

***MEDICAL UNIVERSITY OF PLOVDIV***  
***FACULTY OF PHARMACY***  
***DEPARTMENT OF CHEMICAL SCIENCES***

**BIOINORGANIC CHEMISTRY**  
**ACADEMIC STANDARD**

### **1. Aim**

The primary objective of education in the discipline Bioinorganic Chemistry is the study of the role of inorganic chemical elements in biological systems. The learning content of the training course includes the classification of bioelements, structure and the biological role of their compounds. In addition to the positive aspects of bioelements, bioinorganic chemistry of toxic metals and their harmful effects on living organisms are also studied. The discipline explore inorganic elements used for the diagnosis and treatment of certain diseases in modern medicine.

This objective correlates with the:

- university mission and vision;
- discipline's contents and credit rating (according to ECTS), both made apparent in the curriculum;
- qualification characteristics of the speciality;
- master academic degree.

The objective is entirely consistent with the place of the discipline within the overall curriculum in terms of discipline's importance and timing in the curriculum.

### **2. Learning**

The topics and the hours for lectures and practical exercises are posted on the website of the department: <https://mu-plovdiv.bg/en/faculties/faculty-of-pharmacy/departments/department-of-chemical-sciences/>

Learning content is organized chronologically in such a way that each consecutive lecture and related seminars use previously studied topics and terms. The university's priority objectives, such as developing the students' personal qualities, encouraging their initiative, creating habits for self-education and self-learning skills, acquiring key competencies and skills, are reflected in the curriculum of the discipline, which is in agreement with the respective objectives.

### **3. Prerequisites**

The necessary knowledge and skills the student must have obtained in order to begin and successfully complete his/her tuition in Bioinorganic Chemistry, include basic knowledge of General and inorganic chemistry, which are present in the education programs in master's degree of Pharmacy. The student must be familiar with chemical symbols, nomenclature and terminology, especially – nomenclature of complex compounds. Students must be familiar

with the modern concepts of the construction of a substance, as well as the composition and construction of carbohydrates, fats, proteins, and their functions in living organisms. They must build on this knowledge during their studies in order to complete it successfully.

#### **4. Academic resources**

The academic staff of the department includes 3 professors and 7 assistant professors. One is a doctor of chemical sciences (DCSc) and 8 of them holding an educational and scientific degree Doctor (PhD).

The course is read by professors and associate professors who have the necessary qualifications, theoretical and practical knowledge in the field of General and inorganic chemistry. Up to 30% of the lecture course may be conducted by an assistant professor who holds a PhD in the field mentioned above.

Seminars are held by professor, associate professor, assistant professor or assistant, who have the necessary qualifications, theoretical and practical knowledge in the field of General and inorganic chemistry.

#### **5. Material resources**

The Department of Chemical Sciences at MU – Plovdiv runs 2 classrooms, 6 laboratories equipped for experimental work (1 research laboratory and 5 training laboratories). The total laboratory area is 282 m<sup>2</sup> (equipped with the necessary equipment for conducting experimental work). There are 6 offices (equipped with computers and peripheral equipment). For experimental work of one researcher, the laboratory area is 26 m<sup>2</sup>. The laboratory equipment of the department includes general and special equipment (analytical balances, rectifiers, pH meters, apparatus for determining the melting point, UV/Vis spectrophotometers, FTIR spectrometer, rotary vacuum evaporator, viscometer, tensiometer, potentiometer, polarimeter, electrophoresis apparatus, conductometers, thermostats, centrifuges, dry sterilizers, flasks, electromagnetic stirrers, etc.). Internet access to large scientific and reference databases is provided (Springer, Web of Science, Google Scholar, Science Direct, Scopus, MEDLINE Complete, SciFinder, European Pharmacopeia, etc.).

#### **6. Lecturing**

Multimedia presentations have been prepared for the Bioinorganic Chemistry lecture course, some of which are provided to students before or after the lectures. The volume and format of the lectures are the choice of the lead speaker.

#### **7. Seminar exercises**

During the seminars, short entrance tests are conducted. In this way it is checked:

- student's knowledge for a specific exercise;
- the results of the theoretical knowledge learned.

Numerous topics are given in advance for a self-study extra-auditorium work. Presentations are given by the students during practical classes. Literature recommendations on the topic to be presented are also provided. Students are usually divided into groups and each group prepares a presentation on the topic. This gives priority to teamwork and team

discussions. After the presentation is given, a discussion is held by all students, with each presenter's group defending its own position on the topic.

## 8. Information resources. Basic literature

All lecturers keep developed lectures, practicals, training tests, and other course materials in the discipline, which are also available in electronic format. There is a list of recommended literature for each component:

1. Wolfgang Kaim, Brigitte Schwederski, Aleks Klein, *Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life*, 2nd Edition, Wiley, 2013\*
2. James C. Dabrowiak, *Metals in Medicine*, 2nd Edition, Wiley, 2017\*
3. Julia Burdge, *Chemistry*, 3rd Edition, McGraw Hill, New York, ISBN-13: 978-0073402734, 2014
4. Steven Zumdahl, Susan Zumdahl, *Chemistry*, 9th Edition, Cengage Learning, Boston, ISBN-13: 978-1133611097, 2014
5. Duward *Shriver*, Mark Weller, *Inorganic Chemistry*, 5th Edition, W. H. Freeman and Company, New York, ISBN 978-1-42-921820-7, 2010
6. Rosette M. & Roat-Malone, *Bioinorganic Chemistry. A Short Course*. 2nd Edition, Wiley, 2007
7. Robert R. Crichton, *Biological Inorganic Chemistry: A New Introduction to Molecular Structure and Function*, 2nd Edition, Elsevier, 2013

## 9. Control assignments

Students are occupied dynamically and intensively during the semester. It is assumed that the way in which knowledge and skills are acquired is an important factor in their depth, durability and applicability. Tutors should control student progress at least twice in the semester. Ongoing control can be performed through tests or control assignments. Students are provided with timely information and explanations on the control results, which assists their further preparation.

## 10. Individual work and commitment of the students

The individual work of the students must be led by the assistant professors, who have to guide them in the literary sources, and methods for learning, as well. There are available training tests for individual work and student exercises.

## 11. Collaboration between students and teaching staff

This collaboration consists of:

- The teacher's commitment to the students' preparation on current difficulties in learning the subject and the opportunities with an individual learning program.
- Use of meeting hours for consultations.
- Scientific research with outstanding students.
- Including students in teams for scientific tasks, research projects, etc.

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## 12. Exams

Ongoing assessments provided on the curriculum of the specialty are given for:

1. Student's results in practical classes, individual tasks, work of the student with the lecturer in scientific research etc.
2. At least two written tests.

## 13. Standards of evaluation

Standards for the evaluation of the students' achievements are carefully thought out, and clearly defined so that the student's assessments are objective and not depended on the lecturer. The final grade is determined on the basis of two criteria: 1. Assessment from the current control, which assesses the student's academic activity during the semester. 2. Assessments from the entrance test, theoretical written examination and oral examination in the discipline. The examination regulation is designed to minimize the possibility of manipulating the results. Based on the above, clear evaluation standards have been developed as follows:

- Excellent (6) – for shown individual and logical thinking, additional knowledge and skills, for excellent knowledge of the subject, creativity, interpretation of the concepts, skills to solve complex tasks and right argumentation for the decisions taken, accuracy and rich language culture of the presentation.

- Very good (5) – for well-developed key and additional knowledge, thinking and understanding the subject, good skills to apply the knowledge, adequate use of scientific concepts from the studied field, good language culture.

- Good (4) – for developed additional knowledge, good knowledge of the subject; but without being able to develop learning to analysis; comparatively good language culture; but with inaccuracies in the use of different concepts and terms.

- Satisfactory (3) – simple reproduction and key knowledge of the subject; not ready for analysis of the knowledge gained; poor language culture with a lot of mistakes.

- Poor (2) – for showing scant knowledge and gross errors that cannot be the basis for the next levels of training.

At the beginning of the classes each semester the students must be informed about the evaluation standards, the procedures for conducting the ongoing control and the opportunities for obtaining a feedback on their progress during the semester.

## 14. Final grade formation

Bioinorganic Chemistry training is held in two semesters (II and III semester) and ends with an exam in the winter session. The exam test and the written development of two syllabus topics include questions from all sections, with different levels of difficulty. It is evaluated by a point system, which is converted into a six-point system score.

The exam has three components:

- solving an incoming quiz of choice and open-ended questions;
- a written section in which two questions from the syllabus on the subject develop;

- oral section on the questions of the written work and additional questions for forming the final assessment.

The final grade of the student who fits in the protocol and his student ID is determined by the formula:

$$Q_{\text{final score}} = 0.1Q_{\text{test}} + 0.1Q_{\text{colloquium}} + 0.5Q_{\text{written section}} + 0.3Q_{\text{oral section}}$$

**If one of the components of the final grade is “Poor 2” or "Failed", the final grade is automatically set to “Poor 2”.**

### **15. Documentation, results storage and control of the assessment procedure**

Assessed students have the right and obligation to be informed about the assessment regulation procedures and results, and to make claims and complaints in case of violation of the current rules.

- The students’ rights, in accordance with the meaning of the preceding paragraph, are guaranteed provided that technical omissions or errors have occurred (e.g. in the calculation or assessment) or that there are reasons for a vast contrast between the knowledge, skills and competencies the student have actually shown and his/her final grade.

- Corrections of the grades in cases regarding the provisions of the previous paragraph shall be made in the Student Book, the examination report or the account in the General Registry only by the leader of the discipline.

- Potential disagreements and claims on the part of the students should be directed in a written form to the assessment team, whose responsibility is to provide an argued answer by the end of the next working day.

- Revealed and proven cases of serious violation of the rights of the student in terms of assessing his/her knowledge, skills and competences are directed with a written complaint to the Vice-rector for quality and accreditation.

Exam materials are preserved and the students are informed about them. The period during which the students have access to the examination tests and results is up to 5 working days after the announcement of the results. This requirement shall be met in accordance with the Higher Education Act Art. 56. par. 1, " The members of the academic board shall be obliged to develop and announce in an appropriate way a description of the provided by them course of lectures, including number, titles and sequence of topics of the curriculum, recommended literature, method of evaluation of the mark and form of checking of knowledge and skills."

The academic standard for the discipline Bioinorganic Chemistry was approved by the Departmental Council of Ministers on December 23, 2020 and published on the University website.

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