AL-FARABI KAZAKH NATIONAL UNIVERSITY
Medicine and Health Care Faculty
Higher School of Medicine
Department of Fundamental Medicine

Final exam program of
OMiF1214 Morphology and physiology of human body
(8 credits)

Topics for the final exam

1. The Functions of Muscles, Muscle Attachments. Functional Groups of Muscles, Innervation and Blood Supply,Muscle Names and Learning Strategy
2. Behavior of whole Muscle
3. The Nerve-Muscle Relationship. Behavior of Skeletal Muscle Fibers
4. Muscle Metabolism
5. Muscles of the Anterior Abdominal Wall; Muscles of the Pelvic Floor; Muscles of the Back. Muscles of Respiration
6. Microscopic Anatomy of Skeletal Muscle. Connective tissue of Skeletal muscle. Nerve tissue
7. Muscles of the head and neck
8. Muscles Acting on the Shoulder and Arm; Muscles Acting on the Forearm, the Wrist and Hand
9. Muscles Acting on the Hip and Femur,Muscles Acting on the Knee and Leg. Muscles Acting on the Foot, Intrinsic Muscles of the Foot
10. Blood
11. Blood. Hemopoiesis. Erythrocytes, leukocytes, platelets. Hemopoiesis
12. Cardiac and Smooth Muscle. Overview of the Cardiovascular System. Gross Anatomy of the heart
13. Cardiac Muscle and the Cardiac Conduction System. Electrical and Contractile Activity of the Heart. Cardiac Output
14. Cardiovascular system. Heart. Layers of the Heart Wall. General description of vessels. Arteries and veins. Microcirculation stream. Arterioles. Capillaries. Venules.
15. General Anatomy of the Blood Vessels. Capillary Exchange. Venous Return and Circulatory Shock. Special Circulatory Routes
16. Anatomy of the Pulmonary Circuit, Systemic Vessels of the Axial Region
17. Blood Flow, Heart Sounds,and the Cardiac Cycle. Blood Pressure, Resistance, and Flow
18. Anatomy of the Systemic Vessels of the Appendicular Region
19. Anatomy of the Respiratory System. Pulmonary Ventilation
20. Gas Exchange and Transport. Respiratory Disorders
21. Respiratory system:nasal cavity, trachea, bronchi,bronchioles, alveolar ducts. Histology of urinary system
22. Functions of the Urinary System. Anatomy of the Kidney. Urine Formation I: Glomerular Filtration
23. Histology of urinary system
24. Urine Formation II:Tubular Reabsorption and Secretion. Urine Formation III: Water Conservation
25. Urine and Renal Function Tests

Learning outcomes

Students on the final written and test exam must demonstrate in their responses the ability to:
- describe and identify the structural and organizational structure of internal organs, localize and describe, correctly using the appropriate terminology, on models, drugs and medical imaging materials, the typical structure of internal organs and systems of human organs (musculoskeletal system and skin, respiratory, circulatory systems) in the normal way, taking into account age, gender and individual characteristics;
- understand the functional organization of the human body at the cellular, systemic and organ level, the physiological processes of excitable tissues;
- recognize and identify micro-products; describe, correctly using the appropriate terminology, the microscopic structure of human organs, taking into account age, gender and individual characteristics;
- describe, using appropriate terminology, the stages of human development and explain the main processes and mechanisms of normal morphogenesis;
- explain the relationship of structure and function at the level of tissue, organs and organ systems, and the main physiological mechanisms for maintaining homeostasis, vital activity of the body and their features, taking into account age, gender and individual differences;\
- integrate knowledge about the structure of the musculoskeletal system, skin, respiratory and circulatory systems at the systemic, organ and tissue levels and their phylogenetic development to understand anatomical and physiological features in different periods of normal development;

A rough typology of tasks for the exam

To pass the exam in writing

№	Lesson topics	Exam question
1	**Мышечная система:** - The Functions of Muscles, Muscle Attachments Functional Groups of Muscles, Innervation and Blood Supply,Muscle Names and Learning Strategy - **Behavior of whole Muscle** - Microscopic Anatomy of Skeletal Muscle II - Muscle Metabolism - Muscles of the Anterior Abdominal Wall; Muscles of the Pelvic Floor; - Nerve tissue - Muscles of the Back. Muscles of Respiration - Muscles of the head and neck - The Nerve-Muscle Relationship. Behavior of Skeletal Muscle Fibers - Muscles Acting on the Shoulder and Arm; Muscles Acting on the Forearm, the Wrist and Hand	*describe the various functions of muscular tissue; relate muscle fascicles to the shapes and relative strengths of muscles; name the types of muscle-bone attachments and explain the shortcoming of calling their attachments origins and insertions; distinguish between intrinsic and extrinsic muscles; describe the ways muscles work in groups to aid, oppose, and moderate each other's actions; describe in general terms the nerve and blood supply to skeletal muscles; explain how the Latin names of muscles aid in visualizing and remembering explain describe the stages of a muscle twitch; explain how successive muscle twitches can add up to produce stronger muscle contractions; distinguish between isometric and isotonic contraction; distinguish between concentric and eccentric describe the structural components of a muscle fiber; relate the striations of a muscle fiber to the overlapping arrangement of its protein filaments; name the major proteins of a muscle fiber and state the function of each Describe the structural differences between cardiac muscle and skeletal muscle* *Identification of structural features of the smooth and striated muscular tissues under a microscope and photomicrographs:* *Structural features of striated muscle fibres.* *Structural features of cardiac muscle tissue.* *Mechanism of contraction of striated muscular explain how skeletal muscle meets its energy demands during rest and exercise; discuss why extra oxygen is needed even after an exercise has ende*d ;explain the basis of muscle fatigue and soreness; discuss the factors that affect muscular strength;

	- Muscles Acting on the Hip and Femur,Muscles Acting on the Knee and Leg - Muscles Acting on the Foot, Intrinsic Muscles of the Foot	discuss the effects of resistance and endurance exercises on muscles; distinguish between two physiological types of muscle fibers, and explain their functional *name and locate the muscles of the abdominal wall, back, and pelvic floor ; identify the skeletal attachments, action, and innervation of these muscles.* *Identification of the structural components of neurocytes (neurofibres, basophilic substance), myelinated and unmyelinated nerve fibres under a microscope and photomicrographs. Classification and structural features of neurocytes. Classification of the glia cells. Functional significance of the glia cells. Structural features of the myelinated and unmyelinated nerve fibres.* *name and locate the muscles of the back; identify the skeletal attachments, action, and innervation of these muscles. name and locate the muscles of respiration and explain how they affect airflow and abdominal pressure; identify the skeletal attachments, action, and innervation of these muscles;* *describe the physiological properties that all muscle types have in common; name and locate the muscles that produce facial expressions; name and locate the muscles used for chewing and swallowing; name and locate the neck muscles that move the head;identify the attachments, action, and innervation of these muscles.explain how the Latin names of muscles aid in visualizing and remembering explain what a motor unit is and how it relates to muscle contraction; describe the structure of the junction where a nerve fiber meets a muscle fiber; explain why a cell has an electrical charge difference across its plasma membrane and, in general terms, how this relates to muscle contraction; explain how a nerve fiber stimulates a skeletal muscle fiber* *explain how stimulation of a muscle fiber activates its contractile mechanism; explain the mechanism of muscle contraction; explain how a muscle fiber relaxes; explain why the force of a muscle contraction depends on the muscle's length prior to name and locate the muscles that act on the pectoral girdle, shoulder, elbow, wrist, and hand ;relate the actions of these muscles to the joint movements ; name and locate the muscles that act on the elbow, wrist, and hand ; relate the actions of these muscles to the joint movements ; name and locate the muscles that act on the hip, knee joints; relate the actions of these muscles to the joint movements; describe the skeletal attachments, action, and innervation of these muscles;* *explain what a motor unit is and how it relates to muscle contraction; describe the structure of the junction where a nerve fiber meets a muscle fiber; explain why a cell has an electrical charge difference across its plasma membrane and, in general terms, how this relates to muscle contraction; explain how a nerve fiber stimulates a skeletal muscle fiber* *explain how stimulation of a muscle fiber activates its contractile mechanism; explain the mechanism of muscle*

		contraction; explain how a muscle fiber relaxes; explain why the force of a muscle contraction depends on the muscle's length prior to stimulation *name and locate the muscles that act on the ankle, and toe joints; relate the actions of these muscles to the joint movements; describe the skeletal attachments, action, and innervation of these muscles; describe the structural differences between smooth muscle and skeletal muscle describe the functions and major components of the circulatory system;*
2	**Circulatory System**: **Blood** - introduction,Blood Types. Erythrocytes - Leukocytes - Platelets and Hemostasis, The Control of Bleeding - Hemopoiesis - erythrocytes, leukocytes, blood platelets	*describe the components and physical properties of blood; describe the composition of blood plasma; explain the significance of blood viscosity and osmolarity; describe in general terms how blood is produced; explain what determines a person's ABO and Rh blood types and how this relates to transfusion compatibility; list some blood groups other than ABO and Rh and explain how they may be useful; describe the effects of a blood type incompatibility between mother and fetus* *Describe the structure and function of erythrocytes (RBCs); describe the structure and function of hemoglobin; state and define some clinical measurements of RBC and hemoglobin quantities; describe the life history of erythrocytes; name and describe the types, causes, and effects of RBC excesses and deficiencies discuss the structure of erythrocytes (RBCs); describe the structure of hemoglobin; discuss the structure of leukocytes;Structure of blood platelets. Identification of erythrocytes, thrombocytes and different types of leukocytes in blood smears under microscope and photomicrographs* *explain the function of leukocytes in general and the individual role of each leukocyte type; describe the appearance and relative abundance of each type of leukocyte; describe the formation and life history of leukocytes; discuss the types, causes, and effects of leukocyte excesses and deficiencies* *describe the body's mechanisms for controlling bleeding; list the functions of platelets; describe two reaction pathways that produce blood clots ;explain what happens to blood clots when they are no longer needed; explain what keeps blood from clotting in the absence of injury;describe some disorders of blood clotting* *describe the prenatal and postnatal hemopoiesis, stages of prenatal hemopoiesis.* *Erythropoiesis.Granulopoiesis.Monocytopoiesis. Lymphopoiesis. Platelet formation*
3	**Circulatory System: Heart** - Cardiac and Smooth Muscle - Overview of the Cardiovascular System. Gross Anatomy of the heart - Cardiac Muscle and the Cardiac Conduction System - Cardiovascular system. Heart.	*Describe the structural and physiological differences between cardiac muscle and skeletal muscle; explain why these differences are important to cardiac function; describe the structural and physiological differences between smooth muscle and skeletal muscle; relate the unique properties of smooth muscle to its locations and functions* *describe some disorders of blood clotting define and*

	Layers of the Heart Wall. - Electrical and Contractile Activity of the Heart - Cardiac Output	*distinguish between the pulmonary circuit and systemic circuit ; describe the general location, size, and shape of the heart; describe the pericardial sac that encloses the heart.* *describe the three layers of the heart wall; identify the four chambers of the heart; identify the surface features of the sac heart and correlate them with its internal four-chambered anatomy; identify the four valves of the heart; trace the flow of blood through the four chambers and valves of the heart and adjacent blood vessels; describe the arteries that nourish the myocardium and the veins that drain it* *describe the unique metabolic characteristics of cardiac muscle; explain the functional significance of the intercellular junctions between cardiac muscle cells; describe the heart's pacemaker and internal electrical conduction system; describe the nerve supply to the heart and explain its role* *Structural features of the heart. Cardiac conduction system.* *describe explain why the SA node fires spontaneously and rhythmically describe the unusual action potentials of cardiac muscle and relate them to the contractile behavior of the heart; interpret a normal electrocardiogram* *define cardiac output and explain its importance; identify the factors that govern cardiac output; discuss some of the nervous and chemical factors that alter heart rate, stroke volume, and cardiac output;* *explain how the right and left ventricles achieve balanced output; describe some effects of exercise on cardiac output*
4	**Circulatory System: Vessels** - General Anatomy of the Blood Vessels Capillary Exchange - Cardiovascular system. General description of vessels. Arteries and veins. Microcirculation stream. Arterioles. Capillaries. Venules. - Venous Return and Circulatory Shock - Blood Flow, Heart Sounds,and the Cardiac Cycle - Special Circulatory Routes - Anatomy of the Pulmonary Circuit, Systemic Vessels of the Axial Region - Blood Pressure, Resistance, and Flow Anatomy of the Systemic Vessels of the Appendicular Region	*describe the types of arteries, capillaries, and veins, microscopic and ultramicroscopic structural features of arteries and veins, structural features of blood capillaries, structure of microcirculation vessels.* *trace the general route usually taken by the blood from the heart and back again; describe some variations on this route* *describe how materials get from the blood into the surrounding tissues; describe and calculate the forces that enable capillaries to give off and reabsorb fluid; describe the causes and effects of edema.* *explain how the brain maintains stable perfusion; discuss the causes and effects of strokes and transient ischemic attacks; explain the mechanisms that increase muscular perfusion during exercise; contrast the blood pressure of the pulmonary circuit with that of the systemic circuit, and explain why the difference is important in pulmonary function* *trace the general route usually taken by the blood from the heart and back again; describe some variations on this route* *explain how blood in the veins is returned to the heart; discuss the importance of physical activity in venous return; discuss several causes of circulatory shock; name and describe the stages of shock*

		explain why blood pressure is expressed in millimeters of mercury ; describe how changes in blood pressure operate the heart valves; explain what causes the sounds of the heartbeat, describe in detail one complete cycle of heart contraction and relaxation; relate the events of the cardiac cycle to the volume of blood entering and leaving the heart explain how the brain maintains stable perfusion; discuss the causes and effects of strokes and transient ischemic attacks; explain the mechanisms that increase muscular perfusion during exercise; and contrast the blood pressure of the pulmonary circuit with that of the systemic circuit, and explain why the difference is important in pulmonary function. *identify the principal systemic arteries and veins of the axial region; trace the flow of blood from the heart to any major organ of the axial region and back to the heart.* *identify the principal systemic arteries and veins of the limbs; trace the flow of blood from the heart to any region of the upper or lower limb and back to the heart; trace the route of blood through the pulmonary circuit.* *explain the relationship between blood pressure, resistance, and flow; describe how blood pressure is expressed and how pulse pressure and mean arterial pressure are calculated; describe three factors that determine resistance to blood flow; explain how vessel diameter influences blood pressure and flow; explain describe some local, neural, and hormonal influences on vessel diameter;* *identify the principal systemic arteries and veins of the limbs; trace the flow of blood from the heart to any region of the upper or lower limb and back to the heart; trace the route of blood through the pulmonary circuit.*
5	**The Respiratory System:** - nasal cavity, trachea, bronchi,bronchioles, alveolar ducts - Anatomy of the Respiratory System - Pulmonary Ventilation - Gas Exchange and Transport - Respiratory Disorders	*Describe the basic components of the conducting and respiratory portions of the system (nasal cavity, trachea, bronchi,bronchioles, alveolar ducts) structural elements the blood-air barier identification of structural components of the nasal cavity, trachea, bronchi, bronchioles under microscope and on the photomicrographs* *state the functions of the respiratory system; name and describe the organs of this system; trace the flow of air from the nose to the pulmonary alveoli; relate the function of any portion of the; respiratory tract to its gross and microscopic anatomy.* *name the muscles of respiration and describe their roles in breathing ; describe the brainstem centers that control breathing and the inputs they receive from other levels of the nervous system ; explain how pressure gradients account for the flow of air into and out of the lungs, and how those gradients are produced; identify the sources of resistance to airflow and discuss their relevance to respiration* *define partial pressure and discuss its relationship to a gas mixture such as air; contrast the composition of inspired and alveolar air; discuss how partial pressure affects gas transport by the blood;*

		describe the mechanisms of transporting O2 and CO2; describe the factors that govern gas exchange in the lungs and systemic capillaries; *explain how gas exchange is adjusted to the metabolic needs of different tissues; discuss the effect of blood gases and pH on the respiratory rhythmexplain the significance of anatomical dead space to alveolar ventilation; define the clinical measurements of pulmonary volume and capacity; define terms for various deviations from the normal pattern of breathing* *describe the forms and effects of oxygen deficiency and oxygen excess; describe the chronic obstructive pulmonary diseases and their consequences; explain how lung cancer begins, progresses, and exerts its lethal effects*
6	**Urinary System:** - histology of urinary system - Functions of the Urinary System Anatomy of the Kidney - Urine Formation I: Glomerular Filtration - Urine Formation II:Tubular Reabsorption and Secretion - Urine Formation III: Water Conservation - Urine and Renal Function Tests Urine Storage and Elimination	*Development and structural features of the kidney. Renal tubules; reabsorption and secretion; renal endocrine apparatus; urinary tracts, identification of structural elements of the renal cortex, renal medulla, ureter, urinary bladder under the microscope and on the photomicrographs.* *name and locate the organs of the urinary system; list several functions of the kidneys in addition to urine formation; describe the location and general appearance of the kidneys; identify the external and internal features of the kidney; trace the flow of blood through the kidney; trace the flow of fluid through the renal tubules; describe the nerve supply to the kidney.* *describe the process by which the kidney filters the blood plasma, including the relevant cellular structure of the glomerulus; Explain the forces that promote and oppose filtration, and calculate the filtration pressure if given the magnitude of these forces; describe how the nervous system, hormones, and the nephron itself regulate filtration* *describe how the renal tubules reabsorb useful solutes from the glomerular filtrate and return them to the blood; describe how the tubules secrete solutes from the blood into the tubular fluid; describe how the nephron regulates water excretion. explain how the collecting duct and antidiuretic hormone regulate the volume and concentration of urine; explain how the kidney maintains an osmotic gradient in the renal medulla that enables the collecting duct to function.* *identification of structural elements of the ureter, urinary bladder under the microscope and on the photomicrographs.* *explain how the collecting duct and antidiuretic hormone regulate the volume and concentration of urine; explain how the kidney maintains an osmotic gradient in the renal medulla that enables the collecting duct to function; and describe the hormonal mechanism for adjusting the body's rate of water loss to its state of hydration or dehydration*

The list of anatomical structures

№	Topic	Anatomical structures
	Muscular System	**Muscles of Head and Neck**
1		Frontalis
		Orbicularis oculi
		Occipitalis
		Levator palpebrae superioris
		Corrugator supercilii
		Nasalis
		Orbicularis oris
		Levator labii superioris
		Levator anguli oris
		Zygomaticus major
		Zygomaticus minor
		Risorius
		Depressor anguli oris
		Depressor labii inferioris
		Mentalis
		Buccinator
		Platysma
		Genioglossus
		Hyoglossus
		Styloglossus
		Palatoglossus
		Temporalis
		Masseter
		Lateral pterygoid
		Medial pterygoid
		Digastric
		Geniohyoid
		Mylohyoid
		Stylohyoid
		Omohyoid
		Sternohyoid
		Thyrohyoid
		Sternothyroid

		Superior, middle, and inferior pharyngeal constrictors
		Sternocleidomastoid
		Anterior, middle, and posterior scalenes
		Trapezius
		Splenius capitis
		Splenius cervicis
		Semispinalis capitis
		Semispinalis cervicis
		Muscles of Trunk
		Diaphragm
		External intercostals
		Internal intercostals
		Innermost intercostals
		External abdominal oblique
		Internal abdominal oblique
		Transverse abdominal
		Rectus abdominis
		Erector spinae
		Semispinalis thoracis
		Quadratus lumborum
		Multifidus
		Ischiocavernosus
		Bulbospongiosus
		Deep transverse perineal
		Compressor urethrae
		External anal sphincter
		Levator ani
		Muscles Acting on the Upper Limb
		Pectoralis minor
		Serratus anterior
		Trapezius
		Levator scapulae
		Rhomboid minor
		Rhomboid major
		Pectoralis major
		Latissimus dorsi
		Deltoid
		Teres major
		Coracobrachialis
		Supraspinatus
		Infraspinatus
		Teres minor
		Subscapularis
		Brachialis
		Biceps brachii
		Triceps brachii
		Brachioradialis
		Anconeus
		Pronator quadratus

		Pronator teres
		Supinator
		Flexor carpi radialis
		Flexor carpi ulnaris
		Flexor digitorum superficialis
		Palmaris longus
		Flexor digitorum profundus
		Flexor pollicis longus
		Extensor carpi radialis longus
		Extensor carpi radialis brevis
		Extensor digitorum
		Extensor digiti minimi
		Extensor carpi ulnaris
		Abductor pollicis longus
		Extensor pollicis brevis
		Extensor pollicis longus
		Extensor indicis
		Adductor pollicis
		Abductor pollicis brevis
		Flexor pollicis brevis
		Opponens pollicis
		Abductor digiti minimi
		Flexor digiti minimi brevis
		Opponens digiti minimi
		Four dorsal interosseous
		Three palmar interosseous muscles
		Four lumbrical muscles
		Muscles Acting on the Hip and Femur
		Iliacus
		Psoas major
		Tensor fasciae latae
		Gluteus maximus
		Gluteus medius and gluteus minimus
		Gemellus superior
		Gemellus inferior
		Obturator externus
		Obturator internus
		Piriformis
		Quadratus femoris
		Adductor brevis
		Adductor longus
		Adductor magnus
		Gracilis
		Pectineus
		Muscles Acting on the Knee and Leg
		Quadriceps femoris
		Rectus femoris
		Vastus lateralis
		Vastus medialis

		Vastus intermedius
		Sartorius
		Biceps femoris
		Semitendinosus
		Semimembranosus
		Popliteus
		Muscles Acting on the Foot
		Fibularis (peroneus) tertius
		Extensor digitorum longus
		Extensor hallucis longus
		Tibialis anterior
		Gastrocnemius
		Soleus
		Flexor digitorum longus
		Flexor hallucis longus
		Tibialis posterior
		Fibularis brevis
		Fibularis longus
		Extensor digitorum brevis
		Flexor digitorum brevis
		Abductor digiti minimi
		Abductor hallucis
		Quadratus plantae
		Four lumbrical muscles
		Flexor digiti minimi brevis
		Flexor hallucis brevis
		Adductor hallucis
		dorsal interosseous muscles
		plantar interosseous muscles
2.	**Heart**	pericardial cavity
		parietal pericardium
		base of heart
		apex of heart
		superior vena cava
		inferior vena cava
		aortic arch
		pulmonary trunk
		pulmonary arteries
		aorta
		visceral pericardium
		endocardium
		myocardium
		right and left atria
		pectinate muscles
		auricle
		right and left ventricles
		interventricular septum
		fibrous rings (anuli fibrosi)

		coronary (atrioventricular) sulcus
		anterior interventricular sulcus
		posterior interventricular sulcus
		left atrioventricular (AV) valve
		right AV (tricuspid) valve
		papillary muscles
		aortic valve
		pulmonary valve
		tendinous cords (chordae tendineae)
		left coronary artery
		anterior interventricular branch
		circumflex branch
		left marginal branch
		right coronary artery
		right marginal branch
		posterior interventricular branch
		great cardiac vein
		posterior interventricular (middle cardiac) vein,
		left marginal vein
		coronary sinus
3.	**Blood Vessels**	Arteries
		Veins
		Capillaries
		tunica interna (tunica intima)
		endothelium
		tunica media
		tunica externa (tunica adventitia)
		Conducting (elastic or large) arteries
		Distributing (muscular or medium) arteries
		arterioles
		Carotid sinuses
		Muscular venules
		Arteriovenous anastomosis
		superior lobar artery
		inferior lobar arteries
		ascending aorta
		aortic arch
		brachiocephalic trunk
		common carotid arteries
		left subclavian
		descending aorta
		vertebral arteries
		thyrocervical trunks
		costocervical trunks
		external carotid artery
		superior thyroid artery
		lingual artery
		occipital artery
		maxillary artery

		superficial temporal artery
		ophthalmic artery
		anterior cerebral artery
		middle cerebral artery
		basilar artery
		posterior cerebral arteries
		anterior cerebral arteries
		anterior communicating artery
		posterior communicating arteries
		dural venous sinuses
		superior sagittal sinus
		inferior sagittal sinus
		transverse sinuses
		cavernous sinuses
		internal jugular vein
		facial vein
		external jugular vein
		vertebral vein
		aortic hiatus
		Bronchial arteries
		Esophageal arteries.
		Mediastinal arteries
		Posterior intercostal arteries
		Subcostal arteries
		Superior phrenic arteries
		internal thoracic artery
		pericardiophrenic artery
		anterior intercostal arteries
		thoracoacromial trunk
		subscapular artery
		subclavian vein
		brachiocephalic vein
		superior vena cava
		azygos vein
		ascending lumbar vein
		hemiazygos vein
		inferior phrenic arteries
		superior suprarenal arteries
		celiac trunk
		superior mesenteric artery
		renal arteries
		ovarian arteries
		testicular arteries
		lumbar arteries
		median sacral artery
		common iliac arteries
		common hepatic artery
		gastroduodenal artery
		hepatic artery proper

		splenic artery
		left gastro-omental artery
		ileal arteries
		ileocolic artery
		middle colic artery
		sigmoid arteries
		superior rectal artery
		vaginal artery
		obturator artery
		internal pudendal artery
		superior vesical artery
		uterine artery
		iliolumbar artery
		superior gluteal artery
		inferior vena cava
		common iliac veins
		lumbar veins
		ovarian veins
		testicular veins
		renal veins
		suprarenal vein
		hepatic veins
		ascending lumbar veins
		hepatic portal system
		inferior mesenteric vein
		splenic vein
		hepatic portal vein
		cystic vein
		subclavian artery
		axillary artery
		circumflex humeral arteries
		brachial artery
		radial collateral artery
		ulnar collateral artery
		radial artery
		ulnar artery
		interosseous arteries
		palmar arches
		dorsal venous network
		cephalic vein
		basilic vein
		median cubital vein
		median antebrachial vein
		venous palmar arches
		radial veins
		ulnar veins
		brachial veins
		axillary vein
		subclavian vein

		external iliac artery
		femoral artery
		deep femoral artery
		circumflex femoral arteries
		popliteal artery
		anterior tibial artery
		dorsal pedal artery
		arcuate artery
		posterior tibial artery
		lateral plantar arteries
		deep plantar arch
		fibular artery
		dorsal venous arch
		saphenous vein
		deep plantar venous arch
		fibular veins
		popliteal vein
		femoral vein
		common iliac vein
4.	**Respiratory System**	**Respiratory System**
		Nasal cavity
		Hard palate
		Nostril
		Pharynx
		Larynx
		Trachea
		Pleural cavity
		Pleura (cut)
		Epiglottis
		Posterior nasal aperture
		Soft palate
		Esophagus
		Left lung
		Left main bronchus
		Lobar bronchus
		segmental bronchus
		Diaphragm
		Alar nasal sulcus
		Dorsum nasi
		Nasofacial angle
		Nasal septum
		Nasal bone
		Lateral cartilage
		Minor alar cartilages
		Major alar cartilages
		Dense connective tissue
		Septal nasal cartilage
		nose

		nasal fossae
		nasal conchae
		nasopharynx
		laryngopharynx
		oropharynx
		Frontal sinus
		Meatuses
		Tongue
		Vestibular fold
		Vocal cord
		Uvula
		Medulla oblongata
		Pons
		Auditory tube
		Cribriform plate
		Vestibule
		Guard hairs
		Upper lip
		Naris (nostril)
		Perpendicular plate
		Septal cartilage
		Palatine tonsil
		Lingual tonsil
		Sphenoid sinus
		Hyoid bone
		Thyrohyoid ligamen
		Vomer
		Thyroid cartilage
		Laryngeal prominence
		Arytenoid cartilage
		Cricoid cartilage
		Cricotracheal ligament
		Cuneiform cartilage
		Corniculate cartilage
		Fat pad
		Tracheal cartilage
		Glottis
		Main bronchi
		Tracheal mucosa
		Lateral cricoarytenoid muscle
		Base of tongue
		Trachealis muscle
		Hyaline cartilage ring
		Mucosa
		Mucous gland
		Perichondrium
		Chondrocytes
		Goblet cell
		Ciliated cell

		Mucociliary escalator
		Apex of lung
		Superior lobar bronchus
		Horizontal fissure
		Middle lobar bronchus
		Middle lobe
		Inferior lobar bronchus
		Oblique fissure
		Inferior lobe
		Base of lung
		Mediastinal surfaces
		Costal surface
		Cardiac impression
		Diaphragmatic surface
		Visceral pleura
		Parietal pleura
		Pleural cavity
		Alveoli
		Bronchial smooth muscle
		Branches of pulmonary artery
		Bronchiole
		Alveolar sac
		Terminal bronchiol
		Respiratory bronchiole
		Capillary networks around alveoli
		Great alveolar cell
		Alveolar macrophage
		Respiratory membrane
		Capillary endothelial cell
		Squamous alveolar cell
		Shared basement membrane
		Pontine respiratory group (PRG)
		Dorsal respiratory group (DRG)
		Ventral respiratory group (VRG)
5.	**Urinary System**	kidneys
		ureters
		urinary bladder
		urethra
		hilum
		renal fascia
		perirenal fat capsule
		fibrous capsule
		renal sinus
		renal cortex
		renal medulla
		renal columns
		renal pyramids
		renal papilla
		minor calyx

		major calyx
		renal pelvis
		renal artery
		segmental arteries
		interlobar arteries
		arcuate arteries
		cortical radiate arteries
		afferent arterioles
		nephron
		glomerulus
		efferent arteriole
		peritubular capillaries
		cortical radiate veins
		arcuate veins
		interlobar veins
		renal vein
		vasa recta
		renal corpuscle
		glomerular capsule
		podocytes
		capsular space
		renal tubule
		proximal convoluted tubule
		nephron loop
		descending limb
		distal convoluted tubule
		collecting duct
		papillary duct
		juxtamedullary nephrons
		cortical nephron
		renal plexus
		juxtaglomerular apparatus
		granular cells
		mesangia cells
		macula densa
		principal cells
		Intercalated cells
		detrusor
		external urethral orifice
		urethral glands
		internal urethral sphincter.

List of histological preparations for the exam

1. Striated skeletal muscular tissue of tongue. Iron hematoxylin. x 630.
2. Neurofibrils in multipolar neurons of the anterior horns of the spinal cord. x 400.
3. Human blood smear. Romanovsky-Giemsa. x 400.
4. Human blood smear. Eosinophil. Romanowsky-Giemsa. x 1000.
5. Section of red bone marrow. Hematoxylin – eosin. x 400.
6. Myocardium. Iron hematoxylin. x 400.

7. Muscular artery. Hematoxylin – eosin. x 400.
8. Lung. Large bronchus. Hematoxylin – eosin. x 100.
9. Kidney. Cortex. Hematoxylin-Eosin. x 40.
10. Ureter. Hematoxylin – eosin. x 40.

Example of physiology assignment:

A patient has come to you with the results of a laboratory blood test, whose hematocrit is 15%. Microscopic examination of the blood also reveals several distorted and ruptured red blood cells. In addition, the reticulocyte count is 2%.

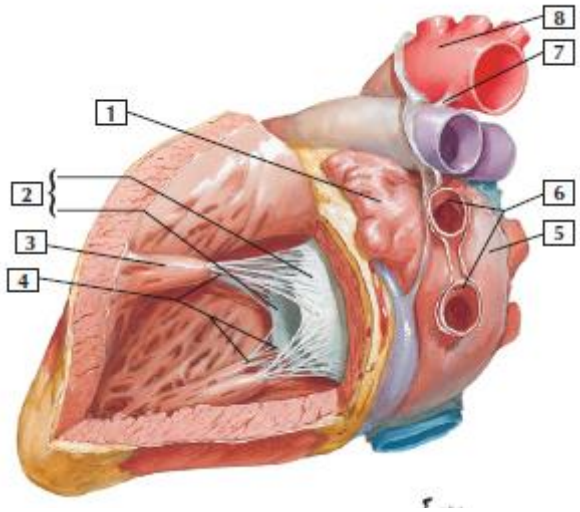
1) Based on all these findings, what disease do you think the patient is suffering from? Explain your conclusion

2) Describe the life cycle of red blood cells, explain all stages of development, name the cells at each stage.

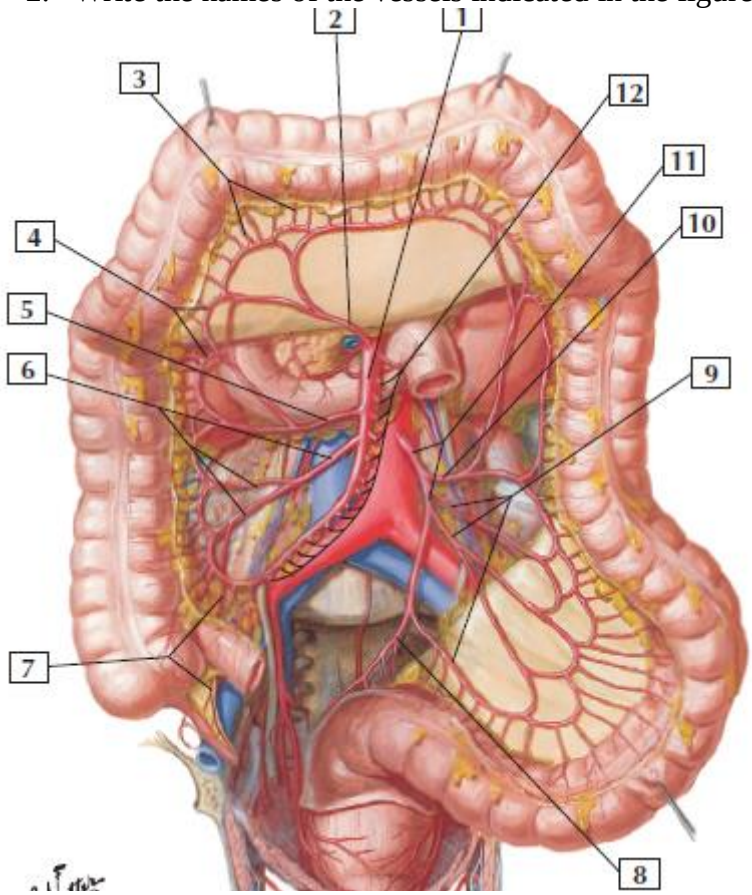
3) What is the physiological significance of the fact that hemoglobin is inside red blood cells and not dissolved in plasma?

Example of anatomy assignment:

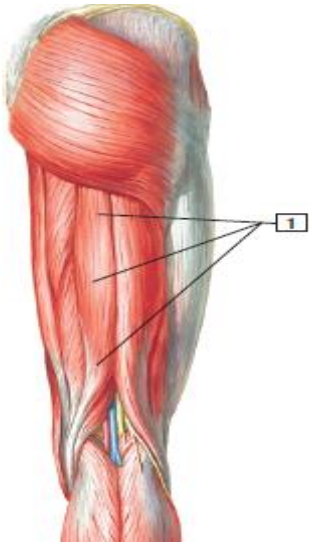
1. **Write the name of the anatomical structures indicated in the picture.**



2. Write the names of the vessels indicated in the figure.

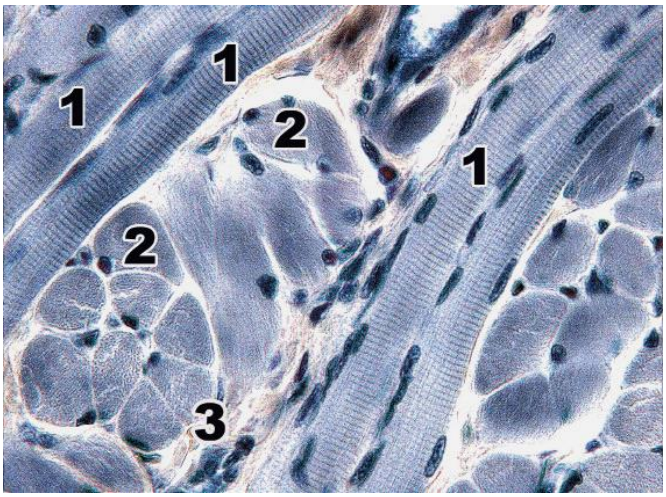


3. Write the names of the muscles shown in the picture. Determine which group they belong to and write down their functions.



Sample assignment for histology

Striated skeletal muscular tissue of tongue. Iron hematoxylin. x 630.
Identify the structures of the skeletal muscular tissue indicated by the numbers. Describe the structure of the muscle fiber. Explain the features of the regeneration of striated muscle tissue.



Response quality scale (written / oral response)

Mark	Criteria	Scale, points
Excellent	1. all key aspects are included and presented logically; 2. high accuracy (relevance, without redundancy) and constant attention to the issue; 3. excellent integration of theoretical questions; 3. providing relevant examples; 4. in-depth analysis and theoretical justification of the problem (if applicable), all key aspects identified and interpreted; 5. fluency in professional terminology	90 - 100
Good	1. all key aspects are included and presented logically; 2. constant focus on the issue with satisfactory accuracy, relevance, and / or some redundancy; 3. satisfactory integration of theoretical questions; 3. the lack of examples;	75 - 89

	4. satisfactory analysis and theoretical justification of the problem (if applicable), most of the key aspects identified and interpreted; 5. correct use of professional terminology	
Satisfactory	1. most of the key aspects are included; 2. satisfactory focus on the question - some errors and / or noticeable redundancy; 3. theoretical problems presented without noticeable integration; 3. Providing failed examples or no examples; 4. some analysis and theoretical justification of this problem (if applicable), most of the key aspects are defined and interpreted; 5. correct use of professional terminology	50 - 70
Unsatisfactory (FX)	1. most of the key aspects are omitted; 2. lack of attention to the issue-irrelevant and significant redundancy; 3. some theoretical problems presented without integration and understanding; 3. missing or outdated examples; 4. some analysis and theoretical justification of this problem (if applicable), most of the key aspects are omitted; 5. problems in using professional terminology	25 - 49
Unsatisfactory (F)	1. most or all of the key aspects are omitted; 2. no focus on the question, not much related to the issue of information; 3. significant gaps in theoretical questions, or their superficial consideration; 3. the lack of examples or irrelevant examples; 4. there is no analysis and no theoretical justification for the given problem (if applicable), most of the key aspects are omitted; 5. problems in using professional terminology	0-24

Grading system

Rating by letter system	**Digital equivalent of points**	**Percentage**	**Evaluation using the traditional system**
A	4,0	95-100	Excellent
A-	3,67	90-94	
B+	3,33	85-89	Good
B	3,0	80-84	
B-	2,67	75-79	
C+	2,33	70-74	Satisfactory
C	2,0	65-69	
C-	1,67	60-64	
D+	1,33	55-59	
D-	1,0	50-54	
FX	0	25-49	Unsatisfactory
F	0	0-24	
I (Incomplete)	-	-	«Discipline is not completed»

			(*it is not taken into account when calculating the GPA)*
P (Pass)	-	-	«Pass» (*it is not taken into account when calculating the GPA)*
NP (No Pass)	-	-	«Not pass» (*it is not taken into account when calculating the GPA)*
W (Withdrawal)	-	-	«Withdrawal» (*it is not taken into account when calculating the GPA)*
AW (Academic Withdrawal)			Academic Withdrawal (*it is not taken into account when calculating the GPA)*
AU (Audit)	-	-	«Audit» (*it is not taken into account when calculating the GPA)*
Cert.		30-60 50-100	Certified
Not cert.		0-29 0-49	Not certified
R (Retake)	-	-	Repeated study of the discipline

Exam technology instruction

1. The exam lasts exactly **3 hours.**
2. At the specified time, the student visits the **"app.oqylyq.kz" website.**
3. Student receives login and password in **IS Univer.**
4. Generation of a ticket for each student is made automatically.
5. The exam begins with obligatory proctoring (you cannot turn off the camera and microphone):
- you need a laptop or home computer with a webcam. If it is not available, you can use the smartphone camera, for example, with the "DroidCam client" application.
6. The answer is printed in the field of the **OQYLYQ** program itself. A handwritten response form on a piece of paper is **NOT PROVIDED.**
7. Upon completion of the exam, the student clicks the "**Finish**" button.

Basic literature:

1. Saladin, Kenneth S: Anatomy & Physiology. The Unity of Form and Function (2016, McGraw-Hill Education) на англ. яз.
2. Costanzo, Linda S.: BRS Physiology. Board Review Series.7 edition. -Wolters Kluwer Health, 2018.- 307p. - ISBN 1496367693, 9781496367693
3. Leslie P. Gartner: Color Atlas and Text of Histology. - 7th Edition. - Wolters Kluwer, 2017. ISBN 1496346734, 9781496346735
4. Russell K. Hobbie, Bradley J. Roth: Intermediate Physics for Medicine and Biology. - Springer, 2015. - ISBN 3319126822, 9783319126821
5. Andersson D, Medical Terminology: The Best and Most Effective Way to Memorize, Pronounce and Understand Medical Terms: Second Edition, ISBN-13 : 978-1519066626, 2016
6. Shoibekova, Alima Zhorabaevna. Latin and Fundamentals of Medical Terminology for Medical Students with Training English [Text] : educational man. / A. Zh. Shoibekova, 2016. - 163, [1] p.

7. Sembulingam, K. Essentials of Medical Physiology [Text] : [monogr.] / K. Sembulingam, P. Sembulingam ; Madha Medical College [et al.]. - 7th ed. - New Delhi ; London ; Philadelphia : Jaypee, 2016. - 1112 p. : il. - Ind.: p. 1069-1112. - ISBN 978-93-85999-11-6

Additional literature:

8. Standring, Susan: Gray's Anatomy: The Anatomical Basis of Clinical Practice. - 41 Elsevier Limited, 2016
9. Elaine N. Marieb, Lori A. Smith: Human Anatomy & Physiology Laboratory Manual, Main Version. - 11 edition. - Pearson Education,2015. - ISBN 9780133999143
10. Scanlon V. C, Essentials of Anatomy and Physiology 8th Edition, F.A. Davis Company, 2018
11. Victor P. Eroschenko, Atlas of Histology with Functional Correlations 13th Edition, LWW, 2017
12. William Bialek: Biophysics: Searching for Principles. -Princeton University Press, 2012. - ISBN 0691138915, 9780691138916
13. Ghosh, Byas Deb. Human Anatomy [Text] : For Students / B. D. Ghosh ; [Anatomical Society of India (West Bengal Chapter) et al.]. - 2nd ed. - New Delhi ; Panama City ; London : Jaypee, 2013. - 948 p. : il. - Ind.: p. 913-948. - ISBN 978-93-5025-942-9
14. Mazumdar, Sibani. Anatomy at a Glance [Text] : An Exam-Oriented Text / S. Mazumdar ; Calcutta National Medical College [et al.]. - 2nd ed. - New Delhi ; London ; Philadelphia : Jaypee, 2014. - 534 p. : il. - Ind.: p. 525-534. - ISBN 978-93-5152-355-0 : App.: p. 519-520. Glossary: p. 521-524.
15. Baktybayeva, Lyaila Kyrgyzbayevna. Base of Physiology [Text] : laboratory practicum / L. K. Baktybayeva, G. T. Zhamanbayeva, M. S. Kulbayeva ; Al-Farabi Kazakh National University. - Almaty : Qazaq University, 2017. - 146 p. : il. - Bibliogr.: p. 145. - ISBN 978-601-04-3138-6

Online resources:

1. https://app.lecturio.com/#/
2. https://3d4medical.com/
3. https://www.youtube.com/channel/UCc_I2c2bUtO0p4DVeo6-Kxg
4. https://sites.google.com/a/umich.edu/bluelink/curricula/anatomy-403?authuser=0
5. https://histologyknmu.wixsite.com/info/gistologicheskie-sajty
6. http://www.histology-world.com/contents/contents.htm
7. http://www.histologyguide.com/slidebox/02-epithelium.html
8. https://histology.medicine.umich.edu/resources
9. https://web.duke.edu/histology/
10. http://virtualslides.med.umich.edu/Histology/view.apml?listview=1&