 2.3. Coordinator of the laboratory/seminar activity |   |               |   |                         |              |                    | Lecturer Dr. Florina Copaciu     |     |
| 2.4. Year of study                                  | I   | 2.5. Semester | I | 2.6. Type of evaluation | Continuously | 2.7. Course regime | Content <sup>2</sup>             | AKD |
|   |   |               |   |                         |              |                    | Level of compulsory <sup>3</sup> | CD  |

### 3. Total estimated time (hours/semester for the teaching activities)

|  |     |                            |    |                                   |       |
|--|-----|----------------------------|----|-----------------------------------|-------|
| 3.1. Number of hours/week– frequency form  | 4   | of which care: 3.2. course | 2  | 3.3. seminar/ laboratory/ project | 2     |
| 3.4. Total hours in the curricula  | 56  | Of which: 3.5.course       | 28 | 3.6. seminar/laboratory           | 28    |
| <b>Distribution of time</b>  |     |                            |    |                                   | hours |
| 3.4.1. Study based on handbook, notes, bibliography                                      |     |                            |    |                                   | 50    |
| 3.4.2. Extra documentation in the library, on specific electronic platforms and on field |     |                            |    |                                   | 40    |
| 3.4.3. Prepare the seminars / laboratories / projects, theme, essays, reports, portfolio |     |                            |    |                                   | 28    |
| 3.4.4. Tutorial  |     |                            |    |                                   | 10    |
| 3.4.5. Examination   |     |                            |    |                                   | 16    |
| 3.4.6. Other activities  |     |                            |    |                                   | 0     |
| 3.7. Total hours of individual study   | 144 |                            |    |                                   |       |
| 3.8. Total hours per semester  | 200 |                            |    |                                   |       |
| 3.9. Number of ECTS <sup>4</sup>   | 8   |                            |    |                                   |       |

### 4. Pre-conditions (where is the case)

|                     |   |
|---------------------|---|
| 4.1. of curriculum  | Cellular and molecular biology, Structural biochemistry, Metabolism, Analytical chemistry, Genetics and genomics, Microbiology, Bioinformatics  |
| 4.2. of competences | -Understanding the concepts of genomics and transcriptomics.<br>-Fundamental concepts of lipid, protein, and carbohydrate biochemistry.<br>-Skills in using analytical methods (chromatography, spectroscopy).<br>-Concepts of food chemistry and nutritional biochemistry.<br>-Basics of molecular genetics and epigenetics. |



## 5. Conditions (where is the case)

|  |   |
|--|---|
| 5.1. of course development                     | The following are available for the course:<br>Textbooks: Available at the library and listed in the required bibliography.<br>Lecture notes:<br>Course materials: PowerPoint presentations.<br>Logistical support: Video projector, interactive whiteboard, and multimedia presentations.<br>Attendance at a minimum of 50% of the lectures is required in order to take the exam.   |
| 5.2. of seminar/laboratory/project development | Textbooks: Available in the university library and in the laboratory.<br>Laboratory/seminar notes: written or pptx format.<br>Location: laboratory room.<br>Laboratory equipment: laboratory glassware, ovens, calciner, rotary evaporator, pH meters, analytical balances.<br>Specialized software:<br>Specific laboratory reagents and consumables.<br>Practical work will be carried out individually or in subgroups, under the supervision and guidance of the teacher. Academic discipline and compliance with occupational safety regulations are required throughout the duration of the work.<br>Participation in 100% of the laboratory work is a prerequisite for taking the exam. |

## 6. Specific acquired competences

|                               |  |
|-------------------------------|--|
| 6.1. Professional competences | <ul style="list-style-type: none"> <li>-Using integrated omics methods (genomics, proteomics, metabolomics, etc.) in biotechnology.</li> <li>-Analyzing data from complex experiments.</li> <li>-Designing strategies for applying omics in industry and research.</li> <li>-Analysis of the structure and functions of lipids, proteins, carbohydrates, glycoproteins, glycolipids using mass spectrometry techniques and various chromatography techniques.</li> <li>-Correlating glycomic changes with biological processes and pathologies.</li> <li>-Analysis of food composition using omics approaches.</li> <li>-Application of omics in food safety and traceability.</li> <li>-Understanding how nutrients influence gene expression.</li> <li>-Identification of genetic variations that influence nutrient response.</li> <li>-Analysis of microflora composition and diversity using next-generation sequencing.</li> </ul>       |
| 6.2. Transversal competences  | <p>Applying strategies of perseverance, rigor, efficiency, and responsibility at work, punctuality, and taking responsibility for the results of personal activity, creativity, common sense, analytical and critical thinking, problem solving, etc., based on the principles, norms, and values of the professional code of ethics in the field of biotechnology.</p> <p>Applying teamwork techniques; enhancing and refining interpersonal communication and empathy skills and taking on specific tasks in group work in order to address/resolve individual/group conflicts, as well as optimal time management</p> <p>Efficient use of various learning and training methods and techniques for acquiring information from bibliographic and electronic databases in both Romanian and an international language, as well as assessing the necessity and usefulness of extrinsic and intrinsic motivations for continuing education.</p> |

## 7. Learning outcomes

|               |   |
|---------------|---|
| 7.1 Knowledge | <ul style="list-style-type: none"> <li>-The student describes the principles of omic technologies and their applications in biotechnology.</li> <li>-The student identifies and explains the classification, structure, and functions of lipids, proteins, and carbohydrates; lipidomic, proteomic, and glycomic analysis techniques.</li> <li>-The student describes omic principles and techniques applied in food analysis.</li> <li>-The student describes mechanisms by which nutrients influence gene expression.</li> <li>-The student describes genetic variability and its impact on nutritional response.</li> <li>-The student describes the principles of metabolomics, as well as the composition, diversity, and role of the microbiome.</li> </ul> |
|---------------|---|



|                                 |   |
|---------------------------------|---|
| 7.2 Skills                      | <ul style="list-style-type: none"> <li>-The student evaluates and analyzes the integrated use of omic data to develop biotechnological products or processes.</li> <li>-The student evaluates the lipid profile and interprets the data to identify biomarkers.</li> <li>-The student applies proteomic analysis methods (electrophoresis, mass spectrometry) and interprets the protein profile.</li> <li>-The student evaluates nutritional and quality markers and applies genomic tools for nutrition personalization.</li> </ul> |
| 7.3 Responsibility and autonomy | <ul style="list-style-type: none"> <li>-The student works independently on research projects and makes ethical decisions in the application of biotechnologies.</li> <li>-The student manages complex experiments and assumes responsibility for the accuracy of the results.</li> <li>-Students assume the ability to integrate proteomic data into clinical or industrial contexts with professional responsibility.</li> <li>-Students propose innovative solutions for food traceability and quality control.</li> </ul>          |

### 8. Subject Objectives (as a result of the specific acquired competences)

|                                 |  |
|---------------------------------|--|
| 8.1. Subject general objectives | <p>Complementary advanced knowledge discipline that allows the development of an integrative perspective on omics sciences and their applicability in biotechnology, health, and the food industry, through understanding the fundamental concepts and technologies used in lipidomics, proteomics, glycomics, metabolomics, nutrigenomics, and nutrigenetics, with the aim of correlating complex molecular data to identify biomarkers, optimize biological processes, and develop personalized or functional food products.</p> <p>Together with the other disciplines in the curriculum, this complementary discipline ensures the implementation and training of complex concepts regarding applications in biomedical research, the food industry, the development of advanced biotechnologies, and the understanding of the role of omic technologies in the systemic analysis of cells, organisms, or foods.</p> |
| 8.2. Specific objectives        | <p>Achieving learning outcomes that result in the development of skills and abilities based on correlating the information received with that acquired in other disciplines such as genomics, bioinformatics, and microbial biotechnology, in order to understand and apply omic technologies for the analysis of complex biological processes, the identification of biomarkers, and the development of innovative solutions in the fields of biotechnology, nutrition, and health.</p>   |



## 9. Content

| 9.1.COURSE  | Teaching methods  | Observations  |
|---|---|---|
| <p><b>Number of hours – 28</b></p> <p><b>Multi-omic applications in biotechnology</b></p> <p>1. Omic applications in biotechnology</p> <p>2. Lipidomics</p> <p>3. Proteomics</p> <p>4. Glycomics</p> <p>5. Food omics</p> <p>6. Nutrigenomics</p> <p>7. Nutrigenetics</p> <p>8. Metabolomics</p> <p>9. Microbiomics</p>   | <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p>  | <p>2 Lectures</p> <p>2 Lectures</p> <p>2 Lectures</p> <p>2 Lectures</p> <p>2 Lectures</p> <p>1 Lecture</p> <p>1 Lecture</p> <p>1 Lecture</p> <p>1 Lecture</p>   |
| <p><b>9.2. Seminar/Projects</b></p> <p><b>Number of hours – 28</b></p>  | <p>Teaching methods</p>   | <p>Observations</p>   |
| <p>1. Labor protection rules. Defining and understanding specific terms, identifying homicidal technologies - questions and answers.</p> <p>2. Immobilization of enzymes by microencapsulation.</p> <p>3. Determination of glucose, lactic acid, using biosensors.</p> <p>4. Use of antimicrobial labels and creation of bio-packaging to reduce the microbial load of fruits and foods.</p> <p>5. Determination of the inhibitory activity of biomolecules in plant tissues in cell proliferation. Study of antimicrobial activity. Quantification of metabolites.</p> <p>6. Biotech food production (jelly with bioactive compounds). Smart food design through omics technologies. Study of food formulation.</p> <p>7. Fortification of foods with active substances obtained from biotechnological processes (juices).</p> <p>8. The use of probiotic bacteria in the formulation of functional foods. Study of microcapsules with probiotics.</p> | <p>Practical work</p> <p>Practical work</p> <p>Practical work</p> <p>Practical work</p> <p>Practical work</p> <p>Practical work</p> <p>Practical work + project</p> <p>Practical work + project</p> | <p>1 Practical work</p> <p>2 Practical works</p> <p>2 Practical works</p> <p>2 Practical works</p> <p>2 Practical works</p> <p>2 Practical works</p> <p>2 Practical works + Project</p> <p>1 Practical work + project</p> |
| <p><i>Compulsory bibliography:</i></p> <ol style="list-style-type: none"> <li>1. Vodnar Dan Cristian. <i>Notiuni de Biotehnologii Alimentare. AcademicPress, ClujNapoca, 2013.</i></li> <li>2. Banu, C. (coordonator)- <i>Biotehnologii în industria alimentară, Editura Tehnică, București, 2004</i></li> <li>3. Jurcoane, Stefana (coordonator) – <i>Tratat de biotehnologie, volumul I, Editura Tehnică, București, 2004</i></li> <li>4. Jurcoane, Stefana (coordonator) – <i>Tratat de biotehnologie, volumul II, Editura Tehnică, București, 2006</i></li> </ol>   |   |   |



5. *Debmalya Barh, Vasudeo Zambare, Vasco Azevedo - Omics : applications in biomedical, agricultural, and environmental sciences, CRC Press/Taylor & Francis, 2013*
6. *Bart C. Weimer, Carolyn Slupsky - Metabolomics in food and nutrition, Woodhead Publishing Series in Food Science, Technology and Nutrition: Number 251, 2013*

Optional bibliography:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3942997/>

Nature Insight: Proteomics. Nature 422: 191-237.

#### 10. Correlations between the subject against the expectations of the epistemic community representatives, of the professional associations and employers' representatives in the domain

In order to identify ways to modernize and continuously improve the teaching and content of the courses, with the most current topics and practical problems, teachers consult the international literature.

#### 11. Evaluation

| Type of activity   | Evaluation criteria  | Evaluation methods  | Percent of the final grade |
|--|--|---------------------|----------------------------|
| <b>10.4. Course</b>  | Logical, correct and coherent application of the acquired notions                      | Written exam (grid) | 70 %                       |
| <b>10.5. Seminar/Laboratory</b>  | Acquiring professional skills;<br>Ability to analyze and interpret results;<br>Project | Project             | 30 %                       |
| <b>10.6. Minimal standard of performance</b>   |  |                     |                            |
| Mastery of scientific information transmitted through lectures and practical work at an acceptable level. Obtaining the pass mark for the ongoing checks is a condition of passing the exam. |  |                     |                            |

<sup>1</sup> level of study – to be chosen one of the following – Bachelor /Post graduate/Doctoral

<sup>2</sup> Course regime (content) - for bachelor level it will be chosen one of the following - **DF** (fundamental subject), **DD** (Subject in tech domain), **DS** (specific subject), **DC** (complementary subject).

<sup>3</sup> Course regime (compulsory level)- to be chosen one of the following – **DI** (compulsory subject)

**DO** (Optional subject) **DFac** (Facultative subject).

<sup>4</sup> One ECTS is equivalent with 25-30 de hours of study (didactical and individual study).

Filled in on  
23.09.2025

Course coordinator  
Lecturer Dr. Florina Copaciu

Laboratory work/seminar coordinator  
Lecturer Dr. Florina Copaciu

Subject coordinator  
Prof. Dr. Andrea Bunea

Approved by the  
Department on  
24.09.2025

Head of the Department  
(The department which coordinates the study program)  
Associate Professor PhD Constantinescu Radu

Approved by the  
Faculty Council on  
24.09.2025

Dean  
Professor PhD Dezmirean Daniel



No. \_\_\_\_\_ of \_\_\_\_\_

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## SUBJECT OUTLINE

### 1. Information on the programme

|                                      |  |
|--------------------------------------|--|
| 1.1. Higher education institution    | University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca |
| 1.2. Faculty                         | Faculty of Animal Science and Biotechnologies                              |
| 1.3. Department                      | Fundamental Sciences   |
| 1.4. Field of study                  | Biotechnology  |
| 1.5. Education level                 | Master   |
| 1.6. Specialization/ Study programme | Applied biotechnologies  |
| 1.7. Form of education               | Full time  |

### 2. Information on the discipline

|   |                                  |                            |      |                                   |                             |       |
|---|----------------------------------|----------------------------|------|-----------------------------------|-----------------------------|-------|
| 2.1. Name of the discipline   | <b>Microbial biotechnologies</b> |                            |      |                                   |                             |       |
| 2.2. Course coordinator   | Lecturer Adriana Urcan PhD       |                            |      |                                   |                             |       |
| 2.3. Seminar/ laboratory/ project coordinator   | Lecturer Adriana Urcan PhD       |                            |      |                                   |                             |       |
|   |                                  |                            |      |                                   | Content <sup>2</sup>        | DA    |
| 3.1. Hours per week – full time programme   | 4                                | out of which: 3.2. lecture | 2    | 3.3. seminar/ laboratory/ project |                             | 2     |
| 3.4. Total number of hours in the curriculum  | 56                               | Out of which: 3.5. lecture | 28   | 3.6. seminar/laboratory           |                             | 28    |
| <b>Distribution of the time allotted</b>  |                                  |                            |      |                                   |                             | hours |
| 3.4.1. Study based on book, textbook, bibliography and notes                                |                                  |                            |      |                                   |                             | 56    |
| 3.4.2. Additional documentation in the library, specialized electronic platforms and field  |                                  |                            |      |                                   |                             | 62    |
| 3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays | 2.5. Semester                    | 2.6. Type of evaluation    | Exam | Discipline status                 |                             | 62    |
| 3.4.4. Tutorials  |                                  |                            |      |                                   |                             | 10    |
| 3.4.5. Examinations   |                                  |                            |      |                                   |                             | 10    |
| 3.4.6. Other activities   |                                  |                            |      |                                   |                             |       |
| 3.7. Total hours of individual study  | 144                              |                            |      |                                   |                             |       |
| 3.8. Total hours per semester   | 200                              |                            |      |                                   |                             |       |
| 3.9. Number of credits <sup>4</sup>   | 8                                |                            |      |                                   |                             |       |
|   |                                  |                            |      |                                   | Compulsoriness <sup>3</sup> | DI    |

### 3. Total estimated time (teaching hours per semester)

### 4. Prerequisites (is applicable)

|                         |   |
|-------------------------|---|
| 4.1. curriculum-related | Cell Biology, General Microbiology, Genetics  |
| 4.2. skills-related     | The student must have knowledge regarding the cell organization, chemical and physiological processes carried out within the cell, the physiological characteristics of the main classes of microorganisms and their most important representatives |

### 5. Conditions (if applicable)

|                      |  |
|----------------------|--|
| 5.1. for the lecture | The course is interactive, students can ask questions regarding the content of |
|----------------------|--|



|   |   |
|---|---|
|   | lecture. Academic discipline requires compliance with the start and end of the course. We do not allow any other activities during the lecture, mobile phones will be turned off. Classroom equipped with projection system.  |
| 5.2. for the seminar/ laboratory/ project | Microbiology laboratory. During practical works, each student will develop an individual activity with laboratory materials (made available in the book that describes the laboratory work). Academic discipline is imposed throughout the course of practical works. |

## 6. Specific competences acquired

|                          |  |
|--------------------------|--|
| Professional competences | To know the specialized language. To understand the gender and species particularities in the case of microorganisms. To identify the genera and species of microorganisms by modern techniques.<br>To know the biological particularities of the selected species, of interest in biotechnological processes.<br>Biotechnological processes using microorganisms. Microfabrics: microbial production of chemicals and pharmaceuticals |
| Transversal competences  | To demonstrate the ability of study and identify different microorganisms<br>To be able to think about scientific activities regarding the involvement of microorganisms in various fields<br>To demonstrate concern about professional development by training through participation in research activities within the discipline,  |

## 7. Learning outcomes

|                                 |  |
|---------------------------------|--|
| 7.1 Knowledge                   | The student/graduate defines the biological and technological characteristics of microorganisms used in microbial biotechnologies, describes traditional and modern fermentative processes, identifies the control parameters of microbial cultures, and explains their role in obtaining products with practical value in the food and pharmaceutical industries.                     |
| 7.2 Skills                      | The student/graduate applies techniques of isolation, cultivation, optimization, and control of microorganisms of biotechnological interest, uses specific equipment for carrying out and monitoring fermentative processes, interprets data regarding the productivity and efficiency of bioprocesses, and proposes solutions for improving their performance.                        |
| 7.3 Responsibility and autonomy | The student/graduate plans and conducts experimental activities with microbial cultures under biosafety conditions, manages fermentative processes in compliance with technological and quality standards, makes decisions regarding the application of microbial biotechnologies depending on the purpose and field of use, demonstrating scientific and professional responsibility. |

## 8. Course objectives (based on the list of competences acquired)

|                               |   |
|-------------------------------|---|
| 8.1. Overall course objective | Basic notions transmission and fixation of applied microbiology necessary for the knowledge of the microorganisms involved in the biotechnological processes. Through the microbial biotechnologies the study of the microorganisms of interest in different biotechnological processes is deepened, with the highlighting of their biological particularities as well as each group physiological specific requirements. |
| 8.2. Specific objectives      | Theoretical and practical knowledge of the classes of microorganisms<br>To understand the morpho-physiological particularities of microorganisms<br>Knowledge of the main groups of microorganisms involved in biotechnological   |



|  |  |
|--|--|
|  | processes. Description of selected species used in different biotechnological processes. |
|--|--|

## 9. Content

| 9.1.LECTURE<br>Number of hours – 28  | Teaching methods                             | Notes               |
|--|--|---------------------|
|  | Lecture                                      | 1 lecture = 2 hours |
| Principles and applications of microbial biotechnologies. Biological systems used in applied biotechnologies: prokaryotic and eukaryotic microorganisms  | lecture, heuristic conversation, explanation | 1 lecture           |
| Principles of microbial biotechnologies: isolation of strains of interest and their improvement; Sources of microorganisms with applications in biotechnologies: <i>de novo</i> isolation of metabolite-producing organisms with biotechnological implications | lecture, heuristic conversation, explanation | 1 lecture           |
| Sources of microorganisms with applications in biotechnologies: the use of collections cultures cited in the specialized literature.   | lecture, heuristic conversation, explanation | 1 lecture           |
| Isolation of interest strains, propagation and preservation  | lecture, heuristic conversation, explanation | 1 lecture           |
| Methods to improve the biotechnological applications of microbial strains; Improve the strains: selection of natural variants of interest and genetic improvement of the strains of interest.  | lecture, heuristic conversation, explanation | 1 lecture           |
| Strains improvement: gene manipulation, expression systems   | lecture, heuristic conversation, explanation | 1 lecture           |
| Principles of identification and classification of the main groups of microorganisms Principles of classical taxonomy identify and classify the main groups of microorganisms.   | lecture, heuristic conversation, explanation | 1 lecture           |
| Identification and classification of microorganisms by molecular techniques  | lecture, heuristic conversation, explanation | 1 lecture           |
| Identification and classification of microorganisms by Fourier transform IR spectroscopy   | lecture, heuristic conversation, explanation | 1 lecture           |
| Useful microorganisms, saprophytes or pathogens present in food. Concepts in the application of the HCCP system  | lecture, heuristic conversation, explanation | 1 lecture           |
| Use of microorganisms in environmental biotechnologies   | lecture, heuristic conversation, explanation | 1 lecture           |



|  |  |           |
|--|--|-----------|
| Bioremediation of sites and aquifers contaminated with chemical pollutants | lecture, heuristic conversation, explanation | 1 lecture |
| Biopesticides and bioinsecticides  | lecture, heuristic conversation, explanation | 1 lecture |
| Use of microorganisms in the production of alternative energy              | lecture, heuristic conversation, explanation | 1 lecture |

|   |  |                             |
|---|--|-----------------------------|
| <b>9.2. PRACTICAL WORK</b><br><b>Number of hours – 28</b>   | Theoretical presentation of practical works  | 1 lab work (2 hours / work) |
| <i>De novo</i> isolation techniques of microorganisms used in biotechnologies   | Conversation<br><br>Demonstrative practical work and individual work in order to achieve specific skills | 1 lab work                  |
| Selection of natural variants of interest. Purification, multiplication and conservation of isolated strains  |  | 1 lab work                  |
| The testing of <i>de novo</i> isolated strains to obtain metabolites with biotechnological implications   |  | 1 lab work                  |
| Genetic improvement of strains of interest: genetic transformation  |  | 1 lab work                  |
| Identification and classification of the main groups of microorganisms by classical microbiology methods  |  | 1 lab work                  |
| Molecular techniques used in genotyping microorganisms  |  | 1 lab work                  |
| Isolation, identification and classification of microorganisms by molecular techniques  |  | 1 lab work                  |
| Quantification of the development of microorganisms by spectrophotometric techniques  |  | 1 lab work                  |
| Identification and classification of microorganisms by Fourier transform IR spectroscopy  |  | 1 lab work                  |
| Techniques for isolating and determining the number of microorganisms present in biological samples.  |  | 1 lab work                  |
| Identification of certain types of microorganisms present in biological products  |  | 1 lab work                  |
| Choice of microorganisms used in <i>in situ</i> and <i>ex situ</i> bioremediation   |  | 1 lab work                  |
| Isolation of microorganisms present in the polluted sites and characterization of the different physiological groups present.   |  | 1 lab work                  |
| The testing the ability of isolated microorganisms to degrade the pollutants tested   |  | 1 lab work                  |
| Compulsory bibliography:<br>1. Lee Yuan Kun ,2003 - Microbial biotechnology: principles and applications, World Scientific, ISBN 9812383239, 9789812383235  |  |                             |
| Optional bibliography:<br>1. Yi-Wei Tang, Charles W. Stratton- Advanced Techniques in Diagnostic Microbiology, Library of Congress Control Number: 2005935335, ISBN-10: 0-387-29741-3 e-ISBN 0-387-32892-0<br>2. Volkmar Braun and Friedrich Götz - Microbial Fundamentals of Biotechnology. DFG, Deutsche Forschungsgemeinschaft, Copyright © 2001 WILEY-VCH Verlag GmbH, Weinheim, ISBN: 3-527-30615-3<br>3. Alasdair H. Neilson and Ann-Sofie Allard, Environmental Degradation and Transformation of Organic Chemicals, CRC Press is an imprint of the Taylor & Francis Group, an informa business Boca Raton London New York |  |                             |



**10. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant stakeholders in the corresponding field**

In order to identify modern methods and continuously improving the teaching and adapting the content of the courses, with the most current topics and practical problems, chemistry and molecular biology, the teachers carry out a continuous information regarding the research in the field as well as with the new techniques available in the identification and characterization of microorganisms. This is achieved by individual study as well as by participation in specialized conferences or meetings of professional associations

**11. Assessment**

| Type of activity  | Assessment criteria  | Assessment methods              | Percentage of the final grade |
|---|--|---------------------------------|-------------------------------|
| <b>11.1. Lecture</b>  | Preparation of a report on the required topics, which will respect the scientific and academic criteria, and which will reflect the knowledge accumulated during the semester. | Oral presentation of the report | 50%                           |
| <b>11.2. Seminar/Laboratory</b>   | Scientific research project in the subject of the discipline, having part of bibliographic documentation, results and discussions, conclusions.                                | Oral presentation               | 50%                           |
| <b>11.3. Minimum performance standards</b>  |  |                                 |                               |
| Knowledge 50% of the information contained in the course.<br>Knowledge 50% of the information provided at practical work / seminar.<br>100% attendance at practical work / seminars is mandatory.<br>Attendance at 50% courses is a condition for entering the exam.<br>Knowledge of the main scientific research methods in the field of microbial biotechnologies.<br>Ability to develop an experimental protocol using available material resources.<br>The ability to apply an experimental protocol and to analyze the obtained results. |  |                                 |                               |

<sup>1</sup> Education levels- choose of the three options: Bachelor/\* Master/Ph.D.

<sup>2</sup> Discipline status (content) - for the master's level one of the options is chosen - DA (deepening discipline), DCA (advanced knowledge discipline), DPC (complementary training discipline), DS (synthesis discipline - options depending on the field).

<sup>3/</sup> Discipline status (compulsoriness)- choose one of the options – CD ( compulsory discipline) OD (optional discipline) ED ( elective discipline).

<sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

<sup>5/\*</sup> Disciplines: AK- Advanced knowledge, CT- Complementary Training, S- Synthesis

**Filled in on  
23.09.2025**

**Course coordinator  
Lecturer Adriana Urcan PhD**

**Laboratory work/seminar coordinator  
Lecturer Adriana Urcan PhD**

**Subject coordinator  
Prof. Adriana Criste PhD**

**Approved by the  
Department on  
24.09.2025**

**Head of the Department  
Assoc prof. Radu Constantinescu PhD**

**Approved by the Faculty  
Council on**

**Dean**



**UNIVERSITATEA DE ȘTIINȚE AGRICOLE ȘI MEDICINĂ VETERINARĂ CLUJ-NAPOCA**

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**24.09.2025**

**Prof. dr. Daniel S. Dezmirean**



No. \_\_\_\_\_ of \_\_\_\_\_

USAMV form 0307010103

## SUBJECT OUTLINE

### 1. Information on the programme

|                                      |  |
|--------------------------------------|--|
| 1.1. Higher education institution    | University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca |
| 1.2. Faculty                         | Animal Sciences and Biotechnologies  |
| 1.3. Department                      | Fundamental Sciences   |
| 1.4. Field of study                  | Biotechnology  |
| 1.5. Education level                 | Master   |
| 1.6. Specialization/ Study programme | Applied Biotechnologies  |
| 1.7. Form of education               | Full time  |

### 2. Information on the discipline

|   |   |               |   |                                    |            |                        |                             |    |
|---|---|---------------|---|------------------------------------|------------|------------------------|-----------------------------|----|
| 2.1. Name of the discipline                   |   | Genomics      |   |                                    |            |                        |                             |    |
| 2.2. Course coordinator                       |   |               |   | Professor Cristian-Radu SISEA, PhD |            |                        |                             |    |
| 2.3. Seminar/ laboratory/ project coordinator |   |               |   | Professor Cristian-Radu SISEA, PhD |            |                        |                             |    |
| 2.4. Year of study                            | I | 2.5. Semester | I | 2.6. Type of evaluation            | continuous | 2.7. Discipline status | Content <sup>2</sup>        | FD |
|   |   |               |   |                                    |            |                        | Compulsoriness <sup>3</sup> | CD |

### 3. Total estimated time (teaching hours per semester)

|   |     |                            |    |                                   |       |
|---|-----|----------------------------|----|-----------------------------------|-------|
| 3.1. Hours per week – full time programme   | 4   | out of which: 3.2. lecture | 2  | 3.3. seminar/ laboratory/ project | 2     |
| 3.4. Total number of hours in the curriculum  | 56  | out of which: 3.5. lecture | 28 | 3.6. seminar/laboratory           | 28    |
| <b>Distribution of the time allotted</b>  |     |                            |    |                                   | hours |
| 3.4.1. Study based on book, textbook, bibliography and notes                                |     |                            |    |                                   | 40    |
| 3.4.2. Additional documentation in the library, specialized electronic platforms and field  |     |                            |    |                                   | 30    |
| 3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays |     |                            |    |                                   | 20    |
| 3.4.4. Tutorials  |     |                            |    |                                   | 9     |
| 3.4.5. Examinations   |     |                            |    |                                   | 20    |
| 3.4.6. Other activities   |     |                            |    |                                   |       |
| 3.7. Total hours of individual study  | 119 |                            |    |                                   |       |
| 3.8. Total hours per semester   | 175 |                            |    |                                   |       |
| 3.9. Number of credits <sup>4</sup>   | 7   |                            |    |                                   |       |

### 4. Prerequisites (is applicable)

|                         |  |
|-------------------------|--|
| 4.1. curriculum-related | Genetics, Genetic engineering, English.              |
| 4.2. skills-related     | Basic knowledge of Genetics and Genetic engineering. |

### 5. Conditions (if applicable)

|   |  |
|---|--|
| 5.1. for the lecture                      | Teaching manuals: -<br>Lecture notes: Cristian-Radu Sisea.<br>Course presentation in pptx format: Cristian-Radu Sisea.<br>Logistic support: video projector, interactive whiteboard and PowerPoint presentations.<br>Participation in a minimum of 50% of courses is a condition for participation in the exam.  |
| 5.2. for the seminar/ laboratory/ project | Teaching manuals: -<br>Laboratory/ seminar notes: Cristian-Radu Sisea<br>Place of laboratory: Laboratory 3, 3rd floor, ICHAT, USAMV CN.<br>Laboratory equipment: molecular biology specific instruments.<br>Specialized software used: free-to-use tools available online.<br>Specific laboratory reagents/ supplies.<br>Participation in 100% laboratory/ seminar work is a condition for the exam participation. |



## 6. Specific competences acquired

|                              |   |
|------------------------------|---|
| 6.1 Professional competences | Development of skills necessary to perform practical activities in the field of molecular biology (Molecular Genetics and Genomics) and new technologies for manipulating genetic material. This process involves correlating the theoretical and practical fundamentals acquired in the discipline with those from Molecular Genetics and Genetic Engineering courses, aiming for application in various fields. |
| 6.2 Transversal competences  | Applying theoretical concepts to solve practical problems in genomics, transcriptomics etc. Developing the ability to utilize received information within other disciplines such as Marker-Assisted Selection, Bioinformatics, Pharmacogenomics, Metagenomics, etc.   |

## 7. Learning outcomes

|                                 |  |
|---------------------------------|--|
| 7.1 Knowledge                   | The student/graduate describes the structural and functional characteristics of animal tissues and organs, the connections between environmental factors and their proper functioning, the morphological and functional traits of pathogenic microorganisms, and the modes of transmission of various traits to offspring.   |
| 7.2 Skills                      | The student/graduate applies methods and techniques for preparing anatomical specimens, manipulate animals for experimental purposes, and have the ability to utilize cellular and molecular processes. They also develop working models that form the foundation for conducting activities in the biotechnological field related to living organisms and their interactions with the environment. |
| 7.3 Responsibility and autonomy | The student/graduate adapts anatomical specimens and work protocols for preparing histological samples, analyzing tissues and biological fluids necessary for using genetic markers in individual selection and highlighting qualitative and quantitative traits in animals, plants, and microorganisms.   |

## 8. Course objectives (based on the list of competences acquired)

|                               |   |
|-------------------------------|---|
| 7.1. Overall course objective | Advanced knowledge discipline (DCA) that allows development of competencies and the implementation and formation of complex concepts on molecular information in cutting-edge practical applications in synthetic biology, medicine, pharmacy, agriculture, animal husbandry, environmental protection, and related fields. |
| 7.2. Specific objectives      | Obtaining learning outcomes that aim in the formation of skills and abilities based on the correlation of the information received with those acquired in other disciplines such as Genetics, Molecular biology, Breeding.  |

## 9. Content

| 9.1. LECTURE<br>Number of hours – 28  | Teaching methods | Notes   |
|---|------------------|---------|
| <b>Classical genetics to modern genetics. Basic resources in Molecular Genetics</b><br>Introduction to the current field of study in Molecular Genetics and Genomics<br>Genetic databases, molecular genetic maps, and model organisms. | Lecture          | 2 hours |
| <b>Cellular structures of genetic importance</b><br>The genome of the cell. Structure of DNA in eukaryotes and prokaryotes.   | Lecture          | 4 hours |
| <b>Functions of genetic material</b><br>The new concept of gene and the functions of genetic material in the post-genomic era.  | Lecture          | 4 hours |
| <b>Mutations</b>  | Lecture          | 2 hours |
| <b>Structural genomics</b><br><i>De novo</i> deciphering of a genome and comparing a genome to a reference genome.  | Lecture          | 4 hours |
| <b>Whole genome shotgun sequencing using NGS technology and genome assembly</b>   | Lecture          | 2 hours |
| <b>Functional genomics</b><br>Annotation of genomic sequences. Computational and experimental analysis of gene function.<br>Annotation of genomic variations.   | Lecture          | 2 hours |
| <b>Comparative genomics</b><br>Practical applications of comparative genomics in fundamental and applied research   | Lecture          | 2 hours |
| <b>Genomic engineering. Introduction to the field of genome editing techniques</b>  | Lecture          | 2 hours |



| <b>9.2. PRACTICAL WORK</b>   |                |         |
|--|----------------|---------|
| <b>Number of hours – 28</b>  |                |         |
| <b>Presentation of the molecular genetics laboratory</b>   | Practical work | 2 hours |
| <b>DNA analysis techniques (PCR, Southern blotting, and microarray)</b>  | Practical work | 4 hours |
| <b>Sanger sequencing and next-generation sequencing (NGS) methods</b>  | Practical work | 4 hours |
| 454 Roche, Illumina, Ion Torrent, PacBio, Oxford Nanopore. Key elements in Next-Gen sequencing: format of sequences, quality assessment, and NGS quality evaluation indices.   |                |         |
| <b>Accessing and utilizing genomic databases (GenBank/EMBL-EBI/DBJ) and model organism databases</b>   | Practical work | 2 hours |
| <b>Tools available on NCBI (PubMed)</b>  | Practical work | 2 hours |
| <b>Using genetic databases and storing molecular information (Genes, GenBank, RefSeq, Orthologs)</b>   | Practical work | 2 hours |
| <b>Using genomic resources/instruments like Genome Browser (Genome Data Viewer, Ensembl)</b>   | Practical work | 2 hours |
| <b>Using genomic databases for identifying molecular variations (OMIM and OMIA)</b>  | Practical work | 2 hours |
| Methods for <i>in silico</i> identification of genomic and transcriptomic polymorphisms  |                |         |
| <b>Computerized analysis of experimental sequences for annotation</b>  | Practical work | 2 hours |
| Sequence alignment methods and similarity analysis between nucleotide and amino acid sequences using BLAST and its variants (Blastn, Megablast), and other specialized tools. Reading and interpreting BLAST results.  |                |         |
| <b>Using BLAST on NCBI for proteomic sequence analysis</b>   | Practical work | 2 hours |
| <b>Using BLAST tools to identify bacterial communities (Mole-BLAST)</b>  | Practical work | 2 hours |
| De novo sequencing of a genomic sequence – strategies for amplification and use of Primer-BLAST  |                |         |
| <b>Knowledge assessment</b>  | -              | 2 hours |
| <p><i>Compulsory bibliography:</i></p> <ol style="list-style-type: none"> <li>Lecture notes.</li> <li>Peter J. Russel, 2009, <i>iGenetics – A Molecular Approach</i>, Ed. Pearson International</li> <li>Shendure, Jay, and Hanlee Ji. "Next-generation DNA sequencing." <i>Nature biotechnology</i> 26.10 (2008): 1135.</li> <li>Trapnell, Cole, and Steven L. Salzberg. "How to map billions of short reads onto genomes." <i>Nature biotechnology</i> 27.5 (2009): 455-457.</li> <li>Schatz, Michael C., Arthur L. Delcher, and Steven L. Salzberg. "Assembly of large genomes using second-generation sequencing." <i>research</i> 20.9 (2010): 1165-1173.</li> <li>Garber, Manuel, et al. "Computational methods for transcriptome annotation and quantification using RNA-seq." <i>Nature methods</i> 8.6 (2011): 479-483.</li> <li>Duran, Chris, et al. "Molecular genetic markers: discovery, applications, data storage and visualisation." <i>Current Bioinformatics</i> 4.1 (2009): 1-10.</li> <li>Varshney, Rajeev K., et al. "Next-generation sequencing technologies and their implications for crop genetics and breeding." <i>Trends in biotech.</i> 27.9 (2009): 522-530.</li> </ol> <p><i>Optional bibliography:</i></p> <ol style="list-style-type: none"> <li>Brown, T.A., 2002, <i>Genomes</i>, John Wiley /Sons Inc., New York</li> <li>Griffiths, J.F., Miller J.H., Suzuki, D.T., Lewontin, C.R., Gelbart, W.M., 1993, <i>An Introduction in Genetic Analysis.</i>, Fifth Edition. W.H.Freeman and Company, New York.</li> <li>Hartwell, L. H., Hood, L., Goldberg, L.M., Ann Reynolds, Silver, Lee M., Veres, R., 2006, <i>Genetics – From Genes to Genomes</i>, McGraw Hill Comp.</li> <li>Watson, D.J., Gilman, M., Witkowski, J., Zoller, M., 1992, <i>Recombinant DNA</i>, Second Edition, W.H. Freeman and Company, New York.</li> <li>Watson, J.D., Baker, T.A, Bell, S.P, Gann, A., Levine, M., Losick, R., <i>Molecular Biology of the Gene</i>, 5th Ed., 2003, Pearson-Benjamin Cummings.</li> <li>Rampal, J.B.- 2007, <i>Microarrays – Application and Data Analysis</i>, in <i>Methods in Molecular Biology</i>, Human Press, NJ.</li> <li>Albala, J.S., Humphery-Smith, I., 2003, <i>Protein Arrays, Biochip and Proteomics-The Next Phase of Genomic Discovery</i>, Marcel Dekker Inc., Basel.</li> <li>Pierce B., 2008, <i>Genetics- A conceptual Approach</i>, Hardcover.</li> <li>Smith G., 2005, <i>The Genomics Age</i>, Amacom USA.</li> </ol> |                |         |

**10. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant stakeholders in the corresponding field**

|   |
|---|
| The course has a similar content compared with other European universities courses and takes into account the level of preparation of students. |
| The course is important/ fundamental for the development of working skills as future specialists in the graduated field.                        |

**11. Assessment**

| Type of activity     | Assessment criteria   | Assessment methods | Percentage of the final grade |
|----------------------|---|--------------------|-------------------------------|
| <b>11.1. Lecture</b> | Assessment of theoretical knowledge related to the course content | Oral examination   | 50%                           |



## UNIVERSITATEA DE ȘTIINȚE AGRICOLE ȘI MEDICINĂ VETERINARĂ CLUJ-NAPOCA

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|   |   |            |     |
|---|---|------------|-----|
| <b>11.2. Seminar/ laboratory</b>  | Assessment of theoretical knowledge related to practical work | Colloquium | 50% |
| <b>11.3. Minimum performance standards</b><br>Knowledge 50% of the information contained in the course.<br>Knowledge 50% of the information provided at practical work/ seminar.<br>100% attendance at practical work / seminars is mandatory.<br>Attendance at 50% courses is a condition for entering the exam. |   |            |     |

<sup>1</sup> Education levels- choose of the three options: Bachelor/Master/Ph.D.

<sup>2</sup> Discipline status (content)- for the undergraduate level, choose one of the options: **FD** (fundamental discipline), **DD** (domain discipline), **SD** (specialty discipline), **CD** (complementary discipline).

Discipline status (content)- for the master level, choose one of the options: **DA** (in-depth discipline), **DCA** (advanced knowledge discipline), **DPC** (complementary preparation discipline), **DS** (synthesis discipline – options depending on the domain).

<sup>3</sup> Discipline status (compulsoriness)- choose one of the options: **CoD** (compulsory discipline), **OD** (optional discipline), **ED** (elective discipline).

<sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

**Filled in on**  
23.09.2025

**Course coordinator**  
Professor Cristian-Radu SISEA, PhD

**Laboratory work/ seminar coordinator**  
Professor Cristian-Radu SISEA, PhD

**Subject coordinator**  
Professor Cristian-Radu SISEA, PhD

**Approved by the  
Department on**  
24.09.2025

**Head of the Department**  
Associate Professor Radu CONSTANTINESCU, PhD

**Approved by the  
Faculty Council on**  
24.09.2025

**Dean**  
Professor Daniel DEZMIREAN, PhD



No. \_\_\_\_\_ from \_\_\_\_\_

Form code USAMV-CN- 0311010104

## COURSE DESCRIPTION

### 1. Date despre program

|                                       |   |
|---------------------------------------|---|
| 1.1. Higher Education Institution     | University of Agricultural Sciences and Veterinary Medicine |
| 1.2. Faculty                          | Animal Sciences and Biotechnologies                         |
| 1.3. Departament                      | II Technological sciences                                   |
| 1.4. Domain of study                  | Biotechnologies   |
| 1.5. Level de studii <sup>1)</sup>    | Masters   |
| 1.6. Specialization/ Program of study | Applied Biotechnologies                                     |
| 1.7. Form of teaching                 | IF  |

### 2. Characteristics of the course

|                                    |        |                             |   |                                 |           |                    |                                  |    |
|------------------------------------|--------|-----------------------------|---|---------------------------------|-----------|--------------------|----------------------------------|----|
| 2.1. Name of the course            |        | <b>Nutritional genomics</b> |   |                                 |           |                    |                                  |    |
| 2.2. Course leader                 |        |                             |   | Lecturer dr. Mihai Iacob Bențea |           |                    |                                  |    |
| 2.3. Coordinator of the laboratory |        |                             |   | Lecturer dr. Mihai Iacob Bențea |           |                    |                                  |    |
| 2.4. Year of study                 | I<br>M | 2.5. Semester               | I | 2.6. Type of evaluation         | Summative | 2.7. Course regime | Content <sup>2</sup>             | DA |
|                                    |        |                             |   |                                 |           |                    | Level of compulsory <sup>3</sup> | DI |

### 3. Total estimated time (hours/ semester for the teaching activities)

|   |     |                       |    |                 |       |
|---|-----|-----------------------|----|-----------------|-------|
| 3.1. Number of hours/week– frequency form   | 2   | of which: 3.2. course | 1  | 3.3. laboratory | 1     |
| 3.4. Total hours in the teaching curricula  | 28  | of which: 3.5 course  | 14 | 3.6. laboratory | 14    |
| <b>Distribution of time</b>   |     |                       |    |                 | hours |
| 3.4.1. Study based on hand book, notes, bibliography                                      |     |                       |    |                 | 26    |
| 3.4.2. Extra documentation in the library, on specific electronic platforms and on field  |     |                       |    |                 | 18    |
| 3.4.3. Prepare the seminars / laboratories / projects, theme, essays, reports, portofolio |     |                       |    |                 | 18    |
| 3.4.4. Tutorial   |     |                       |    |                 | 4     |
| 3.4.5. Examination  |     |                       |    |                 | 6     |
| 3.4.6. Other activities   |     |                       |    |                 |       |
| 3.7. Total hours of individual study  | 72  |                       |    |                 |       |
| 3.8. Total hours on semester  | 100 |                       |    |                 |       |
| 3.9. Number of credits  | 4   |                       |    |                 |       |

### 4. Pre- conditions (where is the case)

|                     |   |
|---------------------|---|
| 4.1. of curriculum  | Biotechnologies in animal nutrition, Animal genetics, Genetic engineering.  |
| 4.2. of competences | The MA student must have knowledge regarding the adequate use of the specific terminology used in nutritional genomics and establishing the influence of diet and individual nutrients on genetic programming of cells and tissues. |

### 5. Conditions (where is the case)

|                            |  |
|----------------------------|--|
| 5.1. of course development | The MA student will take course notes throughout the course.<br>The course presentation is in pptx format by the course owner. Logistic support: laptop, video projector and PowerPoint presentations.<br>The lecture is interactive; the MA students can address questions regarding the content of the presentation. Also, the teacher asks questions regarding the topics presented in the lecture. The academically discipline entails that the beginning and finishing times of the lecture are kept.<br>No other activities are tolerated throughout the lecture; the mobile phones are kept |
|----------------------------|--|



|                                |   |
|--------------------------------|---|
|                                | <p>shut down or set to silent mode.</p> <p>In the case of online courses, the teaching methods are adapted.</p> <p>Participation in at least 50% of the courses is a condition for participation in the exam.</p>   |
| 5.2. of laboratory development | <p>MA student will take laboratory notes throughout the practical work.</p> <p>The places where it is held: the undergraduate student laboratory of the discipline.</p> <p>In practical works each student will acquire knowledge regarding the nutritional profile of the food and will carry out an individual activity that will comprise of identification, characterization and use of some nutrigenomics products.</p> <p>Also, the MA student will identify genes of interest for nutritional genomics: obesity genes, cancer responsible genes and the involvement of nutrigenomics in prevention of diabetes. Academically discipline is required throughout the laboratories duration.</p> <p>In the case of practical work carried out online, the teaching methods are adapted.</p> <p>Participation at 100% of the practical lessons is a condition for participation in the exam.</p> |

## 6. Specific competences gained

|                          |   |
|--------------------------|---|
| Professional competences | <p>The formation of theoretical and practical skills by correlating the information received with that acquired in the disciplines of genomics, genetics and genetic engineering.</p> <p>The training of specialists in the field of applied biotechnologies with an orientation towards the theoretical and applied aspects in the use of biotechnologies in the food, medical and legal fields.</p> <p>Development of efficient methods of using nutrigenomics products.</p> <p>Implementing laboratory techniques (DNA tests, “genetic chip” technology) in order to establish the effects of nutrients or food additives on gene expression in the human body.</p> <p>Developing more efficient methods for the treatment of some nutritional diseases using nutrigenomics.</p> <p>Obtaining learning results that allow the training of skills and practical skills in accordance with the dynamics of the field of Biotechnologies.</p> |
| Transversal competences  | <p>The use of the theoretical notions acquired during the study of the discipline in solving problems in practice, respectively, the prevention and combating of complex chronic diseases.</p> <p>Implementing and using functional genomics in evaluating the risks and benefits of the micro and macro-nutrients.</p> <p>The ability to work in a team.</p> <p>Use of specialized terminology in various contexts.</p> <p>Evaluation of the benefits of nutritional genomics on human health in compliance with the principles of professional ethics in the field.</p>   |

## 7. Learning outcomes

|                                  |   |
|----------------------------------|---|
| 7.1. Knowledge                   | <p>Master's students learn the basic concepts specific to the field of nutritional genomics, the relationships and interactions that exist between nutrients and genes, and how food affects gene function, with a view to combating diseases such as diabetes, heart disease, and cancer.</p>              |
| 7.2. Skills                      | <p>Master's students apply advanced nutritional genomics techniques, use field-specific tools, and interpret complex experimental data, integrating knowledge from various related disciplines.</p>   |
| 7.3. Responsibility and autonomy | <p>Master's students manage interdisciplinary experimental projects, ensure the quality and reproducibility of analyses of the influence of certain nutrients on the proper functioning of genes and, implicitly, on human and animal health, contributing to innovation in the field of biotechnology.</p> |



**8. The objectives of the discipline** (as a result of the specific competences gained)

|                                |  |
|--------------------------------|--|
| 8.1. Subject general objective | Discipline of deepening advanced knowledge that allows the development of knowledge regarding gene-environment interactions based on diet; gene-nutrient interactions; nutrients as modulators of gene expression; genetic variation and nutritional requirements; nutrigenomic products, etc.<br>Together with other subjects in the curriculum, it ensures the implementation and formation of complex concepts regarding how food affects the expression of genetic information in the individual and how the genetic baggage of the individual metabolizes and responds to nutrients and bioadditives. |
| 8.2. Specific objective        | Achieving learning outcomes that aim at the formation of competencies and skills that are based on the correlation of information received with those acquired in other disciplines such as genomics, bioinformatics or multi-omic applications in biotechnologies.<br>Knowing how nutrition influences homeostasis and how some strategies can be developed to prevent and treat diseases.<br>Understanding nutritional genomics tools that allow quantifying the effects of a single key nutrient on the expression profiles of thousands of genes.  |

**9. Content**

|  | Methods of teaching  | Observations   |
|--|--|--|
| <p><b>9.1.COURSE</b><br/><b>Number of hours – 14</b><br/>Defining nutritional genomics and introducing the specific terminology (metabolomics, nutrigenomics, genomics). Acquiring the specific terminology of nutrigenomics.</p> <p>Progress in formulation of optimal feeding regimes. Defining the optimal diet; lipids and specific fatty acids in diet; carbohydrates; proteins; calcium and dairy products, vitamin and mineral supplements. Impact of optimal diet on health status.</p> <p>Interaction between genes and nutritional environment. Measuring genetic and environmental factors: diet-based gene-environment interactions; gene-microorganism interactions.</p> <p>Gene-nutrient interaction in type I and II diabetes.</p> <p>Uses of the animal model. Detecting the gene interactions; polyphenols in green tea and cancer prevention; Maternal nutrition.</p> <p>Nutrients and gene expression. Direct and indirect regulation of gene expression through nutrients; Nutrients as ancestral modulators of gene expression.</p> <p>Nutritional genomics in safe and efficient assessment of food components. Nutrition and genomics convergence. Using functional genomics in assessment of risks and benefits of micro and macro-nutrients. Nutrient-nutrient interaction.</p> <p>Genetic variability and nutritional requirements.<br/>Nutrients and disease prevention. Genetic variability of</p> | <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> | <p>1 lecture</p> <p>2 lectures</p> <p>1 lecture</p> <p>1 lecture</p> <p>2 lectures</p> <p>1 lecture</p> <p>2 lecture</p> <p>2 lectures</p> |



|  |   |   |
|--|---|---|
| human populations and diet.<br><br>Ethical aspects in nutritional genomics. Benefits of nutritional genomics on human health; nutrigenomics products (probiotics, prebiotics, phytochemicals); Access to nutrigenomics.  | Lecture   | 2 lectures  |
| <b>9.2.PRACTICAL WORK</b><br><b>Number of hours – 14</b><br>Determining the nutritional profile of food expressed using the nutritional density index, caloric density index, glycemic index, antioxidant score, alkalizing or acidifying biochemical profile.<br><br>Identification, characterization and use of nutrigenomics products: probiotics, prebiotics, phytochemicals (tannins, carotenoids, flavonoids, phytoestrogens, glucosinolates).<br><br>Knowledge of the effects of organic selenium (Sel-Plex) in nutritional genomics. Determining the ARN levels using fluorescent makers in order to record the nutritional effects of Sel-Plex.<br><br>Use of the PCR technique to identify genes of interest for nutritional genomics like the genes for obesity or the genes that lead different types of cancer. Identification of the gene controlling the sensitivity to insulin (GNB3), of the gene responsible for hunger sensation (NPY) and the gene stimulating the formation of the adipose deposits (Beta 3).<br><br>Using computer to analyze the DNA sequences and identifying genes of metabolic interest (gene for obesity).<br><br>Preventive diagnosis of some specific diseases (type I and II diabetes, early obesity) and highlighting the genes responsible for this diseases.<br><br>Knowledge regarding the differentiated nutrition, according to a person's blood type. | Carrying out chemical analysis<br><br>The study of nutrigenomics products<br><br>Carrying out chemical analysis<br><br>Carrying out laboratory techniques<br><br>Carrying out computer techniques<br><br>Carrying out laboratory techniques<br><br>Nutrition study group according to a person's blood type | 2 seminars<br><br>2 seminars<br><br>2 seminars<br><br>3 seminars<br><br>2 seminars<br><br>2 seminars<br><br>1 seminar |
| <p><i>Compulsory bibliography:</i></p> <ol style="list-style-type: none"> <li>1. Simopoulos, J.M. Ordoas- Nutrigenetics and nutrigenomics, Ed. World Review of Nutrition and Dietetics, 2004.</li> <li>2. Kaput Jim, Raymond L. Rodriguez- Nutritional genomics, Ed. Wiley- Interscience, 2006.</li> <li>3. Surai P. – Selenium in nutrition and health, Ed. Nottingham University Press, 2006.</li> <li>4. Coșier Viorica – Inginerie genetică, Ed. Risoprint Cluj- Napoca, 2008.</li> <li>5. Course note</li> </ol>  |   |   |
| <p><i>Facultative bibliography:</i></p> <ol style="list-style-type: none"> <li>1. Mencinicopschi G., Nutrigenomica, Ed. Planta Romanica București, nr. 13, pg. 18, 2006.</li> <li>2. Ong E. R. T. J. – Nutritional genomics. BMJ 324, 1438 – 42, 2002.</li> <li>3. Nutriția și gena Performanță Profitabilitate- Turneul de conferințe pentru Europa , Orientul Mijlociu și Africa de Nord, Alltech 2007</li> <li>4. www.medicinalive.com</li> </ol>   |   |   |

**10. Corroboration of the subject content with the expectations of the epistemic communities representatives, of the professional associations and representatives employers in the domain**

The course has a similar content to the courses in other European universities and takes into account the level of



preparation of the master's students.

The course is important for the development of work skills as future specialists in the graduated field.

In order to modernize and improve the topics of the lecture and seminar, the teaching staff participate to international symposiums held at our country and abroad, where present themes are debated regarding the contribution of nutrigenomic products to the quality improvement of the human life.

## 11. Evaluare

| Type of activity  | 11.1. Evaluation criteria  | 11.2. Evaluation methods  | 11.3. Percent of the final grade |
|---|--|---|----------------------------------|
| <b>11.4. Course</b>   | Progress made in elaborating optimal food regimes.<br>Knowledge regarding the gene-environment and gene-nutrient interactions in the prevention of some maladies.<br>Knowledge regarding the influence of nutrients on gene expression.<br>Genetic variability and nutritional requirements.<br>Benefits of nutritional genomics on health status. | oral exam   | 70%                              |
| <b>11.5. Laboratory</b>   | Knowledge regarding the nutritional profile of food.<br>Knowledge and use of nutrigenomic products: probiotics, prebiotics, phytochemicals, organic minerals and their implications in nutrigenomics.<br>Knowledge regarding the implication of some genes in the epidemiology of certain maladies.  | A colloquy is taking place, with regard to the evaluation criteria presented. | 30%                              |
| <b>11.6. Minimal standard of performance</b>  |  |   |                                  |
| Knowing 50% of the information contained in the course is a condition for promotion.<br>Knowing 50% of the information provided in practical work is a condition for entering the exam.<br>100% attendance at practical work is mandatory.<br>50% attendance at classes is a condition for entering the exam. |  |   |                                  |

Filled in on  
23.09.2025

Course coordinator  
Lecturer dr. Mihai Iacob Bențea

Leader of the laboratory  
Lecturer dr. Mihai Iacob Bențea

Discipline coordinator  
Lecturer dr. Mihai Iacob Bențea

Approved by the  
Department on  
24.09.2025

Department manager  
Conf.dr. Cristian Ovidiu Coroian



**UNIVERSITATEA DE ȘTIINȚE AGRICOLE ȘI MEDICINĂ VETERINARĂ CLUJ-NAPOCA**

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**Approved by the  
Faculty Council on  
24.09.2025**

**Dean**

**Prof.dr. Daniel Severus Dezmirean**



Nr. \_\_\_\_\_ din \_\_\_\_\_

Form USAMV CN 0311010105

## SUBJECT OUTLINE

### 1. Information on the program

|                                       |  |
|---------------------------------------|--|
| 1.1. Higher education institution     | University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca |
| 1.2. Faculty                          | Animal Science and Biotechnologies   |
| 1.3. Department                       | Fundamental Sciences   |
| 1.4. Field of study                   | Biotechnology  |
| 1.5. Cycle of study <sup>1</sup>      | Master   |
| 1.6. Specialization / Study programme | Applied biotechnologies  |
| 1.7. Form of education                | Full time  |

### 2. Information on the discipline

|   |                               |               |   |                         |           |                        |                             |    |
|---|-------------------------------|---------------|---|-------------------------|-----------|------------------------|-----------------------------|----|
| 2.1. Name of the discipline                     | Academic Ethics and Integrity |               |   |                         |           |                        |                             |    |
| 2.2. Course coordinator                         | Professor Alina Simona Rusu   |               |   |                         |           |                        |                             |    |
| 2.3. Seminar / laboratory / project coordinator |                               |               |   |                         |           |                        |                             |    |
| 2.4. Year of study                              | I                             | 2.5. Semester | I | 2.6. Type of evaluation | Continous | 2.7. Discipline status | Content <sup>2</sup>        | UO |
|   |                               |               |   |                         |           |                        | Compulsoriness <sup>3</sup> | CD |

### 3. Total estimated time (teaching hours per semester)

#### 4. Prerequisites (is applicable)

|   |                |                               |    |                                      |       |
|---|----------------|-------------------------------|----|--------------------------------------|-------|
| 3.1. Hours per week – full time programme   | 2              | Out of which:<br>3.2. lecture | 1  | 3.3. seminar/ laboratory/<br>project |       |
| 3.4. Total number of hours in the curriculum  | 28             | Out of which:<br>3.5. lecture | 14 | 3.6. seminar/laboratory              |       |
| <b>Distribution of the time allotted</b>  |                |                               |    |                                      | hours |
| 3.4.1. Study based on book, textbook, bibliography and notes                                  |                |                               |    |                                      | 13    |
| 3.4.2. Additional documenting in the library, specialized electronic platforms and field      |                |                               |    |                                      | 10    |
| 3.4.3. Preparing seminars / laboratories / projects, subjects, reports, portfolios and essays |                |                               |    |                                      | 20    |
| 3.4.4. Tutorials  |                |                               |    |                                      | 2     |
| 3.4.5. Examinations   |                |                               |    |                                      | 2     |
| 3.4.6. Other activities   |                |                               |    |                                      | -     |
| 3.7. Total hours of individual study  | 47             |                               |    |                                      |       |
| 3.8. Total hours per semester   | 75             |                               |    |                                      |       |
| 3.9. Number of credits <sup>4</sup>   | 3              |                               |    |                                      |       |
| 4.1. curriculum-related   | Not applicable |                               |    |                                      |       |
| 4.2. skills-related   | Not applicable |                               |    |                                      |       |

#### 5. Conditions (if applicable)

|                                   |   |
|-----------------------------------|---|
| 5.1. For the lecture              | The lectures are delivered in an interactive manner, i.e. students can ask questions regarding the content. In case the lectures are delivered online, the teaching activities will be adapted accordingly to ensure maximum comprehension of the information, as well as optimal engagement in the teaching process of the students. |
| 5.2. For the seminar/ laboratory/ |   |



|         |  |
|---------|--|
| project |  |
|---------|--|

## 6. Specific competences acquired

|                          |   |
|--------------------------|---|
| Professional competences | <p>Students are expected to gain competences specific to academic ethics and academic integrity, such as critical thinking, identification of their own moral values and assertive communication.</p> <p>This course aims to enable students to develop ethical driven academic papers (seminar projects, essays, theses and dissertations) according to the latest standards in the field.</p> <p>The course will allow students to search electronic databases to identify the latest developments in the field, to manage bibliographic references and to use them in accordance with national and international laws on plagiarism.</p> |
| Transversal competences  | <ul style="list-style-type: none"> <li>• Competences related to the main of view in academic ethics and abilities to recognise and solve problems with ethical implications (moral dilemmas).</li> <li>• Ability to apply the knowledge to the writing of non-academic documents (e.g. letter of intent, bio notes, e-mails, resumes, CVs).</li> <li>• Theoretical and procedural knowledge required to understand, respect, and implement ethical codes and professional integrity, such as (but not limited to) the laws and regulations regarding plagiarism and other forms of intelectual and moral misconduct.</li> </ul>             |

## 7. Learning outcomes

|                                 |  |
|---------------------------------|--|
| 7.1 Knowledge                   | The student/graduate recognizes knowledge of ethical standards relevant to learning and research, as well as interactions within the academic community.                               |
| 7.2 Skills                      | The student/graduate applies ethical principles in preparation and presentation of all types of academic work and utilizes the officially indicated digital tools to avoid plagiarism. |
| 7.3 Responsibility and autonomy | The student/graduate upholds and promotes ethics and integrity standards throughout academic and professional activities, in accordance to national and EU legislation.                |

## 8. Course objectives (based on the list of competences acquired)

|                               |   |
|-------------------------------|---|
| 8.1. Overall course objective | This course is intended to familiarize the student with concepts and approaches in academic ethics and academic integrity. The course is compulsory for students of the first year.   |
| 8.2. Specific objectives      | <ul style="list-style-type: none"> <li>• Developing the knowledge of the main perspectives regarding ethics and academic integrity.</li> <li>• Ability to identify the values of a moral university and how students can contribute to their development and prevention of misconduct.</li> <li>• The ability to prevent different forms of plagiarism and correctly understand the guidelines for publishing scientific materials, including dissertation work.</li> </ul> |

## 9. Contents

| 9.1.Lectures<br>Number of hours – 14   | Teaching methods      | Observations<br>One lecture = one hour |
|--|-----------------------|--|
| <b>Introductory framework and presentation of ethical regulations in the academic environment - Interdisciplinary and integrative approaches</b> | Presentation/ Lecture | 2                                      |
| <b>Approaches of analyzing an ethical problem. Frameworks</b>  | Lecture               | 2                                      |



|  |   |  |
|--|---|--|
| <p><b>and benchmarks of moral evaluations. Connections to the field of specialization.</b></p> <p><b>The translation of moral values into prosocial behaviors among students</b></p> <p><b>Characteristics and values of a moral university - Institutional tools for promoting ethics and academic integrity</b></p> <p><b>Intellectual property, copyright, the concept of plagiarism and methods to avoid plagiarism</b></p> <p><b>Tools for determining the degree of originality - what does citing the source mean</b></p> <p><b>Instructions for authors in scientific publications and research ethics statements</b></p> <p><b>Final evaluation</b></p>   | <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>-</p> | <p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>1</p> <p>1 hour</p> |
| <p><i>Compulsory references:</i></p> <p>Socaciu, E., Vică, C., Mihailov, E., Gibea, T., Mureșan, V., &amp; Constantinescu, M. (2023). <i>Etică și Integritate Academică</i>. Universitatea din București. Capitolele I-IV. Accesibil online în format pdf.</p> <p>Bailey, S. (2015). <i>Academic Writing: A Handbook For International Students</i>, The forth Edition. London and New York: Routledge. Available online at: <a href="https://bowenstaff.bowen.edu.ng/lectureslides/158559278_7.pdf">https://bowenstaff.bowen.edu.ng/lectureslides/158559278_7.pdf</a></p> <p>Rusu, A.S. (2021). <i>Etică și Integritate Academică. Abordări Interdisciplinare (Manual didactic)</i>. Editura Presa Universitară Clujeană. Disponibil gratuit în format e-book.<br/> <a href="http://www.editura.ubbcluj.ro/www/ro/ebooks/authors_d.php?ida=190">http://www.editura.ubbcluj.ro/www/ro/ebooks/authors_d.php?ida=190</a></p> <p>***Codul de Etică al USAMV Cluj-Napoca <a href="https://www.usamvcluj.ro/codul-de-etica/">https://www.usamvcluj.ro/codul-de-etica/</a></p> <p>***Punctele tari de caracter și virtuți <a href="https://www.viacharacter.org/">https://www.viacharacter.org/</a></p> <p>***Turnitin Blog <a href="https://www.turnitin.com/blog/how-to-uphold-academic-integrity-in-remote-learning">https://www.turnitin.com/blog/how-to-uphold-academic-integrity-in-remote-learning</a> [1]</p> <p>***Oficiul European pentru Drepturi de Autor (2022) <a href="https://www.eucopyright.com/ro">https://www.eucopyright.com/ro</a></p> |   |  |
| <p><i>Optional references:</i></p> <p>***TED x talk Emilia Șercan – Împotriva fabricii de doctorate<br/> <a href="https://www.ted.com/talks/emilia_ercan_impotriva_fabricii_de_doctorate">https://www.ted.com/talks/emilia_ercan_impotriva_fabricii_de_doctorate</a></p> <p>***Positive Psychology Center <a href="https://ppc.sas.upenn.edu/people/martin-ep-seligman">https://ppc.sas.upenn.edu/people/martin-ep-seligman</a></p> <p>Rusu, A.S. (2020). <i>Educația bazată pe compasiune și învățarea spre comunitate (Service-Learning)</i>. Dezvoltare curriculară interdisciplinară. Ed. Presa Universitară Clujeană, ISBN 978-606-37-0865-7, 110 pagini.</p>   |   |  |

**10. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant employers in the corresponding field**

The course has a similar content compared with other European universities courses and takes into account the level of training of students.

**11. Assessment**

| Type of activity | 11.1. Assessment criteria | 11.2. Assessment methods    | 11.3. Percentage of the final grade |
|------------------|---------------------------|-----------------------------|-------------------------------------|
| <b>Lecture</b>   | Lecture attendance.       | Written exam in the form of | 100%                                |



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|  |  |  |  |
|--|--|--|--|
|  | Correct and comprehensive responses to periodic verification tests.<br>The mandatory approach and proper treatment of all subjects on the examination sheet. | an essay on a topic relevant to the bibliography and the content taught. |  |
|--|--|--|--|

**10.6. Minimum performance standards**

Knowledge 50% of the information contained in the course.

Attendance at 50% courses is a condition for entering the exam.

Acquiring the information provided at the lecture and practical sessions at a level that allows passing the designated forms of verification.

<sup>3</sup> <sup>1</sup> Cycle of studies- choose of the three options: Bachelor/Master/Ph.D.

<sup>4</sup> <sup>2</sup>Discipline status (content) - for the undergraduate level, choose one of the options: **FD** (fundamental discipline), **BD** (basic discipline), **CS** (specific disciplines-clinical sciences), **AP** (specific disciplines-animal production), **FH** (specific disciplines-food hygiene), **UO** (disciplines based on the university's options).

<sup>5</sup> <sup>3</sup>Discipline status (compulsoriness) - choose one of the options – **CD** (compulsory discipline) **OD** (optional discipline) **ED** (elective discipline).

<sup>6</sup> <sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

7

|                       |  |   |
|-----------------------|--|---|
|                       | Course coordinator<br><b>Prof. Dr. Alina S. Rusu</b> | Laboratory work/seminar coordinator<br><b>Prof. Dr. Alina S. Rusu</b> |
| Filled in on<br>..... | .....  | .....   |

Approved by the  
Department on  
.....

Head of the Department  
**Associate Prof. Dr. Radu Constantinescu**

.....

Approved by the Faculty  
Council on  
.....

Dean  
**Prof. Daniel S. Dezmirean, PhD**

.....



No. \_\_\_\_\_ of \_\_\_\_\_

USAMV form 0311010106

## SUBJECT OUTLINE

### 1. Information on the programme

|                                      |  |
|--------------------------------------|--|
| 1.1. Higher education institution    | University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca |
| 1.2. Faculty                         | Animal Sciences and Biotechnologies  |
| 1.3. Department                      | Fundamental Sciences   |
| 1.4. Field of study                  | Biotechnology  |
| 1.5. Education level                 | Master   |
| 1.6. Specialization/ Study programme | Applied Biotechnologies  |
| 1.7. Form of education               | Full time  |

### 2. Information on the discipline

|   |   |   |    |                                    |            |                        |                             |    |
|---|---|---|----|------------------------------------|------------|------------------------|-----------------------------|----|
| 2.1. Name of the discipline                   |   | Marker Assisted Selection in Animal Populations |    |                                    |            |                        |                             |    |
| 2.2. Course coordinator                       |   |   |    | Professor Cristian-Radu SISEA, PhD |            |                        |                             |    |
| 2.3. Seminar/ laboratory/ project coordinator |   |   |    | Professor Cristian-Radu SISEA, PhD |            |                        |                             |    |
| 2.4. Year of study                            | I | 2.5. Semester                                   | II | 2.6. Type of evaluation            | continuous | 2.7. Discipline status | Content <sup>2</sup>        | FD |
|   |   |   |    |                                    |            |                        | Compulsoriness <sup>3</sup> | CD |

### 3. Total estimated time (teaching hours per semester)

|   |     |                            |    |                                   |       |
|---|-----|----------------------------|----|-----------------------------------|-------|
| 3.1. Hours per week – full time programme   | 4   | out of which: 3.2. lecture | 2  | 3.3. seminar/ laboratory/ project | 2     |
| 3.4. Total number of hours in the curriculum  | 56  | out of which: 3.5. lecture | 28 | 3.6. seminar/laboratory           | 28    |
| <b>Distribution of the time allotted</b>  |     |                            |    |                                   | hours |
| 3.4.1. Study based on book, textbook, bibliography and notes                                |     |                            |    |                                   | 50    |
| 3.4.2. Additional documentation in the library, specialized electronic platforms and field  |     |                            |    |                                   | 40    |
| 3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays |     |                            |    |                                   | 30    |
| 3.4.4. Tutorials  |     |                            |    |                                   | 4     |
| 3.4.5. Examinations   |     |                            |    |                                   | 20    |
| 3.4.6. Other activities   |     |                            |    |                                   |       |
| 3.7. Total hours of individual study  | 144 |                            |    |                                   |       |
| 3.8. Total hours per semester   | 200 |                            |    |                                   |       |
| 3.9. Number of credits <sup>4</sup>   | 8   |                            |    |                                   |       |

### 4. Prerequisites (is applicable)

|                         |  |
|-------------------------|--|
| 4.1. curriculum-related | Genetics, Molecular Biology, Population Genetics, Quantitative Genetics, Genomics.   |
| 4.2. skills-related     | Basic knowledge of population genetics, quantitative genetics and molecular markers. |

### 5. Conditions (if applicable)

|   |  |
|---|--|
| 5.1. for the lecture                      | Teaching manuals: -<br>Lecture notes: Cristian-Radu Sisea.<br>Course presentation in pptx format: Cristian-Radu Sisea.<br>Logistic support: video projector, interactive whiteboard and PowerPoint presentations.<br>Participation in a minimum of 50% of courses is a condition for participation in the exam.  |
| 5.2. for the seminar/ laboratory/ project | Teaching manuals: -<br>Laboratory/ seminar notes: pptx format, Cristian-Radu Sisea<br>Place of laboratory: Laboratory 3, 3rd floor, ICHAT, USAMV CN.<br>Laboratory equipment: molecular biology specific instruments.<br>Specialized software used: specific free software used in population genetics<br>Specific laboratory reagents/ supplies.<br>Participation in 100% laboratory/ seminar work is a condition for the exam participation. |



## 6. Specific competences acquired

|                              |  |
|------------------------------|--|
| 6.1 Professional competences | Skills and expertise in the methodology and technologies of molecular markers used in animal biotechnologies, by integrating information from the discipline with knowledge from Genomics. Training specialists to lead research activities with qualified assistance.<br>Learning outcomes and expertise in molecular marker technologies applicable in various related fields. |
| 6.2 Transversal competences  | Applying theoretical concepts to solve practical problems.<br>Developing the ability to utilize the information from the discipline in applications of other fields related to molecular markers, such as medicine, genomic selection, etc.  |

## 7. Learning outcomes

|                                 |   |
|---------------------------------|---|
| 7.1 Knowledge                   | The student/graduate describes the biotechnological methods used for improving plants and animals, and understand the role of biotechnologies in studying biodiversity and conserving genetic resources.                                |
| 7.2 Skills                      | The student/graduate efficiently utilize natural resources to produce biotechnological products and promote environmental protection.   |
| 7.3 Responsibility and autonomy | The student/graduate manages programs for biotechnological improvement, bioremediation, and decontamination within the field.<br>The student/graduate coordinates projects focused on genetic conservation and biodiversity protection. |

## 8. Course objectives (based on the list of competences acquired)

|                               |  |
|-------------------------------|--|
| 7.1. Overall course objective | A supplementary training discipline for biotechnologists, breeders and professionals in the field of animal breeding. Together with the other disciplines in the curriculum, it ensures the implementation and formation of complex concepts on the use of molecular markers in various fields related to life sciences. |
| 7.2. Specific objectives      | Obtaining learning outcomes that aim in the formation of skills and abilities based on the correlation of the information received with those acquired in other disciplines such as Genetics, Genomics and Breeding  |

## 9. Content

| 9.1. LECTURE<br>Number of hours – 28  | Teaching methods | Notes   |
|---|------------------|---------|
| The emergence of molecular marker technology  | Lecture          | 2 hours |
| Qualitative versus quantitative traits. Types of markers. Types of inheritance.   | Lecture          | 2 hours |
| DNA variability and polymorphisms. Genotyping techniques. Molecular markers used in selection.  | Lecture          | 2 hours |
| Quantitative Trait Loci (QTL) and their identification  | Lecture          | 2 hours |
| Mapping QTL through linkage analysis and association analysis   | Lecture          | 2 hours |
| Specialized mapping methods, including bulk segregation analysis and candidate gene approach  | Lecture          | 2 hours |
| Molecular markers associated with traits of economic interest. Markers linked to disease resistance.  | Lecture          | 2 hours |
| Marker-assisted selection (MAS) in animal populations   | Lecture          | 2 hours |
| Population dynamics in animals using molecular markers  | Lecture          | 2 hours |
| Hardy-Weinberg principle and the utilization of molecular data  | Lecture          | 2 hours |
| Reproduction and mating systems   | Lecture          | 2 hours |
| Processes that modify the genetic structure of populations (migration, mutation, selection, drift, inbreeding)  | Lecture          | 2 hours |
| New forms of selection – genomic selection  | Lecture          | 2 hours |
| <b>9.2. PRACTICAL WORK<br/>Number of hours – 28</b>   |                  |         |
| Marker assisted selection. Levels of biological diversity. Relationships between genotype and other phenotypic characteristics. DNA variations and the molecular markers. | Lecture          | 4 hours |



|   |                         |         |
|---|-------------------------|---------|
| Development of hypotheses and experimental design. Sample preparation, sampling procedures, conducting experiments  | Lecture, practical work | 6 hours |
| Calculating allele and genotype frequencies using molecular marker data in cases of allelic variation and gene interactions   | Case study              | 2 hours |
| Software tools for analyzing the genetic structure of populations based on molecular data and their association with traits of interest   | Case study              | 2 hours |
| Measuring genetic variability using biallelic and codominant molecular markers  | Case study              | 2 hours |
| Genotyping loci of interest   | Case study              | 2 hours |
| Determining the genetic structure of populations  | Case study              | 2 hours |
| Associating polymorphisms with traits of economic importance  | Case study              | 2 hours |
| Statistical processing of experimental data   | Case study              | 2 hours |
| Data interpretation   | Case study              | 2 hours |
| Knowledge assessment  | -                       | 2 hours |
| <p><i>Compulsory bibliography:</i></p> <ol style="list-style-type: none"> <li>1. Lecture notes.</li> <li>2. Dekkers, C.M.. <i>Commercial application of marker- and gene-assisted selection in livestock: Strategies and lessons. J Anim Sci, 82:E313-E328 (2004).</i></li> <li>3. Dekkers J.C.M. and Van Der Werf, J.H.J. <i>Marker-assisted selection – Current status and future perspectives in crops, livestock, forestry and fish. Chapter 10. Guimaraes EP (ISBN 978-92-5-105717-9) (2007).</i></li> <li>4. Goddard M.E., Hayes B.J., Meuwissen T.H.. <i>Genomic selection in livestock populations. Genet Res (Camb), 92(5-6): 413-21 (2010).</i></li> <li>5. Peter J. Russel, 2009, <i>iGenetics – A Molecular Approach, Ed. Pearson International.</i></li> <li>6. Kent E. Holsinger, 2012, <i>Lecture Notes in Population Genetics, University of Connecticut.</i></li> </ol> <p><i>Optional bibliography:</i></p> <ol style="list-style-type: none"> <li>1. Meuwissen T.H.E., Goddard M.E.. <i>The use of markers haplotypes in animal breeding schemes. Gen Sel Evol. 28, 161-176 (1996).</i></li> <li>2. Juane J., A. Sonnino. <i>Marker assisted selection as a tool for genetic improvement of crops, livestock, forestry and fish in developing countries: An overview of the issues. FAO of the United Nations, Rome, (2007).</i></li> <li>3. Williams J.L.. <i>The use of marker assisted selection in animal breeding and biotechnology. Rev Sci Techn Off Int Epiz. 24(1):379-388 (2005).</i></li> <li>4. Rampal, J.B.- 2007, <i>Microarrays – Application and Data Analysis, in Methods in Molecular Biology, Human Press, NJ.</i></li> <li>5. 8. Goddard M.E., Hayes B.J.. <i>Genomic selection, J Anim Breed Genet, 124(6), 323-30 (2007).</i></li> </ol> |                         |         |

### 10. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant stakeholders in the corresponding field

|   |
|---|
| The course has a similar content compared with other European universities courses and takes into account the level of preparation of students. |
| The course is important/ fundamental for the development of working skills as future specialists in the graduated field.                        |

### 11. Assessment

| Type of activity   | Assessment criteria   | Assessment methods | Percentage of the final grade |
|--|---|--------------------|-------------------------------|
| <b>11.1. Lecture</b>   | Assessment of theoretical knowledge related to the course content | Oral examination   | 50%                           |
| <b>11.2. Seminar/ laboratory</b>   | Assessment of theoretical knowledge related to practical work     | Colloquium         | 50%                           |
| <p><b>11.3. Minimum performance standards</b></p> <p>Knowledge 50% of the information contained in the course.</p> <p>Knowledge 50% of the information provided at practical work/ seminar.</p> <p>100% attendance at practical work / seminars is mandatory.</p> <p>Attendance at 50% courses is a condition for entering the exam.</p> |   |                    |                               |

<sup>1</sup> Education levels- choose of the three options: Bachelor/Master/Ph.D.

<sup>2</sup> Discipline status (content)- for the undergraduate level, choose one of the options: **FD** (fundamental discipline), **DD** (domain discipline), **SD** (specialty discipline), **CD** (complementary discipline).

Discipline status (content)- for the master level, choose one of the options: **DA** (in-depth discipline), **DCA** (advanced knowledge discipline), **DPC** (complementary preparation discipline), **DS** (synthesis discipline – options depending on the domain).

<sup>3</sup> Discipline status (compulsoriness)- choose one of the options: **CoD** (compulsory discipline), **OD** (optional discipline), **ED** (elective discipline).

<sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).



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**Filled in on**  
23.09.2025

**Course coordinator**  
Professor Cristian-Radu SISEA, PhD

**Laboratory work/ seminar coordinator**  
Professor Cristian-Radu SISEA, PhD

**Subject coordinator**  
Professor Cristian-Radu SISEA, PhD

**Approved by the  
Department on**  
24.09.2025

**Head of the Department**  
Associate Professor Radu CONSTANTINESCU, PhD

**Approved by the  
Faculty Council on**  
24.09.2025

**Dean**  
Professor Daniel DEZMIREAN, PhD



No. \_\_\_\_\_ of \_\_\_\_\_

USAMV form 0311010107

## SUBJECT OUTLINE

### 1. Information on the programme

|                                      |  |
|--------------------------------------|--|
| 1.1. Higher education institution    | University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca |
| 1.2. Faculty                         | Animal Sciences and Biotechnologies  |
| 1.3. Department                      | Fundamental Sciences and Biotechnologies                                   |
| 1.4. Field of study                  | Biotechnologies  |
| 1.5. Education level                 | Master   |
| 1.6. Specialization/ Study programme | Applied biotechnologies  |
| 1.7. Form of education               | Full time  |

### 2. Information on the discipline

|   |  |               |    |                         |            |                        |                             |     |
|---|--|---------------|----|-------------------------|------------|------------------------|-----------------------------|-----|
| 2.1. Name of the discipline                   | Embryo biotechnology                   |               |    |                         |            |                        |                             |     |
| 2.2. Course coordinator                       | Associate professor Ileana Miclea, PhD |               |    |                         |            |                        |                             |     |
| 2.3. Seminar/ laboratory/ project coordinator | Associate professor Ileana Miclea, PhD |               |    |                         |            |                        |                             |     |
| 2.4. Year of study                            | I                                      | 2.5. Semester | II | 2.6. Type of evaluation | continuous | 2.7. Discipline status | Content <sup>2</sup>        | AKD |
|   |  |               |    |                         |            |                        | Compulsoriness <sup>3</sup> | DI  |

### 3. Total estimated time (teaching hours per semester)

|   |     |                            |    |                                   |       |
|---|-----|----------------------------|----|-----------------------------------|-------|
| 3.1. Hours per week – full time programme   | 4   | out of which: 3.2. lecture | 2  | 3.3. seminar/ laboratory/ project | 2     |
| 3.4. Total number of hours in the curriculum  | 56  | Out of which: 3.5. lecture | 28 | 3.6. seminar/laboratory           | 28    |
| <b>Distribution of the time allotted</b>  |     |                            |    |                                   | hours |
| 3.4.1. Study based on book, textbook, bibliography and notes                                |     |                            |    |                                   | 50    |
| 3.4.2. Additional documentation in the library, specialized electronic platforms and field  |     |                            |    |                                   | 50    |
| 3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays |     |                            |    |                                   | 20    |
| 3.4.4. Tutorials  |     |                            |    |                                   | 10    |
| 3.4.5. Examinations   |     |                            |    |                                   | 14    |
| 3.4.6. Other activities   |     |                            |    |                                   | -     |
| 3.7. Total hours of individual study  | 144 |                            |    |                                   |       |
| 3.8. Total hours per semester   | 200 |                            |    |                                   |       |
| 3.9. Number of credits <sup>4</sup>   | 8   |                            |    |                                   |       |

### 4. Prerequisites (is applicable)

|                         |   |
|-------------------------|---|
| 4.1. curriculum-related | Animal reproduction, Animal improvement, Animal genetics, Biochemistry, Biotechnology for embryo transfer and IVF |
| 4.2. skills-related     | English language  |

### 5. Conditions (if applicable)

|                      |   |
|----------------------|---|
| 5.1. for the lecture | Lecture notes: yes. Logistic support: video projector, interactive whiteboard and PowerPoint presentations. The course is interactive, students can ask questions regarding the content of the presentation. Academic discipline requires compliance with the timetable for the start and end of the course. An attendance score of at least 50% for lectures is mandatory for participating in the final exam. |
|----------------------|---|



|   |  |
|---|--|
| 5.2. for the seminar/ laboratory/ project | Students will have protective equipment (laboratory coat, gloves). Laboratory notes: yes. Using the provided protocols and materials students will work alone or in small groups to complete the requisite lab work. Academic discipline is mandatory throughout the development of practical work. An attendance score of at least 100% for laboratory work is mandatory for participating in the final exam. |
|---|--|

## 6. Specific competences acquired

|                              |   |
|------------------------------|---|
| 6.1 Professional competences | In vitro manipulation of gametes and embryos to produce offspring in farm animals in unconventional ways.   |
| 6.2 Transversal competences  | The use of theoretical aspects learned in solving practical problems. Ability to work in a team. Use of specialized terminology in various contexts. Involvement in scientific activities, such as the elaboration of scientific papers and specialized studies. Participation in scientific projects, compatible with the requirements of integrating into European higher education. Compliance with the principles of professional ethics. |

## 7. Learning outcomes

|                                 |   |
|---------------------------------|---|
| 7.1 Knowledge                   | The student can describe the fundamental principles of gametes collection and culture, knows modern methods of cell culture and embryo handling. The student can also explain the mechanisms of embryo in vitro production and development together with the use of reproduction biotechnology in a medical context.  |
| 7.2 Skills                      | The student employs techniques for cell isolation, culture and handling. The student utilizes biotechnological techniques for the production, assessment, micromanipulation and preservation of gametes and embryos.  |
| 7.3 Responsibility and autonomy | The bachelor manages and is responsible for experiments in the field of cell and embryo biotechnology. The bachelor is capable of autonomous decisions with regard to the selection and use of technology for the purpose of research or economic activity. All this is done while complying with legislation and regulations on bioethics, biosecurity and good laboratory practice with regard to the handling of live biological material. |

## 8. Course objectives (based on the list of competences acquired)

|                               |   |
|-------------------------------|---|
| 7.1. Overall course objective | Fundamental discipline that allows the acquisition of advanced knowledge related to preimplantation embryos. This is particularly related to preparations for the manipulation of gametes intended for in vitro fertilisation and associated techniques but also for embryo micromanipulation and cryopreservation of genes in animals. |
| 7.2. Specific objectives      | Training the ability to critically interpret and synthesize data, to formulate hypothesis or conclusions but also to take decisions in the various situations encountered in assisted reproduction.   |

## 9. Content

|   |   |  |
|---|---|--|
| <b>9.1.LECTURE</b><br><b>Number of hours – 28</b><br>Use of primordial germ cells and oocytes in assisted reproduction. Molecular mechanisms involved in oocyte growth and maturation. In vitro culture of primordial germ cells. In vitro culture of immature oocytes.<br>Sperm analysis and preparation for use in assisted reproduction. Molecular mechanisms involved in sperm capacitation. New methods to assess function and acrosome integrity.<br>Oocyte – sperm cell interactions. Sperm cell activation. Oocyte activation. Formation of pronuclei | Teaching methods  | Notes<br>1 lecture = 2 hours<br>3 lectures |
|   |   | 2 lectures                                 |
|   | Lectures,<br>exposure with the use of audio-video (video and Power-Point presentation), | 1 lecture                                  |



|   |  |  |
|---|--|--|
| <p>and syngamy.</p> <p>Assisted in vitro fertilization techniques. Intracytoplasmic sperm injection. Analysis, preparation, selection and manipulation of sperm cells. Preparation and manipulation of oocytes. Partial digestion of the zona pellucida.</p> <p>In vitro manipulation of preimplantation embryos. Isolation, culture and manipulation of embryo stem cells. Culture conditions for embryo stem cells. Co-culture techniques for embryo stem cells. Microinjection of embryo stem cells into blastocyst. Alternate methods for the production of animal chimeras. Transfer of nuclei from somatic cells. Analysis of polar bodies for genetic diagnosis. Assisted hatching.</p> <p>Long-term preservation of animal germplasm. Long-term preservation of gametes/embryos. New techniques to cryopreserve oocytes/embryos. Methods to cryopreserve oocytes and embryos in various species.</p>  | <p>explanation, problem solving, brain-storming</p>  | <p>2 lectures</p> <p>4 lectures</p> <p>3 lectures</p>  |
| <p><b>9.2. PRACTICAL WORK</b><br/> <b>Number of hours – 28</b><br/> Oocyte maturation on a somatic cell monolayer (fibroblasts)<br/> Assessment of oocyte maturation using fluorescent coloration<br/> Sperm cell capacitation methods: Percoll vs. swim-up<br/> Assessment of sperm cell capacitation using CTC<br/> Fixation, alignment and equilibration of micropipettes<br/> Preparation and selection of high quality sperm cells for injection<br/> Morphological assessment of oocyte maturation and aspiration into the holding micropipette<br/> Sperm cell injection into oocytes<br/> Partial digestion of zona pellucida using acidic solutions<br/> Assessment of in vitro developed embryos based on energy usage<br/> Blastomere extraction and in vitro culture<br/> Analysis and injection of blastomeres into the embryo<br/> Cryopreservation of swine sperm cells.<br/> New techniques for oocyte cryopreservation: minimum drop size technique and open pulled straw<br/> Modern techniques for the cryopreservation of embryos: one step technique<br/> Examination.</p> | <p>Explanation, demonstration, individual and team work.<br/> Laboratory activities in laboratory, specific laboratory techniques.</p> | <p>1 lab work (2 hours / work)</p> <p>1 laboratory work</p> <p>1 laboratory work</p> <p>1 laboratory work</p> <p>1 laboratory work</p> <p>1 laboratory work</p> <p>1 laboratory work</p> <p>1 laboratory work</p> <p>1 laboratory work</p> <p>1 laboratory work</p> <p>1 laboratory work</p> <p>1 laboratory work</p> <p>1 laboratory work</p> |
| <p><b>Compulsory bibliography</b></p> <ol style="list-style-type: none"> <li>1. Course material</li> <li>2. Elder K. and B. Dale, 2000, In vitro fertilization. Second edition, Cambridge University Press, U.K.</li> <li>3. Fleming S.D. and R.S. King, 2003, Micromanipulation in Assisted Conception-A Users' Manual and Troubleshooting Guide. Cambridge University Press, United Kingdom</li> <li>4. Gardner D.K., M. Lane, A.J. Watson, 2006, A Laboratory Guide to the Mammalian Embryo. Oxford University Press, United Kingdom</li> </ol>  |  |  |
| <p><b>Optional bibliography:</b></p> <ol style="list-style-type: none"> <li>1. Gordon I., 1994, Laboratory production of cattle embryos, CAB International, UK</li> <li>2. Marshak D.R., D. Gottlieb, R.L. Gardner, 2001, Stem cell biology. Cold Spring Laboratory Press</li> <li>3. Schatten Heide, 2004, Germ Cell Protocols - Volume 1: Sperm and Oocyte Analysis. Humana Press, Methods in Molecular Biology, vol. 253</li> <li>4. Schatten Heide, 2004, Germ Cell Protocols - Volume 2: Molecular Embryo Analysis, Live Imaging, Transgenesis,</li> </ol>   |  |  |



and Cloning. Humana Press, Methods in Molecular Biology, vol. 254

**10. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant stakeholders in the corresponding field**

The course has a similar content compared with other European universities courses and takes into account the level of preparation of students.

The course is important / fundamental for the development of working skills as future specialists in the graduated field.

**11. Assessment**

| Type of activity   | Assessment criteria                                  | Assessment methods              | Percentage of the final grade |
|--|--|---------------------------------|-------------------------------|
| <b>11.1. Lecture</b>   | Attendance   | Interaction during the course   | 5%                            |
|  | Knowledge of the subject presented during the course | Final exam                      | 60%                           |
| <b>11.2. Laboratory</b>  | Work technique                                       | Continuous observation          | 5%                            |
|  | Practical examination                                | Essay on a subject in the field | 30%                           |
| <b>11.3. Minimum performance standards</b>                             |  |                                 |                               |
| Knowledge 50% of the information contained in the course.              |  |                                 |                               |
| Knowledge 50% of the information provided at practical work / seminar. |  |                                 |                               |
| 100% attendance at practical work / seminars is mandatory.             |  |                                 |                               |
| Attendance at 50% courses is a condition for entering the exam.        |  |                                 |                               |

<sup>1</sup> Education levels- choose of the three options: Bachelor/Master/Ph.D.

<sup>2</sup> Discipline status (content)- for the undergraduate level, choose one of the options: **FD** (fundamental discipline), **DD** (domain discipline), **SD** (specialty discipline), **CD** (complementary discipline).

Discipline status (content)- for the master level, choose one of the options: **DA** (in-depth discipline), **DCA** (advanced knowledge discipline), **DPC** (complementary preparation discipline), **DS** (synthesis discipline – options depending on the domain).

<sup>3</sup> Discipline status (compulsoriness)- choose one of the options: **CoD** (compulsory discipline), **OD** (optional discipline), **ED** (elective discipline).

<sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

**Filled in on**  
**23.09.2025**

Course coordinator  
Associate professor Ileana Miclea, PhD

Laboratory work coordinator  
Associate professor Ileana Miclea, PhD

Subject coordinator  
Professor Marius Zăhan, PhD

**Approved by the**  
**Department on**  
**24.09.2025**

Head of the Department  
Associate professor Radu Constantinescu, PhD

**Approved by the Faculty**  
**Council on**  
**24.09.2025**

Dean  
Professor dr. Daniel Dezmirean, PhD



No. \_\_\_\_\_ of \_\_\_\_\_

USAMV form 0311010108

## SUBJECT OUTLINE

### 1. Information on the programme

|                                      |  |
|--------------------------------------|--|
| 1.1. Higher education institution    | University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca |
| 1.2. Faculty                         | Animal Sciences and Biotechnologies  |
| 1.3. Department                      | Fundamental Sciences   |
| 1.4. Field of study                  | Biotechnology  |
| 1.5. Education level                 | Master   |
| 1.6. Specialization/ Study programme | Applied Biotechnologies  |
| 1.7. Form of education               | Full time  |

### 2. Information on the discipline

|   |   |  |    |                                |            |                        |                             |    |
|---|---|--|----|--------------------------------|------------|------------------------|-----------------------------|----|
| 2.1. Name of the discipline                   |   | Molecular techniques for food authentication and GMO detection |    |                                |            |                        |                             |    |
| 2.2. Course coordinator                       |   |  |    | Prof. Cristian-Radu Sisea, PhD |            |                        |                             |    |
| 2.3. Seminar/ laboratory/ project coordinator |   |  |    | Prof. Cristian-Radu Sisea, PhD |            |                        |                             |    |
| 2.4. Year of study                            | I | 2.5. Semester  | II | 2.6. Type of evaluation        | continuous | 2.7. Discipline status | Content <sup>2</sup>        | FD |
|   |   |  |    |                                |            |                        | Compulsoriness <sup>3</sup> | CD |

### 3. Total estimated time (teaching hours per semester)

|   |     |                            |    |                                   |       |
|---|-----|----------------------------|----|-----------------------------------|-------|
| 3.1. Hours per week – full time programme   | 3   | out of which: 3.2. lecture | 1  | 3.3. seminar/ laboratory/ project | 2     |
| 3.4. Total number of hours in the curriculum  | 42  | out of which: 3.5. lecture | 14 | 3.6. seminar/laboratory           | 28    |
| <b>Distribution of the time allotted</b>  |     |                            |    |                                   | hours |
| 3.4.1. Study based on book, textbook, bibliography and notes                                |     |                            |    |                                   | 48    |
| 3.4.2. Additional documentation in the library, specialized electronic platforms and field  |     |                            |    |                                   | 37    |
| 3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays |     |                            |    |                                   | 30    |
| 3.4.4. Tutorials  |     |                            |    |                                   | 8     |
| 3.4.5. Examinations   |     |                            |    |                                   | 10    |
| 3.4.6. Other activities   |     |                            |    |                                   | 0     |
| 3.7. Total hours of individual study  | 133 |                            |    |                                   |       |
| 3.8. Total hours per semester   | 175 |                            |    |                                   |       |
| 3.9. Number of credits <sup>4</sup>   | 7   |                            |    |                                   |       |

### 4. Prerequisites (is applicable)

|                         |  |
|-------------------------|--|
| 4.1. curriculum-related | Genetics, Food Chemistry, Genetic Engineering, Food Microbiology   |
| 4.2. skills-related     | Adequate knowledge and use of concepts specific to Biochemistry, Food Microbiology, and Genetic Engineering. |

### 5. Conditions (if applicable)

|   |   |
|---|---|
| 5.1. for the lecture                      | Teaching manuals: -<br>Lecture notes: Cristian-Radu Sisea.<br>Course presentation in pptx format: Cristian-Radu Sisea.<br>Logistic support: video projector, interactive whiteboard and PowerPoint presentations.<br>Participation in a minimum of 50% of courses is a condition for participation in the exam. |
| 5.2. for the seminar/ laboratory/ project | Teaching manuals: -<br>Laboratory/ seminar notes: Cristian-Radu Sisea.<br>Place of laboratory: Laboratory 3, 3 <sup>rd</sup> floor, ICHAT, USAMV CN.<br>Laboratory equipment: molecular biology specific instruments.<br>Specialized software used: -<br>Specific laboratory reagents/ supplies.                |



|  |   |
|--|---|
|  | Participation in 100% laboratory/ seminar work is a condition for the exam participation. |
|--|---|

### 6. Specific competences acquired

|                              |  |
|------------------------------|--|
| 6.1 Professional competences | Development of theoretical and practical skills through the correlation of received information with knowledge acquired in other specialized disciplines.<br>Training of specialists in the field of biotechnology who are capable of pursuing master studies with a focus on both theoretical and applied aspects.<br>Learning outcomes that enable the development of competencies and practical skills aligned with the dynamic nature of the field of biotechnology. |
| 6.2 Transversal competences  | Applying theoretical concepts to solve practical problems.<br>Developing the ability to use information received within related disciplines.<br>The ability to work in a team.<br>Using specialized terminology in various contexts.<br>Adhering to principles of professional ethics.   |

### 7. Learning outcomes

|                                 |   |
|---------------------------------|---|
| 7.1 Knowledge                   | The student/graduate describes the biotechnological methods used for the improvement of plants and animals, understand the role of biotechnologies in studying biodiversity and conserving genetic resources.                         |
| 7.2 Skills                      | The student/graduate efficiently utilizes natural resources to produce biotechnological products and for environmental protection.  |
| 7.3 Responsibility and autonomy | The student/graduate manages biotechnological improvement programs, bioremediation, and decontamination projects within the field.<br>The student/graduate coordinates projects for genetic conservation and biodiversity protection. |

### 8. Course objectives (based on the list of competences acquired)

|                               |   |
|-------------------------------|---|
| 7.1. Overall course objective | <b>Fundamental discipline (to be replaced as appropriate)</b> of advanced knowledge that allows the development of knowledge regarding the molecular techniques used for food authentication, especially those derived from or containing GMOs.<br>Together with the other disciplines in the curriculum, it ensures the implementation and formation of complex concepts on GMOs and the methods used for GMO testing. |
| 7.2. Specific objectives      | Obtaining learning outcomes that aim in the formation of skills and abilities based on the correlation of the information received with those acquired in other disciplines focused on Genetics, Molecular Genetics, Genetic Markers, Genetic Engineering, Plant Breeding and their practical applications.   |

### 9. Content

| 9.1. LECTURE<br>Number of hours – 14  | Teaching methods    | Notes   |
|---|---------------------|---------|
| DNA fingerprinting and identification using PCR-derived markers. DNA barcodes.  | Lecture             | 2 hours |
| Molecular techniques for food authentication based on proteic variability analysis (gel electrophoresis in polyacrylamide, Western blot, ELISA) | Lecture             | 1 hour  |
| Molecular techniques for food authentication based on DNA variability analysis  | Lecture             | 1 hour  |
| Implementation of molecular diagnostic tests for the genetic traceability of agri-food products through DNA fingerprinting                      | Lecture             | 1 hour  |
| Genetically Modified Organisms (GMOs): introduction, definitions, history   | Lecture             | 1 hour  |
| Genetic engineering technologies  | Lecture             | 1 hour  |
| PROs and CONs regarding the use of genetic engineering and GMOs   | Lecture             | 1 hour  |
| Attitudes toward the production and consumption of GM foods   | Lecture             | 1 hour  |
| Distribution of GMOs and GM foods   | Lecture             | 1 hour  |
| National, European and international regulations on GMOs and GM foods. Food labelling.  | Lecture             | 1 hour  |
| European and global organizations involved in studying, monitoring and assessing GMOs and GM foods. EFSA  | Lecture             | 1 hour  |
| Impact of GMOs and GM foods. Genetically modified foods vs. organic foods.  | Lecture, case study | 2 hours |
| <b>9.2. PRACTICAL WORK</b>  |                     |         |



|  |                |         |
|--|----------------|---------|
| <b>Number of hours – 28</b>  |                |         |
| Methods for detecting genetically modified foods: ELISA and PCR  | Lecture        | 2 hours |
| Purification of nucleic acids and proteins from various biological samples (tissue, food and feed products etc.) and assessment of their characteristics   | Practical work | 6 hours |
| Assessment of the declared authenticity (species) of meat and milk products using DNA markers and PCR and real-time PCR techniques   | Practical work | 4 hours |
| Sampling for GMO testing   | Practical work | 2 hours |
| GMO testing using ELISA and PCR techniques   | Practical work | 4 hours |
| Production and commercialization of GMOs   | Case study     | 2 hours |
| Genetically modified foods versus organic foods  | Case study     | 2 hours |
| Labelling of GMO foods   | Case study     | 2 hours |
| PROs and CONs regarding the use of GMOs and GM foods   | Case study     | 2 hours |
| Knowledge assessment   | Case study     | 2 hours |
| <p><i>Compulsory bibliography</i><br/> <i>Lecture notes.</i><br/>           Garcia L, Chen Y, editors. <i>GMO Detection and Monitoring in Agriculture</i>. Amsterdam: Elsevier; 2023.<br/>           Kumar S, Patel R. <i>Next-Generation Sequencing for GMO Identification</i>. New York: Springer Nature; 2023.<br/>           Patel R, Kumar S. <i>Molecular Techniques for Food Authentication: Recent Developments</i>. Amsterdam: Elsevier; 2023.<br/>           Garcia M, Lee J, Ghosh S. <i>Modern Approaches to Food Authenticity and Traceability</i>. New York: Springer Nature; 2022.<br/>           Johnson M, Patel R. <i>Molecular Approaches for GMO Identification</i>. New York: Springer Nature; 2022.<br/>           Lee J, Nguyen T. <i>Quantitative PCR Approaches in GMO Detection</i>. London: CRC Press; 2022.<br/>           Martinez P, Lopez A. <i>Analytical Methods in GMO Testing</i>. Amsterdam: Elsevier; 2022.<br/>           Nguyen T, Martinez P. <i>Analytical Methods for Food Authentication and Origin Verification</i>. London: CRC Press; 2022.<br/>           Wang X, Chen Y. <i>Biosensor Technologies for GMO Detection</i>. London: Academic Press; 2022.<br/>           Kharat M, Singh A, editors. <i>Advances in GMO Detection Techniques</i>. London: Elsevier; 2021.<br/>           Lopez A, Singh R, editors. <i>Food Integrity: New Frontiers in Authentication and Quality Control</i>. Berlin: Springer; 2021.<br/>           Lopez A, Gopinath M. <i>GMO Detection in Food Products: Recent Developments</i>. Amsterdam: Elsevier; 2021.<br/>           Zhang L, Chen Y, editors. <i>Advances in Food Authentication Technologies</i>. London: Elsevier; 2021.</p> <p><i>Optional bibliography:</i><br/>           Rao KR, Ghosh SK. <i>Authenticity and traceability of food: a modern approach</i>. 1st ed. Amsterdam: Elsevier; 2018.<br/>           Kumar S, Gopinath M. <i>PCR-Based Approaches for GMO Detection and Quantification</i>. Berlin: Springer; 2016.<br/>           Jiao W, Wang Y, editors. <i>Techniques in GMO Detection and Quantification</i>. London: CRC Press; 2015.<br/>           De Noni S, La Vecchia FP. <i>Food authentication: principles, techniques, and applications</i>. New York: CRC Press; 2014.<br/>           Sillanpää V, Karjalainen HK, Kallio KK. <i>Food authentication and traceability</i>. 1st ed. New York: Springer; 2013.<br/>           Guttman A, Sela N. <i>Molecular Diagnostics in Genetically Modified Organisms</i>. Springer: New York; 2012.<br/>           Singh RRS, editor. <i>Food authentication</i>. 1st ed. London: Elsevier; 2012.</p> |                |         |

**10. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant stakeholders in the corresponding field**

The course has a similar content compared with other European universities courses and takes into account the level of preparation of students.  
 The course is important/ fundamental for the development of working skills as future specialists in the graduated field.

**11. Assessment**

| Type of activity   | Assessment criteria   | Assessment methods | Percentage of the final grade |
|--|---|--------------------|-------------------------------|
| <b>11.1. Lecture</b>   | Assessment of theoretical knowledge related to the course content | Oral examination   | 50%                           |
| <b>11.2. Seminar/ laboratory</b>   | Assessment of theoretical knowledge related to practical work     | Colloquium         | 50%                           |
| <p><b>11.3. Minimum performance standards</b><br/>           Knowledge 50% of the information contained in the course.<br/>           Knowledge 50% of the information provided at practical work/ seminar.<br/>           100% attendance at practical work / seminars is mandatory.<br/>           Attendance at 50% courses is a condition for entering the exam.</p> |   |                    |                               |

<sup>1</sup> Education levels- choose of the three options: Bachelor/Master/Ph.D.

<sup>2</sup> Discipline status (content)- for the undergraduate level, choose one of the options: **FD** (fundamental discipline), **DD** (domain discipline), **SD** (specialty discipline), **CD** (complementary discipline).



## UNIVERSITATEA DE ȘTIINȚE AGRICOLE ȘI MEDICINĂ VETERINARĂ CLUJ-NAPOCA

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Discipline status (content)- for the master level, choose one of the options: **DA** (in-depth discipline), **DCA** (advanced knowledge discipline), **DPC** (complementary preparation discipline), **DS** (synthesis discipline – options depending on the domain).

<sup>3</sup> Discipline status (compulsoriness)- choose one of the options: **CoD** (compulsory discipline), **OD** (optional discipline), **ED** (elective discipline).

<sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

**Filled in on**  
23.09.2025

**Course coordinator**  
Professor Cristian-Radu SISEA, PhD

**Laboratory work/ seminar coordinator**  
Professor Cristian-Radu SISEA, PhD

**Subject coordinator**  
Professor Cristian-Radu SISEA, PhD

**Approved by the  
Department on**  
24.09.2025

**Head of the Department**  
Associate Professor Radu CONSTANTINESCU, PhD

**Approved by the  
Faculty Council on**  
24.09.2025

**Dean**  
Professor Daniel DEZMIREAN, PhD

## SUBJECT OUTLINE

## 1. Information on the programme

|                                      |  |
|--------------------------------------|--|
| 1.1. Higher education institution    | University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca |
| 1.2. Faculty                         | Animal Science and Biotechnology   |
| 1.3. Department                      | I-Fundamental Sciences-Biotechnology                                       |
| 1.4. Field of study                  | Biotechnology  |
| 1.5. Education level <sup>1)</sup>   | Master   |
| 1.6. Specialization/ Study programme | Applied biotechnology  |
| 1.7. Form of education               | Full time  |

## 2. Information on the discipline

|   |                                  |               |    |                         |          |                        |                              |    |
|---|----------------------------------|---------------|----|-------------------------|----------|------------------------|------------------------------|----|
| 2.1. Name of the discipline                   | Bioinformatics and biostatistics |               |    |                         |          |                        |                              |    |
| 2.2. Course coordinator                       | Lecturer. Dr. Bogdan A. Vlaic    |               |    |                         |          |                        |                              |    |
| 2.3. Seminar/ laboratory/ project coordinator | Lecturer. Dr. Bogdan A. Vlaic    |               |    |                         |          |                        |                              |    |
| 2.4. Year of study                            | I                                | 2.5. Semester | II | 2.6. Type of evaluation | Sumative | 2.7. Discipline status | Content <sup>2)</sup>        | DA |
|   |                                  |               |    |                         |          |                        | Compulsoriness <sup>3)</sup> | DI |

## 3. Total estimated time (teaching hours per semester)

|   |     |                            |    |                                   |       |
|---|-----|----------------------------|----|-----------------------------------|-------|
| 3.1. Hours per week – full time programme   | 4   | out of which: 3.2. lecture | 2  | 3.3. seminar/ laboratory/ project | 3     |
| 3.4. Total number of hours in the curriculum  | 56  | Out of which: 3.5. lecture | 28 | 3.6. seminar/laboratory           | 42    |
| <b>Distribution of the time allotted</b>  |     |                            |    |                                   | hours |
| 3.4.1. Study based on book, textbook, bibliography and notes                                |     |                            |    |                                   | 25    |
| 3.4.2. Additional documentation in the library, specialized electronic platforms and field  |     |                            |    |                                   | 40    |
| 3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays |     |                            |    |                                   | 25    |
| 3.4.4. Tutorials  |     |                            |    |                                   | 20    |
| 3.4.5. Examinations   |     |                            |    |                                   | 19    |
| 3.4.6. Other activities   |     |                            |    |                                   |       |
| 3.7. Total hours of individual study  | 119 |                            |    |                                   |       |
| 3.8. Total hours per semester   | 175 |                            |    |                                   |       |
| 3.9. Number of credits <sup>4)</sup>  | 7   |                            |    |                                   |       |

## 4. Prerequisites (is applicable)

|                         |   |
|-------------------------|---|
| 4.1. curriculum-related | Cellular Biology, Molecular Biochemistry, Molecular Genetics, Computer Science and Computer Use   |
| 4.2. skills-related     | Knowledge of the theoretical foundations of Molecular Biology, Molecular Genetics and Informatics for understanding the scientific basis the concepts of bioinformatics |

## 5. Conditions (if applicable)

|   |   |
|---|---|
| 5.1. for the lecture                      | Teaching manuals : Bioinformatics for Beginners 1st Edition, 2014, Supratim Choudhuri, ISBN: ISBN 9780124104716, Academic Press<br>Lecture notes: Course notes<br>Course presentation in pptx format: Vlaic Bogdan<br>Logistic support: video projector, interactive whiteboard and PowerPoint presentations.<br>Participation in a minimum of 50% of courses is a condition for participation in the exam. |
| 5.2. for the seminar/ laboratory/ project | Teaching manuals:<br>Seminar notes:<br>Place of laboratory: laboratory room<br>Laboratory equipment: laptops, desktops for students, videoprojector<br>Specialized Software used: SPSS, R, Excell, PLINK; VCF tools, online tools   |

|  |  |
|--|--|
|  | Participation in 100% laboratory/seminar work is a condition for the exam participation. |
|--|--|

## 6. Specific competences acquired

|                          |   |
|--------------------------|---|
| Professional competences | <ol style="list-style-type: none"> <li>1) The formation of theoretical and practical skills by correlating the information received with those acquired in the disciplines Informatics, Statistics, Molecular genetics</li> <li>2) The training of specialists in the field of Applied Biotechnology who have the ability to follow master programs in the field of Applied Biotechnology with orientation towards theoretical and applicative aspects</li> </ol> <p>Learning outcomes which allow the formation of skills and practical skills in dynamics of the field Bioinformatics and Biostatistics</p> |
| Transversal competences  | <ol style="list-style-type: none"> <li>1) The use of theoretical aspects learned in solving practical problems.</li> <li>2) Developing the capacities to use the information received within other disciplines (Informatics, Statistics, Molecular genetics ).</li> <li>3) Ability to work in a team.</li> <li>4) Use of specialised terminology in various contexts.</li> <li>5) Compliance with the principles of professional ethics.</li> </ol>   |

## 7. Learning outcomes

|  |   |
|--|---|
| <b>7.1 Knowledge</b>                   | The student/graduate knows the fundamentals of bioinformatics and biostatistics in the analysis of biological data          |
| <b>7.2 Skills</b>                      | The student/graduate uses bioinformatics and statistical software for the analysis and interpretation of biological data,   |
| <b>7.3 Responsibility and autonomy</b> | The student/graduate critically interprets the results obtained from the use of bioinformatics and biostatistical software, |

## 8. Course objectives (based on the list of competences acquired)

|                               |  |
|-------------------------------|--|
| 8.1. Overall course objective | Fundamental discipline (to be replaced as appropriate) of advanced knowledge that allows the development of knowledge regarding understanding the conceptual scientific bases of bioinformatics and their use in genetic resources, understanding the implications of bioinformatics in the field of in-depth knowledge of biological phenomena. |
| 8.2. Specific objectives      | Obtaining learning outcomes that aim in the formation of skills and abilities based on the correlation of the information received with those acquired in other disciplines such as Informatics, Statistics, Molecular genetics  |

## 9. Content

| 9.1.LECTURE<br>Number of hours – 14  | Teaching methods | Notes     |
|--|------------------|-----------|
| Fundamentals of bioinformatics. Introduction to bioinformatics<br>Definition of bioinformatics<br>Brief history of bioinformatics<br>Applications of bioinformatics in genomics, transcriptomics, proteomics and phylogeny | Lecture          | 1 lecture |

|   |         |            |
|---|---------|------------|
| <p>Databases<br/>Databases of biological interest<br/>Database classification</p>   | Lecture | 1 lecture  |
| <p>The concept of the assembly of nucleotide and amino acid sequences. Sequence alignment and similarity analysis<br/>Similarity and sequence homology<br/>Sequence alignment. Global alignment and local alignment<br/>Global alignment<br/>Local alignment<br/>Pair alignment and multiple alignment<br/>Search the databases using Smith-Waterman heuristic algorithms -BLAST and FASTA.<br/>The BLAST algorithm<br/>FASTA algorithm</p> | Lecture | 2 lectures |
| <p>Parameters vs. statistical indices<br/>Types of variables. Truncated data<br/>Theoretical (ideal) distributions for adjusting the experimental ones (empirical)<br/>Statistical distributions. Properties and parameters of normal distribution</p>  | Lecture | 1 lecture  |
| <p>Elements of general statistics. General presentation. The population. Sample.<br/>Frequency distribution. Class interval. Relative frequency.<br/>Absolute frequency. Frequency diagram. Frequency polygon. The cumulative frequency. Data types.</p>  | Lecture | 1 lecture  |
| <p>Introduction to variant analysis<br/>- F distribution F<br/>one-way ANOVA for independent samples, the nonparametric Kruskal -Wallis test<br/>one-way ANOVA for correlated samples, Friedman nonparametric test<br/>-two-way ANOVA</p>   | Lecture | 1 lectures |

|   |                |                   |
|---|----------------|-------------------|
| <p><b>9.2. SEMINARS</b><br/><b>Number of hours – 42</b></p>   |                |                   |
| <p>Searching, accessing and storing specialized information based on www. (Based services)</p>  |                | 1 practical work  |
| <p>Classification and access to databases for publications. Searching and selecting information from bibliographic databases</p>  | Practical work | 1 practical works |
| <p>Familiarize and access the databases for nucleic acids. Structure of information in nucleic acid databases. Search and analysis of DNA or RNA fragments of interest. Organizing information in banks for nucleic acids.</p>      |                | 1 practical work  |
| <p>NCBI and EMBL-EBI databases<br/>Classification of sequence analysis tools<br/>Classifying the types of alignment analyzes, performing and analyzing the data obtained through alignment and similarity analyzes. Gene cards.</p> |                | 1 practical works |
| <p>Protein databases<br/>Presentation of the main protein databases. Protein banks of NCBI and EMBL-EBI</p>   |                | 2 practical works |

|  |  |                                       |
|--|--|---------------------------------------|
| Search and analyze data from protein banks<br>PDB-RCSB protein bank. Presentation. Tools. Protein search and analysis. Other databases for PIR, PRFDB proteins<br>Tools for protein identification and characterization.   |  | 2 practical works                     |
| Databases and programs of interest for molecular genetics analysis.<br>KEGG Pathways. Ribosomal databases-RDB.<br>Programs used to characterize and analyze DNA fragments with applicability in different molecular analyzes   |  | 2 practical work<br>2 practical works |
| Windows operating system: basics   |  | 1 practical work                      |
| Microsoft Excel: calculations, function library  |  | 1 practical work                      |
| Microsoft Excel: making graphs   |  | 1 practical work                      |
| Microsoft Excel: calculations dedicated to the statistical domain  |  | 2 practical work                      |
| R software: use, function library  |  | 2 practical work                      |
| R software: graphic design   |  | 2 practical work                      |
| Software and software packages for statistical applications: GraphPad Prism, Biostat, Statistics, Origin   |  | 2 practical work                      |
| <i>Compulsory bibliography:</i>  |  |                                       |
| <ol style="list-style-type: none"> <li>1. Course notices</li> <li>2. Bioinformatics for Beginners 1st Edition, <b>2014</b>, Supratim Choudhuri, <b>ISBN:</b> ISBN 9780124104716, Academic Press</li> <li>3. Mount DW. (2001) Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor, New York: Cold Spring Harbor Laboratory Press.</li> <li>4. <a href="http://www.ebi.ac.uk/">http://www.ebi.ac.uk/</a></li> <li>5. <a href="http://www.ncbi.nlm.nih.gov/">http://www.ncbi.nlm.nih.gov/</a></li> <li>6. <a href="http://www.nig.ac.jp/home.html">http://www.nig.ac.jp/home.html</a></li> <li>7. <a href="http://www.srs.ebi.ac.uk/">http://www.srs.ebi.ac.uk/</a></li> <li>8. <a href="http://www.rcsb.org/pdb/">http://www.rcsb.org/pdb/</a></li> <li>9. Rice JA (1995) Mathematical statistics and data analysis, 2nd edn. , Duxbury Press, Belmont CA, 603 p.</li> <li>10. Sokal RR, Rohlf FJ (1987) Introduction to Biostatistics, WH Freeman &amp; Co., New York, 363 p.</li> <li>11. Bogdan Vlaic, 2015, Bioinformatică ,Manual didactic, Editura AcademicPres Cluj-Napoca, ISBN 978-973-744-419-6, Manual didactic, 140 pag.</li> </ol> |  |                                       |
| <i>Supplementary bibliography:</i>   |  |                                       |
| <ol style="list-style-type: none"> <li>1. Bioinformatics For Dummies, 2nd Edition, Jean-Michel Claverie, Cedric Notredame, 2006, ISBN: 978-0-470-08985-9</li> <li>2. Bioinformatics and Functional Genomics, 3rd Edition, Jonathan Pevsner, 2015, ISBN: 978-1-118-58178-0, Wiley-Blackwell</li> </ol>  |  |                                       |

#### 10. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant stakeholders in the corresponding field

The course has a similar content compared with other European universities courses and takes into account the level of preparation of students.  
The course is important / fundamental for the development of working skills as future specialists in the graduated field.

#### 11. Assessment

| Type of activity   | 11.1. Assessment criteria   | 11.2. Assessment methods | 11.3. Percentage of the final grade |
|--|---|--------------------------|-------------------------------------|
| <b>11.4. Lecture</b>   | Assimilation of notions and deepening of specialized knowledge, ability to synthesize | Written examination      | 70%                                 |
| <b>11.5. Seminar/Laboratory</b>  | Thematic report on a given theme  | Power point presentation | 30 %                                |
| <b>11.6. Minimum performance standards</b>   |   |                          |                                     |
| Knowledge 50% of the information contained in the course.<br>Knowledge 50% of the information provided at practical work / seminar.<br>100% attendance at practical work / seminars is mandatory.<br>Attendance at 50% courses is a condition for entering the exam. |   |                          |                                     |

<sup>1</sup> Education levels- choose of the three options: Bachelor/ \* Master/Ph.D.

<sup>2</sup> Discipline status (content)- for the undergraduate level, choose one of the options:- **FD** (fundamental discipline), **BD** (basic discipline), **CS** (specific disciplines-clinical sciences), **AP** (specific disciplines-animal production), **FH** (specific disciplines-food hygiene), **UO** (disciplines based on the university's options).

<sup>3/</sup> Discipline status (compulsoriness)- choose one of the options – **CD** ( compulsory discipline) **OD** (optional discipline) **ED** ( elective discipline).

<sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

<sup>5/\*</sup> Disciplines: AK- Advanced knowledge, CT- Complementary Training, S- Synthesis

Filled in on  
6.09.2024

Course coordinator  
**Lecturer Bogdan Vlaic**

*Laboratory work/seminar coordinator*  
**Lecturer Bogdan Vlaic**

Subject coordinator  
.....

Approved by the  
Department on  
13.09.2024

Head of the Department  
**Conf. Radu Constantinescu, PhD**

Approved by the Faculty  
Council on  
27.09.2024

Dean  
**Prof. Dezmiorean S.Daniel, PhD**



No. \_\_\_\_\_ of \_\_\_\_\_

USAMV form 0311020101

## SUBJECT OUTLINE

### 1. Information on the programme

|                                      |  |
|--------------------------------------|--|
| 1.1. Higher education institution    | University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca |
| 1.2. Faculty                         | Animal Sciences and Biotechnologies  |
| 1.3. Department                      | Technological Sciences   |
| 1.4. Field of study                  | Biotechnologies  |
| 1.5. Education level                 | Master   |
| 1.6. Specialization/ Study programme | Applied Biotechnologies  |
| 1.7. Form of education               | Full time  |

### 2. Information on the discipline

|   |   |               |   |                         |                |                        |                             |     |
|---|---|---------------|---|-------------------------|----------------|------------------------|-----------------------------|-----|
| 2.1. Name of the discipline                   | <b>Principles and isolation techniques of metabolites from natural matrices</b> |               |   |                         |                |                        |                             |     |
| 2.2. Course coordinator                       | Lecturer Adela Ramona Moise, PhD  |               |   |                         |                |                        |                             |     |
| 2.3. Seminar/ laboratory/ project coordinator | Lecturer Adela Ramona Moise, PhD  |               |   |                         |                |                        |                             |     |
| 2.4. Year of study                            | II  | 2.5. Semester | I | 2.6. Type of evaluation | Continuou<br>s | 2.7. Discipline status | Content <sup>2</sup>        | DA  |
|   |   |               |   |                         |                |                        | Compulsoriness <sup>3</sup> | CoD |

### 3. Total estimated time (teaching hours per semester)

|   |     |                            |    |                                   |       |
|---|-----|----------------------------|----|-----------------------------------|-------|
| 3.1. Hours per week – full time programme   | 4   | out of which: 3.2. lecture | 2  | 3.3. seminar/ laboratory/ project | 2     |
| 3.4. Total number of hours in the curriculum  | 56  | Out of which: 3.5. lecture | 28 | 3.6. seminar/laboratory           | 28    |
| <b>Distribution of the time allotted</b>  |     |                            |    |                                   | hours |
| 3.4.1. Study based on book, textbook, bibliography and notes                                |     |                            |    |                                   | 54    |
| 3.4.2. Additional documentation in the library, specialized electronic platforms and field  |     |                            |    |                                   | 30    |
| 3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays |     |                            |    |                                   | 25    |
| 3.4.4. Tutorials  |     |                            |    |                                   | 20    |
| 3.4.5. Examinations   |     |                            |    |                                   | 15    |
| 3.4.6. Other activities   |     |                            |    |                                   | -     |
| 3.7. Total hours of individual study  | 144 |                            |    |                                   |       |
| 3.8. Total hours per semester   | 200 |                            |    |                                   |       |
| 3.9. Number of credits <sup>4</sup>   | 8   |                            |    |                                   |       |

### 4. Prerequisites (is applicable)

|                         |  |
|-------------------------|--|
| 4.1. curriculum-related | Chemistry of natural compounds<br>Biochemistry<br>Techniques for the separation of bioactive compounds   |
| 4.2. skills-related     | The student must have knowledge regarding the use of simple laboratory equipment and the application of physico-chemical techniques in order to perform laboratory analyses. |

### 5. Conditions (if applicable)

|                      |  |
|----------------------|--|
| 5.1. for the lecture | Teaching manuals: according to the bibliography<br>Lecture notes |
|----------------------|--|



|  |  |
|--|--|
|  | <p>Course presentation in pptx format: Lecturer Adela Ramona Moise<br/>         Logistic support: video projector, interactive whiteboard and PowerPoint presentations.<br/>         Participation in a minimum of 50% of courses is a condition for participation in the exam.<br/>         The course takes place interactively, in amphitheatres and laboratories, students benefiting from logistical support. Second cycle students will be involved in discussions related to the topics addressed.<br/>         The university discipline requires the observance of the start and end time of the course.<br/>         No other activities will be tolerated during the lecture, and mobile phones will be switched off.</p>       |
| <p>5.2. for the seminar/ laboratory/ project</p> | <p>Teaching manuals: according to the bibliography<br/>         Laboratory/seminar notes<br/>         Place of laboratory: laboratory room of Apiculture and Sericulture Unit<br/>         Laboratory equipment: existing in the Apiculture and Sericulture laboratory<br/>         Specialized software: attached to laboratory equipment<br/>         Specific laboratory reagents and supplies<br/>         Participation in 100% of laboratory/seminar work is a condition for participation in the exam<br/>         Research laboratories will be available to master's students for making determinations with modern equipment.<br/>         The projects are prepared according to the theme and can constitute a case study.</p> |

**6. Specific competences acquired**

|                                     |   |
|-------------------------------------|---|
| <p>6.1 Professional competences</p> | <p>1) Knowledge of theoretical and practical skills by correlating the received information with those acquired in the disciplines of Biochemistry, Biotechnologies, Apiculture and Sericulture<br/>         2) Training of specialists in the field of Applied Biotechnologies who have the ability to study at master's programs in the field of Biotechnologies, with orientation towards the theoretical and applied aspects of modern laboratory techniques<br/>         3) Learning outcomes that enable the formation of practical skills and abilities in the agreement the dynamics of the field of Biotechnologies. Thus, master's students will have to:<br/>         - Know, analyze and apply the processes related to analytical techniques for the investigation of primary and secondary metabolites from natural matrices<br/>         - Have the ability to contextualize some analytical methods or techniques, in accordance with the concrete situations and/or the resources available in the laboratories<br/>         - determine the concentrations of primary and secondary metabolites with nutritional and/or pharmaceutical action<br/>         - Choose the identification and quantification techniques of metabolites isolated from natural matrices<br/>         - To expertize and control the quality of beekeeping products with high values of bioactive compounds<br/>         - Acquire practical skills related to the determination of bioactive compounds through advanced analytical methods</p> |
|-------------------------------------|---|



|                             |  |
|-----------------------------|--|
| 6.2 Transversal competences | <ol style="list-style-type: none"> <li>1) Use of theoretical notions in solving practical problems.</li> <li>2) Developing the capacities to use the information received within other disciplines (Biochemistry, Biotechnologies, Beekeeping and Sericulture).</li> <li>3) The ability to work in a team</li> <li>4) Use of specialized terminology in various contexts</li> <li>5) Compliance with the principles of professional ethics</li> <li>6) Development of information and documentation skills, collaboration with the group and use of information and processing and interpretation of analytical data.</li> <li>7) Abilities to solve different problems, to demonstrate cognitive flexibility.</li> <li>8) Establishing good communication between student and teacher.</li> <li>9) Attracting and involving the master student in the teaching process.</li> <li>10) Development of methodological skills: formulating research topics, presenting them in writing, scientific approach to topics, collaboration and teamwork.</li> </ol> |
|-----------------------------|--|

### 7. Learning outcomes

|                                 |   |
|---------------------------------|---|
| 7.1 Knowledge                   | The student/graduate describes and knows the principles, methods and techniques for isolating and characterizing metabolites from natural matrices.   |
| 7.2 Skills                      | The student/graduate applies advanced techniques for extraction, purification and analysis of metabolites, uses specific laboratory instruments, interprets complex experimental data and develops practical applications in the field of biotechnology, integrating knowledge from various related disciplines.        |
| 7.3 Responsibility and autonomy | The student/graduate manages interdisciplinary experimental projects, ensures the quality and reproducibility of the analyses performed, makes autonomous decisions regarding the optimization of the isolation and production processes of natural matrices, contributing to innovation in the field of biotechnology. |

### 8. Course objectives (based on the list of competences acquired)

|                               |   |
|-------------------------------|---|
| 7.1. Overall course objective | <p>In-Depth discipline of advanced knowledge that allows the development of knowledge regarding modern laboratory techniques applied in the principles of plant biotechnology.</p> <p>Together with the other subjects in the curriculum, it ensures the implementation and formation of complex concepts regarding the knowledge of metabolites from natural matrices and the operating principles of modern equipment used in specialized laboratories</p>  |
| 7.2. Specific objectives      | <p>Obtaining learning results that have as their purpose the formation of skills and abilities that are based on the correlation of the information received with those acquired in other disciplines such as Biochemistry, Biotechnologies, Beekeeping and Sericulture</p> <p>Knowledge of the principles underlying the separation of different classes of natural compounds with biological value</p> <p>Characterization of the composition and determination of some properties of biomolecules separated from natural matrices</p> <p>Foundation of modern methods for separating compounds with a biological role from natural matrices (high-performance liquid chromatography, gas chromatography, atomic absorption spectrometry)</p> |

### 9. Content

| 9.1. LECTURE<br>Number of hours – 28   | Teaching methods | Notes      |
|--|------------------|------------|
| <p>THE MAIN GROUPS OF SECONDARY METABOLITES FROM DIFFERENT NATURAL MATRICES AND THEIR BIOLOGICAL SIGNIFICANCE</p> <p>The concept of primary and secondary metabolites, metabolic pathways of formation. Natural sources of</p> | Lecture          | 2 Lectures |



|  |  |   |
|--|--|---|
| <p>metabolites of practical interest</p> <p><b>METABOLITES OF PHARMACEUTICAL AND FOOD INTEREST</b><br/>Biologically active nutrients: volatile compounds, fatty acids, amino acids, organic acids. Compounds with pharmaceutical action: flavonoids, phenolic acids, anthocyanins, carotenoids, alkaloids</p> <p><b>ISOLATION METHODS OF SECONDARY METABOLITES</b><br/>Liquid-liquid extraction. Solid phase extraction (SPE), solid phase microextraction (SPME), gas phase solid phase microextraction (Headspace). Organic solvent extraction assisted by ultrasound and/or microwaves</p> <p><b>TECHNIQUES FOR CHARACTERIZING METABOLITES: SPECTROMETRY</b><br/>Optical methods of analysis: infrared absorption spectrometry, visible and ultraviolet absorption spectrometry, fluorescence analysis. Mass spectrometry. Electron Spin Resonance Spectrometry (RES) and Nuclear Magnetic Resonance Spectrometry (NMR)</p> <p><b>TECHNIQUES FOR CHARACTERIZATION OF METABOLITES: LIQUID CHROMATOGRAPHY</b><br/>Basic characteristics of chromatographic processes. Apparatus and detectors used in high performance liquid chromatography. Mobile phases, columns and stationary phases in liquid chromatography. Determination of biologically active compounds by HPLC: qualitative and quantitative analysis. Interpretation of chromatograms: defining elements of a chromatogram</p> <p><b>TECHNIQUES FOR CHARACTERIZATION OF METABOLITES: GAS CHROMATOGRAPHY</b><br/>Apparatus and detectors used in gas chromatography. Chromatographic materials: stationary phases, carrier gases. Qualitative analysis and quantitative analysis in gas chromatography</p> | <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p>   | <p>2 Lectures</p> <p>2 Lectures</p> <p>2 Lectures</p> <p>4 Lectures</p> <p>2 Lectures</p> |
| <p><b>9.2. PRACTICAL WORK</b><br/><b>Number of hours – 28</b><br/>Plants rich in secondary metabolites: extraction using different organic solvents</p> <p>Spectrophotometric determination of the content of total polyphenols and flavonoids (flavones, flavonols) in plants</p> <p>Bee products rich in secondary metabolites: extraction and quantification methods (determination of vitamin C</p>  | <p>Study of plants rich in biologically active secondary metabolites. Use and efficiency of different organic solvents for their extraction.</p> <p>The use of spectrophotometry as a method for quantifying polyphenols and flavonoids in natural plant matrices.</p> <p>Knowledge of the composition of the main</p> | <p>2 Practical work</p> <p>2 Practical work</p> <p>2 Practical work</p>                   |



|   |   |                  |
|---|---|------------------|
| from pollen and 10-HDA acid from royal jelly by HPLC-PDA)   | beekeeping products as natural matrices and of the main methods for their identification and quantification, with laboratory examples of the determination of vitamin C and 10-HDA acid |                  |
| Primary metabolites from fruits: carbohydrates - determination by HPLC-IR   | Study of the main carbohydrates in fruits by identifying, separating and quantifying them using the HPLC-IR technique   | 2 Practical work |
| Secondary metabolites from fruits: organic acids - extraction and quantification by HPLC-PDA  | Study of the main acids in fruits by identifying, separating and quantifying them using the HPLC-PDA technique  | 2 Practical work |
| Polyphenolic profile of plant extracts: HPLC-PDA analysis   | Knowledge of the technique for quantifying polyphenols from various plant extracts using HPLC-DPA chromatography  | 1 Practical work |
| Analytical signal processing methods: applications related to extracting information from chromatograms   | Knowledge of methods for interpreting chromatograms by analysing signals obtained on chromatograms  | 1 Practical work |
| Amino acids from vegetable sources. Determination of amino acid content by LC-MS  | Knowledge of the operating principle of LC-MS and identification of amino acids from plant sources.   | 2 Practical work |
| <i>Compulsory bibliography:</i>   |   |                  |
| <ol style="list-style-type: none"> <li>1. Course notes</li> <li>2. Socaciu C., Chimie Fizică și coloidală, Editura Academic Press Cluj-Napoca, 2000</li> <li>3. Jercan E., Metode de Separare în Chimia Analitică, Editura Tehnică, București 1983</li> <li>4. Andrei, S., Chimie analitică și analiză instrumentală, Editura Academic Press, 2010</li> <li>5. Atkins, P., Jones, L., Chemical Principles The Quest for Insight, Third Edition, W.H.Freeman and Company, New York, 2005</li> </ol>  |   |                  |
| <i>Optional bibliography:</i>   |   |                  |
| <ol style="list-style-type: none"> <li>1. L.Al.Mărghițaș, Daniel S. Dezmirean, Otilia Bobiș, Melinda Tofalvi – Extracte vegetale utilizate în hrana albinelor, Ed Academic Press, 2011</li> <li>2. Liviu Al.Mărghițaș, Daniel S. Dezmirean, Otilia Bobiș, Victorița Bonta, Oltica Giorgiana Stanciu, Iosif Gherghen, Monica Hărmănescu - Metode moderne de determinare a rezidurilor și contaminanților din miere și produse apicole – - Ed. Academic Press, 2010</li> <li>3. Socaciu C., Chimie fizica si coloidală – lucrari practice si exercitii, Academic Press 2000</li> <li>4. Dulf, F.V., Analiza compușilor lipidici – acizi grași și fitosteroli, Editura Mediamira, 2012</li> <li>5. Luca, C., Duca, A.I., Crișan, I.Al., Chimia analitică și analiza instrumentală, Editura Didactică și Pedagogică București, 1983</li> <li>6. Perkampus, H.H., UV-VIS Spectroscopy and Its Applications, Springer Verlag, 1992</li> <li>7. Various scientific articles published in specialized international journals</li> </ol> |   |                  |

**10. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant stakeholders in the corresponding field**

The course has a similar content to courses in other European universities and takes into account the level of preparation of the students.

The course is fundamental for the development of work skills as future specialists in the graduated field.

In order to update the knowledge of analytical and instrumental chemistry, to identify ways to modernize and continuously improve teaching and course content, with the most current topics and practical problems, teachers



participate in scientific events organized in the country and abroad, in training courses

### 11. Assessment

| Type of activity   | Assessment criteria  | Assessment methods                         | Percentage of the final grade |
|--|--|--|-------------------------------|
| <b>11.1. Lecture</b>   | Groups of primary and secondary metabolites and their significance<br>Metabolites of nutritional and pharmaceutical interest<br>Metabolite isolation methods<br>Characterization techniques:<br>spectrometry<br>Characterization techniques: liquid chromatography<br>Characterization techniques: gas chromatography  | Exam                                       | 70%                           |
| <b>11.2. Seminar/Laboratory</b>  | Plants rich in secondary metabolites: extraction using different organic solvents<br>Spectrophotometric determination of the content of total polyphenols and flavonoids in plants<br>Bee products rich in secondary metabolites: extraction and quantification methods<br>Primary metabolites from fruits: carbohydrates - determination by HPLC-IR<br>Secondary metabolites from fruits: organic acids - extraction and quantification by HPLC-PDA<br>Polyphenolic profile of plant extracts: HPLC-PDA analysis<br>Analytical signal processing methods:<br>Applications related to extracting the formation from chromatograms<br>Amino acids from vegetable sources.<br>Determination of amino acid content by LC-MS | Thematic report with the established theme | 30%                           |
| <b>11.3. Minimum performance standards</b><br>Knowledge 50% of the information contained in the course.<br>Knowledge 50% of the information provided at practical work / seminar.<br>100% attendance at practical work / seminars is mandatory.<br>Attendance at 50% courses is a condition for entering the exam. |  |  |                               |

<sup>1</sup> Education levels- choose of the three options: Bachelor/Master/Ph.D.

<sup>2</sup> Discipline status (content)- for the undergraduate level, choose one of the options: **FD** (fundamental discipline), **DD** (domain discipline), **SD** (specialty discipline), **CD** (complementary discipline).

Discipline status (content)- for the master level, choose one of the options: **DA** (in-depth discipline), **DCA** (advanced knowledge discipline), **DPC** (complementary preparation discipline), **DS** (synthesis discipline – options depending on the domain).

<sup>3</sup> Discipline status (compulsoriness)- choose one of the options: **CoD** (compulsory discipline), **OD** (optional discipline), **ED** (elective discipline).

<sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).



**UNIVERSITATEA DE ȘTIINȚE AGRICOLE ȘI MEDICINĂ VETERINARĂ CLUJ-NAPOCA**

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[www.usamvcluj.ro](http://www.usamvcluj.ro)

**Filled in on  
23.09.2025**

**Course coordinator**

Lecturer Adela Ramona Moise, PhD

**Laboratory work/seminar coordinator**

Lecturer Adela Ramona Moise, PhD

**Subject coordinator**

**Professor Daniel Severus Dezmirean, PhD**

**Approved by the  
Department on  
24.09.2025**

**Head of the Department**

**Assoc. Prof. Cristian Ovidiu Coroian, PhD**

**Approved by the Faculty  
Council on  
24.09.2025**

**Dean**

**Professor Daniel Severus Dezmirean, PhD**



No. \_\_\_\_\_ of \_\_\_\_\_

USAMV form 0311020102

## SUBJECT OUTLINE

### 1. Information on the programme

|                                      |  |
|--------------------------------------|--|
| 1.1. Higher education institution    | University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca |
| 1.2. Faculty                         | Animal Sciences and Biotechnologies  |
| 1.3. Department                      | Fundamental Sciences and Biotechnologies                                   |
| 1.4. Field of study                  | Biotechnologies  |
| 1.5. Education level                 | Master   |
| 1.6. Specialization/ Study programme | Applied biotechnologies  |
| 1.7. Form of education               | Full time  |

### 2. Information on the discipline

|   |  |               |   |                         |            |                        |                             |    |
|---|--|---------------|---|-------------------------|------------|------------------------|-----------------------------|----|
| 2.1. Name of the discipline                   | Cell and tissue engineering            |               |   |                         |            |                        |                             |    |
| 2.2. Course coordinator                       | Associate professor Ileana Miclea, PhD |               |   |                         |            |                        |                             |    |
| 2.3. Seminar/ laboratory/ project coordinator | Associate professor Ileana Miclea, PhD |               |   |                         |            |                        |                             |    |
| 2.4. Year of study                            | II                                     | 2.5. Semester | I | 2.6. Type of evaluation | continuous | 2.7. Discipline status | Content <sup>2</sup>        | FD |
|   |  |               |   |                         |            |                        | Compulsoriness <sup>3</sup> | CD |

### 3. Total estimated time (teaching hours per semester)

|   |     |                            |    |                                   |       |
|---|-----|----------------------------|----|-----------------------------------|-------|
| 3.1. Hours per week – full time programme   | 4   | out of which: 3.2. lecture | 2  | 3.3. seminar/ laboratory/ project | 2     |
| 3.4. Total number of hours in the curriculum  | 56  | Out of which: 3.5. lecture | 28 | 3.6. seminar/laboratory           | 28    |
| <b>Distribution of the time allotted</b>  |     |                            |    |                                   | hours |
| 3.4.1. Study based on book, textbook, bibliography and notes                                |     |                            |    |                                   | 50    |
| 3.4.2. Additional documentation in the library, specialized electronic platforms and field  |     |                            |    |                                   | 50    |
| 3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays |     |                            |    |                                   | 20    |
| 3.4.4. Tutorials  |     |                            |    |                                   | 10    |
| 3.4.5. Examinations   |     |                            |    |                                   | 14    |
| 3.4.6. Other activities   |     |                            |    |                                   | -     |
| 3.7. Total hours of individual study  | 144 |                            |    |                                   |       |
| 3.8. Total hours per semester   | 200 |                            |    |                                   |       |
| 3.9. Number of credits <sup>4</sup>   | 8   |                            |    |                                   |       |

### 4. Prerequisites (is applicable)

|                         |  |
|-------------------------|--|
| 4.1. curriculum-related | Multi-omics applications in biotechnology; Animal cell and tissue culture; Plant cell and tissue culture |
| 4.2. skills-related     | English language   |

### 5. Conditions (if applicable)

|                      |   |
|----------------------|---|
| 5.1. for the lecture | Lecture notes: yes. Logistic support: video projector, interactive whiteboard and |
|----------------------|---|



|   |  |
|---|--|
|   | PowerPoint presentations. The course is interactive, students can ask questions regarding the content of the presentation. Academic discipline requires compliance with the timetable for the start and end of the course. An attendance score of at least 50% for lectures is mandatory for participating in the final exam.  |
| 5.2. for the seminar/ laboratory/ project | Students will have protective equipment (laboratory coat, gloves). Laboratory notes: yes. Using the provided protocols and materials students will work alone or in small groups to complete the requisite lab work. Academic discipline is mandatory throughout the development of practical work. An attendance score of at least 100% for laboratory work is mandatory for participating in the final exam. |

## 6. Specific competences acquired

|                              |   |
|------------------------------|---|
| 6.1 Professional competences | Developing and perfecting innovative applications for animal and plant tissue. The ability to find solutions to problems within plant and animal tissue engineering protocols.<br>The ability to develop tissue engineering applications for regenerative medicine.<br>Providing consultancy within the field of cell and tissue engineering.   |
| 6.2 Transversal competences  | The use of theoretical aspects learned in solving practical problems. Ability to work in a team and adapt to unexpected tasks. Use of specialized terminology in various contexts. Involvement in scientific activities, such as the elaboration of scientific papers and specialized studies. Participation in scientific projects, compatible with the requirements of integrating into European higher education. Compliance with the principles of professional ethics. |

## 7. Learning outcomes

|                                 |  |
|---------------------------------|--|
| 7.1 Knowledge                   | The student describes the fundamental principles of cell and tissue engineering, knows modern methods of cell culture, can explain the mechanisms of 3D cell culture and their use in a medical context.   |
| 7.2 Skills                      | The student uses specific techniques for the isolation, culture and manipulation of cells and tissues. The student can harvest and preserve cells using biotechnological methods.  |
| 7.3 Responsibility and autonomy | The bachelor manages and is responsible for experiments in the field of cell biotechnology. The bachelor is capable of autonomous decisions with regard to the selection and use of technology for the purpose of research or economic activity. All this is done while complying with legislation and regulations on bioethics, biosecurity and good laboratory practice with regard to the handling of live biological material. |

## 8. Course objectives (based on the list of competences acquired)

|                               |  |
|-------------------------------|--|
| 7.1. Overall course objective | Fundamental discipline that allows the development of abilities in the field of cell and tissue engineering and their integration in fundamental scientific research and applications in various fields. |
| 7.2. Specific objectives      | Training the ability to critically interpret and synthesize data, to formulate hypothesis or conclusions but also to take decisions in various situations encountered in cell and tissue engineering.    |

## 9. Content

| 9.1.LECTURE   | Teaching methods                                  | Notes               |
|---|---|---------------------|
| <b>Number of hours – 28</b>   |   | 1 lecture = 2 hours |
| Introduction to the field of cell and tissue engineering: definitions, history, aim, future perspectives. |   | 1 lecture           |
| Biocompatible materials: synthetic, natural, inorganic, organic.  |   | 2 lectures          |
| Interactions between cells and biomaterials.  |   |                     |
| Culture methods in cell and tissue engineering, maturation of tissue constructs.                          | Lectures,   | 2 lectures          |
| Using stem cells in tissue engineering.   | exposure with the use of                          | 1 lecture           |
| Skin tissue engineering: skin grafts, 3D methods for the  | audio-video (video and Power-Point presentation), | 1 lecture           |



|   |  |   |
|---|--|---|
| culture of skin cells.<br>Reconstruction of cartilage using tissue engineering.<br>Regeneration of bone tissue using tissue engineering.<br>Tissue engineering in neuroscience.<br>Building and repairing the vascular network using tissue engineering.<br>Tissue engineering of the heart: biomaterials for repairing the myocardium and heart valves.<br>Liver tissue engineering: cells and methods that can regenerate the liver.<br>Tissue engineering of the pancreas. | explanation, problem solving, brain-storming | 1 lecture<br><br>1 lecture<br>1 lecture<br>1 lecture<br><br>1 lecture<br><br>1 lecture<br><br>1 lecture |
|---|--|---|

|   |  |  |
|---|--|--|
| <b>9.2. PRACTICAL WORK</b><br><b>Number of hours – 28</b><br>Requirements of the discipline and work safety and biohazard.<br>Fluorescent microscopy for cell morphology.<br>Assessment of epithelial cell viability in contact with biomaterials.<br>Analyzing the biocompatibility of various materials: the MTT proliferation test.<br>Analyzing the biocompatibility of various materials: the cytotoxicity LDH test.<br>Production and use of plant tissue as 3D matrix for the culture of animal cells.<br>Assessing the expression level of various markers for the detection of stem cells.<br>Examination. | Explanation, demonstration, individual and team work.<br>Laboratory activities, specific laboratory techniques | 1 lab work (2 hours / work)<br><br>1 laboratory session<br><br>1 laboratory session<br>3 laboratory sessions<br><br>3 laboratory sessions<br><br>3 laboratory sessions<br><br>1 laboratory session<br><br>1 laboratory session<br><br>1 laboratory session |
|---|--|--|

**Compulsory bibliography**

1. Minuth W.W., Strehl R., Schumacher K., 2005, Tissue Engineering. Essentials for Daily Laboratory Work, Wiley-VCH Verlag, Weinheim.
2. Eibl R., Eibl D., Pörtner R., Catapano G., Czermak P., 2009, Cell and Tissue Reaction Engineering, Springer-Verlag, Berlin Heidelberg.
3. Dutta R.C., Dutta A.K., 2018, 3D Cell Culture: Fundamentals and Applications in Tissue Engineering and Regenerative Medicine, Pan Stanford, Singapore.
4. Appasani K., Appasani R.K., 2011, Stem Cells & Regenerative Medicine. From Molecular Embryology to Tissue Engineering Humana Press, New York.

**Optional bibliography:**

1. Dib, N., Taylor D.A., Diethrich E.B., 2006, Stem Cell Therapy and Tissue Engineering for Cardiovascular Repair, Springer Science, New York.
2. Vishwakarma A., Sharpe P., Shi S., Ramalingam M., 2015, Stem Cell Biology and Tissue Engineering in Dental Sciences, Academic Press.
3. Berardi A.C., 2018, Stem Cell Biology and Regenerative Medicine, Humana Press, Cham, Switzerland.

**10. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant stakeholders in the corresponding field**

The course has a similar content compared with other European universities courses and takes into account the level of preparation of students.  
The course is important / fundamental for the development of working skills as future specialists in the graduated field.

**11. Assessment**

| Type of activity     | Assessment criteria                                  | Assessment methods            | Percentage of the final grade |
|----------------------|--|-------------------------------|-------------------------------|
| <b>11.1. Lecture</b> | Attendance   | Interaction during the course | 5%                            |
|                      | Knowledge of the subject presented during the course | Final exam                    | 60%                           |



|  |                       |                                 |     |
|--|-----------------------|---------------------------------|-----|
| <b>11.2. Seminar/Laboratory</b>  | Work technique        | Continuous observation          | 5%  |
|  | Practical examination | Essay on a subject in the field | 30% |
| <b>11.3. Minimum performance standards</b><br>Knowledge 50% of the information contained in the course.<br>Knowledge 50% of the information provided at practical work / seminar.<br>100% attendance at practical work / seminars is mandatory.<br>Attendance at 50% courses is a condition for entering the exam. |                       |                                 |     |

<sup>1</sup> Education levels- choose of the three options: Bachelor/Master/Ph.D.

<sup>2</sup> Discipline status (content)- for the undergraduate level, choose one of the options: **FD** (fundamental discipline), **DD** (domain discipline), **SD** (specialty discipline), **CD** (complementary discipline).

Discipline status (content)- for the master level, choose one of the options: **DA** (in-depth discipline), **DCA** (advanced knowledge discipline), **DPC** (complementary preparation discipline), **DS** (synthesis discipline – options depending on the domain).

<sup>3</sup> Discipline status (compulsoriness)- choose one of the options: **CoD** (compulsory discipline), **OD** (optional discipline), **ED** (elective discipline).

<sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

**Filled in on**  
**23.09.2025**

Course coordinator  
Associate professor Ileana Miclea, PhD

Laboratory work coordinator  
Associate professor Ileana Miclea, PhD

Subject coordinator  
Associate professor Ileana Miclea, PhD

**Approved by the**  
**Department on**  
**24.09.2025**

Head of the Department  
Associate professor Radu Constantinescu, PhD

**Approved by the Faculty**  
**Council on**  
**24.09.2025**

Dean  
Professor Daniel Dezmarean, PhD



No. \_\_\_\_\_ of \_\_\_\_\_

USAMV form 0311020103

## SUBJECT OUTLINE

### 1. Information on the programme

|                                      |   |
|--------------------------------------|---|
| 1.1. Higher education institution    | University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca |
| 1.2. Faculty                         | Animal Breeding and Biotechnologies                                     |
| 1.3. Department                      | Technological Sciences  |
| 1.4. Field of study                  | Biotechnologies   |
| 1.5. Education level                 | Master  |
| 1.6. Specialization/ Study programme | Applied Biotechnologies   |
| 1.7. Form of education               | Full time   |

### 2. Information on the discipline

|   |   |               |   |                         |            |                        |                             |     |
|---|---|---------------|---|-------------------------|------------|------------------------|-----------------------------|-----|
| 2.1. Name of the discipline                   | Biotechnology application in Entomology |               |   |                         |            |                        |                             |     |
| 2.2. Course coordinator                       | Lecturer Adela Ramona Moise, PhD        |               |   |                         |            |                        |                             |     |
| 2.3. Seminar/ laboratory/ project coordinator | Lecturer Adela Ramona Moise, PhD        |               |   |                         |            |                        |                             |     |
| 2.4. Year of study                            | II                                      | 2.5. Semester | I | 2.6. Type of evaluation | continuous | 2.7. Discipline status | Content <sup>2</sup>        | DA  |
|   |   |               |   |                         |            |                        | Compulsoriness <sup>3</sup> | CoD |

### 3. Total estimated time (teaching hours per semester)

|   |     |                            |    |                                   |       |
|---|-----|----------------------------|----|-----------------------------------|-------|
| 3.1. Hours per week – full time programme   | 4   | out of which: 3.2. lecture | 2  | 3.3. seminar/ laboratory/ project | 2     |
| 3.4. Total number of hours in the curriculum  | 56  | Out of which: 3.5. lecture | 28 | 3.6. seminar/laboratory           | 28    |
| <b>Distribution of the time allotted</b>  |     |                            |    |                                   | hours |
| 3.4.1. Study based on book, textbook, bibliography and notes                                |     |                            |    |                                   | 54    |
| 3.4.2. Additional documentation in the library, specialized electronic platforms and field  |     |                            |    |                                   | 30    |
| 3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays |     |                            |    |                                   | 25    |
| 3.4.4. Tutorials  |     |                            |    |                                   | 20    |
| 3.4.5. Examinations   |     |                            |    |                                   | 15    |
| 3.4.6. Other activities   |     |                            |    |                                   |       |
| 3.7. Total hours of individual study  | 144 |                            |    |                                   |       |
| 3.8. Total hours per semester   | 200 |                            |    |                                   |       |
| 3.9. Number of credits <sup>4</sup>   | 8   |                            |    |                                   |       |

### 4. Prerequisites (is applicable)

|                         |   |
|-------------------------|---|
| 4.1. curriculum-related | Apiculture and sericultural biotechnology, Genetic engineering, Molecular biology, General and special microbiology           |
| 4.2. skills-related     | Use of simple laboratory equipment. Application of physico-chemical techniques and working protocols for laboratory analyses. |

### 5. Conditions (if applicable)

|                      |   |
|----------------------|---|
| 5.1. for the lecture | Teaching manuals: according to the bibliography<br>Lecture notes<br>Course presentation in pptx format: Lecturer Adela Ramona Moise |
|----------------------|---|



|  |  |
|--|--|
|  | <p>Logistic support: video projector, interactive whiteboard and PowerPoint presentations.</p> <p>Participation in a minimum of 50% of courses is a condition for participation in the exam.</p> <p>The course takes place interactively, in amphitheatres and laboratories, students benefiting from logistical support. Second cycle students will be involved in discussions related to the topics addressed.</p> <p>The university discipline requires the observance of the start and end time of the course.</p> <p>No other activities are tolerate during the lecture, and mobile phones will be switched off.</p>   |
| <p>5.2. for the seminar/ laboratory/ project</p> | <p>Teaching manuals: according to the bibliography</p> <p>Laboratory/seminar notes</p> <p>Place of laboratory: laboratory room of Apiculture and Sericulture Unit</p> <p>Laboratory equipment: existing in the Apiculture and Sericulture laboratory</p> <p>Specialized software: attached to laboratory equipment</p> <p>Specific laboratory reagents and supplies</p> <p>Participation in 100% of laboratory/seminar work is a condition for participation in the exam</p> <p>Research laboratories will be available to master's students for making determinations with modern equipment.</p> <p>The projects are prepared according to the theme and can constitute a case study.</p> |

## 6. Specific competences acquired

|                                     |   |
|-------------------------------------|---|
| <p>6.1 Professional competences</p> | <p>1) The formation of theoretical and practical skills by correlating the received information with those acquired in the disciplines of Anatomy, Biochemistry, Biotechnologies, Beekeeping and Sericulture, Entomology</p> <p>2) The training of specialists in the field of Applied Biotechnologies who have the ability to study at master's programs in the field of Biotechnologies, with orientation towards the theoretical and applied aspects of Entomology</p> <p>3) Learning outcomes that enable the formation of practical skills and abilities in the agreement to the dynamics of the field of Biotechnologies. Thus, master's students will have to:</p> <ul style="list-style-type: none"> <li>- know, analyse and apply procedures related to analytical techniques for investigating biotechnological potential in entomology;</li> <li>- have the ability to choose a certain method or technique in a certain context, in accordance with the specific situations and with the resources available in the laboratories of biotechnologies applied in entomology.</li> <li>- identify and purify biologically active compounds from bee and sericulture products with high value for nanotechnologies.</li> <li>- know the techniques for identifying and quantifying the hygienic behaviour of bees and their genetic resistance to diseases (genetic resistance to <i>Varroa</i>).</li> <li>- acquire practical skills related to the biotechnological potential of entomology.</li> </ul> |
|-------------------------------------|---|



|                             |   |
|-----------------------------|---|
| 6.2 Transversal competences | <ol style="list-style-type: none"> <li>1) The use of theoretical aspects learned in solving practical problems.</li> <li>2) Developing the capacities to use the information received within other Disciplines (Anatomy, Biochemistry, Biotechnologies, Apiculture and Sericulture, Entomology).</li> <li>3) Ability to work in a team.</li> <li>4) Use of specialised terminology in various contexts.</li> <li>5) Compliance with the principles of professional ethics.</li> <li>6) Development of information and documentation skills, collaboration with the group and use of information and processing and interpretation of analytical data.</li> <li>7) Abilities to solve different problems, to demonstrate cognitive flexibility.</li> <li>8) Establishing good communication between students and teacher.</li> <li>9) Attracting and involving the master student in the teaching process.</li> <li>10) Development of methodological skills: formulation of research topics, their presentation in writing, scientific approach to topics, collaboration and teamwork.</li> </ol> |
|-----------------------------|---|

### 7. Learning outcomes

|                                 |  |
|---------------------------------|--|
| 7.1 Knowledge                   | The student/graduate knows the principles and methods of marker-assisted selection in animal population improvement, molecular techniques used for food authentication and detection of genetically modified organisms, the foundations of bioinformatics and biostatistics in biological data analysis, as well as biotechnological applications in entomology. |
| 7.2 Skills                      | The student/graduate applies molecular methods and genetic analysis for animal selection and product authentication, uses statistical techniques for interpreting biological data, and implements biotechnological methods in the study and exploitation of insects of economic and research interest.   |
| 7.3 Responsibility and autonomy | The student/graduate independently manages assisted genetic selection processes, ensures accuracy in food product authentication, critically interprets bioinformatics and bio-statistically the results, respects ethical norms in entomological research and contributes to the development of the biotechnology field.  |

### 8. Course objectives (based on the list of competences acquired)

|                               |  |
|-------------------------------|--|
| 7.1. Overall course objective | In-depth discipline of advanced knowledge that allows the development of knowledge regarding modern techniques applied in biotechnologies principles. Together with the other disciplines in the curriculum, it ensures the implementation and formation of complex concepts on insect's knowledge and assimilation of in-depth knowledge of modern techniques applied in the principles of biotechnology as well as knowledge of modern equipment used in specialized laboratories. |
| 7.2. Specific objectives      | Obtaining learning outcomes that aim in the formation of skills and abilities based on the correlation of the information received with those acquired in other disciplines such as Anatomy, Biochemistry, Biotechnologies, Apiculture and Sericulture, Entomology   |

### 9. Content

| 9.1. LECTURE   | Teaching methods | Notes      |
|--|------------------|------------|
| <b>Number of hours – 28</b>  |                  |            |
| <b>ENTOMOLOGY AND ITS BIOTECHNOLOGICAL POTENTIAL</b><br>The concept of biotechnologies applied in entomology (useful insects)  | Lecture          | 1 lecture  |
| <b>BIOTECHNOLOGIES APPLIED IN APIDOLOGY</b><br>Honey bees as a study model for the evolution and regulation of social behaviour at the endocrine, cellular, genomic and molecular level                    | Lecture          | 2 lectures |
| <b>GENETICS OF VARROA RESISTANCE</b><br>Genetic mechanisms underlying bee resistance to <i>Varroa destructor</i> . Mapping with SNP and QTL markers, high intensity mapping. Transcriptomics in apidology. | Lecture          | 4 lecture  |



|   |  |  |
|---|--|--|
| <p><b>BIOTECHNOLOGIES APPLIED IN SERICOLOGY</b><br/>Silkworms, study model at individual, endocrine, cellular, genomic and molecular level. Applications in nanotechnologies and bio economics. The concept of Farma-Farming.</p> <p><b>EXPLOITATION OF SERICIGEN PRODUCTS</b><br/>Identification of protein sources in the silk glands of larvae, silk cocoons and chrysalides. Collagen production through genetic engineering techniques.</p> <p><b>CONTROL AND TREATMENT TECHNIQUES</b><br/>New control and treatment techniques based on the biologically active effect of bee products and plant secondary metabolites applied in entomology</p> <p><b>OTHER INSECTS WITH BIOTECHNOLOGICAL POTENTIAL</b></p>          | <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p>  | <p>2 lectures</p> <p>3 lecture</p> <p>1 lecture</p> <p>1 lecture</p>   |
| <p><b>9.2. PRACTICAL WORK</b><br/><b>Number of hours – 28</b><br/>Applied apidology: monitoring individuals in the bee family during metamorphosis in various experimental designs.</p> <p>Experimental design to identify resistance to <i>Varroa destructor</i>. Transcriptomics experiments and techniques.</p> <p>Techniques for identifying sensitive hygienic behavior in honey bees</p> <p>Applied improvement schemes</p> <p>Applied sericology: organization of silkworm rearings in a controlled system and on an artificial diet</p> <p>Techniques for extracting proteins from cocoons and chrysalis</p> <p>Laboratory diagnosis of the main pathogens</p> <p>Practical applications of some useful insects</p> | <p>Knowledge of the stages of complete metamorphosis in bees and other honeybee species; the main transformations of insects, their role in apidology and the importance of apidology</p> <p>Knowledge of the biology of the <i>Varroa destructor</i> parasite and the behaviour of bees in the event of their parasitism; implementation of experiments and techniques useful in the detection and control of the parasite.</p> <p>Knowledge of the hygienic behaviour of bees and its identification</p> <p>Study of the main selection methods applicable to insects</p> <p>Knowledge of the main stages of raising and exploiting silkworms as a useful species in obtaining sericulture products and by-products</p> <p>Application of laboratory methods for the extraction and quantification of proteins from silk matrices</p> <p>Knowledge of laboratory techniques necessary to identify the main groups of insect pathogens</p> <p>Studying the importance of insects for humans, the environment and health</p> | <p>2 practical work</p> <p>2 practical work</p> <p>1 practical works</p> <p>2 practical work</p> <p>3 practical work</p> <p>1 practical work</p> <p>1 practical work</p> <p>1 practical work</p> |
| <p><b>Compulsory bibliography:</b></p> <ol style="list-style-type: none"> <li>Note de curs</li> <li>Dezmirean, D.S. (2013). Curs de biotehnologii în apicultură și sericultură, Ed. Academic Press</li> <li>Mărghitaș L. (2005). Albinele și produsele lor, Ed. Ceres, București, Ediția a III-a</li> <li>Dezmirean, D.S. (2007). Tehnologii apicole speciale, Ed. Academic Press</li> <li>Dezmirean, D.S. (2013). Indrumător de lucrări practice pentru biotehnologii în apicultură, Ed. AcademicPress, Cluj-Napoca</li> </ol> <p><b>Optional bibliography:</b></p>  |  |  |



1. L. Al. Mărghitaș, Daniel S. Dezmirean, Otilia Bobiș, Melinda Tofalvi, (2011), Extracte vegetale utilizate în hrana albinelor, Ed Academic Press.
2. Liviu Al. Mărghitaș, Daniel S. Dezmirean, Otilia Bobiș, Victorița Bonta, Oltica Giorgiana Stanciu, Iosif Gherghen, Monica Hărmanescu, (2010), Metode moderne de determinare a rezidurilor și contaminanților din miere și produse apicole, Ed. AcademicPress.
3. Dezmirean D.S. (2007), Tehnologii Apicole Speciale, Ed. AcademicPress,
4. Cîrnu I. (1974) - Plante melifere, Ed. Ceres, București
5. Piere Jean Prost, Yves le Conte- Apiculture (2005) – Connaitre labeile, Conduire le rucher
6. [www.beekeeping.com](http://www.beekeeping.com)
7. [www.aphiteraphy.blogspot.com](http://www.aphiteraphy.blogspot.com)
8. [www.madr.ro](http://www.madr.ro)

**10. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant stakeholders in the corresponding field**

The course has a similar content to courses in other European universities and takes into account the level of preparation of the students.

The course is fundamental for the development of work skills as future specialists in the graduated field.

In order to update knowledge in the field of beekeeping and sericulture, to identify ways to modernize and continuously improve teaching and course content, with the most current topics and practical problems. Teachers will participate in scientific events organized in the country and abroad, in events of the Association Beekeepers from Romania, at the annual meeting of the International Honey Commission and at the conferences organized by the International Sericultural Commission.

**11. Assessment**

| Type of activity   | Assessment criteria   | Assessment methods  | Percentage of the final grade |
|--|---|---|-------------------------------|
| <b>11.1. Lecture</b>   | Mechanisms for identification of resistance to <i>Varroa</i> ;<br>Study model in apidology;<br>Breeding systems based on multiplying resistant strains;<br>QTL mapping;<br>Mechanisms for identifying the parasite host interaction;<br>Study model in serology;<br>Identification of mechanisms for extraction of protein sources in the sericigene glands, cocoons and chrysalis;<br>Controlled growth systems for Farma Farming;<br>Collagen production by genetic engineering techniques at <i>Bombyx mori</i> ;<br>Exploitation of biotechnological potential in entomology. | Exam  | 70%                           |
| <b>11.2. Seminar/Laboratory</b>  | Experimental design for apidological study at the level of individual and bee family;<br>Transcriptomic techniques;<br>Techniques for identifying sensitive hygienic behaviour in <i>Varroa</i> ;<br>Protein extraction techniques for sericigenic gland, silk cocoons and chrysalides;<br>FTIR analysis techniques;<br>QTL techniques and mapping.   | Oral presentation of a scientific report on a predetermined topic | 30%                           |
| <b>11.3. Minimum performance standards</b>                             |   |   |                               |
| Knowledge 50% of the information contained in the course.              |   |   |                               |
| Knowledge 50% of the information provided at practical work / seminar. |   |   |                               |



**UNIVERSITATEA DE ȘTIINȚE AGRICOLE ȘI MEDICINĂ VETERINARĂ CLUJ-NAPOCA**

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Tel: 0264-596.384, Fax: 0264-593.792

www.usamvcluj.ro

100% attendance at practical work / seminars is mandatory.  
Attendance at 50% courses is a condition for entering the exam.

<sup>1</sup> Education levels- choose of the three options: Bachelor/Master/Ph.D.

<sup>2</sup> Discipline status (content)- for the undergraduate level, choose one of the options: **FD** (fundamental discipline), **DD** (domain discipline), **SD** (specialty discipline), **CD** (complementary discipline).

Discipline status (content)- for the master level, choose one of the options: **DA** (in-depth discipline), **DCA** (advanced knowledge discipline), **DPC** (complementary preparation discipline), **DS** (synthesis discipline – options depending on the domain).

<sup>3</sup> Discipline status (compulsoriness)- choose one of the options: **CoD** (compulsory discipline), **OD** (optional discipline), **ED** (elective discipline).

<sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

**Filled in on**  
**23.09.2025**

**Course coordinator**  
**Lecturer Adela Ramona Moise, PhD**

**Laboratory work/seminar coordinator**  
**Lecturer Adela Ramona Moise, PhD**

**Subject coordinator**  
**Prof. Daniel Dezmirean, PhD**

**Approved by the**  
**Department on**  
**24.09.2025**

**Head of the Department**  
**Assoc. Prof. Cristian Ovidiu Coroian, PhD**

**Approved by the Faculty**  
**Council on**  
**24.09.2025**

**Dean**  
**Prof. Daniel Dezmirean, PhD**



No. \_\_\_\_\_ from \_\_\_\_\_

Form UASVM–CN-0311020105

### DISCIPLINE SHEET

#### 1. Data about the program

|  |   |
|--|---|
| 1.1. The institution of higher education | University of Agricultural Sciences and Veterinary Medicine from Cluj -Napoca |
| 1.2. Faculty                             | Animal science and Biotechnologies  |
| 1.3. Department                          | II Technological Science – Animal Science                                     |
| 1.4. Study Domain                        | Biotechnologies   |
| 1.5. Study Cycle <sup>1)</sup>           | Master  |
| 1.6. Specialization / Study Domain       | Applied Biotechnologies   |
| 1.7. Education form                      | IF  |

#### 2. Data about the discipline

|  |  |               |    |                      |           |                        |                             |    |
|--|--|---------------|----|----------------------|-----------|------------------------|-----------------------------|----|
| 2.1. Name of the discipline                              | Biotechnology of fermentation products |               |    |                      |           |                        |                             |    |
| 2.2. The holder of course activities                     | Lect. dr. Andrada Ihuț                 |               |    |                      |           |                        |                             |    |
| 2.3. The Holder of seminar/laboratory/project activities | Lect. dr. Andrada Ihuț                 |               |    |                      |           |                        |                             |    |
| 2.4. Study year  | II                                     | 2.5. Semester | II | 2.6. Assessment type | Summative | 2.7. Discipline Regime | Content <sup>2</sup>        | DA |
|  |  |               |    |                      |           |                        | Compulsoriness <sup>3</sup> | DI |

#### 3. Total time estimated (teaching activities hours per semester)

|  |     |                         |    |                                   |     |
|--|-----|-------------------------|----|-----------------------------------|-----|
| 3.1. Number of hours per week – form with frequency  | 4   | from which: 3.2. course | 2  | 3.3. seminar/ laboratory/ project | 2   |
| 3.4. Total hours from the education plan   | 48  | from which: 3.5.course  | 24 | 3.6.seminar/laboratory            | 24  |
| <b>The distribution of the time fund</b>   |     |                         |    |                                   | ore |
| 3.4.1. Study according to the textbook, course support, bibliography and notes                       |     |                         |    |                                   | 32  |
| 3.4.2. Additional documentation in the library, on specialized electronic platforms and in the field |     |                         |    |                                   | 25  |
| 3.4.3. Preparation of seminars/laboratories/projects, assignments, reports, portfolios and essays    |     |                         |    |                                   | 25  |
| 3.4.4.The tutorial   |     |                         |    |                                   | 10  |
| 3.4.5. Examinations  |     |                         |    |                                   | 10  |
| 3.4.6. Other activities  |     |                         |    |                                   |     |
| 3.7. Total hours of individual study   | 102 |                         |    |                                   |     |
| 3.8. Total hours per semester  | 150 |                         |    |                                   |     |
| 3.9. Number of credits <sup>4</sup>  | 6   |                         |    |                                   |     |

#### 4. Prerequisites

|                      |  |
|----------------------|--|
| 4.1. of Curriculum   | General Biotechnology, Biotechnology of the processing products of plant and animal origin |
| 4.2. of Competencies | The student must have knowledge of fermentation processes in the food industry.            |

#### 5. Conditions (where applicable)

|                            |  |
|----------------------------|--|
| 5.1. course implementation | The course notes are presented as interactive lectures in class students can ask questions about the course.<br>Course presentation is projected on a video projector in PPT format. The university discipline requires compliance with the start and end times of the course as well as the participation of at least 50% of the classes so that the student can participate in the exam. |
| 5.2. of conducting the     | For the practical works, it is mandatory to consult the specific didactic material   |



|                             |   |
|-----------------------------|---|
| seminar/laboratory/ project | provided (the manual of practical works or laboratory notes), each student will carry out an individual or team activity, with the laboratory materials, equipment and reagents necessary for the analysis of the physical chemical of food products. Academic discipline is required throughout the duration of laboratory work and 100% attendance at laboratory work |
|-----------------------------|---|

## 6. Accumulated specific competencies

|                           |   |
|---------------------------|---|
| Professional competencies | Formation of theoretical and practical skills by correlating the information from the Biotechnology of Fermentation Products discipline.<br>The training of specialists in the understanding and knowledge of the fermentation processes that take place in food products to obtain quality products of both animal and plant origin;<br>Learning outcomes allow the formation of competencies and practical skills by the dynamics of the biotechnological field regarding the stages of fermentation processes to improve the quality of food products. |
| Transversal competencies  | The use of theoretical notions in solving practical problems regarding product quality.<br>The capability to use the information received within other technological disciplines.<br>The ability to work in a team is necessary for scientific activities related to the biotechnology of fermentation processes by improving the quality of food products.<br>The ability to use specialized terminology in various contexts and to respect ethical principles in the field of the food industry regarding fermentation processes.                       |

## 7. Learning outcomes

|                                 |  |
|---------------------------------|--|
| 7.1 Knowledge                   | The student/graduate defines the biological and technological characteristics of microorganisms used in industrial biotechnologies, describes traditional and modern fermentation processes, identifies the control parameters of microbial cultures, and explains their role in obtaining products with applicative value in the food and pharmaceutical industries.                          |
| 7.2 Skills                      | The student/graduate applies techniques for the isolation, cultivation, optimization, and control of microorganisms of biotechnological interest, uses specific equipment for the implementation and monitoring of fermentation processes, interprets data on the productivity and efficiency of bioprocesses, and proposes solutions for improving their performance.                         |
| 7.3 Responsibility and autonomy | The student/graduate plans and carries out experimental activities with microbial cultures under biosafety conditions, manages fermentation processes in compliance with technological and quality standards, makes decisions regarding the application of microbial biotechnologies according to their purpose and field of use, and demonstrates scientific and professional responsibility. |

## 8. Discipline objectives

|  |   |
|--|---|
| 8.1. The general objective of the discipline | The specialized discipline of advanced knowledge allows the development of knowledge and improvement in biotechnology of fermentation processes in the food industry.<br>Together with the other subjects in the curriculum, it ensures the implementation and formation of acquisition knowledge of complex concepts regarding the fermentation processes. |
| 8.2. The specific objectives                 | To ensure the learning results with the aim of the skills and abilities formation based on the correlation of the received information with those acquired in other disciplines, such as the technology of the products obtained through the fermentation process. To know the factors that influence fermentation processes in the food industry.          |



## 9. Content

| 9.1. COURSE   | Teaching methods | Observations |
|---|------------------|--------------|
| <b>Number of hours – 24</b>   | Lecture          | 1 Lecture    |
| Classification of fermentation processes in the food industry. Fermentative processes of alcoholic fermentation: the development of microbial populations and the production of metabolic products. | Lecture          | 2 Lectures   |
| Biotechnological aspects in propionic and butyric fermentation.   | Lecture          | 1 Lecture    |
| Starter cultures for fermentative biotechnologies of plant products.  | Lecture          | 1 Lecture    |
| The obtaining of the yeasts biomass with a probiotic role.  | Lecture          | 1 Lecture    |
| The obtaining of fermentation products from cereals and vegetables with the aid of microorganisms.  | Lecture          | 1 Lecture    |
| The use of Starch hydrolysates for improving the quality of fermented products.   | Lecture          | 1 Lecture    |
| Fermentation processes in the meat industry.  | Lecture          | 2 Lectures   |
| Fermentation processes in the milk industry.  | Lecture          | 2 Lectures   |
| Fermentative food products probiotic type.  | Lecture          | 1 Lecture    |
| The role of starter cultures in ensuring the quality of food products.  | Lecture          | 1 Lecture    |

| 9.2. PRACTICAL WORK  |            |                    |
|--|------------|--------------------|
| <b>Number of hours – 24</b>  |            |                    |
| Assessing the quality of fermentation products through sensory tests             | Laboratory | 2 Laboratory works |
| Determination of the physico-chemical parameters of fermentation products.       | Laboratory | 3 Laboratory works |
| Control of physical parameters involved in fermentation processes.               | Laboratory | 2 Laboratory works |
| Assessment of the quality of the yeast used to obtain fermentation products.     | Laboratory | 2 Laboratory works |
| Assessing the quality of probiotic food products: sensory examination.           | Laboratory | 2 Laboratory works |
| Assessing the quality of probiotic food products: physical-chemical examination. | Laboratory | 3 Laboratory works |

**Mandatory Bibliography:**

- IURCĂ, I. (2002) - Biotehnologia prelucrării produselor agroalimentare. Ed. I.C.P.I.A.F., Cluj-Napoca.
- IURCĂ, I., CAMELIA RĂDUCU (2005) - Tehnologia industrializării produselor animale. AcademicPres. Cluj - Napoca.

**Optional Bibliography:**

- BANU, C., ș.a.(2000) – Biotehnologii în industria alimentară. Ed. Tehnică, București.
- BANU, C., ș.a. (1993) - Progrese tehnice, tehnologice și științifice în industria alimentară. Vol. II. Ed. Tehnică, București.
- BAMFORTH, C. W., & Cook, D. J. (2005). Food, fermentation and micro-organisms (pp. 172-181). Oxford, UK.: Blackwell Science.
- BERZESCU, P., KATHERIN, I., DUMITRESCU, M., HOPULETE, T., STOICESCU, M. (1981) -Tehnologia berii și a malțului. Ed. Ceres, București.
- CRUZ, R. M., KHMELINSKII, I., & VIEIRA, M. (Eds.). (2014). Methods in food analysis. CRC Press.
- HUTKINS, R. W. (2008). Microbiology and technology of fermented foods. John Wiley & Sons.
- MENCINICOPSCHI, G., KATHREIN, I., TEODORU, V. (1987) - Biotehnologii în prelucrarea produselor agroalimentare. Ed. Ceres, București.
- RAICU, P., ș.a. (1990) – Biotehnologii moderne. Ed. Tehnică, București.

## 10. Corroboration of the contents of the discipline with the expectations of representatives of epistemic communities, professional associations and representative employers in the field related to the program



The course has similar content to the other European universities in the biotechnology field, particularly the fermentation process field, regarding the training level of the students to ensure the development of work competencies as future specialists in the graduated field.

## 11. Evaluare

| Type of activity   | 11.1. Evaluation criterias  | 11.2. Evaluation methods | 11.3. Percentage from the final mark |
|--|---|--------------------------|--------------------------------------|
| <b>11.4. Lecture</b>   | Classification of fermentation processes in the food industry.<br>Starter cultures for fermentative biotechnologies of plant products.<br>Utilisation of starch hydrolyzates to improve the quality of fermentation products.<br>Fermentation processes in the meat industry.<br>Fermentation processes in the milk industry.<br>Fermentative food product, probiotic type.<br>The role of starter cultures in ensuring the quality of food products. | Examen scris/oral        | 80 %                                 |
| <b>11.5. Seminar/Laboratory</b>  | Assessing the quality of fermentation products through sensory examinations and physico-chemical analyses.<br>Assessment of the quality of the yeast used to obtain fermentation products.<br>Assessing the quality of probiotic food products: sensory examination and physical-chemical analyses.   | Colloquium               | 20 %                                 |
| <b>11.6. Minimum performance standard</b>  |   |                          |                                      |
| Learning of 50% of the information contained in the course.<br>Learning of 50% of the information provided in practical laboratory/seminar.<br>100% attendance at laboratory/seminars is mandatory.<br>50% attendance at classes is a condition for entering the exam. |   |                          |                                      |

<sup>1</sup> Study cycle - choose one of the options - Bachelor's/Master's/Doctorate

<sup>2</sup> Discipline regime (content) - for the degree level, choose one of the variants - DF (fundamental discipline), DD (discipline in the field), DS (speciality discipline), DC (complementary discipline).

<sup>3</sup> Discipline regime (compulsory) - choose one of the variants - DI (compulsory discipline) DO (optional discipline) DFac (optional discipline).

<sup>4</sup> One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

**Completion date**

**24.09.2025**

**Course holder**

**Lecturer dr. Andrada Ihut**

**Holder of laboratory works/seminars**

**Lecturer dr. Andrada Ihut**

**Prof. dr. Camelia Răducu**

**Date of approval in the department**

**Director of Department**

**Assoc.prof. Cristian Coroian**



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