

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: Biochemistry of kidneys.

Duration 4 hours

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

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1. EDUCATIONAL AND UPBRINGING GOALS, MOTIVATION FOR MASTERING THE TOPIC, REQUIREMENTS FOR THE INITIAL LEVEL OF KNOWLEDGE: to study the features of kidney metabolism and the biochemical basis of their functions in health and disease. Master the method of urine analysis using test strips. To instill in students a sense of pride in their chosen profession and to form in them a culture of respect for their health.

The purpose of the class: to form ideas about the peculiarities of carbohydrate, lipid, and protein metabolism in the kidneys; to expand the concept of the excretory function of the kidneys; to consolidate ideas about the mechanisms of urine formation; to systematize ideas about the violation of the processes of filtration, reabsorption, and secretion; to generalize ideas about homeostatic (non-excretory) functions of the kidneys; develop skills and abilities to conduct urine analysis using test strips.

Class goals:

The student should know:

1. The structure and function, features of the blood supply to the kidneys.
2. The structure and functions, features of the blood supply to the nephron.
3. The mechanism of urine formation.
4. Vitamin D metabolism and mechanism of action.
5. Metabolism of carbohydrates, lipids, and proteins.
6. Homeostasis concept.
7. Mechanisms for regulating blood glucose levels.
8. Principles and mechanisms of ABB regulation.

The student should be able to:

1. Work with micropipettes.
2. Work with a semi-automatic biochemical analyzer.

2. CONTROL QUESTIONS FROM RELATED DISCIPLINES:

- 2.1. The structure and functions, features of the blood supply to the kidney and nephron (histology).
- 2.2. The mechanism of urine formation. Principles and mechanisms of regulation of the acid-base balance (ABB) (physiology).

3. CONTROL QUESTIONS ON THE TOPIC OF THE CLASS.

- 3.1 Excretory function of the kidneys. The mechanism of urine formation: filtration (clearance, its definition and diagnostic value), reabsorption (mechanism of active transport of glucose, amino acids), secretion. Osmolality of urine. Glomerular filtration rate and methods for its determination. The main indicators of urine in normal and pathological conditions. Mechanisms of development of glucosuria and proteinuria. Violation of the processes of filtration, reabsorption, and secretion.
- 3.2 Homeostatic (non-excretory) functions of the kidneys. The role of the kidneys in regulation:

- a) the volume of circulating blood and blood pressure. Renin-angiotensin-aldosterone system. The mechanism of action of diuretics.
- b) electrolyte balance. The role of aldosterone in the regulation of the work of Na^+/K^+ -ATPase. Transport mechanisms Na^+ , K^+ , Ca^{2+} , Cl^- .
- c) acid-base balance. Mechanisms of acidogenesis, ammoniogenesis.
- d) erythropoiesis and metabolism of vitamin D.

3.3 Metabolic heterogeneity of renal tissue. Features of carbohydrate, lipid, and protein metabolism in the kidneys. The kidney as an organ of catabolism of biologically active substances.

3.4 Disorders of metabolism in acute and chronic renal failure.

3.5 Kidney stones, types, causes and mechanism of formation.

3.6 The structure of the nephron, features of its blood supply.

3.7 General properties of urine in normal and pathological conditions (daily amount, color, transparency, density, pH, etc.).

4. PRACTICAL PART OF THE CLASS

Laboratory work "Urinalysis with Bayer Corp. test strips".

Laboratory work is performed according to the publication "Biological Chemistry: Workbook" (in 2 hours, part 2) / Koval A.N. [etc.]. - Gomel: GomGMU, 2020, Part 2. – 88 p.

5. PROCESS OF THE CLASS

5.1 Introduction

5.2 The theoretical part of the class: control questions are considered, the tasks of the SIWS are dealt with.

5.3 Practical part of the class: laboratory work is performed using a workbook on biological chemistry.

5.4 Control of mastering the topic.

5.5 The final part of the class. Summing up, checking the protocols, announcing assignments (as well as topics for abstracts of the SSART) for the next class.

6. QUESTIONS FOR SELF-CONTROL OF KNOWLEDGE

Self-control of knowledge on the topic "Biochemistry of kidneys" is carried out by computer testing using the Moodle platform access mode: <https://dl.gsmu.by/course/view.php?id=81>

7. LITERATURE

1. Биохимия : учебник / под ред. Е.С. Северина. – 5-е изд., испр. и доп. – М.: ГЭОТАР-Медиа, 2020. – 768 с.: ил.
2. Схемы и реакции основных метаболических путей : учеб.-метод. пособие для студентов учреждений высш. образования, обучающихся по специальностям 1-79 01 01 "Лечеб. дело", 1-79 01 04 "Мед.-диагност. дело" / М-во здравоохранения РБ, УО "ГомГМУ", Каф. общей, биоорганической и биологической химии ; А.И. Грицук [и др.]. – Гомель: ГомГМУ, 2018. – 127 с. – Рек. УМО по высш. мед., фармацевт. образованию.

3. Baynes, J. W. Medical biochemistry / J.W. Baynes, M. H. Dominiczak ; ELSEVIER . – 2019. – 682 p.
4. Ferrier, D. R. Lippincott's Illustrated Reviews: Biochemistry / D. R. Ferrier ; Wolters Kluwer . – 2014. – 552 p.
5. Chatterjea, M. N. Textbook of Medical Biochemistry / M. N. Chatterjea, R. Shinde ; Jitendar P Vij. – 2012. – 876 p.
6. Vasudevan, D. M. Textbook of Biochemistry for Medical Students / D. M. Vasudevan, S. Sreekumari, K. Vaidyanathan ; Jitendar P Vij. – 2011. – 657 p.
7. Marks, D. B. Board Review Series: Biochemistry / D. B. Marks ; Harwal Publishing . – 1994. – 337 p.