

COURSE DESCRIPTION

ADVANCED BIOCHEMISTRY

University year 2026-2027

1. Information regarding the programme

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|------------------------------------|---|
| 1.1. Higher education institution | Universitatea Babeş-Bolyai din Cluj Napoca |
| 1.2. Faculty | Chemistry and Chemical Engineering |
| 1.3. Department | Chemistry |
| 1.4. Field of study | Chemistry |
| 1.5. Study cycle | Master |
| 1.6. Study programme/Qualification | Chemical biology in life and medical sciences |
| 1.7. Form of education | Învățământ cu frecvență / Full-time education |

2. Information regarding the discipline

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|-----------------------------|---|-----------------------------------|---|-------------------------|---|------------------------|-----------------|------------------------|-----------------------------|
| 2.1. Name of the discipline | | Advanced Biochemistry | | | | | Discipline code | | CME6141 |
| 2.2. Course coordinator | | Prof. dr. Radu Silaghi-Dumitrescu | | | | | | | |
| 2.3. Seminar coordinator | | Prof. dr. Radu Silaghi-Dumitrescu | | | | | | | |
| 2.4. Year of study | 1 | 2.5. Semester | 1 | 2.6. Type of evaluation | E | 2.7. Discipline regime | DS | 2.8 Type of discipline | Fundamental discipline (FD) |

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

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|--|----|----------------------|----|------------------------|--------------|
| 3.1. Hours per week | 4 | of which: 3.2 course | 2 | 3.3 seminar/laboratory | 2 |
| 3.4. Total hours in the curriculum | 56 | of which: 3.5 course | 28 | 3.6 seminar/laborator | 28 |
| Time allotment for individual study (ID) and self-study activities (SA) | | | | | hours |
| 3.5.1. Learning using manual, course support, bibliography, course notes (SA) | | | | | 30 |
| 3.5.2. Additional documentation (in libraries, on electronic platforms, field documentation) | | | | | |
| 3.5.3. Preparation for seminars/labs, homework, papers, portfolios and essays | | | | | 10 |
| 3.5.4. Tutorship | | | | | 10 |
| 3.5.5. Evaluations | | | | | 4 |
| 3.5.6. Other activities: | | | | | - |
| 3.7. Total individual study hours | | 44 | | | |
| 3.8. Total hours per semester | | 125 | | | |
| 3.9. Number of ECTS credits | | 5 | | | |

4. Prerequisites (if necessary)

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| 4.1. curriculum | - |
| 4.2. competencies | - |

5. Conditions (if necessary)

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| 5.1. for the course | <ul style="list-style-type: none"> Students will turn off their mobile phones Students will attend the courses having the material made available prior to each lecture Students arriving late to the courses will not be let in |
| 5.2. for the seminar /lab activities | <ul style="list-style-type: none"> Students will turn off their mobile phones Students will attend the seminar with the notes referring to the seminar topic It is prohibited access with food in the lab/seminars |

6.1. Competences obtained upon completion of the study programme (taken from the curriculum)

| Professional competences | |
|--------------------------|--|
| Competence code | Competence |
| CP1 | Descrierea, analiza și utilizarea conceptelor și teoriilor avansate din domeniul chimiei. Description, analysis and use of advanced concepts and theories in the field of chemistry. |
| CP2 | Efectuarea de experimente cu grad de dificultate ridicat pentru sinteza și analiza reactivității compușilor biochimici și chimici la nivel molecular și supramolecular; aplicarea riguroasă a metodelor de analiză (inclusiv teoretice și asistate de calculator) și interpretarea rezultatelor cu respectarea normelor de securitate și sănătate în muncă. Conducting experiments with high degree of difficulty for the synthesis and analysis of the reactivity of biochemical and chemical compounds at molecular and supramolecular level, applying rigorous analytical methods (including theoretical and computer-assisted) and interpreting the results with the observance of safety and health rules at work. |
| Transversal competences | |
| CT2 | Planificarea, monitorizarea și asumarea sarcinilor profesionale ale unui grup/ grupuri profesional(e) subordonate. Demonstrarea capacității de coordonare a activității, gândire analitică, adaptabilitate și flexibilitate, colaborare cu membrii echipei. Planning, monitoring, and assuming the duties of a subordinate professional group/groups. Demonstrating the capacity of coordination, analytical thinking, adaptability and flexibility, collaboration with team members. |

6.2. Programme learning outcomes (taken from the curriculum)

| Learning outcomes targeted by this course | | |
|---|---|---|
| Competence code | Knowledge and understanding | Specific academic skills |
| CP1, CP2 | 1. The student/graduate explains at molecular level the role and metabolism of biomacromolecules and enzymes. | 1. The student/graduate operates with advanced concepts, principles and methods of biochemistry for solving complex problems. |
| CP1, CP2 | 2. The student/graduate describes the regulation of metabolic pathways and their integration in biological systems. | 2. The student/graduate designs and interprets biochemical experiments with a high degree of difficulty. |

7. Discipline-specific learning outcomes

| Knowledge and understanding |
|---|
| 1. Explains at molecular level the role and metabolism of biomacromolecules, enzymes and their mechanisms of action. |
| 2. Describes the main metabolic pathways (energy, lipids, amino acids, nucleic acids) and their regulation. |
| 3. Interprets structure-function relationships of proteins and enzymes, including advanced aspects of inhibition and catalysis. |
| Specific academic skills |
| 1. Applies modern biochemical methods for the study of proteins, enzymes and metabolites. |
| 2. Analyzes and interprets experimental data from spectroscopy, electrophoresis, chromatography, and enzyme activity assays. |
| 3. Designs simple experiments to test biochemical hypotheses, critically evaluating the results. |




8. Content

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| 8.1 Course | Teaching methods | Remarks |
| 8.1.1. Membrane proteins. Transmembrane trafficking | Presentation; Explanation | |
| 8.1.2. Transport of molecular oxygen and of carbon dioxide | Conversation; Description; Problematicization | |
| 8.1.3-8.1.5. The immune system. The structure of antibodies. Specificity. Monoclonal antibodies. Abzymes. Possibilities of use in organic synthesis. Antibody conjugates | Debate | |
| 8.1.6. Blood coagulation | Presentation; Explanation | |
| 8.1.7. Motility: muscles flagella, cilia | Conversation; Description; Problematicization | |
| 8.1.8-8.1.11. Cellular communication. Hormones, neurotransmitters | Debate | |
| 8.1.12-8.1.13. Metabolic integration and organ specialization | Presentation; Explanation | |
| 8.1.14. Directed mutagenesis and directed evolution, means of obtaining new biocatalysts for ex-vivo use | Conversation; Description; Problematicization | |
| Bibliography: 1. FD Irimie, Elemente de Biochimie, I, II, Erdely Hirado Cluj 1998 2. Garrett, R.H, Grisham, C.M. Biochemistry, 5th edition, ISBN-13: 978-1133106296, 2013 3. Lecture material/notes provided by teaching staff 4. R. Silaghi-Dumitrescu, D. Cioloboc, M. Kinga Árkosi, N. Tomoiogă, Metalele in sistemele vii – ediția a II-a, 2023, Presa Universitara Clujeana, Cluj-Napoca, ISBN 978-606-37-1937-0 | | |
| 8.2. Laboratory / Seminar | Teaching methods | Remarks |
| 8.2.1 Transmembrane proteins –examples relevant to drug resistance | Explanation, Conversation, Description, Problematicization | |
| 8.2.2-8.2.3 Oxygen-carrying proteins – affinity measurement, methods for modifying affinity | Explanation, Conversation, Description, Problematicization | |
| 8.2.4-8.2.5 Practical methods for generating monoclonal and polyclonal antibodies, practical applications | Explanation, Conversation, Description, Problematicization | |
| 8.2.6 Coagulation control mechanisms: practical applications | Experiment, Explanation, Conversation, Description, Problematicization | |
| 8.2.7 Motility and quorum sensing | Experiment, Explanation, Conversation, Description, Problematicization | |
| 8.2.8 Coagulation control mechanisms: practical applications | Experiment, Explanation, Conversation, Description, Problematicization | |
| 8.2.9 Molecular mechanisms in cellular communication, hormones, neurotransmitters | Experiment, Explanation, Conversation, Description, Problematicization | |
| 8.2.10-8.2.14 Case studies on the metabolic integration of organs | Experiment, Explanation, Conversation, Description, Problematicization | |
| Bibliography <ul style="list-style-type: none"> • Lab procedures provided in advance • Alina Filip, Laszlo Csaba Bencze, Biochimie avansată- Lucrări practice, Ed. Napoca Star, Cluj-Napoca, 2017 • P. Moldovan, M. Toşa, D. Leţ, C. Majdik, Cs. Paizs, FD Irimie, Aplicații pentru laboratorul de biochimie, Editura Napoca Star, Cluj-Napoca 2006 | | |

9. Evaluation

| Activity type | 9.1 Evaluation criteria | 9.2 Evaluation methods | 9.3 Percentage of final grade |
|--|--|---|-------------------------------|
| 9.4 Course | Correctness of answers – proper understanding and learning of notions and concepts discussed during lectures; Correct use of concepts in new contexts. | Oral examination. Proven or intended fraud is punished according to the ECST rules of UBB | 80% |
| | Correct solving of the problems as part of the examination subjects | | |
| 10.5 Laboratory / Seminar | Preparation of the worksheets (experimental procedure, identification of the products) | Activity in the laboratory/seminars | 20% |
| | Performing correctly and safely the experiments | | |
| 9.6 Minimum standard of performance | | | |
| <ul style="list-style-type: none">Grade 5 (five) at the oral exam, participation to the final oral exam is conditioned by participation to all laboratory classes and minimum grade 5 (five) for the lab work.Adequate knowledge and usage of concepts in each of the modules of the course | | | |

10. Labels ODD (Sustainable Development Goals)¹

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Date:
21.04.2026

Signature of course coordinator
Prof. dr. Radu Silaghi-Dumitrescu

Signature of seminar coordinator
Prof. dr. Radu Silaghi-Dumitrescu

Date of approval:
24.04.2026

Signature of the head of department
Prof. Habil. Ing. Dr. Monica Ioana Toşa

¹ Keep only the labels that, according to the [Procedure for applying ODD labels in the academic process](#), suit the discipline and delete the others, including the general one for *Sustainable Development* – if not applicable. If no label describes the discipline, delete them all and write „Not applicable.”.