

Ministry of Health of the Republic of Belarus
Educational institution
"Gomel State Medical University"

Department of Biological Chemistry

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METHODOLOGICAL RECOMMENDATIONS

for a practical lesson in the academic discipline "Biological Chemistry"
for 2nd year **students** of the Faculty of Foreign Students
majoring in 1-79 01 04 "Medical Care"

Topic: Enzymes 2. The mechanism of action of enzymes.

Duration 4 hours

Approved at the meeting of the Department of Biological Chemistry
(Protocol No. 10 dated 29.08.2025)

Gomel, 2025

1. TRAINING AND EDUCATIONAL OBJECTIVES, MOTIVATION FOR COMPLETION OF THE TOPIC, REQUIREMENTS FOR THE INITIAL LEVEL OF KNOWLEDGE

The reason for the low rate of most organic reactions is the high energy barrier that molecules must overcome before they can react. The catalyst lowers the activation energy and directs the reaction down a different path. In this case, the alternative reaction proceeds at a higher rate despite the formation of a large number of intermediate products.

Purpose of the class:

To study the properties of enzymes and their mechanism of action. Find out the basics of thermodynamics of enzymatic catalysis. To analyze the main factors influencing the rate of enzymatic reactions, to master the method for determining the activity of blood α -amylase using a unified method according to Caravey and to evaluate the diagnostic significance of the results obtained. To instill in students a sense of pride in their chosen profession and to form in them a culture of caring for their health.

Class objectives:

The student should know:

1. structure and mechanisms of action of enzymes,
2. fundamentals of thermodynamics of enzymatic catalysis,
3. ways to regulate enzyme activity,
4. theoretical foundations of chemical kinetics,
5. structure and mechanism of catalysis by coenzymes NAD^+ and NADP^+ .

The student should be able to:

1. determine blood α -amylase activity by a unified method according to Caraway. and assess the diagnostic significance of the results obtained.

2. CHECKLIST OF THE QUESTIONS FROM RELATED SUBJECTS

- 2.1. The concept of catalysts (general chemistry). General principles of the action of catalysts (bioorganic chemistry).
- 2.2. Theoretical foundations of chemical kinetics and thermodynamics. The influence of various factors on the rate of reactions (general chemistry).

3. CHECKLIST OF CONTROL QUESTIONS FOR THE LESSON

- 3.1. Enzyme properties (pH sensitivity, thermolability, specificity, etc.).
- 3.2. The mechanism of action of enzymes. Formation of the enzyme-substrate complex. Stages of enzyme-substrate interaction. Theory of intermediate compounds. Fundamentals of thermodynamics of catalysis.
- 3.3. Kinetics of enzymatic reactions. Methods of linearization of the kinetic curve (Lineweaver-Burk, Eady-Hofsti, etc.).
- 3.4. Enzyme inhibition. Types of inhibitors, their mechanism of action, examples.
- 3.5. Regulation of enzyme activity (chemical modification of enzymes, protein-protein interactions). The role of hormones, cAMP, Ca^{2+} , ITP, $\text{C}_{20:4}$ metabolites, NO.

4. PRACTICAL PART OF THE LESSON

Laboratory work No. 1 "Studying the action of enzymes", laboratory work No. 2 "Studying the influence of various factors on the rate of enzymatic reactions" are performed

according to the publication “Biological Chemistry: Workbook” (in 2 parts, part 1) / Gritsuk A.I. [et. al.]. - Gomel: GomSMU, 2021. - 76 p.

Laboratory work No. 3 “Determining of γ -glutamyltransferase activity in blood plasma by optimized kinetic method” is performed using a set of reagents (γ -glutamyltransferase-Vital).

5. PROCESS OF THE LESSON

1. Introduction.
2. Theoretical part of the lesson: control questions are considered, an oral survey of students is conducted.
3. Practical part of the lesson: laboratory work No. 1 “Studying the action of enzymes”, laboratory work No. 2 “Studying the influence of various factors on the rate of enzymatic reactions” are performed using a workbook in biological chemistry. Laboratory work No. 3 “Determining of γ -glutamyltransferase activity in blood plasma by optimized kinetic method” is performed experimentally according to the instructions.
4. The control of mastering the topic.
5. The final part of the lesson. Summing up, checking the protocols, announcing tasks for the next lesson.

6. QUESTIONS FOR KNOWLEDGE SELF-CONTROL

Self-control of knowledge on the topic "The mechanism of action of enzymes" is carried out by computer testing using the Moodle platform. Access mode: <https://dl.gsmu.by/mod/quiz/view.php?id=5025>.

7. LIST OF REFERENCES:

1. Harper’s Illustrated Biochemistry / Victor W. Rodwell [and oth.]. — 30th edit. -New York[and oth.] : McGraw-Hill Education, 2015. — 817 p.
2. Meisenberg, G. Principles of medical biochemistry / G. Meisenberg, W. H. Simmons. — 4th ed. -Philadelphia: Elsevier, [2017]. — xii, 617 p.
3. Vasudevan, D. M. Textbook of biochemistry for medical students / DM Vasudevan, S Sreekumari. — 5th ed. — New Delhi : Jaypee brothers medical publishers, 2009. — xvi, 535 p.
4. Gritsuk, A. I. Biochemistry. P. 1 : lectures, notes / A. I. Gritsuk, A. N. Koval ; Gomel state medical University, Department of biochemistry. — Gomel, 2016. — 380 p.