COURSE DESCRIPTION

Organic Compounds in Biological Systems

Academic year 2026-2027

1. Programme-related data

1.1. Higher Education Institution	Babeş-Bolyai University, Cluj-Napoca
1.2. Faculty	Chemistry and Chemical Engineering
1.3. Department	Chemistry
1.4. Field	Chemistry
1.5. Level of study	Master
1.6. Degree programme / Qualification	Forensic Chemistry (CCR), / Chemist
1.7. Form of education	Full-time education

2. Course-related data

2.1. Course title	Organic Compounds in Biological Systems			Course code	CME 6211
2.2. Course coordinator	Prof. Dr. Niculina Hădade				
2.3. Seminar coordinator	Prof. Dr. Niculina Hădade				
2.4. Year of study	I	2.5. Semester	1	2.6. Type of assessment	Exam
2.7. Course status	Compulsory			2.8. Course type	Specialisation subject

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

3.1. Number of hours per week	**4**	of which: 3.2. course	**2**	3.3. seminar/ laboratory/ project	**2**
3.4. Total of hours in the curriculum	56	of which: 3.5. course	28	3.6. seminar/ laboratory	**28**
Time allocation for individual study (IS) and self-taught activities (ST)					**hours**
Learning from textbooks, course materials, bibliography, and notes (IS)					33
Additional research in the library, on subject-specific electronic platforms, and on-site					14
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					10
Tutoring (professional guidance)					4
Examinations					2
Other activities					2
3.7. Total hours of individual study (IS) and self-taught activities (ST)				**69**	
3.8. Total hours per semester				**125**	
3.9. Number of credits				**5**	

4. Prerequisites (where applicable)

4.1. curriculum-related	Not the case	
4.2 skills-related	Not the case	

5. Specific conditions (where applicable)

5.1. course-related	Students will have access to the course materials in electronic format. Materials and information will be made available on e-learning platforms. Interactive participation will be encouraged. The course will be held in person at the Faculty of Chemistry and Chemical Engineering
5.2. seminar/laboratory-related	Attendance at seminar and laboratory activities is mandatory according to the rules established by the regulations.

	Strict adherence to occupational safety standards. Filling-out the experiment sheet regarding risk factors and safety measures. Laboratory equipment is mandatory. The tasks that the student must complete during the laboratory session are well-defined and discussed with the students at the beginning of the activity. Students are required to prepare the laboratory activities and to understand the procedures, having the necessary bibliographic materials and the report for the work available. Students will have access to materials/video tutorials (via the MS Teams platform) to prepare for the laboratory work. During each session, students will record their experimental observations in the laboratory notebook. The completion and submission of seminar assignments will be done according to the schedule established by the instructor coordinating the activity.

6.1. Competencies resulting from the completion of the degree programme *(as referred to in the curriculum)*[1]

Professional competencies	
Competency code	**Competency**
PC1	Analysing forensic samples using specific equipments for chemical analysis
PC4	Conducts research activities, including at an interdisciplinary level, and disseminates the results through specific means. interdisciplinary level
PC5	Develop scientific theories
Transversal competencies	
Competency code	**Competency**
TC2	Search for information using databases
TC3	Works confidently within a group

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)[2]

Learning outcomes targeted by the subject		
Competency code	**Knowledge and comprehension**	**Specific academic skills**
CP2, CP7, CP10, CT4, CT5	Knows, understands and interprets advanced concepts of analytical, organic and biochemistry	Uses knowledge to investigate phenomena, conduct interdisciplinary research, develop scientific theories, and interpret complex information
CP3, CP7, CP10, CT2	Knows multivariate analysis techniques for interpreting and classifying experimental data, software for data systems and computer tools	Uses modern statistical methods for interpreting and classifying experimental data, data systems software, and computer tools

7. Subject-specific learning outcomes

[1] The professional and/or transversal skills targeted by the subject for which the course description is prepared will be copied from the curriculum of the degree programme. For each competency, the complete entry, including the competency code, will be copied with the exact wording that appears in the curriculum, without any changes. If no competency is copied from either of the two categories, the row corresponding to that category is deleted from the table.

[2] The learning outcomes relevant for the degree programme and targeted by the subject for which the course description is prepared will be listed. The entries, copied without any changes from the Curriculum by subject type (Core Subject/Specialisation Subject/Complementary Subject), are listed under the corresponding competency.

Knowledge and comprehension
1. Explains the relationship between the structure of organic and bioorganic compounds and their properties, reactivity, and biological activity in living systems.
2. Describes the structure, role, and chemical behaviour of the main classes of biomolecules and of selected natural or synthetic organic compounds with biological activity.
3. Explains the principles of isolation, purification, and identification methods for organic and bioorganic compounds from complex biological mixtures, including spectroscopic approaches.
4. Understands molecular recognition mechanisms, organic compound-biomolecule interactions, chemical modification of biomolecules, and the essential concepts related to toxicity and toxophoric groups.
Specific academic skills
1. Applies appropriate experimental techniques for the extraction, isolation, synthesis, and analysis of organic and bioorganic compounds from natural sources or biological systems.
2. Interprets experimental and spectroscopic data for compound identification, correlating structure with reactivity, biological activity, and toxic potential.
3. Documents experimental work correctly, complies with laboratory safety rules, and communicates results using appropriate scientific language, including in reports and laboratory discussions.

8. Contents

8.1. Course	Teaching and learning methods	Remarks[3]
8.1.1 – 8.1.2 Correlation between the structure of organic and bio-organic compounds and their reactivity and properties – general notions.	Lecture, guided discussion, inquiry-based learning, and problem-solving methods	4 hours
8.1.3 – 8.1.5 Bio-organic compounds: proteins, nucleic acids, oligosaccharides, lipids.	Lecture, guided discussion, inquiry-based learning, and problem-solving methods	6 hours
8.1.6 – 8.1.7 Synthetic and natural organic compounds with biological activity.	Lecture, guided discussion, inquiry-based learning, and problem-solving methods	4 hours
8.1.8 – 8.1.10 Methods for the isolation and identification of organic (e.g., alkaloids, flavonoids, vitamins) and bio-organic compounds from complex biological mixtures using spectroscopic techniques.	Lecture, guided discussion, inquiry-based learning, and problem-solving methods	6 hours
8.1.11 – 8.1.12 Chemical modification of biomolecules. Study of molecular interactions using miniaturized and parallel formats.	Lecture, guided discussion, inquiry-based learning, and problem-solving methods	4 hours
8.1.13 Molecular recognition and affinity: interaction of organic compounds with biomolecules.	Lecture, guided discussion, inquiry-based learning, and problem-solving methods	2 hours
8.1.14 Toxicity of organic compounds. Toxophore or potentially toxophore groups.	Lecture, guided discussion, inquiry-based learning, and problem-solving methods	2 hours

Bibliography

1. PDF course support material provided to students.
2. A. Miller and J. Tanner, *Essentials of Chemical Biology – Structure and Dynamics of Biological Macromolecules*, John Wiley & Sons Ltd, 2005
3. D. Van Vranken and G. Weiss, *Introduction to Bioorganic Chemistry and Chemical Biology*, Garland Science, Taylor & Francis Group, 2013
4. Shinji Funayama, Geoffrey A. Cordell, *Alkaloids: A Treasury of Poisons and Medicines*, Elsevier Science, 2014
5. Amit Kumar Nayak, Dilipkumar Pal, *Bioactive Natural Products for Pharmaceutical Applications*, Springer International Publishing, 2020

[3] For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

6. Reviews and articles from recent literature – Wiley, ACS, RSC, Elsevier publication groups		
8.2. Seminar/ laboratory	**Teaching and learning methods**	**Remarks**
8.2.1 Safety training. Presentation of laboratory work and related bibliography. Instructions for completing the lab worksheet.	Guided discussion, inquiry-based learning, and problem-solving	To increase efficiency, the laboratory and seminar hours are grouped into 7 sessions. Session 1 – 2 hours
8.2.2 Extraction/Isolation of DNA from tomatoes. DNA hydrolysis.	Hands-on experimentation, guided discussion, inquiry-based learning, and problem-solving	4 hours
8.2.3 Synthesis of adenine.	Hands-on experimentation, guided discussion, inquiry-based learning, and problem-solving	2 hours
8.2.4 Isolation of casein and lactose from milk.	Hands-on experimentation, guided discussion, inquiry-based learning, and problem-solving	4 hours
8.2.5 Isolation of citric acid from lemon.	Hands-on experimentation, guided discussion, inquiry-based learning, and problem-solving	4 hours
8.2.6 Analysis of an analgesic mixture.	Hands-on experimentation, guided discussion, inquiry-based learning, and problem-solving	4 hours
8.2.7 Isolation of alkaloids from plant sources (hydrastine, berberine, or caffeine).	Hands-on experimentation, guided discussion, inquiry-based learning, and problem-solving	4 hours

Bibliography

1. R. M. Silverstein, F. X. Webster, D. J. Kiemle "Spectrometric Identification of Organic Compounds", Wiley, New-York, 2005.
2. Anumukonda, L. N.; Young, A.; Lynn, D. G.; Buckley, R.; Warrayat, A.; Graves, C. L.; Bean, H. D.; Hud N. V. *J. Chem. Educ.* **2011**, *88*, 1698–1701;
3. L. N.; Young, A.; Lynn, D. G.; Buckley, R.; Warrayat, A.; Graves, C. L.; Bean, H. D.; Hud N. V. *J. Chem. Educ.* **2011**, *88*, 1698–1701.
4. Charles Dickson Experiments in Pharmaceutical Chemistry - second edition, CRC Press, 2014.
5. Pavia, D. L.; Lampman, G. M.; Kritz, G. S.; Engel, R. G. *Introduction to Laboratory Techniques*, 4th Ed. Thomson Brooks/Cole: Mason, OH, 2006

9. Evaluation

Type of activity	9.1 Evaluation criteria[4]	9.2 Evaluation methods[5]	9.3 Percentage in the final grade
9.4. Course	The extent to which students have assimilated the course topics and understood the illustrated concepts will be assessed through a written examination.	Any form of academic dishonesty during the exam is subject to disciplinary action, including expulsion, in accordance with the ECTS regulations of Babeş-Bolyai University (UBB).	60 %
	The student's reasoning, accuracy, and ability to justify the solutions to problems and exercises		
9.5. Seminar/ laboratory	Accuracy of answers to exercises and problems, demonstrating understanding and assimilation of the topics	Ongoing assessment	40 %
	Preparation of laboratory reports including the working procedure and identification of the substances used	Laboratory report correctly prepared and submitted at the end of the same session	

[4] The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

[5] Both final evaluation methods and ongoing evaluation strategies should be established.

9.6 Minimum standard for passing
Obtaining a minimum grade of 5 (five) in the exam, according to the official grading criteria, is required. Access to the final exam is conditional upon passing the laboratory assessment with a minimum grade of 5 (five). Recognition of reaction types/specific reactivity of bio-organic compounds and understanding of the principles of structural analysis methods discussed during the course.

10. SDG labels (Sustainable Development Goals)[6]

	○	Sustainable Development Generic Label

								
○	○	○	X	○	○	○	○	○
								No label applies
○	○	○	○	○	○	○	○	○

Date of entry:
17.04.2026

Signature of course coordinator

Prof.Dr. Niculina Hădade

Signature of seminar coordinator

Prof.Dr. Niculina Hădade

Date of approval in the department:
28.04.2026

Signature of the head of department

Prof. Dr. Monica Toşa

[6] Select a single label which, according to the *Implementation of SDG labels in the academic process*, best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: *"No label applies."*