APPROVED BY
The decision of the Academic Council of the Institute of Medicine, Ecology and Physical Culture of UlSU
The Protocol No. 10/210 of June "19", 2019
Chairman _____ (Vladimir I. Midlenko)
(signature, signature clarification)
« 19 » June 2019
approved by department, implementing the subject

WORKING PROGRAM OF SUBJECT

Subject	Physiology of visceral system
Faculty	Medical named after T.Z. Biktimirov
Department	Physiology and Pathophysiology
Course	Second

Direction (specialty) 31.05.01 General Medicine
Directivity
(profile / specialization) _____

The form of education full-time
Date of introduction in the teaching process at Ulyanovsk State University: «1 » september 2019

The program was updated at the Department Meeting: Protocol No.____ of 01 / 09 / 2020
The program was updated at the Department Meeting: Protocol No.____ of ___/___/_____
The program was updated at the Department Meeting: Protocol No.____ of ___/___/_____

Information about developers:

Full name	Department	Position, academic degree, title
Gening T.P.	Physiology and Pathophysiology	Head of the Department, Dr.Bio.Sci., professor
Abakumova T.V.	Physiology and Pathophysiology	PhD in Biology, associate professor
Gening S.O.	Physiology and Pathophysiology	Assistant

ACCORDED WITH	ACCORDED WITH
Head of the Department implementing the Subject	Head of the Graduating Department
_____ /Tatyana P.Gening/ *(Signature)* *(Full Name)*	_____ /Marina A. Vise-Khripunova *(Signature)* *(Full Name)*
« 13 » June 2019	« 19 » June 2019

1. AIMS AND OBJECTIVES OF DEVELOPING DISCIPLINE:

- **The purpose of the Course**

- to form students' systematic knowledge about holistic living organism and its parts, the basic laws of functioning and mechanisms of their regulation of the interaction between each other and with environmental factors, on the physiological basis of clinical and physiological methods of research used in functional diagnosis and the study integrative human activity.

Objectives:

- the formation of students ' systematic approach to understanding the physiological mechanisms underlying interaction with environmental factors and implementation of adaptive strategies of the human body, the implementation of the normal functions of the human body from the standpoint of the theory of functional systems;
- the study of the methods and principles of the research assessment of the state regulatory and homeostatic systems of the organism in the experiment, taking into account their applicability in clinical practice;
- teaching students methods of evaluation of human functional state, state regulators and homeostatic in different types of purposeful activity;
- formation bases of clinical thinking based on the analysis of the nature and structure interorganic and intersystem relations from the position of integrated physiology for future practical activities of the doctor.

2. PLACE OF DISCIPLINE IN THE STRUCTURE OF THE MAIN PROFESSIONAL EDUCATIONAL PROGRAMS:

The discipline "Physiology of Visceral Systems" refers to the basic part of B1.B.55 of the main professional educational program. For its successful development, knowledge of biochemistry, anatomy, histology, embryology, cytology, embryonic development of body tissues and normal physiology, the practice of obtaining primary professional abilities and skills, including primary abilities and skills of research activities (Care of therapeutic and surgical sick. (Part 1), Clinical practice (Care of therapeutic and surgical patients (Part 2), assistant to the nursing staff.

"Physiology of visceral systems" forms a knowledge base for the subsequent study of pathophysiology, clinical pathophysiology, neuroanatomy, propaedeutics of internal diseases, the basics of functional and laboratory diagnostics, pathological anatomy, pathological anatomy, pathophysiology of extreme conditions, anesthesiology, intensive care and intensive care, forensic medicine, surgical gastroenterology and endoscopy and the preparation and passing of the state exam; hygiene, endocrinology, phthisiology, psychology and pedagogy of medical practice, obstetrics and gynecology, diagnosis and treatment of extrapulmonary tuberculosis, modern biomedical technologies, nanotechnology in medicine, a biopsychosocial approach to medical rehabilitation, the practical application of the international classification of functioning in rehabilitation for various pathologies.

3. THE LIST OF PLANNED RESULTS OF TRAINING ON THE DISCIPLINE (MODULE), ASSOCIATED WITH THE PLANNED RESULTS OF THE EDUCATIONAL PROGRAM

The process of studying the discipline is aimed at developing the ability to assess morphofunctional, physiological conditions and pathological processes in the human body to solve professional problems (GPC-9); ability and readiness to implement a set of measures aimed at maintaining and improving health and including the formation of a healthy lifestyle, preventing the onset and spread of diseases, their early diagnosis, identifying the causes and conditions of their occurrence and development, as well as aimed at eliminating the harmful effects on human health environmental factors (PC-1)

Code and name implemented competence	The list of planned learning outcomes in the discipline (module), correlated with indicators of achievement of competences
GPC-9	**Know:** • physical and chemical essence of processes occurring in a living organism at the molecular, cellular and organ levels; • quantitative and qualitative indicators of the state of the internal environment of the organism, the mechanisms of its regulation and protection; • the role of biogenic elements and their compounds in living organisms, using their compounds in medical practice; • basic chemistry of hemoglobin, its part in the gas exchange and the maintenance of acid-base balance; • the structure of the functional systems of the organism, its main physiological functions and mechanisms of regulation. **be able to:** • use educational, scientific literature, electronic resources for the studying of the discipline; • use physical, chemical and biological equipment; • work with magnifying equipment (microscopes, optical and simple loops); • perform calculations on the results of the experiment, conduct elementary processing of experimental data; • identify and evaluate the results of electrocardiography; spirometry; thermometry; hematological parameters
PC-1 ability and willingness to implement a set of measures aimed at maintaining and strengthening health and including the formation of a healthy lifestyle, preventing the onset and spread of diseases, their early diagnosis, identifying the causes and conditions of their	**Know:** - modern methods of laboratory diagnostics for the prevention and spread of diseases; **Be able to**: -interpret the results of laboratory diagnostics for the prevention and spread of diseases; **Be seised of:** - Skills of laboratory diagnostics and interpretation of the obtained results for the prevention and spread of diseases.

occurrence and development, as well as aimed at eliminating the harmful effects on human health environmental factors	

4. TOTAL WORK CONTENT OF DISCIPLINE

4.1. Volume of the discipline is 2 credit units.

4.2. Volume of the discipline by activity types (hours):

Training activity types	**Quantity of hours (Full-time attendance)**	
	Total number as planned	**Including semesters**
		4 semester
1	2	3
Students work with the teacher	54	54
Auditorium learning:		
Lectures	-	-
Practical occupations, seminars occupations	54/6*	54/6*
Laboratory work (laboratory practice)	-	-
Self-guided work	18	18
The form of current control of knowledge and control of independent work: test, colloquium, abstract and others (at least 2 types)	5 colloquiums Interview Testing Verification of work protocols Solving situational tasks	5 colloquiums Interview Testing Verification of work protocols Solving situational tasks
Term paper	-	-
Middle assessment types (exam, pass)	Credit*	Credit*
Total workload in credit hours	72	72

* - *the number of hours spent in an interactive form*

4.3. Content of the discipline (module). Distribution of hours within the subjects and the training activity types:

Mode of study: **full-time**

Name of sections and themes	**Total**	**Types of academic studies**			**Form of current**
		Auditorium learning	**Training in**	**Self-**	

		lectures	workshops, seminars	laboratory work	an interactive form	guided work	knowledge control
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Section 1. Regulation of physiological functions							
1.1.Regulation of physiological functions. The internal environment of the human body. Principles of maintaining the constancy of the internal environment. Self-regulation. Functional systems of the body.	2					2	Questions in the final lesson. Interview
1.2. Nervous regulation of human vegetative functions.	2					2	Questions in the final lesson. Interview
1.3. Humoral regulation of human physiological processes.	1					1	Questions in the final lesson. Interview
1.4. Endocrine glands. Hormone-producing cells outside the gland.	6		6		1		Questions in the final lesson. Interview
Section 2. Functional homeostasis systems							
2.1. Human blood circulation. The structure and function of the heart.	6	-	6	-	1		Questions in the final lesson. Interview
2.2. Heart physiology. Methods for assessing cardiac activity.	4		3	-	1	1	Questions in the final lesson. Interview
2.3. Regulation of the heart.	4		3	-	1	1	Questions in the final lesson. Interview
2.4. Microcirculation processes	2					2	Questions in the final lesson. Interview

2.5. Functional system to maintain the optimal level of blood pressure for metabolism.	4	-	3	-	-	1	Questions in the final lesson. Interview
2.6.Physiology of respiration	4	-	3		1	1	Questions in the final lesson. Interview
2.7. Human digestion. Morphofunctional organization of the digestive system. Physiology in the mouth and stomach.	5	-	3	-		2	Questions in the final lesson. Interview
2.8. Human digestion. Secretion and absorption in the digestive tract. 2.8. Human digestion. Secretion and absorption in the digestive tract.	7	-	6	-	1	1	Questions in the final lesson. Interview
2.9.Allocation Physiology	3	-	3				Questions in the final lesson. Interview
2.10. The exchange of substances and energy in the human body.	4		3			1	Questions in the final lesson. Interview
2.11. Heat exchange and thermoregulation.	1					1	Questions in the final lesson. Interview
Section 3. Homeostasis. The internal environment of the body.							
3.1. Blood, lymph and extracellular fluid are components of the internal environment of the human body.	10		9			1	Questions in the final lesson. Interview
3.2. Protective blood function. Hemostasis. Human immunophysiology.	7		6			1	Questions in the final lesson. Interview
Total	72/2 CU		54/6*		6	18	Questions in the credit. Interview

*Used interactive educational technologies

The following educational technologies are used in conducting classroom studies: lectures and

practical exercises. When organizing classes in an active and interactive form, information technologies, computer simulation programs "Virtual Workshop on Human and Animal Physiology", situational tasks and tests are used, in discussing the results of which the discussion technology is used: brainstorming technology is used when studying new theoretical material before performing practical assignments.

5. CONTENT OF THE COURSE (MODULE).

Section 1. Regulation of physiological functions.

1.1.Regulation of physiological functions. The internal environment of the human body. Principles of maintaining the constancy of the internal environment. Self-regulation Functional systems of the body.

1.2. Nervous regulation of human vegetative functions.

1.3. Humoral regulation of human physiological processes.

1.4. Endocrine glands. Hormone-producing cells outside the gland.

Physiology of endocrine glands.

Physiology of endocrine glands and their role in the formation of functional systems of the body.

The mechanism of action of hormones.

Methods of studying the endocrine glands.

The hypothalamic-hypophysis system.

Thyroid. Parathyroid. Endocrine function of the pancreas. The adrenal glands. Sex glands. Epiphysis Thymus.

Age features of the endocrine system.

Section 2. Functional systems for maintaining homeostasis.

2.1. Human blood circulation. Heart structure and function

Heart physiology.

The physiological properties of the heart muscle.

Cardiac cycle and its phases.

Hemodynamic functions of the heart.

2.2.Physiology of the heart.

Methods for assessing cardiac activity.

Heart sounds.

Phono-, ballisto-, echo-, vector- and electrocardiography.

2.3. Regulation of the heart.

Autoregulation, nervous, humoral regulation.

Reflexes of the heart.

Integration of mechanisms regulating the work of the heart.

2.4.Microcirculation processes.

Methods of research microcirculation.

2.5. Functional system to maintain the optimal level of blood pressure for metabolism.

Basic laws of hemodynamics

Changes in blood pressure, resistance and blood flow in different parts of the bloodstream.

Arterial and venous pulse.

Regulation of blood circulation.

Regional blood circulation.

Methods of studying organ circulation (occlusive, plethysmography, ultrasound and electromagnetic flowmetry).

Vasodomotor center, vasomotor nerves.

Nervous and humoral effects on vascular tone.

Pressor and depressor reflexes.

Basic tone.

Features and regulation of capillary blood flow.

Functional features of the pulmonary circulation, coronary blood flow.
Factors of a healthy lifestyle, preventing the circulatory system.
Age features of the circulatory system.
Changes in organ circulation during muscular load, eating, pregnancy, hypoxia, stress and other conditions.
2.6.Physiology of respiration. External breathing The mechanism of inhalation and exhalation.
Stages of breathing.
The mechanism of the first breath. Respiratory movements in the embryonic period.
Pressure in the pleural cavity.
Elastic properties of the lungs.
Spirometry, spirography, pneumotachography.
2.7. Human digestion. Morphofunctional organization of the digestive system. Functional system of digestion and the place in it of the processes of digestion.
Digestion is the main component of FUS, maintaining a constant level of nutrition in the body.
Digestion in the mouth.
Swallowing, its phases, methods of study, regulation.
Nutritional motivation. The physiological basis of hunger and saturation.
Food motivation I.P.Pavlov about the food center.
Eating regulation.
Age features of the digestive system.
2.8. Human digestion. Secretion and absorption in the digestive tract.
2.9. Physiology selection.
The main processes occurring in the kidney: filtration, secretion.
Regulation of urination and urination.
Adaptive changes in kidney function under various environmental conditions.
Skin as an excretory organ. Functions of sebaceous and sweat glands, regulation of their activity.
Physiology selection. Clinical methods for the study of renal function. Regulation of renal function.
2.10. The exchange of substances and energy in the human body.
Metabolism and energy.
Physiology of metabolism and energy.
Plastic and energy role of nutrients.
Caloric and respiratory coefficients.
Main and working exchange.
The concept of water balance.
Energy costs of the body with different types of labor.
Age features of the metabolic system.
Physiological basis of nutrition.
2.11. Heat exchange and thermoregulation.
Heat control.
System mechanisms of thermoregulation and heat transfer.
Mechanisms of hardening of the body.
Age features of the thermoregulation system.

Section 3. Homeostasis. The internal environment of the body.

3.1. Blood, lymph and extracellular fluid are components of the internal environment of the human body.
Lymphatic system, its structure and function.
Lymphatic formation and mechanisms of its regulation. Factors that provide lymph flow and mechanisms of its regulation. Lymph, its composition, quantity, function, physiological value.
Extravascular fluid media of the body (interstitial, cerebrospinal, synovial, pleural, peritoneal,

fluid medium of the eyeball, mucus) and their role in ensuring the vital activity of the body cells.
Blood physiology
The main constants of blood and self-regulating mechanisms for their maintenance.
Protective blood function.
Blood groups. Rh factor.
Mechanisms of blood coagulation.
3.2. Protective blood function. Hemostasis. Human immunophysiology.
The body and its protective systems.
Factors that ensure the integrity of the body. Barriers to the external and internal environment of the body.
Immunity and its types.
Protective reflexes.

6. THEMES OF PRACTICAL AND SEMINAR ACTIVITIES

Section 1. Regulation of physiological functions.

1.4. Endocrine glands. Hormone-producing cells outside the gland.
1.4.1. Effect of adrenaline and pilocarpine on the movement of the gastrointestinal tract in a warm-blooded animal.
Objective: to determine the effect of adrenaline and pilocarpine on the motor function of the gastrointestinal tract.
Work content: The narcotized animal is fixed on a wooden plate, the abdominal cavity is opened. Immersed in a warm solution of Ringer to the shoulder girdle and observe changes in gastrointestinal motility under the influence of adrenaline and pilocarpine.
Results of work: a decrease in the motility of the gastrointestinal tract after application of an adrenaline solution and an increase in motility under the influence of pilocarpine are recorded.
1.4.2. Action insulin on white mice.
Objective: to observe the effect of excess insulin on white mice.
Work content: A hungry mouse is injected with 1 U of insulin under the skin and placed in a separate glass jar. Observe the condition and behavior of the animal. Intraperitoneally injected with 1 ml of 10% glucose solution.
The results of the work: some time after the introduction of insulin, there are signs of hypoglycemic shock, the introduction of glucose in a few minutes leads to the restoration of the normal state.
1.4.3. Virtual workshop. Effect of thyroxin, thyrotropic hormone and propylthiouracil on metabolism. Objective: To demonstrate the effect of thyroxin, a thyroid-stimulating hormone and propylthiouracil on the metabolism of three different rats: the first healthy; the second with the thyroid gland removed; the third with the pituitary gland removed. Analyze the data. To conclude.
1.4.4.The effect of insulin and alloxan on blood glucose levels. Virtual workshop. Objective: To demonstrate the effect of insulin on a healthy rat and on a rat with insulin-dependent diabetes (caused by alloxan, a substance that destroys beta cells in the pancreatic islets of Langerhans).

Section 2. Functional systems for maintaining homeostasis.

2.1. Human blood circulation. The structure and function of the heart.
2.1.1. Graphic registration of the frog's heart contractions. Virtual workshop.
Objective: to analyze the cardiogram of the heart of a frog on the basis of a multimedia task.
Results: recording and analysis of the frog's cardiogram.
2.1.2. Analysis of the cardiac conduction system (Stannius experience).
Objective: to show the presence and gradient of automaticity in the heart.
Work content: They impose the first, second, and third Stannius ligatures, successively counting the number of heartbeats.
Results: after each ligature, the number of heartbeats is consistently reduced.

2.1.3. Features of the excitability of the heart and extrasystole. Virtual workshop.
Objective: to show that after an extraordinary irritation at the onset of diastole an extrasystole occurs.
Work content: The frog's cardiogram is recorded normally and after causing irritation at the beginning of the diastole.
Results: after extrasystoles, the ventricles receive a compensatory pause.
2.2. Heart physiology. Methods for assessing cardiac activity.
2.2.1. Percussion and auscultation of tones of the human heart.
Objective: to familiarize with the technique of listening to the tones of the human heart.
Work content: With the help of a phonendoscope, heart sounds are heard at certain places in the chest. The mitral valve is heard in the place of a cardiac impulse, in the fifth intercostal space, on the finger medial to the nipple line. The tricuspid valve is heard at the lower end of the sternum. The lunate artery lunar valve is heard in the second intercostal space, slightly to the left of the left edge of the sternum. The semilunar aortic valve is heard in the second intercostal space on the right, near the very edge of the sternum.
Results of work: note the first tone - deaf and long, it coincides with a heart beat (systolic tone). The second tone is shorter and sharper (diastolic).
2.2.2. Finding a heart beat in a person.
Objective: to determine the cardiac impulse in humans.
Content of work: a cardiac push can be heard, or seen in the form of protrusion (protrusion) in the area of the fifth intercostal space to the left of the midclavicular line.
The results of the work: determined the heart beat.
2.2.3. ECG recording and its interpretation.
Objective: to familiarize with the electrocardiography technique and principles of ECG analysis.
Work content: Subject is laid on a couch. Impose electrodes in accordance with the types of overlay with bipolar leads and at the same time fix the electrode on the right leg. Record the ECG. Designate teeth, segments and intervals on an ECG curve.
The results of the work: recorded ECG in three standard leads.
2.3. Regulation of the heart.
2.3.1. The effect of irritation of the mixed vagosympathetic nerve on the activity of the heart of the frog. Virtual workshop.
Objective: to demonstrate negative tropic effects in the heart with an increase in the tone of the nucleus of the vagus nerve.
Work content: A cardiogram of a frog is recorded before and after irritation of short branches of the vagosympathetic stem.
The results of the work: when irritation get a reduction, up to cardiac arrest.
2.3.2. Exogenous reflexes to the heart (Holtz reflexes, Danini-Ashner reflex).
Objective: to demonstrate the conjugate reflexes of the heart.
Work content: They irritate the receptors of the abdomen of the frog (the Holtz reflex) and the receptors of the eyeballs in humans (the Danini-Ashner reflex).
Results of work: observe a decrease in heart rate and explain the mechanism of these phenomena.
2.3.3. The effect of temperature on the activity of the heart.
Objective: to show that with a change in temperature in the region of the sinus node, the heart rate changes.
Work content: Count the number of heartbeats in a spinal frog is normal; after heating and after cooling by 10 degrees to the area of the sino-atrial node.
Results of work: increase and decrease in heart rate respectively are observed.
2.3.4. The effect on the activity of the heart of potassium and calcium ions.
Objective: to investigate the role of potassium and calcium ions in the humoral regulation of the

heart.
Content of work: The number of heart contractions of a spinal frog is normal, after adding CaCl2 through cannula and after washing with KCl.
The results of the work: they observe an increase and, accordingly, a decrease in the heart rate.
2.4. Microcirculation processes.
2.4.1. The influence of the vasoconstrictor nerve fibers of the sciatic nerve on the regulation of the vascular tone of the capillaries of the frog's swimming membrane.
Objective: to show that the size of the lumen of blood vessels depends on the nervous influences.
Work content: Under the microscope, the blood circulation in the vessels of the frog's swimming membrane is observed normally and after transection of the sciatic nerve.
The results of the work: there is dilation of blood vessels.
2.5. Functional system to maintain the optimal level of blood pressure for metabolism.
2.5.1. Measurement of blood pressure in humans.
Objective: to familiarize with the method of determining blood pressure by the Riva-Rocci method and by the method of Korotkov.
Work content: Determine systolic and diastolic pressure using the Korotkov method: put the cuff on the shoulder, put a phonendoscope on the pulsating brachial artery, pump air into the cuff, releasing the air and listen for vascular tones. The moment of appearance of the tones corresponds to the systolic pressure, and the disappearance - to the diastolic.
Riva Rocci method. Palpation method find the pulse. By pressing the radial artery, air is forced into the cuff on the shoulder until the pulse disappears. Watching the pressure in the gauge, release air. When the pressure in the cuff becomes slightly less than the systolic, a pulse appears. According to the Riva-Rocci method, only the maximum pressure is determined.
Results of work: determination of pressure in two ways.
2.5.2. Determination of blood pressure during exercise.
Objective: to determine blood pressure Korotkov method with physical activity.
Work content: We determine blood pressure at rest and after 20 squats.
Results: after exercise increases systolic blood pressure.
2.5.3. Counting the pulse and determining the duration of the cardiac cycle in humans by the pulse.
Objective: to familiarize with the method of determining the duration of the cardiac cycle.
Work content: The subject is groped with a pulse of the radial artery. Count the number of pulse beats for 5 seconds several times within 3 minutes. 5 is divided into each number, thereby calculating the duration of one cardiac cycle. Calculate the average duration of the cardiac cycle. Then determine the number of pulse beats for 1 min. 60 divided by the number found and find the average duration of the cardiac cycle.
Results of work: compare the results of two ways of counting.
2.5.3. Colloquium on the physiology of the circulation of blood.
2.6. The physiology of respiration.
2.6.1. Pneumography in humans.
Objective: to obtain a pneumogram of a person in various physiological states (hyperventilation, while reading aloud).
Work content: With the help of the Wiopac software, the respiratory effort sensors and the temperature sensor, the patient's pneumogram is recorded at rest, hyperventilation, hypoventilation, while reading aloud. Breathing pattern analysis is conducted (depth, frequency, duration of respiratory phases).
Results: after hyperventilation as a result of hypoxia, breathing decreases, after hypoventilation, an increase in the frequency of breathing is observed, an arbitrary regulation of breathing is observed when reading aloud.
2.6.2. Spirometry Determination of volume of breth, vital capacity of the lungs (VCL).

Calculation of proper vital capacity (PVCL) and maximum ventilation of the lungs (MVL). Conducting dynamic spirometry.
Objective: to determine the person pulmonary volumes.
Work content: Determine the respiratory volume, reserve volume of inhalation, reserve volume of exhalation and VC using dry air spirometer.
Results: determined pulmonary volumes.
2.6.3. Arbitrary breath-hold under various conditions with ECG recording (test for inspiration and expiration, with ECG, with report).
Objective: to evaluate the effect of CO2 on the respiratory center.
Work content: We define an arbitrary breath hold in the normal state, after hyperventilation in the lungs and after exercise.
Results of work: minimal arbitrary breath holding was determined after exercise.
2.6.4. The final lesson on the topic: The physiology of respiration.
2.7. The physiology of digestion. Morphofunctional organization of the digestive system. Methods for studying the functions of the gastrointestinal tract. Digestion in the mouth and stomach.
2.7.1. Enzymatic properties of saliva in humans. (Virtual workshop).
Objective: to experimentally study the composition and properties of human saliva.
Work content: Salivary amylase is mixed with three carbohydrates with different structures. The Trommer`s reaction for the identification of monosaccharides is performed and the red color which appears at the end of the reaction proves that only starch is decomposed by the enzyme.
Results: α-amylase is most effective in conditions close to the physiological conditions of the oral cavity (slightly alkaline medium, temperature 37 degrees).
2.7.2. Reflex salivation.
Objective: to master the method intended for mass study of total salivation in humans, to note the difficult-reflex nature of the work of the salivary glands in humans.
Content of work: in the oral cavity with the help of a gauze napkin collect saliva released in 2 minutes at rest, while holding the breath, when telling about cutting a lemon, when kneading in a cup of cranberries. Wipes soaked in saliva are weighed.
Results: the regulation of salivation is subject to conditioned and unconditioned reflex effects.
2.7.3. The physiology of digestion. Digestion in the stomach and intestines. Functions of the pancreas and liver.
The composition and properties of gastric juice.
Objective: to experimentally study the composition and properties of gastric juice.
Work content: Put 10 equal volumes of crushed fibrin into 10 tubes, chopped chicken protein, a piece of raw and a piece of boiled meat, respectively, in 11-13 tubes. The contents of the tubes are poured with artificial and natural gastric juice, and incubated in different acid and temperature conditions. A biuret reaction is carried out to check the presence of protein in the solution.
Results: gastric juice works in an acidic environment.
2.6.4. Bile and its role in the digestive process.
Objective: to experimentally study the composition of bile and its role in the digestive process.
Work content: Pittenoffer is tested for bile acids, Gmelin reaction to bile pigments. The effect of bile on fats is observed (emulsification of bile fats, the effect of bile on fat filtration).
Results of work: determined the composition of bile (bile acids, bilirubin) and its effect on fats (emulsification, acceleration of filtration).
2.7.5. Enzymatic properties of intestinal juice.
Objective: to investigate the effect of intestinal juice enzymes on the digestion of protein and carbohydrate fission products.
Content of work: Pour 3 ml of intestinal juice into 4 tubes, one of them is boiled. Peptone

solution is added to 1 and 2 tubes, to 3 - a piece of fibrin, to 4 - washed exposed film. Incubated for 45 minutes at 39 degrees. Divide the contents of the tubes into 2 parts and conduct a biuret reaction and a reaction to tryptophan with bromine water.
Pour 3 ml of 5% sucrose solution into 3 tubes, add intestinal juice, boiled intestinal juice and water, respectively. Incubate for 30 minutes at 39 degrees. Spend with them and the control tubes with sucrose solution sample Trommer.
Results: intestinal juice has an alkaline environment, breaks down peptones into dipeptides and amino acids, and sugars into hexoses.
2.8. The physiology of digestion. Motility of the gastrointestinal tract and its regulation. Absorption in different parts of the digestive tract.
2.8.1. Motor function of the digestive tract in warm-blooded animals.
Objective: to study the features of motor function of various parts of the gastrointestinal tract.
Work content: The narcotized animal is fixed on a wooden plate, the abdominal cavity is opened. Immersed in warm Ringer's solution to the shoulder girdle.
Results of work: the stomach and intestines freely floats in solution, making all kinds of motor activity.
2.8.2. Parietal digestion in the intestines.
Objective: to prove the stimulating effect of a piece of the intestinal wall on the hydrolysis of starch by intestinal juice amylase.
Content of work: Pour 3 ml of starch paste and 10 ml of Ringer's solution with extract from the walls of the jejunum into 10 tubes. In tubes, except for 5 controls, lower a piece of washed small intestine and incubate at 38 degrees. Remove from the thermostat one tube from the test and control series every 3 minutes. Do a Trommer trial.
Results: Trommer samples were more intense in test tubes that were longer incubated and contained a piece of the intestinal wall.
2.8.3. The study of the mechanism of absorption of various solutions in the acute experience. (Heidengine's experience).
Objective: to experimentally study the absorption in the intestine of a mammal.
Contents of the work: An addicted rat is opened into the abdominal cavity and the intestines are exposed. Isolate a section of the small intestine with a length of 10-15 cm. Cannulas are inserted into both its ends, one of which is connected to a graduated burette, and the second to a diversion tube. The system is flushed, the outlet tube is clamped and the system is filled with isotonic NaCl solution. The amount of solution absorbed in 10 minutes is measured. The same is done with hypo-and hypertonic solutions of NaCl.
Results: when the hypotonic solution is absorbed, the rate of absorption increases, while that of the hypertonic one decreases, compared to the isotonic one.
2.8.4. The final lesson on the topics: "The physiology of digestion"
2.9. Allocation physiology.
The main processes occurring in the kidney: filtration, secretion. Regulation of urination and urination.
Adaptive changes in renal function in various environmental conditions.
Skin as an excretory organ. Functions of sebaceous and sweat glands, regulation of their activity.
Physiology selection. Clinical methods for the study of renal function.
2.9.1. Research on perspiration. Minor experience.
Objective: to master the method of studying perspiration in Minor.
Work content: Palm is wiped dry and moistened with iodine solution. The greased area is powdered with starch. The other hand is immersed in hot water. Watching the color change of starch.
The results of the work: in the place of sweat formation black spots are formed.

2.9.2. Virtual workshop. Effect of hydrostatic pressure, osmotic pressure and diameters of the glomerular afferent and efferent arterioles on urine flow
Objective: Demonstration of the influence of the glomerular filtration rate, the hydrostatic blood pressure and oncotic blood pressure on urine flow
Work content: The intensity of the blood flow is determined before and after modifying of the glomerular afferent and efferent arterioles, hydrostatic blood pressure and oncotic blood pressure.
The results of the work: Determine the intensity of diuresis (ml/min)
2.9.3. Virtual workshop. Influence of the aldosterone and the antidiuretic hormone on the urine flow
Objective: Demonstration of the effect of aldosterone and ADH on urine flow
Work content: Determination of the urine flow before and after aldosterone administration and then before and after ADH administration
The results of the work: Determine the intensity of diuresis (ml/min)
2.9.4. Virtual workshop Influence of glucose on urine flow
Objective: Demonstration of the enhancement of urine flow and of glucose level in the urine as a result of an increase in blood glucose
Work content: Urine flow and glucose level in the urine are estimated before and after the intravenous administration of a concentrated glucose solution
The results of the work: Determine the intensity of diuresis (ml/min)
Spend Trommer probe in the urine in normal and glucose administration
2.10. The exchange of substances and energy in the human body.
Determination of basal metabolism according to the tables of Harris and Benedict
Objective: to use formula to estimate metabolic rate at rest, and from that a daily energy expenditure.
Work content: With the help of a stadiometer and weights, determine the height and weight of the test. In the tables of Harris and Benedict find the values corresponding to the weight, age and height of the test. Add the numbers from the tables.
Results of work: the main exchange is calculated.
2.10.1. Making diet
Objective: to study and master the principles of drawing up food rations for adults and children.
Work content: Take the daily need for kilocalories, proteins, fats and carbohydrates and divide these values into parts corresponding to breakfast lunch and dinner. From the table in which the calorie content of products is indicated, select the required products and take the required number of them.
The results of the work: the diet for a person of a certain gender and age.
2.10.2. Final lesson on topics: Metabolism. Endocrinology. Thermoregulation. Highlight.
Section 3. Homeostasis. The internal environment of the body.
3.1. Blood physiology. Formed elements of blood. Erythrocyte physiology. Respiratory blood function.
3.1.1. Blood sampling from the finger.
Objective: to learn the technique of taking blood to calculate red blood cells.
Work content: Make blood collection from the thumb or ring finger of your left hand (it is permissible to receive blood from any other finger). A blood taker must wear rubber gloves. Wipe the skin of the fingertip with a cotton swab moistened with 70% alcohol and wait for it to dry. Use your left hand to slightly squeeze the pulp of the finger in the area of the intended injection. Take a sterile scarifier in your right hand, orienting it strictly perpendicular to the skin surface at the injection site. The most convenient place to puncture the skin is the point to the left of the midline at some distance from the nail. Make a prick to the entire depth of the needle point, while cutting through the skin across the fingerprint lines. Remove the first drop of blood

because it contains inadvertent impurities, lymph and damaged corpuscles. Next, take the blood for the necessary tests. After the end of the blood sampling, apply a cotton swab moistened with alcohol or iodine solution to the puncture site. Finger blood draw in special in each case glass capillaries to standardize the process of blood collection.

Results of work: The correct receipt of capillary blood is one of the decisive conditions that ensure the accuracy and reproducibility of the results. The total time spent on blood collection should not exceed 2 - 3 minutes. In the taken blood there should be no signs of clotting.

3.1.2. Determination of the number of erythrocytes in the blood

Objective: To master the method of counting red blood cells using the Goryaev's chamber.

Work content: Dilute blood in 200 times with 3% NaCl solution. We collect the blood in the mixer to the level of 0.5 and bring the solution to the mark of 101 NaCl. Or mix in vitro 4 ml of 3% sodium chloride with 20 μl of blood. Mix the blood with the reagents in the tube. Red blood cells wrinkle and become more prominent. Prepare the Goryaev's chamber: rub the coverslip to the object glass. The solution is placed in a chamber and counted red blood cells under a microscope with a small increase in 5 large squares divided into 16 small ones. The resulting amount of red blood cells inserted in the formula: X = A * 4000 * 200/80, where X is the desired number of red blood cells, A is the number of red blood cells in 80 small squares.

Results of work: the results of the calculation of red blood cells are compared with this indicator in the norm.

3.1.3. Determination of hemoglobin (Hb) content in blood**.**

Objective: To master the methodology for estimating hemoglobin in blood by the Sahli colorimetric method and to determine its concentration

Work content: In a graduated test tube of the hemoglobinometer, pour the acid to the marker. Add 0.02 ml of blood. Shake the tube several times and leave for 7-10 minutes. Add distilled drop of water and mix with a glass rod until the color standard of the hemin. Take the testimony in the lower liquid meniscus.

Results of work: The method of Sahli is based on the conversion of hemoglobin into hemin with the addition of hydrochloric acid to the blood.

3.1.4. The calculation of the color index of blood (CIB)

Objective: to evaluate the degree of hemoglobin saturation of each individual red blood cell.

Work content: Using data on the content of erythrocytes and hemoglobin in the examined blood, calculate the color index of blood by the formula:

$$CIB = \frac{\text{Hb (g/l)}}{\textbf{the number of erythrocytes} \text{ (the first three digits)}} \times 3$$

Compare the obtained results with the available standards.

Results of work: get the value of a color indicator and compare with the indicator in the norm.

3.1.5. Determination of the erythrocyte sedimentation rate (ESR).

Objective: to learn the technique of ESR determination, measure it and give an opinion on the conformity of the received data to the existing standards.

Work content: Wash the capillary with sodium citrate. Collect the citrate to the label of reagent P and blow to the watch glass. Draw blood into the capillary to the K mark twice and blow it out onto the watch glass. Thus, we mix sodium citrate and blood in a ratio of 1: 4. Fill the capillary with a mixture to the mark 0, put in a tripod for 60 minutes.The results of the work: get the value of ESR and compared with the indicator in the norm.

Results of work: Estimate the height of the plasma column in mm after 1 hour

3.2. Blood physiology. Leukocyte physiology. Physical and chemical properties of blood.
3.2.1. Determination of the number of leukocytes in the blood
Objective: To master the method of counting white blood cells using a counting chamber to determine their blood and give an opinion on the conformity of the data to the existing standards.
Work content: To dilute the blood in 20 times with a solution of the Turk. Collect blood into the mixer to the level 1 and get the Türk solution up to level 11. Mix the blood with the reagent in the watch glass. The solution of acetic acid hemolysis of erythrocytes. Methylene blue stains the nuclei of leukocytes. Prepare the Goryaev's chamber. The solution is placed in the chamber and counted white blood cells under a microscope with a small increase in 25 large squares of 16 small separated ones. Substitute the number in the formula: X = (B * 4000 * 20) / 400, where X is the number of leukocytes, B is the number of leukocytes in 25 large squares.
Results: calculate the number of leukocytes in the blood and compared with the normal rate.
3.2.2. Determination of the osmotic resistance of erythrocytes.
Objective: to get acquainted with the method of investigation of osmotic resistance of erythrocytes. Determine the minimum and maximum resistance of red blood cells.
Work content: In 10 test tubes with a solution of sodium chloride, a decreasing concentration is added in 0.02 ml of blood, shaken and left in a tripod for 1 hour.
Results of work: note, at what concentration of sodium chloride came partial hemolysis - the border of the minimum resistance of erythrocytes. The limit of maximum resistance is determined by the concentration of sodium chloride in the first tube, in which there is no sediment and the liquid is intensely colored.
3.2.3. Types of hemolysis.
Objective: to show that hemolysis can be caused by various factors that have a different mechanism of action.
Content of work: 2 drops of blood were added to 4 tubes with saline, distilled water, 0.1% hydrochloric acid solution and 5% ammonia solution. A test tube of citrated blood is placed in the freezer for 1 hour and thawed in hot water.
Results: Osmotic (in a test tube with distilled water), chemical (in test tubes with hydrochloric acid solution and ammonia solution) and thermal (in a test tube from the freezer chamber) types of hemolysis are observed.
3.2.4. Determination of blood viscosity.
Objective: to get acquainted with the method of determining blood viscosity.
Work content: Water and blood are drawn into the capillaries up to the mark 0. Suction of the blood level to the mark 1. It is noted on what division the water level stopped.
Results: blood viscosity is equal to the distance traveled by water divided by the distance traveled by blood.
3.3. Blood physiology. Blood coagulation The doctrine of blood types.
3.3.1. Decalcification blood. Anticoagulant agents.
Objective: to determine the effect of calcium on blood clotting.
Work content: 1 drop of blood is dripped onto a glass slide and the rate of coagulation is determined. Mix a drop of blood with a drop of sodium oxalate solution, and then a drop of blood and a drop of calcium solution, measure the rate of coagulation.
The results of the work: the addition of sodium oxalate slows down the coagulation rate, because it binds calcium ions, and when calcium is added, it increases, because calcium is one of the factors of blood coagulation.
3.3.2. Determination of blood types.
Objective: Determine blood group ABO system reagents Colyclons.
Contents of the work: Applied to plate or plate individual pipettes Colyclons anti-A, anti-B and anti-AB one large drop (0.1 ml) under appropriate labels. Near drops antibody coated on one

small drop of blood examined (0.01 - 0.03 ml). Mix the blood with a reagent shaking plate. Tracking the progress of the reaction with Colyclons visually under gentle shaking the plate for 3 minutes. Agglutination of red blood cells with Colyclons usually occurs in the first 3 - 5 seconds, but monitoring should be carried out 3 minutes later due to the appearance of the agglutination with erythrocytes containing weak variety of antigens A or B. The result of the reaction in each drop can be positive or negative. A positive result is expressed as the agglutination (gluing) of red blood cells. Agglutinates appear as small red assembly rapidly mixing in large flakes. When a drop backlash is uniformly reddened, agglutinates it can not be detected. Results: I group determined by the absence of agglutination in all drops, group II - by agglutination with sera of groups I and III, group III - by agglutination with sera of groups I and II, group IV - by agglutination with all three drops.

The results of the work: The presence of agglutination indicates the presence of blood groups.

3.3.3. Determination of Rh factor.

Objective: Determination of Rh reagents Colyclons.

Work content: 1. Applied to plate or plate individual pipettes Colyclons anti-D one large drop (0.1 ml) under appropriate labels. Near drops antibody coated on one small drop of blood examined (0.01 - 0.03 ml). Mix the blood with a reagent shaking plate. Tracking the progress of the reaction with Colyclons visually under gentle shaking the plate for 3 minutes. Agglutination of red blood cells with Colyclons usually occurs in the first 3 - 5 seconds, but monitoring should be carried out 3 minutes later due to the appearance of the agglutination with erythrocytes containing weak variety of antigens D. The result of the reaction in each drop can be positive or negative. A positive result is expressed as the agglutination (gluing) of red blood cells. Agglutinates appear as small red assembly rapidly mixing in large flakes. When a drop backlash is uniformly reddened, agglutinates it can not be detected. Results: the agglutination reaction is observed if the blood is Rh-positive, is absent, if the blood is Rh-negative.

The results of the work: The presence of agglutination indicates the presence of Rh-factor. When agglutination with Colyclon anti-D appears, the blood is Rh-positive, in the absence of agglutination, the blood is Rh-negative

3.4. Final lesson on: Physiology of blood.

7. LABORATORY WORKS (LABORATORY WORKSHOP) - no provided

8. THEMES OF COURSE, CONTROL WORKS, ABSTRATES - no provided

9. QUESTIONS FOR THE CREDIT:

Index competencies	No task задания	Question
GPC-9	1.	Excitability of the heart muscle.
GPC-9	2.	Contractility of the heart muscle. Extrasystole.
GPC-9	3.	Conduction of the heart muscle. Holding excitement in the heart.
GPC-9	4.	Heart Automation.
GPC-9	5.	Conductive system of the heart. The experience of Stanius.
GPC-9	6.	The ratio of excitation, contraction and excitability in different phases of the cardiac cycle.
GPC-9	7.	Self-regulation of the heart.
GPC-9	8.	Nervous regulation of the heart.

GPC-9	9.	Reflexes of the heart.
GPC-9	10.	Humoral effects on the work of the heart.
GPC-9	11.	Integration of mechanisms regulating the work of the heart.
GPC-9 PC-1	12.	Heart beat, heart sounds and their origin.
GPC-9 PC-1	13.	ECG, vector cardiography.
GPC-9 PC-1	14.	Phonocardiography.
GPC-9	15.	Phases of the heart cycle.
GPC-9	16.	Classification of the cardiovascular system.
GPC-9	17.	The basic laws of hydrodynamics and their use to explain the physiological patterns of blood movement in vessels
GPC-9	18.	Factors that ensure the movement of blood through the vessels.
GPC-9	19.	Change in resistance, blood pressure and blood flow velocity in various parts of the vascular bed.
GPC-9 PC-1	20.	Arterial and venous pulse.
GPC-9 PC-1	21.	Blood circulation time
GPC-9 PC-1	22.	Blood pressure and methods for measuring it (according to Korotkov and Riva-Rochi).
GPC-9	23.	Regulation of blood pressure.
GPC-9	24.	Capillary blood flow, microcirculation.
GPC-9	25.	The importance of respiration for the body.
GPC-9	26.	The main stages of breathing.
GPC-9	27.	External respiration.
GPC-9	28.	The mechanism of ventilation.
GPC-9	29.	Respiratory muscles, the effect of their contractions on the volume of the chest.

GPC-9	30.	The mechanism of inhalation and exhalation.
GPC-9	31.	Pressure in the pleural cavity.
GPC-9	32.	The elastic properties of the lungs.
GPC-9	33.	Surfactant. Its nature and significance.
GPC-9	34.	The mechanism of active and passive inhalation and exhalation.
GPC-9	35.	Spirometry, spirography, pneumatography.
GPC-9	36.	Physiology of the respiratory tract.
GPC-9	37.	Gas exchange in the lungs. Composition of inhaled, exhaled, alveolar air.
GPC-9	38.	Blood gas transport.
GPC-9	39.	Oxyhemoglobin dissociation curve, factors affecting the course of the curve.
GPC-9	40.	Gas exchange in tissues.
GPC-9	41.	Respiratory Center (N.A. Mislavsky). Automation of the respiratory center.
GPC-9	42.	The role of mechanoreceptors of vagus lung and afferent fibers in the regulation of respiration.
GPC-9	43.	Reflex self-regulation of respiration. The mechanism of change of respiratory phases.
GPC-9	44.	The main physiological mechanisms of changes in respiration when climbing to a height.
GPC-9	45.	Goering-Breyer reflexes. Respiration at high and low atmospheric pressure.
GPC-9	46.	The role of humoral factors in the regulation of respiration.
GPC-9	47.	The effect on the respiratory center of the gas composition and the pH of the blood and cerebrospinal fluid.
GPC-9	48.	Peripheral and central chemoreceptors.
GPC-9	49.	Regulatory effects on respiration from the hypothalamus, limbic system, and cerebral cortex.
GPC-9	50.	Protective respiratory reflexes.
GPC-9	51.	Functional breathing system, ensuring the constancy of the gas composition of the blood.
GPC-9	52.	Digestion is the main component of a functional system that maintains a constant level of nutrition in the body.
GPC-9	53.	The importance of digestion, the function of the digestive tract.
GPC-9	54.	Types of digestion depending on the features of hydrolysis and its localization.
GPC-9	55.	Methods of studying the functions of the digestive tract (I.P. Pavlov).

PC-1		
GPC-9 PC-1	56.	Methods of studying the activity of the digestive system in humans.
GPC-9	57.	Digestion in the oral cavity.
GPC-9	58.	The amount, composition and properties of saliva.
GPC-9	59.	Salivation mechanism.
GPC-9	60.	Swallowing and its phases.
GPC-9	61.	Digestion in the stomach. Gastric juice, its composition and properties.
GPC-9	62.	Regulation of gastric secretion. Secretory nerves of the stomach.
GPC-9	63.	The effect of humoral factors on the work of the gastric glands.
GPC-9	64.	The adaptive nature of gastric secretion.
GPC-9	65.	Exocrine pancreatic activity. The amount, composition and properties of pancreatic juice.
GPC-9	66.	Nervous and humoral regulation of pancreatic secretion.
GPC-9	67.	The role of the liver in digestion.
GPC-9	68.	The barrier role of the liver.
GPC-9	69.	Digestion in the jejunum and ileum.
GPC-9	70.	The secretion of intestinal juice, its composition, properties, regulation.
GPC-9	71.	Oral and membrane hydrolysis of food substances.
GPC-9	72.	Digestion in the colon.
GPC-9	73.	Types of contraction of the stomach. Their role in gastric digestion.
GPC-9	74.	Evacuation of gastric contents into the intestines.
GPC-9	75.	The effect of gastric and intensin hormones on the motor function of the stomach.
GPC-9	76.	Motor activity of the small intestine.
GPC-9	77.	Types and mechanism of absorption of substances through the membrane.
GPC-9	78.	Absorption in various parts of the digestive tract.
GPC-9	79.	Absorption of water and minerals.

GPC-9	80.	Absorption of hydrolysis products of proteins, fats and carbohydrates.
GPC-9	81.	Parietal digestion.
GPC-9	82.	The general concept of metabolism in the body.
GPC-9	83.	The processes of assimilation and dissimilation of substances.
GPC-9	84.	Plastic and energy role of substances.
GPC-9	85.	Balance of receipt and consumption of substances.
GPC-9	86.	Nitrogen balance. Positive and negative nitrogen balance.
GPC-9	87.	Regulation of the metabolism of nutrients in the body.
GPC-9	88.	The energy balance of the body.
GPC-9	89.	The caloric value of food.
GPC-9 PC-1	90.	Direct and indirect calorimetry.
GPC-9 PC-1	91.	Calorimetric equivalent and its meaning.
GPC-9 PC-1	92.	Respiratory rate and its value.
GPC-9 PC-1	93.	The main exchange, its size and factors influencing it.
GPC-9	94.	Hess law.
GPC-9 PC-1	95.	The laws of the preparation of the diet.
GPC-9 PC-1	96.	The formation and secretion of hormones, their transport by blood, the effect on cells and tissues.
GPC-9 PC-1	97.	The relationship and interaction of the endocrine glands.
GPC-9	98.	Pituitary hormones. Functional relationships of the hypothalamus with the pituitary gland. The role of the pituitary gland in the regulation of endocrine organs.
GPC-9	99.	Thyroid gland.

GPC-9	100.	The parathyroid glands and the role of thyrocalcitonin in the regulation of calcium and phosphorus metabolism.
GPC-9	101.	Pancreatic hormones.
GPC-9	102.	Adrenal hormones.
GPC-9	103.	Sex hormones.
GPC-9	104.	Excretory organs.
GPC-9	105.	Nephron as a structurally functional unit of the kidney.
GPC-9	106.	The main processes occurring in the kidney: filtration, reabsorption, secretion.
GPC-9	107.	The formation of primary urine, its composition.
GPC-9	108.	Features of the mechanisms of reabsorption of water, salts and organic substances. The concept of selective and mandatory reabsorption.
GPC-9	109.	The formation of final urine.
GPC-9	110.	Mechanisms for regulating the activity of the kidneys.
GPC-9	111.	The effect of blood pressure and blood supply to the tubules on the formation of urine.
GPC-9	112.	Humoral regulation of kidney activity.
GPC-9	113.	Reflex mechanisms.
GPC-9	114.	The role of the spinal cord and brain in the regulation of kidney activity (K.M. Bykov).
GPC-9	115.	The participation of the kidneys in the FUS, ensuring the constancy of the osmotic pressure of the blood, the volume of body fluid.
GPC-9	116.	Heat production. Metabolism as a source of heat. The role of individual organs in heat production. Physiological mechanisms of heat transfer.
GPC-9	117.	Heat transfer. Methods of heat transfer from the surface of the body. Physiological mechanisms of heat transfer.
GPC-9	118.	The main functions of the blood.
GPC-9	119.	The composition of human blood.
GPC-9 PC-1	120.	Physiological constants of blood and the mechanisms of their maintenance.
GPC-9	121.	Blood plasma. Electrolyte composition. Osmotic and oncotic blood pressure.
GPC-9 PC-1	122.	Erythrocytes: structure and function.
GPC-9	123.	The concept of erythron.

GPC-9	124.	Nervous and humoral regulation of erythropoiesis.
GPC-9 PC-1	125.	White blood cells, their types, number, function.
GPC-9 PC-1	126.	The concept of leukocytosis and leukopenia.
GPC-9 PC-1	127.	Leukocyte formula.
GPC-9	128.	Regulation of leukopoiesis.
GPC-9 PC-1	129.	Hemoglobin and its compounds. Platelets, structure, quantity.
GPC-9	130.	ESR mechanism.
GPC-9 PC-1	131.	Definition of a color indicator.
GPC-9 PC-1	132.	The process of blood coagulation and its significance. Theory of A.A.Schmidt.
GPC-9 PC-1	133.	Modern ideas about the main factors involved in blood coagulation.
GPC-9	134.	Blood coagulation phases.
GPC-9	135.	The concept of retraction and fibrinolysis.
GPC-9	136.	Blood coagulation and anticoagulation systems.
GPC-9	137.	Factors that accelerate and slow down blood coagulation.
GPC-9 PC-1	138.	The doctrine of blood groups.

10. INDEPENDENT WORK OF STUDENTS

Full-time form of education

The following educational technologies are used in the organization of independent work of classes.

Outside classroom independent work is performed by the student on the instructions of the

teacher, but without his direct participation. The main types of independent work of students without the participation of teachers are:
1. the formation and assimilation of the content of the recommended textbooks, including information educational resources (electronic textbooks, electronic libraries, etc.)
2. preparation for practical exercises, their design.

No	Semester	The name of the section of the discipline (module)	Types of independent work of student	Total hours	Form of control
1	2	3	4	5	6
1	4	Regulation of physiological functions	Preparation for classes (PC) Preparation for current control (PCC)	5	Oral survey
2		Homeostasis. The internal environment of the body.	Preparation for classes (PC) Preparation for current control (PCC)	11	Oral survey
3		Functional systems for maintaining homeostasis	Preparation for classes (PC) Preparation for current control (PCC)	2	Oral survey
TOTAL hours per semester:				18	

11. LEARNING AND TEACHING RESOURCES OF THE DISCIPLINE.

a) Recommended literature list

principal literature

1. Gening T.P., Abakumova T.V., Gening S.O. Physiology of visceral systems: Education guidancefor students of medical faculty /. – Ulyanovsk: UlSU, 2019. – 96 p.
2. Gening T.P., Abakumova T.V., Mikhailova, Kadysheva E.N. Normal physiology. Part II. Physiology of Cardio-vascular system, Breath, Digestion, Excretion, Endocrine glands, Metabolism and Energy, Blood. Second Edition Ulyanovsk State University. 2018 135 p. URL: ftp://10.2.96.134/Text/Gening2018-2.pdf

additional literature

1. Cardiac Biomechanics in Normal Physiology and Disease/Encyclopedia of Cardiovascular Research and Medicine 2018, Pages 411-419
UPL: https://www.sciencedirect.com/science/article/pii/B9780128096574110592
2. Anatomy & Physiology: Current Research
URL: https://www.omicsonline.org/anatomy-physiology.php

educational literature

1. Workshop on physiology of visceral system: methodological guidance for students of medical faculty. / T.P.Gening, T.V.Abakumova, S.O.Gening. – Ulyanovsk: UlSU, 2019. – 25 p.

Agreed: Main librarian / Stadolnikova D.S. /

The position of an employee of the scientific library	Full name	signature	date

b) Professed data base, directory and search systems:

SPS Consultant Plus
The electronic library system IPRBooks

System " Antiplagiat.HIGHER EDUCATIONAL»

Agreed:

Employee of the Department of information technology and telecommunications | Full name | signature | data

12. MATERIAL AND TECHNICAL SUPPORT OF THE DISCIPLINE

LIST OF EQUIPMENT USED IN PRACTICAL CLASSES ON NORMAL PHYSIOLOGY

№	Name	Count	Planned to be
1.	Electrocardiograph one/three-channel 3	3	3
2.	Distiller	1	1
3.	Audiometer	1	1
4.	Sterilizer GP-20	1	1
5.	Fridge	2	2
6.	Centrifuge	1	1
7.	The microscope	2	2
8.	Electrostimulator	3	3
9.	A set of pipette	8	8
10.	Neurological hammer	3	4
11.	Spring clips – serpinas	10	10
12.	The Engelmann's levers	4	4
13.	Scales (from 0.005 to 150 g)	1	1
14.	Libra pharmacy	4	4
15.	The weights from 1 mg to 500 g	1	4
16.	Mechanic tonometer	6	6
17.	Water thermometer	2	2
18.	Phonendoscope	10	10
19.	The forked electrodes	4	4
20.	Polygraph for electrophysiological studies MF30 (Biopac Student Lab), expanded.	1	1

FACILITY-BASED AND TECHNICAL RESOURCES OF THE DISCIPLINE

Object name, lecture hall	Material support, availability of material and technical support, with a list of main equipment	Address (location) of the object confirming the presence of hardware and technical support (indicating the number of such an object in accordance with the technical inventory documents)
Lecture audience №310 for lectures, with a set of demonstration equipment to ensure the presentation of illustrative material on the discipline in accordance with the work program. The room is equipped with a set of student furniture for 400 seats.	Technical means: 1. Multimedia projector 2. Interactive whiteboard 3. Board in the classroom 4. The workplace of the teacher	Ulyanovsk region, Ulyanovsk, 1, University Embankment Str, building 4, audience 310.
Lecture audience №209 with a set of demonstration equipment to ensure	Technical means: 1. Multimedia projector	Ulyanovsk region, Ulyanovsk, 2/1, Arch.Livchak Str, audience 209

the presentation of illustrative material on the discipline in accordance with the work program. The room is equipped with a set of student furniture for 186 seats.	2. Interactive whiteboard 3. Board in the classroom 4. Training Visual Aids 5. Workplace teacher	
Class room number 204 for lectures, practical group (1/2 group) classes with a set of demonstration equipment to ensure the presentation of illustrative material on the subject in accordance with the work program. The room is equipped with a set of student furniture for 36 seats.	Technical means: 1. Multimedia equipment (TV, laptop) 2. Interactive whiteboard 3. Board classroom 4. Rack with educational visual aids 5. Workplace teacher 6. The device for electrophysiological researches on the person Biopac Student Lab 7. Computer for conducting a virtual workshop on many topics of the course according to the work program 8. 2 working lab tables for training equipment (perimeter, electrocardiograph, etc.) 9. Couch 10. Hand dryer 11. Electrostimulator 12. Refrigerator 13. Fume hood 14. Rollers on wheels 15. Laboratory tools (scissors, tweezers, dissecting needles, Galvani forks, pharmacy scales, scalpels, etc.) 16. Computer table 17. Laboratory washing table	Ulyanovsk region, Ulyanovsk, 2/1, Arch.Livchak Str, audience 204, square=54,97м^2
Class room number 203 for lectures, practical group (1/2 group) classes with a set of demonstration equipment to ensure the presentation of illustrative material on the subject in accordance with the work program. The room is equipped with a set of student furniture for 26 seats.	Technical means: 1. Board classroom 2. Rack for educational visual aids 3. Workplace teacher 4. A computer for conducting a virtual workshop on many topics of the course according to the work program 5. The device for electrophysiological researches on the person Biopac Student Lab. 6. Computing station for data processing to analyze the results of PCR in dir. real time (to Biopac Student Lab) 6. Working laboratory table for educational equipment (perimeter, electrocardiograph, etc.) 7. Electrostimulator 8. Rollers on wheels 9. Computer table 10. Computer for conducting a virtual workshop on many topics of the course according to the work program 11 Laboratory tools (scissors, tweezers, dissecting needles, Galvani forks, pharmacy scales, scalpels, etc.)	Ulyanovsk region, Ulyanovsk, 2/1, Arch.Livchak Str, audience 203, square=41,5м^2
Class room number 205 for lectures,	Technical means:	Ulyanovsk region, Ulyanovsk,

practical group (1/2 group) classes with a set of tables to ensure the presentation of illustrative material on the discipline in accordance with the work program. The room is equipped with a set of student furniture for 27 seats.	1. Board classroom 2. Rack for educational visual aids 3. Workplace teacher 4. A computer for conducting a virtual workshop on many topics of the course according to the work program 5. Working laboratory table for educational equipment (perimeter, electrocardiograph, etc.) 6. Electrostimulator 7. Rollers on wheels 8. Computer table 9. Thermostat 10. Distiller 11. Centrifuge 12 Laboratory tools (scissors, tweezers, dissecting needles, Galvani forks, pharmacy scales, scalpels, etc.) 13. Laboratory washing table 14.Sterilizer	2/1, Arch.Livchak Str, audience 205, square=42,5м2

LIST OF VIDEOS ON PHYSIOLOGY OF VISCERAL SYSTEMS

1 Heart physiology

1-1 action potentials in cardiac myocytes

1-2 Electrical system of the heart

1-3 action potentials in pacemaker cells

2 Heart physiology

2-1 Normal sinus rhythm on an ECG

2-2 Cardiology - Relationship of conduction system, ventricular contraction and ECG

2-3 Cardiovascular System Physiology - Cardiac Output (stroke volume, heart rate, preload and afterload)

3 Circulation

3-1 General overview of the RAAS system Cells and hormones

3-2 Aldosterone and ADH

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