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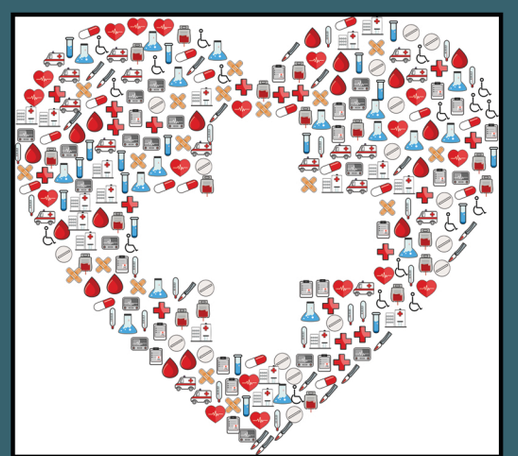
THE WORLD OF MEDICINE

K.V. Nikitina O.A. Mayorova



Study-guide for independent work

Ufa
2019

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(ФГБОУ ВО БГМУ Минздрава России)

К.В. Никитина О.А. Майорова

МИР МЕДИЦИНЫ

Учебное пособие для самостоятельной работы обучающихся

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СОДЕРЖАНИЕ

ВВЕДЕНИЕ

Данное учебное пособие для самостоятельной работы обучающихся составлена в соответствии с требованиями ФГОС ВО, рабочей программы дисциплины «Иностранный язык». Целью пособия является формирование у обучающихся основных умений использования английского языка для решения задач профессиональной деятельности. Работа с учебным пособием призвана совершенствовать у обучающихся навыки чтения и перевода аутентичных медицинских текстов, пополнение словарного запаса специальной терминологией, а также развитие навыков профессионально-ориентированной устной и письменной коммуникации для более широкого включения в сферу общения на английском языке в областях медицины.

Настоящее учебное пособие профессионально ориентировано для обучающихся на лечебном и педиатрическом факультетах. Тематика текстового материала соответствует требованиям программы и отражает содержание профессиональной подготовки специалистов в области медицины. Недостаток в учебной литературе таких заданий не позволяет овладеть на достаточном уровне типичными для научного стиля речевыми моделями и грамматическими структурами. Данное издание восполняет этот пробел и нацелено на развитие и совершенствование навыков чтения на английском языке в рамках тематики, предусмотренной рабочей программой.

Учебное пособие для самостоятельной работы обучающихся построено по тематическому принципу и состоит из 6 разделов, охватывающих основные направления профессиональной подготовки будущих медиков. Каждый раздел состоит из нескольких уроков. Всего пособие включает в себе 29 уроков. Каждый урок состоит из глоссария, который содержит незнакомые слова, встречающиеся в тексте, пред- и послетекстовых упражнений, аутентичного текста на английском языке. Упражне-

ния обращают внимание обучающихся на типичные для научного стиля явления и готовят студентов к работе с текстами с последующим вовлечением в процесс коммуникации.

Обучающиеся должны знать основные особенности научного стиля медицинской литературы; основы аннотирования и реферирования специального научного текста; основные принципы самостоятельной работы с оригинальной литературой; основные виды словарно-справочной литературы и правила работы с ними; типичные коммуникативные формулы, необходимые для участия в межкультурном профессиональном общении на иностранном языке; уметь читать и переводить специальные тексты по различным медицинским темам на основе владения активным и пассивным лексическим минимумом; фиксировать полученную из текста информацию в форме аннотации, реферата (устно и письменно); участвовать в беседе на иностранном языке по темам, связанными с медицинским образованием в России и стране изучаемого языка; владеть 2200 лексическими единицами, из них 1000 продуктивно; основными грамматическими конструкциями, присущими устным и письменным формам общения.

Изучение английского языка направлено на формирование у студентов следующих общекультурных (ОК), общепрофессиональных и профессиональных (ПК) компетенций:

- **ОК-1** – способность к абстрактному мышлению, анализу и синтезу;
- **ОК-5** – готовность к саморазвитию, самореализации, самообразованию и использованию творческого потенциала;
- **ОПК-1** – готовность решать стандартные задачи профессиональной деятельности с использованием информационных, библиографических ресурсов, медико-биологической терминологии, информационно-коммуникационных технологий и учетом основных требований информационной безопасности;

- **ОПК-2** – готовность к коммуникации в устной и письменной формах на русском и иностранном языках для решения задач профессиональной деятельности;

- **ПК-17** – готовность к анализу и публичному представлению информации в области профилактической медицины.

- **ПК-18** – способность к участию в проведении научных исследований.

Поскольку все аспекты языка взаимосвязаны, настоящее Учебное пособие для самостоятельной работы обучающихся поможет развитию навыков не только всех видов чтения (просмотрового, поискового, ознакомительного, изучающего), но и перевода, устной и письменной коммуникации.

UNIT 1. MUSCULAR AND SKELETAL SYSTEM

Lesson 1. Bones of the human body

Glossary.

rigid	твердый, прочный
mobility	подвижность
support	поддержка, опора
connective	соединительный
lightweight	легковесный
cortical	корковый, кортикальный
cancellous	губчатый; *syn*. Spongy
marrow	мозг; bone marrow – костный мозг
endosteum	эндост, внутренняя надкостница
periosteum	периост, надкостница
cartilage	хрящ
ossein	Оссеин (коллаген, входящий в состав костной ткани), остеин
fuse	объединяться, сплавляться, сливаться
sesamoid	сесамовидная кость, сесамовидный
stapes	стремя, стремечко
shaft	ствол, столб
diaphysis	диафиз (центральная цилиндрическая часть длинной трубчатой кости)
epiphysis	эпифиз, шишковидное тело
carpal	кистевой, запястный
tarsal	предплюсна, относящийся к предплюсне
tendon	связка

ossification	окостенение
sinuses	пазухи, синус
ethmoid	решетчатый, этмоидальный , решетчатая кость
sphenoid	клиновидный, сфеноидальный , клиновидная кость

Read and translate the text.

A bone is a rigid organ that constitutes part of the vertebral skeleton. Bones support and protect the various organs of the body, produce red and white blood cells, store minerals and also enable mobility as well as support for the body. Bone tissue is a type of dense connective tissue. Bones come in a variety of shapes and sizes and have a complex internal and external structure. They are lightweight yet strong and hard, and serve multiple functions. Mineralized osseous tissue, or bone tissue, is of two types, cortical and cancellous, and gives a bone rigidity and a coral-like three-dimensional internal structure. Other types of tissue found in bones include marrow, endosteum, periosteum, nerves, blood vessels and cartilage.

Bone is an active tissue composed of different types of bone cells. Osteoblasts are involved in the creation and mineralisation of bone; osteocytes and osteoclasts are involved in the reabsorption of bone tissue. The mineralised matrix of bone tissue has an ossein organic component mainly of collagen and an inorganic component of bone mineral made up of various salts.

In the human body at birth, there are over 270 bones, but many of these fuse together during development, leaving a total of 206 separate bones in the adult, not counting numerous small sesamoid bones. The largest bone in the body is the thigh-bone (femur) and the smallest is the stapes in the middle ear.

There are five types of bones in the human body: long, short, flat, irregular, and sesamoid (Figure 1).

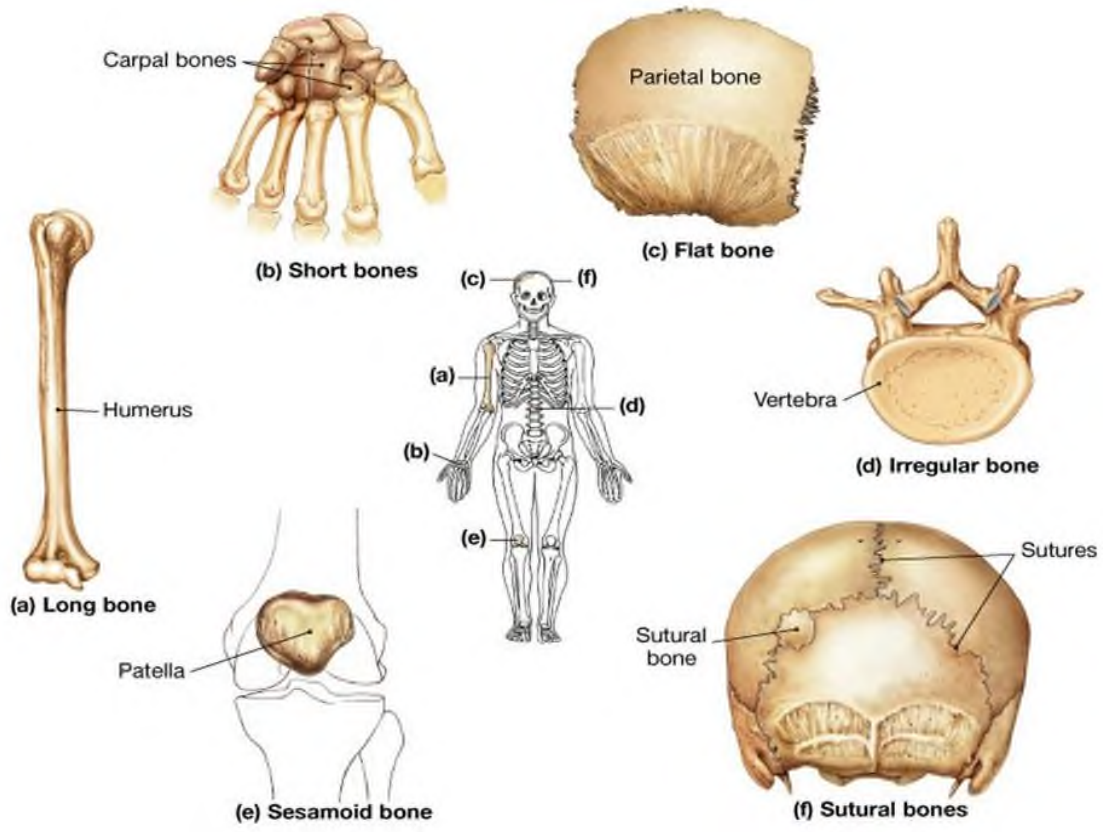

Figure 1. *Classification of bones (http://slideplayer.com)*

- Long bones are characterized by a shaft, the diaphysis, that is much longer than its width; and by an epiphysis, a rounded head at each end of the shaft. They are made up mostly of compact bone, with lesser amounts of marrow, located within the medullary cavity, and spongy, cancellous bone. Most bones of the limbs, including those of the fingers and toes, are long bones. The exceptions are the eight carpal bones of the wrist, the seven articulating tarsal bones of the ankle and the sesamoid bone of the kneecap. Long bones such as the clavicle, that have a differently shaped shaft or ends are also called modified long bones.

- Short bones are roughly cube-shaped, and have only a thin layer of compact bone surrounding a spongy interior. The bones of the wrist and ankle are short bones.

- Flat bones are thin and generally curved, with two parallel layers of compact bones sandwiching a layer of spongy bone. Most of the bones of the skull are flat bones, as is the sternum.

- Sesamoid bones are bones embedded in tendons. Since they act to hold the tendon further away from the joint, the angle of the tendon is increased and thus the leverage of the muscle is increased. Examples of sesamoid bones are the patella and the pisiform.
- Irregular bones do not fit into the above categories. They consist of thin layers of compact bone surrounding a spongy interior. As implied by the name, their shapes are irregular and complicated. Often this irregular shape is due to their many centers of ossification or because they contain bony sinuses. The bones of the spine, pelvis, and some bones of the skull are irregular bones. Examples include the ethmoid and sphenoid bones.

➢ *Insert prepositions where necessary:*

support _____ the body, serve _____ functions, composed _____ different, types _____ bone cells, involved _____, reabsorption _____ bone tissue. made _____ _____ various salts, characterized _____, located _____ the medullary cavity, embedded _____ tendons, the angle _____ the tendon, fit _____ the above categories, due _____.

➢ *Make a plan of the text.*

➢ *Answer the following questions.*

1. What are the functions of the bones?
2. What are the types of bone tissue?
3. What are the types of bone cells?
4. Are there 270 or 206 bones in an adult body?
5. The stapes is the smallest bone, is not it?
6. How many types of bones are there in the human body?
7. What are the characteristics of long bones?
8. Can you name the examples of short bones?
9. What types does most of the skull bones belong to?
10. Can you name the examples of sesamoid bones?
11. Why are irregular bones called so?

Lesson 2. Muscular System. Classifications of Muscles

Glossary.

to attach	прикреплять
to make up	составлять
discrete	отдельный
tendon	сухожилие
dense	плотный
collagen fiber	коллагеновое волокно
stationary	неподвижный
connected via	соединяться при помощи
maintenance of posture	поддержание осанки
endurance	выносливость
location	расположение
rectus abdominis	прямая мышца живота
transverse abdominis	поперечная мышца живота
tibialis anterior	большеберцовый
brachioradialis	плечелучевой
sternocleidomastoid	грудино-ключично-сосцевидной
occipital bone	затылочная кость
biceps	двуглавая мышца
triangular shape	треугольная форма
oblique muscles	косые мышцы живота
to flex	сгибать
to adduct	соединять

➢ *Read and translate the text.*

The muscular system is responsible for the movement of the human body. Attached to the bones of the skeletal system are about 700 named mus-

cles that make up roughly half of a person's body weight. Each of these muscles is a discrete organ constructed of skeletal muscle tissue, blood vessels, tendons, and nerves. Muscle tissue is also found inside of the heart, digestive organs, and blood vessels. In these organs, muscles serve to move substances throughout the body.

Function of Muscle Tissue.

The main function of the muscular system is movement. Muscles are the only tissue in the body that has the ability to contract and therefore move the other parts of the body.

Related to the function of movement is the muscular system's second function: the maintenance of posture and body position. Muscles often contract to hold the body still or in a particular position rather than to cause movement. The muscles responsible for the body's posture have the greatest endurance of all muscles in the body—they hold up the body throughout the day without becoming tired.

Another function related to movement is the movement of substances inside the body. The cardiac and visceral muscles are primarily responsible for transporting substances like blood or food from one part of the body to another.

The final function of muscle tissue is the generation of body heat. As a result of the high metabolic rate of contracting muscle, our muscular system produces a great deal of waste heat. Many small muscle contractions within the body produce our natural body heat. When we exert ourselves more than normal, the extra muscle contractions lead to a rise in body temperature and eventually to sweating.

Gross Anatomy of a Skeletal Muscle.

Most skeletal muscles are attached to two bones through tendons. Tendons are tough bands of dense regular connective tissue whose strong collagen fibers firmly attach muscles to bones. Tendons are under extreme stress when muscles pull on them, so they are very strong and are woven into the coverings of both muscles and bones.

Muscles move by shortening their length, pulling on tendons, and moving bones closer to each other. One of the bones is pulled towards the other bone, which remains stationary. The place on the stationary bone that is connected via tendons to the muscle is called the origin. The place on the moving bone that is connected to the muscle via tendons is called the insertion. The belly of the muscle is the fleshy part of the muscle in between the tendons that does the actual contraction.

Names of Skeletal Muscles.

Skeletal muscles are named based on many different factors, including their location, origin and insertion, number of origins, shape, size, direction, and function (Figure 2).

Figure 2. *Types of skeletal muscles (http://images.slideplayer.com)*

- *Location*. Many muscles derive their names from their anatomical region. The rectus abdominis and transverse abdominis, for example, are found in the abdominal region. Some muscles, like the tibialis anterior, are named after the part of the bone (the anterior portion of the tibia) that they are attached to. Other muscles use a hybrid of these two, like the brachioradialis, which is named after a region (brachial) and a bone (radius).

- *Origin and Insertion*. Some muscles are named based upon their connection to a stationary bone (origin) and a moving bone (insertion). These muscles become very easy to identify once you know the names of the bones that they are attached to. Examples of this type of muscle include the sternocleidomastoid (connecting the sternum and clavicle to the mastoid process of the skull) and the occipitofrontalis (connecting the occipital bone to the frontal bone).

- *Number of Origins*. Some muscles connect to more than one bone or to more than one place on a bone, and therefore have more than one origin. A muscle with two origins is called a biceps. A muscle with three origins is a triceps muscle. Finally, a muscle with four origins is a quadriceps muscle.

- *Shape, Size, and Direction*. We also classify muscles by their shapes. For example, the deltoids have a delta or triangular shape. The serratus muscles feature a serrated or saw-like shape. The rhomboid major is a rhombus or diamond shape. The size of the muscle can be used to distinguish between two muscles found in the same region. The gluteal region contains three muscles differentiated by size—the gluteus maximus (large), gluteus medius (medium), and gluteus minimus (smallest). Finally, the direction in which the muscle fibers run can be used to identify a muscle. In the abdominal region, there are several sets of wide, flat muscles. The muscles whose fibers run straight up and down are the rectus abdominis, the ones running transversely (left to right) are the transverse abdominis, and the ones running at an angle are the obliques.

- *Function*. Muscles are sometimes classified by the type of function that they perform. Most of the muscles of the forearms are named based on

their function because they are located in the same region and have similar shapes and sizes. For example, the flexor group of the forearm flexes the wrist and the fingers. The supinator is a muscle that supinates the wrist by rolling it over to face palm up. In the leg, there are muscles called adductors whose role is to adduct (pull together) the legs.

- *Make an abstract of the text.*
- *Are the statements true or false?*

1. Muscles are constructed of skeletal muscle tissue, blood vessels and nerves.
2. Some muscles serve to move substances throughout the body.
3. Muscles like some other tissue in the body have the ability to contract.
4. One of the functions of muscle tissue is the generation of body heat.
5. Most skeletal muscles are attached to two bones through tendons.
6. The rectus abdominis and transverse abdominis are found in the skull.
7. A muscle with three origins is a biceps muscle.
8. In the abdominal region, there are several sets of wide, flat muscles.
9. The muscles whose fibers run straight up and down are the rectus abdominis.
10. In the leg, there are muscles called adductors whose role is to adduct (pull together) the legs.

- *Give definitions to the following notions using the text:*
  - tendons;
  - insertion;
  - belly of the muscle;
  - biceps, quadriceps;
  - deltoid, obliques;
  - flexor group;
  - supinator;
  - adductor.

UNIT 2. CARDIOVASCULAR SYSTEM

Lesson 3. The heart and Cardiovascular Diseases

Glossary.

pump	насос
mammal	млекопитающее
counterpart	коллега
backflow	противоток
pericardium	перикард
epicardium	эпикард
myocardium	миокард
endocardium	эндокард
sinoatrial node	синусовый узел
atrioventricular node	атриовентрикулярный узел
vena cava	полая вена
pulmonary circulation	легочное кровообращение
Cardiovascular diseases	заболевания сердечно-сосудистой системы

➢ *Read and translate the text.*

The heart is a muscular organ in humans and other animals, which pumps blood through the blood vessels of the circulatory system. Blood provides the body with oxygen and nutrients, as well as assists in the removal of metabolic wastes. The heart is located between the lungs, in the middle compartment of the chest.

In humans, other mammals, and birds, the heart is divided into four chambers: upper left and right atria; and lower left and right ventricles (Figure 3). Commonly the right atrium and ventricle are referred together as the right heart and their left counterparts as the left heart. Fish in contrast have two chambers, an atrium and a ventricle, while reptiles have three chambers. In a healthy heart blood flows one way through the heart due to heart valves, which prevent backflow. The heart is enclosed in a protective sac, the pericardium,

which also contains a small amount of fluid. The wall of the heart is made up of three layers: epicardium, myocardium, and endocardium.

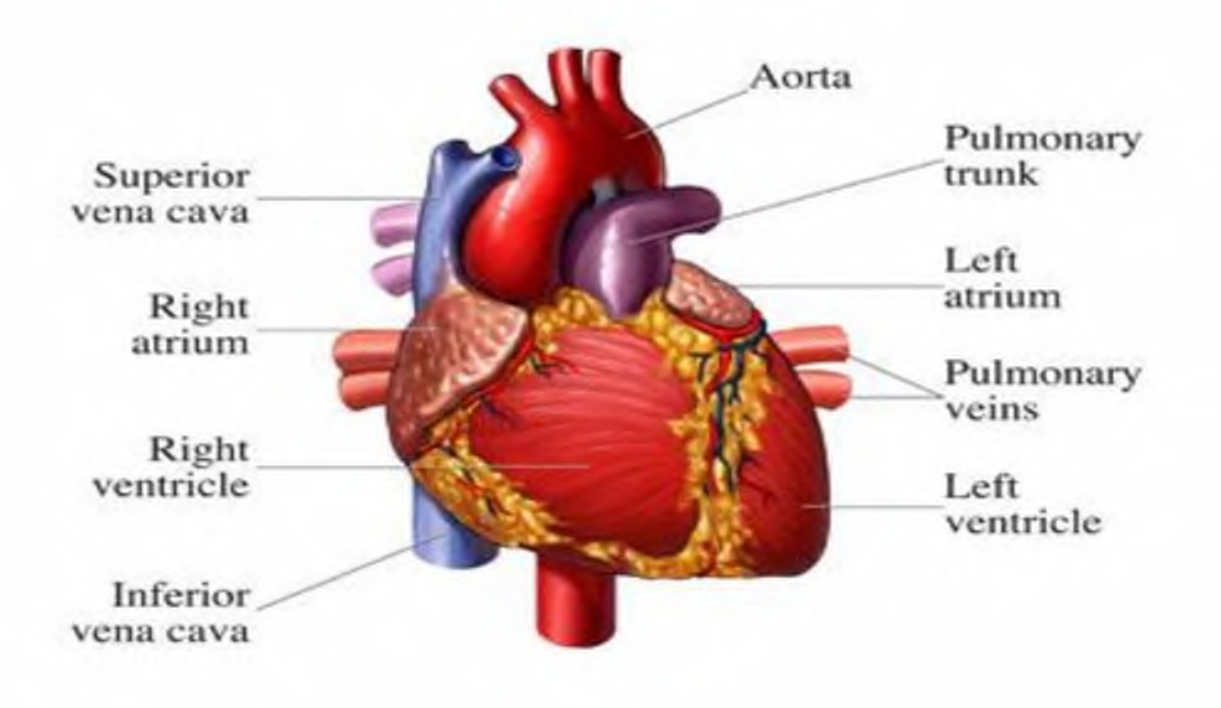

Figure 3. *The human heart (https://human-anatomy101.com)*

The heart pumps blood with a rhythm determined by a group of pace-making cells in the sinoatrial node. These generate a current that causes contraction of the heart, traveling through the atrioventricular node and along the conduction system of the heart. The heart receives blood low in oxygen from the systemic circulation, which enters the right atrium from the superior and inferior venae cavae and passes to the right ventricle. From here it is pumped into the pulmonary circulation, through the lungs where it receives oxygen and gives off carbon dioxide. Oxygenated blood then returns to the left atrium, passes through the left ventricle and is pumped out through the aorta to the systemic circulation−where the oxygen is used and metabolized to carbon dioxide. The heart beats at a resting rate close to 72 beats per minute. Exercise temporarily increases the rate, but lowers resting heart rate in the long term, and is good for heart health.

Cardiovascular diseases (CVD) are the most common cause of death globally as of 2008, accounting for 30 % of deaths. Of these more than three

quarters are a result of coronary artery disease and stroke. Risk factors include: smoking, being overweight, little exercise, high cholesterol, high blood pressure, and poorly controlled diabetes, among others. Cardiovascular diseases frequently have no symptoms or may cause chest pain or shortness of breath. Diagnosis of heart disease is often done by the taking of a medical history, listening to the heart-sounds with a stethoscope, ECG, and ultrasound. Specialists who focus on diseases of the heart are called cardiologists, although many specialties of medicine may be involved in treatment.

➢ *Find equivalents for the following phrases in the text:*

кровь снабжает тело кислородом и питательными веществами; средний отдел грудной клетки; у людей; упоминаться вместе как; сокращение сердца; восходящая полая вена, нисходящая полая вена; ишемическая болезнь сердца; ультразвуковое исследование.

➢ *Answer the questions:*

1. What provides the body with nutrients?
2. Where is the heart located?
3. What are the four chambers of the heart?
4. What does the term “right heart” mean?
5. What is the pericardium?
6. Where does blood low in oxygen enter the heart?
7. What are the risk factors of CVD?

➢ *Write an essay on the topic*: “Cardiovascular diseases are the most common cause of death”.

Lesson 4. The Structure of the Human Heart

Glossary.

chamber	камера
via	через, посредством
atrioventricular valve	предсердно-желудочковый клапан

septum	перегородка
sulcus	борозда
atrial appendage	ушко предсердия
interventricular septum	межжелудочковая перегородка
longitudinal	продольный
fibrous ring	фиброзное кольцо
conduct electricity	проводить электричество
tricuspid valve	трехстворчатый клапан
chorda tendineae	сухожильные хорды
papillary muscle	папиллярная мышца
mitral valve	митральный клапан
bicuspid valve	двустворчатый клапан
semilunar valve	полулунный клапан

➢ *Read and translate the text.*

The heart has four chambers, two upper atria, the receiving chambers, and two lower ventricles, the discharging chambers. The atria open into the ventricles via the atrioventricular valves, present in the atrioventricular septum. This distinction is visible also on the surface of the heart as the coronary sulcus. There is an ear-shaped structure in the upper right atrium called the right atrial appendage, or auricle, and another in the upper left atrium, the left atrial appendage. The right atrium and the right ventricle together are sometimes referred to as the right heart. Similarly, the left atrium and the left ventricle together are sometimes referred to as the left heart. The ventricles are separated from each other by the interventricular septum, visible on the surface of the heart as the anterior longitudinal sulcus and the posterior interventricular sulcus.

The cardiac skeleton is made of dense connective tissue and this gives structure to the heart. It forms the atrioventricular septum which separates the

atria from the ventricles, and the fibrous rings which serve as bases for the four heart valves. The cardiac skeleton also provides an important boundary in the heart's electrical conduction system since collagen cannot conduct electricity. The interatrial septum separates the atria and the interventricular septum separates the ventricles. The interventricular septum is much thicker than the interatrial septum, since the ventricles need to generate greater pressure when they contract.

The heart has four valves, which separate its chambers. One valve lies between each atrium and ventricle, and one valve rests at the exit of each ventricle.

The valves between the atria and ventricles are called the atrioventricular valves. Between the right atrium and the right ventricle is the tricuspid valve. The tricuspid valve has three cusps, which connect to chordae tendinae and three papillary muscles named the anterior, posterior, and septal muscles, after their relative positions. The mitral valve lies between the left atrium and left ventricle. It is also known as the bicuspid valve due to its having two cusps, an anterior and a posterior cusp. These cusps are also attached via chordae tendinae to two papillary muscles projecting from the ventricular wall.

The papillary muscles extend from the walls of the heart to valves by cartilaginous connections called chordae tendinae. These muscles prevent the valves from falling too far back when they close. During the relaxation phase of the cardiac cycle, the papillary muscles are also relaxed and the tension on the chordae tendineae is slight. As the heart chambers contract, so do the papillary muscles. This creates tension on the chordae tendineae, helping to hold the cusps of the atrioventricular valves in place and preventing them from being blown back into the atria.

Two additional semilunar valves sit at the exit of each of the ventricles. The pulmonary valve is located at the base of the pulmonary artery. This has three cusps which are not attached to any papillary muscles. When the ventricle relaxes blood flows back into the ventricle from the artery and this flow of

blood fills the pocket-like valve, pressing against the cusps which close to seal the valve. The semilunar aortic valve is at the base of the aorta and also is not attached to papillary muscles. This too has three cusps which close with the pressure of the blood flowing back from the aorta.

➢ *Look at the picture below (Figure 4) and write an essay on the structure of the heart.*

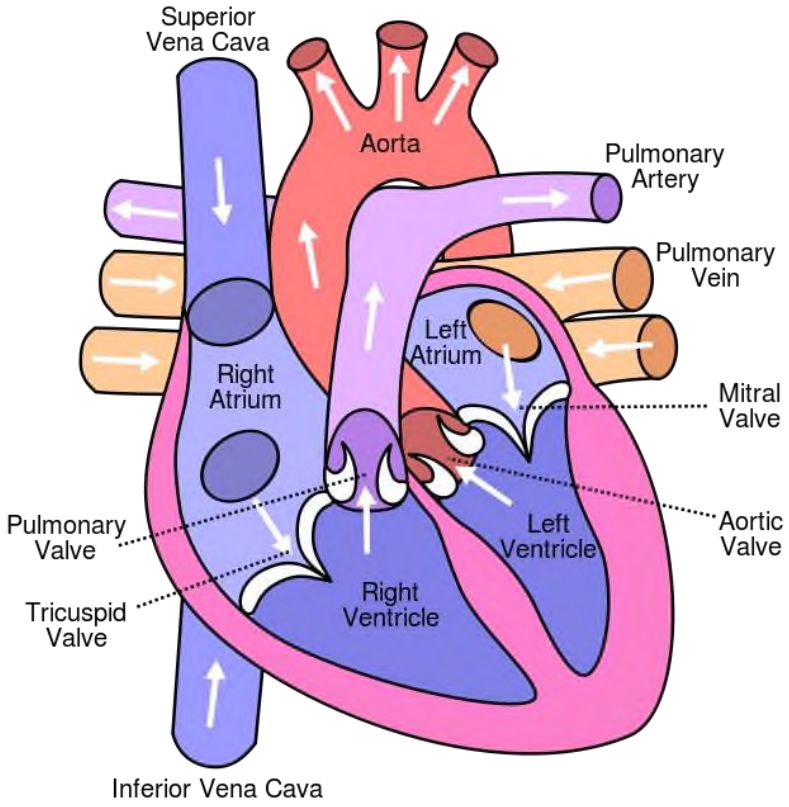

Figure 4. *The structure of the heart (http//i.pinimg.com)*

➢ *Find English equivalents for the following words and phrases:*

Поверхность сердца, аналогично, отделены друг от друга, продольная борозда, система проведения электрического импульса, межпредсердная перегородка, образовывать давление, перегородочная мышца, расширяться, хрящевые соединения, во время фазы расслабления, сердечный цикл, легочный клапан, легочная артерия.

➢ *Make a summary of the text.*

Lesson 5. Blood Vessels

Glossary.

branching	ветвящийся
converging	сходящийся
convey blood	передавать кровь
pattern	шаблон, схема
flattened cells	уплощенные клетки
elastic fibres	эластичные волокна
endothelium	эндотелий
constriction	сужение, сжатие
dilatation	расширение, растяжение
nitric oxide	оксид азота
intermittently	периодически
distensible	эластичный
pressure drop	падение давления
pulsatility	пульсации
adjacent cells	соседние ячейки
high density	высокая плотность
impermeable	непроницаемый
osmotic force	осмотическая сила
dynamic equilibrium	динамическое равновесие
oedema	отеки
distend	раздуваться, надуваться; расширяться
haemorrhage	кровотечение
microscopic air-sacs	микроскопические воздушные мешочки
gas exchange	газообмен

➢ *Read and translate the text.*

Blood vessels are the system of branching and converging tubes which convey blood from the heart to all the various parts of the body and back again, and from the heart to the lungs and back. The size of blood vessels varies enormously, from a diameter of about 25 mm (1 inch) in the aorta to only 8 μm in the capillaries. This is a 3000-fold range.

The thickness of blood vessel walls also varies enormously, being largest in the large arteries, much less in veins of comparable diameter, and only a single cell thick in the capillaries. Despite the range of sizes the components of the blood vessel walls have a common pattern. All vessels are lined with a single layer of flattened cells called the endothelium. Except for capillaries, all vessels also contain elastic fibres, stiff collagen fibres (similar structure to muscle tendons), and smooth muscle fibres which can constrict or dilate in response to chemical and nervous stimuli. The relative proportions of these components vary in different blood vessels in accordance with their functions (Figure 5).

Recently, the endothelium has been recognized to be of importance in the regulation of the state of constriction or dilatation of the vessels themselves. Of particular note in this respect is 'endothelial derived relaxation factor', later shown to be nitric oxide: when this is released, notably in response to the shearing force of the blood on the vessel, it causes dilatation of the vessel.

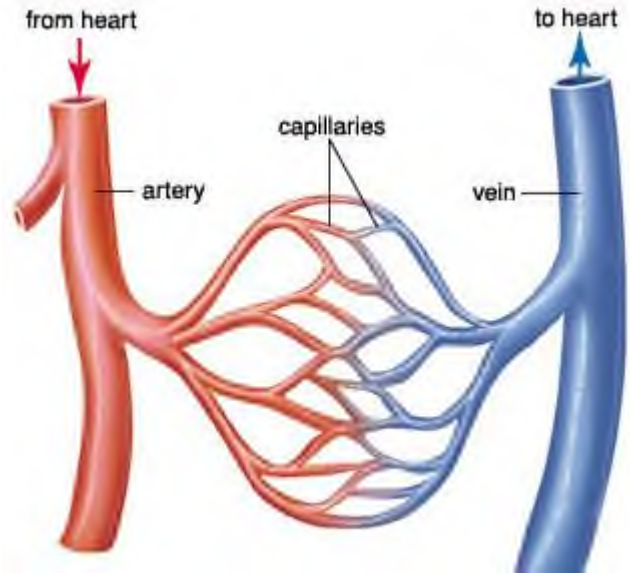

Figure 5. *Blood vessels in the human body (https://im0-tub-ru.yandex.net)*

Large arteries.

The aorta and its main branches are called elastic arteries. Although they also possess fibrous collagen tissue and smooth muscle, about half of their structure is composed of elastic fibres. These give large arteries a characteristic pale yellow colour. Their wide bore means that they offer little resistance to blood flow, so there is little pressure drop throughout the system of major arteries. The physiological significance of the elastic fibres is that they allow the vessels to expand when blood is ejected intermittently into them from the heart and to constrict again as blood flows out of them into the smaller vessels. The combination of a distensible large vessel and a downstream resistance (arterioles) transforms an intermittent cardiac ejection into a continuous capillary flow.

Small arteries and arterioles.

These are the resistance vessels of the circulation and are responsible for determining blood pressure. Arterioles are the vessels at the end of the arterial tree and have a diameter of 20 to 30 μm. Their particular significance is that they have very thick walls in relation to their diameters. Furthermore, the main constituent in their walls is smooth muscle, and the degree of contraction of this muscle regulates the diameter of the vessels and consequently the amount of blood flowing through them. Arterioles are responsible for the largest pressure drop in the circulation. Blood pressure in arteries typically varies from 120 to 80 mm Hg, depending on the phase of the cardiac cycle. In capillaries, the pulsatility is lost and pressure is only about 30 mm Hg.

The muscle in the walls of arterioles possesses an inherent tone. That means that they are normally partly contracted, reducing the size of the lumen to less than the widest possible. The degree of contraction is modified by factors external to the vessels. In particular, the chemical products that are formed as tissues use up energy — the ‘metabolites’ — reach the muscle fibres in the walls of the arterioles and cause them to relax and dilate. This local vasodilatation has the effect of matching local blood flow to tissue energy requirement.

Arterioles can also be regulated by nerves and hormones. These effects tend to be widespread and are concerned mainly with the regulation of arterial blood pressure. Sympathetic nerves have an important role in the control of arterioles. As the frequency of sympathetic nerve impulses increases, more of the transmitter, noradrenaline, is released at the nerve endings, and this causes arterioles to constrict. The adrenal glands also release noradrenaline into the blood but their secretion is mainly of adrenaline. Adrenaline also constricts blood vessels — except those in skeletal muscle, where it dilates them. This diverts blood to the muscle and prepares the body for emergencies as part of the 'fight or flight' response.

Capillaries.

These are the 'exchange vessels', allowing passage of substances between blood and the fluids outside them which surround the body cells. They consist of a single layer of endothelial cells, with microscopic spaces between adjacent cells which allow the solutes of the blood, including salts, glucose, and dissolved oxygen, to pass into the tissues, and products of tissue metabolism, including carbon dioxide, to pass into the blood. The number of capillaries is so vast that even though they are microscopic their overall resistance to blood flow is low and blood passes through them slowly. The high density of capillaries means the distance for diffusion by the nutrients and gases is small. The more active tissues tend to have a denser supply of capillaries.

Capillaries are formed as a complex system of branching blood vessels between arterioles and venules (microscopic veins). Those near the arteries are at a higher pressure than those near veins. The gaps between endothelial cells are small enough to be almost impermeable to the protein molecules present in the blood, causing the capillary bed to function as a semipermeable membrane. These molecules exert an osmotic force which tends to draw fluid from the tissue spaces into the capillary. This is opposed by the hydrostatic pressure forcing fluid out. A dynamic equilibrium is established, such that at the higher pressure capillaries fluid leaves the circulation, and at the lower pressure ones it

is drawn back in. An additional system of vessels, the lymphatics, are fine tubes which provide an alternative route for tissue fluid, via the lymph nodes and back to the circulation.

Disturbance of the balance of the fluid exchange at capillaries can lead to oedema, which is swelling caused by excess tissue fluid. Major causes of this are: a generalized increase in tissue fluid as in heart failure; obstruction to flow through veins or lymphatic vessels such as by cancer growths; and deficiency of blood protein, as in liver or kidney disease or malnutrition, which reduces the osmotic reabsorption force.

Veins.

Blood returns from the tissues to the heart along veins. Larger veins possess valves which ensure that blood travels in the correct direction and prevents the development of undue back pressure. Sometimes the valves may cease to function, causing veins to distend abnormally and permanently. This is the cause of varicose veins.

Veins have another important role in addition to being conduits. Approximately 70 % of the entire blood volume is contained within the veins, and these are very distensible. This means that they can readily accommodate quite large changes in their volume, either as a result of a change in the total quantity of blood in the circulation (haemorrhage or transfusion), or because of changes in blood distribution (leg veins distend on standing up, for example). The reason that veins can change their volume with little change in pressure is partly because they collapse when empty, which applies to veins above heart level. When filled, the elastic tissue in their walls is readily distensible, although expansion is eventually limited by the relatively indistensible fibrous tissue (collagen).

There is another, active, way in which the volume of blood in veins can be controlled: some veins have the ability to constrict in response to nerve stimulation. Sympathetic nerves supply smooth muscle in the vein walls, and an increase in sympathetic activity, resulting for example from a decreased

stimulus to baroreceptors (falling blood pressure), causes venous volume to decrease. The effect of this is to increase filling of the heart and to enhance its output.

Pulmonary vessels.

Although the total flow of blood per minute through the lungs is the same as that through the systemic circulation, the pressures are very much lower. Pressure in the pulmonary artery is typically 25/12 mm Hg (systolic/diastolic) compared with 120/80 mm Hg in the aorta and its main branches. The pressure in the lung vessels is lower because they are shorter, wider, have less muscle in their walls, and are very numerous. In particular, there are no muscular resistance vessels like those in the systemic circulation. The pulmonary vessels form a vast low-resistance capillary network which encircles the microscopic air-sacs (alveoli). Gas exchange — of oxygen for carbon dioxide — takes place between blood in the pulmonary capillaries and air in the alveoli.

➢ *Make a plan of the text.*

➢ *Fill in the gaps using the words and phrases: aorta, capillaries, vessels, veins, oedema, blood pressure, adrenaline, pulmonary vessels, arterioles, hormones.*

1. All _____ are lined with a single layer of flattened cells called the endothelium.

2. The _____ and its main branches are called elastic arteries.

3. _____ are the vessels at the end of the arterial tree and have a diameter of 20 to 30 μm.

4. _____ in arteries typically varies from 120 to 80 mm Hg, depending on the phase of the cardiac cycle.

5. Arterioles can also be regulated by nerves and _____.

6. _____ also constricts blood vessels — except those in skeletal muscle, where it dilates them.

7. _____ are formed as a complex system of branching blood vessels between arterioles and venules (microscopic veins).

8. Disturbance of the balance of the fluid exchange at capillaries can lead to _____, which is swelling caused by excess tissue fluid.

9. Blood returns from the tissues to the heart along _____.

10. The _____ form a vast low-resistance capillary network which encircles the microscopic air-sacs (alveoli).

➢ *Give definitions of the following notions of the text:*

– blood vessels;

– large arteries;

– aorta;

– small arteries;

– arterioles;

– capillaries;

– veins;

– pulmonary vessels.

Lesson 6. Hemoglobin and its role in disease and diagnosis

Glossary.

metalloprotein	металлопротеин
annelid worm	кольчатый червь
aquatic	водный
larva (pl. larvae)	личинка
loosely	неплотно, свободно
reversibly	обратимо, реверсивно
gills	жабры
heme	гем
bind	связывать, привязать

hemoglobinopathy	гемоглобинопатия
sickle-cell disease	серповидно-клеточная анемия
thalassaemia	талассемии
resultant	равнодействующий, проистекающий
hypochromic	гипохромный
microcytic	микроцитарный
hemolysis	гемолиз
renal	почечный
scarce	дефицитный, скудный, недостаточный, едва
intermittent	прерывистый, перемежающийся, скачкообразный
life span	продолжительность жизни
porphyria	порфирия, порфириновая болезнь
blood count	анализ крови

➢ *Read and translate the text.*

Hemoglobin or haemoglobin (frequently abbreviated as Hb) is the iron-containing oxygen-transport metalloprotein in the red cells of the blood in mammals and almost all other vertebrates. Some invertebrates also employ hemoglobin in oxygen transport, such as annelid worms, which have the hemoglobin dissolved in the blood, and the larval aquatic stages of a few insects. Only a few vertebrates, such as eel larvae and some species of Antarctic "icefish," have been found to lack hemoglobin. Hemoglobin is the most efficient oxygen-carrier known (Figure 6).

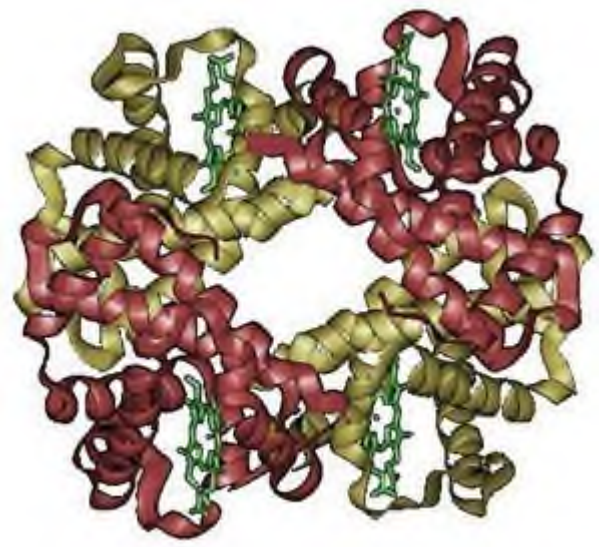

Figure 6. *3-dimentional structure of hemoglobin (https://im0-tub-ru.yandex.net)*

A protein-metal complex, hemoglobin binds loosely and reversibly with oxygen under suitable conditions and then releases the gas under other conditions. In vertebrates, hemoglobin transports oxygen from the lungs or gills to the rest of the body, such as to the muscles, where it releases the oxygen load. Structurally, hemoglobin is a globular protein with an embedded heme (or haem) group; each heme group contains an iron atom, and this is responsible for the binding of oxygen. The most common types of hemoglobin contains four such subunits.

Mutations in the gene for the hemoglobin protein result in a group of hereditary diseases termed hemoglobinopathies, the most common members of which are sickle-cell disease and thalassaemia.

Because carbon monoxide binds preferentially to hemoglobin over oxygen, smoking tobacco can greatly impact oxygen transport, blocking up to 20% of the oxygen active sites on hemoglobin. This is just one of the many serious, health related effects of tobacco smoking, and represents a degrading of the human body.

Hemoglobin provides a great deal of symbolism in human culture. Hemoglobin provides the red color in blood, being bright red when oxidized and dark purplish red when unloaded. The color red has been used to represent

blood, war, and Mars. As with hemoglobin, the red color of Mars is also attributed to iron oxides.

Hemoglobin has been used to determine evolutionary relationships. The alpha chains of humans and chimpanzees have identical sequences of amino acids, whereas humans differ by one amino acid (our of 141) from the gorilla, and 25 from rabbits, and 71 from carp.

Role in disease and diagnosis.

Decreased levels of hemoglobin, with or without an absolute decrease of red blood cells, leads to symptoms of anemia. Anemia has many different causes, although iron deficiency and its resultant iron deficiency anemia, are the most common causes in the Western world. As absence of iron decreases heme synthesis, and red blood cells in iron deficiency anemia are hypochromic (lacking the red hemoglobin pigment) and microcytic (smaller than normal). Other anemias are rarer. In hemolysis (accelerated breakdown of red blood cells), associated jaundice is caused by the hemoglobin metabolite bilirubin, and the circulating hemoglobin can cause renal failure.

Mutations in the globin chain are associated with haemoglobinopathies, such as sickle-cell anemia and thalassemia. Sickle-cell anemia is a recessive genetic disease which causes a single amino-acid defect (a valine molecule replaces a molecule of glutamic acid) in one of the the protein chains of hemoglobin. This defect causes the red blood cells to become deformed when oxygen is scarce (as when the individual is exercising strenuously) and they combine with each other, forming blockages to blood flow at just the time when the body needs oxygen the most. As a result, people with sickle-cell anemia tend to have intermittent illness and have shorter than normal life spans.

There is a group of genetic disorders, known as the porphyrias, that are characterized by errors in metabolic pathways of heme synthesis. King George III of the United Kingdom was probably the most famous porphyria sufferer.

To a small extent, hemoglobin A slowly combines with glucose at a certain location in the molecule. The resulting molecule is often referred to as Hb

A1c. As the concentration of glucose in the blood increases, the percentage of Hb A that turns into Hb A1c increases. In diabetics whose glucose usually runs high, the percent Hb A1c also runs high. Because of the slow rate of Hb A combination with glucose, the Hb A1c percentage is representative of glucose level in the blood averaged over a longer time (typically 3 months).

Hemoglobin levels are among the most commonly performed blood tests, usually as part of a full blood count. Results are reported in g/L, g/dl or mmol/L. For conversion, 1 g/dl is 0.62 mmol/L. For example, hemoglobin levels are used in testing for glucose levels.

Glucose levels in blood can vary widely each hour, so one or only a few samples from a patient analyzed for glucose may not be representative of glucose control in the long run. For this reason, a blood sample may be analyzed for Hb A1c, which is more representative of glucose control averaged over a longer time period. People whose Hb A1c runs 6.0 % or less show good longer-term glucose control. Hb A1c values which are more than 7.0 % are elevated. This test is especially useful for diabetics.

➢ *Fill in prepositions where necessary:*

the blood _____ mammals, dissolved _____ the blood, releases the gas _____ other conditions, a globular protein _____ an embedded heme group, responsible _____ the binding _____ oxygen, mutations _____ the gene, bind _____ hemoglobin _____ oxygen, block _____ _____ 20% v the oxygen, health related effects _____ tobacco smoking, a great deal _____ symbolism _____ human culture, identical sequences _____ amino acids, humans differ _____ one amino acid _____ the gorilla, leads _____ symptoms _____ anemia, associated _____ haemoglobinopathies, combine _____ each other, blockages _____ blood flow, _____ a small extent, combines _____ glucose _____ a certain location _____ the molecule, because _____ the slow _____ Hb A combination _____ glucose.

➢ *Give definitions to the following notions using the text:*

– hemoglobin;

– hemoglobinopathy;

– anemia;

– hypochromic anemia;

– microcytic anemia;

– hemolysis;

– sickle-cell anemia;

– porphyria;

– hemoglobin level;

– glucose level.

➢ *Write an essay on the topic:* "Hemoglobin deficiency and the problems it may cause".

UNIT 3. RESPIRATORY SYSTEM

Lesson 7. Lungs and Their Anatomy

Glossary.

spongy	губчатый, пористый
survive	выживать
hazardous	опасный
stretched	растянутый
pleura (*pl*. pleurae)	плевра
serous membranes	серозная оболочка
parietal	париетальный, пристеночный, наружный
hollow space	полое пространство
cone-shaped	конусообразный
superior end	верхний край
inferior end	нижний край
dome-shaped	куполообразный
indentation	выемка, впадина
horizontal fissure	горизонтальная щель легкого
oblique fissure	косая щель легкого

➢ *Read and translate the text.*

The human lungs are a pair of large, spongy organs optimized for gas exchange between our blood and the air (Figure 7). Our bodies require oxygen in order to survive. The lungs provide us with that vital oxygen while also removing carbon dioxide before it can reach hazardous levels.

If the inner surface of the lungs could be stretched out flat, they would occupy an area of around 80 to 100 square meters – about the size of half of a tennis court! The lungs also provide us with the air we need in order to speak, laugh at jokes, and sing.

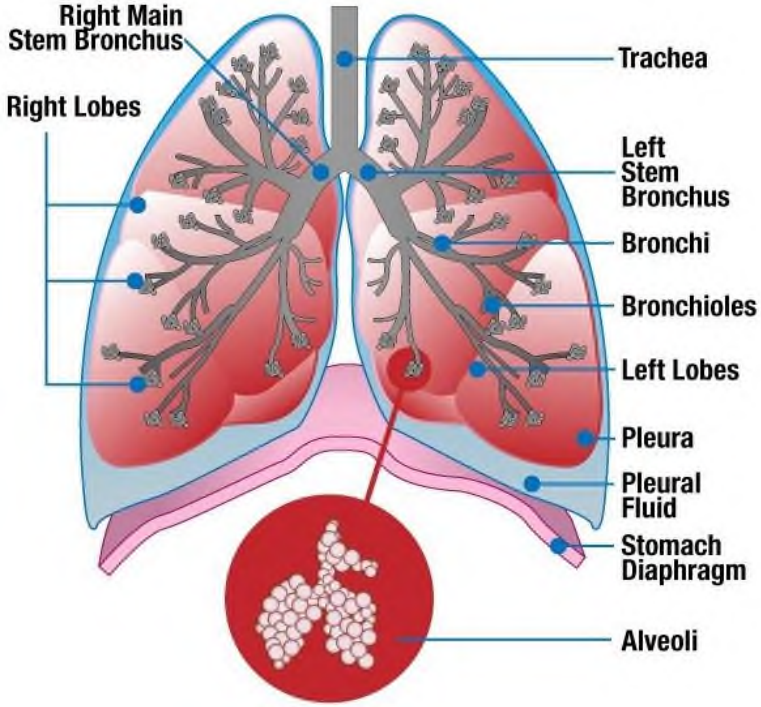

Figure 7. *Human lungs –a pair of spongy organs (https://smithonstocks.com)*

Pleura.

The pleura are double-layered serous membranes that surround each lung. Attached to the wall of the thoracic cavity, the parietal pleura forms the outer layer of the membrane. The visceral pleura forms the inner layer of the membrane covering the outside surface of the lungs.

Between the parietal and visceral pleura is the pleural cavity, which creates a hollow space for the lungs to expand into during inhalation. Serous fluid secreted by the pleural membranes lubricates the inside of the pleural cavity to prevent irritation to the lungs during breathing.

External Anatomy.

Occupying most of the space within the thoracic cavity, the lungs extend laterally from the heart to the ribs on both sides of the chest and continue posteriorly toward the spine. Each soft, spongy lung is roughly cone-shaped with the superior end of the lung forming the point of the cone and the inferior end forming the base. The superior end of the lungs narrows to a rounded tip known as the apex. The inferior end of the lungs, known as the base, rests on the dome-shaped diaphragm. The base of the lungs is concave to follow the contour of the diaphragm.

The left lung is slightly smaller than the right lung because 2/3 of the heart is located on the left side of the body. The left lung contains the cardiac notch, an indentation in the lung that surrounds the apex of the heart.

Each lung consists of several distinct lobes. The right lung (the larger of the two) has 3 lobes – the superior, middle, and inferior lobes. The horizontal fissure separates the superior lobe from the middle lobe, while the right oblique fissure separates the middle and inferior lobes. The smaller left lung only has 2 lobes – superior and inferior – separated by the left oblique fissure.

➢ *Find the English equivalents for:* газообмен, легкие снабжают нас, достигать опасного уровня, внутренняя поверхность, занимать площадь, прикрепляться к стенкам, внешний слой, плевральная полость, расширяться во время вдоха, сужаться, известный как, куполообразная мембрана, повторять очертания, верхушка сердца.

➢ *Answer the questions:*

1. What is the main function of the lungs?
2. Can you describe the pleura?
3. What creates a hollow space for the lungs to expand into during inhalation?
4. Serous fluid secreted by the pleural membranes lubricates the inside of the pleural cavity to prevent irritation to the lungs during breathing, doesn’t it?
5. In what directions do lungs extend?
6. Why is the base of the lungs concave?
7. Is the base of the lungs the inferior or superior end?
8. Which lung is smaller? Why?
9. What is the cardiac notch?
10. How many lobes are there in the right lobe?

➢ *Make an abstract of the text.*

Lesson 8. Bronchi and Bronchioles

Glossary.

hyaline cartilage	гиалиновый хрящ
split into	распадаться на
hollow tubes	полые трубки
ciliated	реснитчатый
pseudostratified	псевдослойный
rigid	жесткий, негибкий
branch off	отходить от главного направления, делать ответвление
tertiary	третичный
evenly	равномерно
goblet cells	бокаловидные клетки
mucus	слизь
pathogen	возбудитель, патогенный микроорганизм
environmental pollutants	загрязнителей окружающей среды
airflow	воздушный поток

➢ *Read and translate the text.*

Air enters the body through the nose or mouth and passes through the pharynx, larynx, and trachea. Just before reaching the lungs, the trachea then splits into the left and right bronchi – large, hollow tubes made of hyaline cartilage and lined with ciliated pseudostratified epithelium. The hyaline cartilage of the bronchi forms incomplete rings shaped like the letter "C" with the open part of the ring facing toward the posterior end of the bronchi. The rigid hyaline cartilage prevents the bronchi from collapsing and blocking airflow to the lungs. Pseudostratified epithelium lines the inside of the hyaline ring and connects the unfinished ends of the ring to form a hollow tube shaped like the letter "D" with the flat part of the tube facing the posterior direction. Each lung receives air from a single, large primary bronchus.

As the primary bronchi enter the lungs, they branch off into smaller secondary bronchi that carry air to each lobe of the lung. Thus, the right bronchus

branches off into 3 secondary bronchi while the left lung branches off into 2 secondary bronchi. The secondary bronchi further branch into many smaller tertiary bronchi within each lobe. The secondary and tertiary bronchi improve the efficiency of the lungs by distributing air evenly within each lobe of the lungs.

The pseudostratified epithelium that lines the bronchi contains many cilia and goblet cells. Cilia are small hair-like cellular projections that extend from the surface of the cells. Goblet cells are specialized epithelial cells that secrete mucus to coat the lining of the bronchi. Cilia move together to push mucus secreted by the goblet cells away from the lungs. Particles of dust and even pathogens like viruses, bacteria and fungi in the air entering the lungs stick to the mucus and are carried out of the respiratory tract. In this way mucus helps to keep the lungs clean and free of disease.

Many small bronchioles branch off from the tertiary bronchi. Bronchioles differ from bronchi both in size (they are smaller) and in the composition of their walls. While bronchi have hyaline cartilage rings in their walls, bronchioles are made of elastin fibers and smooth muscle tissue. The tissue of the bronchiole walls allows the diameter of bronchioles to change to a significant degree. When the body requires greater volumes of air entering the lungs, such as during exercise, the bronchioles dilate to permit greater airflow. In response to dust or other environmental pollutants, the bronchioles can constrict to prevent the pollution of the lungs.

The bronchioles further branch off into many tiny terminal bronchioles. Terminal bronchioles are the smallest air tubes in the lungs and terminate at the alveoli of the lungs. Like bronchioles, the terminal bronchioles are elastic, capable of dilating or contracting to control airflow into the alveoli.

➢ *Образуйте множественное число существительных*:

– bronchus;

– bronchiole;

– pharynx;

– larynx;

– trachea;

– epithelium;

– cilium;

– cell;

– pathogen;

– tube;

– virus;

– bacterium;

– fungus;

– alveolus.

➢ *Fill in the gaps:*

Air enters the body through the nose or mouth and passes through the pharynx, _____, and trachea.

The rigid _____ _____ prevents the bronchi from collapsing and blocking airflow to the lungs.

Each lung receives air from a single, large _____ bronchus.

As the _____ bronchi enter the lungs, they branch off into smaller _____ bronchi that carry air to each lobe of the lung.

The _____ bronchi further branch into many smaller _____ bronchi within each lobe.

The _____ _____ that lines the bronchi contains many cilia and goblet cells.

_____ are small hair-like cellular projections that extend from the surface of the cells.

_____ _____ are specialized epithelial cells that secrete mucus to coat the lining of the bronchi.

Many small _____ branch off from the tertiary bronchi.

The bronchioles further branch off into many tiny _____ _____.

➢ *Make a plan of the text.*

Lesson 9. Normal Respiratory Frequency and Ideal Breathing

Glossary.

respiratory rate	частота дыхания
at rest	в состоянии покоя
pulmonary dysfunction	легочная дисфункция
chronic health condition	хроническое заболевание
values	значения
define	определять
unaware	не подозревающий
record	запись, записывать
wakeful states	состояние бодрствования
amplitude	амплитуда, широта
vasoconstriction	сужение сосудов
suppress	пресекать, сдерживать
hypocapnia	гипокапния
DIY (do it yourself)	самостоятельный

➢ *Read and translate the text.*

Respiratory rate (also known as ventilation rate, respiration rate, breathing rate, pulmonary ventilation rate, breathing frequency, and respiratory frequency or Rf) is the number of breaths a person takes during one minute. It is usually measured at rest, while sitting.

Medical research suggests that respiration rate is the marker of pulmonary dysfunction. Patients breathe more often at rest with advance of a large number of chronic health conditions.

Medical textbooks suggest that the normal respiratory rate for adults is only 12 breaths per minute at rest. Older textbooks often provide even smaller values (e.g., 8-10 breaths per minute). Most modern adults breathe much faster (about 15-20 breaths per minute) than their normal breathing frequency. The respiratory rates in the sick persons are usually higher, generally about 20 breaths/min or more (Figure 8).

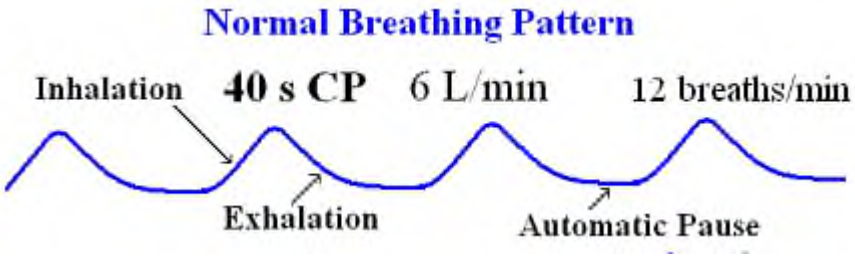

Figure 8. *Normal breathing pattern (http://qph.ec.quoracdn.net)*

You cannot define your own breathing rate by simply counting it. As soon as you try it, your breathing will be more deep and slow. You can ask other people to count it, when you are unaware about your breathing, or you can record your breathing using sensitive microphones fixed near your nose at night or when you sit quietly and are busy with some other activities. It is also possible to define your breathing frequency by asking other people to count the number of your breathing cycles during one minute when you are sleeping (During sleep the respiratory frequency remains about the same as during wakeful states at rest, but the tidal volume or amplitude of breathing is reduced).

When we breathe more than the medical norm, we lose CO2 and reduce body oxygenation due to vasoconstriction and the suppressed Bohr effect caused by hypocapnia (CO2 deficiency). Hence, overbreathing leads to reduced cell oxygenation, while slower and easier breathing (with lower respiratory rates) improves cell-oxygen content.

From physiological viewpoint, the body-oxygen test is a more meaningful and important DIY test, than one's breathing frequency. If you have less than 20 s of oxygen in the morning (when you wake up), you are likely to have health problems.

➢ *Speak about respiratory rates in different people using the information below.*

Average resting respiratory rates by age are:

– birth to 6 weeks: 30–40 breaths per minute;
– 6 months: 25–40 breaths per minute;
– 3 years: 20–30 breaths per minute;
– 6 years: 18–25 breaths per minute;
– 10 years: 17–23 breaths per minute;
– adults: 12-18-breaths per minute;
– elderly ≥ 65 years old: 12-28 breaths per minute;
– elderly ≥ 80 years old: 10-30 breaths per minute.

➢ *Write an essay on the topic*: "Ideal Breathing Pattern".

Lesson 10. Diaphragmatic breathing

Glossary.

expansion	расширение
complementary	дополнительный
eupnea (eupnoea)	эупноэ, нормальное дыхание
bloodstream	кровоток
relief	облегчение, утешение, помощь
anxiety	беспокойство, тревога, боязнь, страх
shallow	мелкий
beneficial	выгодный, благотворный, целебный
cardiopulmonary disease	сердечно-легочная болезнь
posture	поза, осанка, фигура

chest deformity	деформация грудной клетки
sternum	грудина
pectus excavatum	воронкообразная деформация

➢ *Read and translate.*

Diaphragmatic breathing, abdominal breathing, belly breathing or deep breathing is breathing that is done by contracting the diaphragm, a muscle located horizontally between the thoracic cavity and abdominal cavity. Air enters the lungs and the belly expands during this type of breathing.

This deep breathing is marked by expansion of the abdomen rather than the chest when breathing. It is a form of complementary and alternative treatment.

Diaphragmatic breathing is also known scientifically as eupnea, which is a natural and relaxed form of breathing in all mammals. Eupnea occurs in mammals whenever they are in a state of relaxation, i.e. when there is no clear and present danger in their environment.

According to the National Center for Complementary and Integrative Health, "12.7 percent of American adults [have] used deep-breathing exercises... for health purposes," which it describes as follows, "Deep breathing involves slow and deep inhalation through the nose, usually to a count of 10, followed by slow and complete exhalation for a similar count. The process may be repeated 5 to 10 times, several times a day."

According to the University of Texas Counseling and Mental Health Center, "Diaphragmatic breathing allows one to take normal breaths while maximizing the amount of oxygen that goes into the bloodstream. It is a way of interrupting the 'Fight or Flight' response and triggering the body's normal relaxation response." They provide a video demonstration.

Some practitioners of complementary and alternative medicine believe that particular kinds of breathing they identify as diaphragm breathing can be used to bring about health benefits.

Deep breathing exercises are sometimes used as a form of relaxation, that, when practiced regularly, may lead to the relief or prevention of symptoms commonly associated with stress, which may include high blood pressure, headaches, stomach conditions, depression, anxiety, and others.

Due to the lung expansion being lower (inferior) on the body as opposed to higher up (superior), it is referred to as 'deep' and the higher lung expansion of rib cage breathing is referred to as 'shallow'. The actual volume of air taken into the lungs with either means varies.

Hatha Yoga, tai chi and meditation traditions draw a clear distinction between diaphragmatic breathing and abdominal breathing or belly breathing. The more specific technique of diaphragmatic breathing is said to be more beneficial.

The use of diaphragmatic breathing is commonly practiced, especially in those patients with cardiopulmonary disease, to improve a variety of factors such as pulmonary function, cardiorespiratory fitness, posture, respiratory muscle length, and respiratory muscle strength. Specifically, diaphragmatic breathing exercise is essential to asthmatics since breathing in these patients is of the thoracic type in association with decreased chest expansion and chest deformity as a result of a deformed sternum like pectus excavatum (funnel chest); a shortened diaphragm, intercostal and accessory muscles from prolonged spasm causing stenosis of the major airways leading to an abnormal respiratory pattern.

➢ *Insert prepositions and conjunctions:* that is done ___ contracting the diaphragm; breathing is marked ___ expansion of the abdomen; is also known scientifically ___ eupnea; relaxed form of breathing ___ all mammals; danger ___ their environment; inhalation ____ the nose; practitioners ___ complementary and alternative medicine; used to bring ____ health benefits; it is referred ___ ___ 'deep'; volume of air taken ___ the lungs; a clear distinction ____ diaphragmatic breathing and abdominal breathing; patients ____ cardiopulmonary disease; essential to asthmatics; leading ____ an abnormal respiratory pattern.

➢ *Are the statements true or false?*

1. Diaphragmatic breathing is breathing that is done by contracting the diaphragm.
2. Air enters the lungs and the belly contracts during this diaphragmatic breathing.
3. Diaphragmatic breathing is marked by expansion of the chest rather than the abdomen when breathing.
4. Diaphragmatic breathing is also known scientifically as eupnea.
5. In traditional medicine it is believed that particular kinds of breathing they identify as diaphragm breathing can be used to bring about health benefits.
6. Deep breathing exercises may lead to the relief or prevention of symptoms commonly associated with stress.
7. Meditation traditions draw a clear distinction between diaphragmatic breathing and abdominal breathing or belly breathing.
8. The practitioners of Hatha Yoga believe that the more specific technique of diaphragmatic breathing is more beneficial.
9. The use of diaphragmatic breathing is commonly practiced to improve a variety of factors such as pulmonary function, cardiorespiratory fitness, respiratory muscle length, and respiratory muscle strength.
10. Diaphragmatic breathing exercise is useless for asthmatics.

➢ *Make a summary of the text.*

UNIT 4. DIGESTIVE SYSTEM

Lesson 11. Digestive System Physiology

Glossary.

turn into	превратиться в, становиться
repair	чинить, ремонтировать, налаживать
ingestion	проглатывание
enzyme	фермент
intake of food	прием пищи
orifice	отверстие
saliva	слюна
hydrochloric acid	соляная кислота
GI tract (gastrointestinal tract)	ЖКТ, желудочно-кишечный тракт
disassemble	разбирать на части
emulsify	превращаться в эмульсию, эмульгировать
globule	глобула, капля, шарик
peristalsis	перистальтика
chew	жевать, пережевывать
pancreatic juice	поджелудочный сок
nucleic acid	нуклеиновая кислота
duodenum	двенадцатиперстная кишка

➢ *Read and translate the text:*

The digestive system is responsible for taking whole foods and turning them into energy and nutrients to allow the body to function, grow, and repair itself (Figure 9). The six primary processes of the digestive system include:

1. Ingestion of food;
2. Secretion of fluids and digestive enzymes;
3. Mixing and movement of food and wastes through the body;
4. Digestion of food into smaller pieces;
5. Absorption of nutrients;
6. Excretion of wastes.

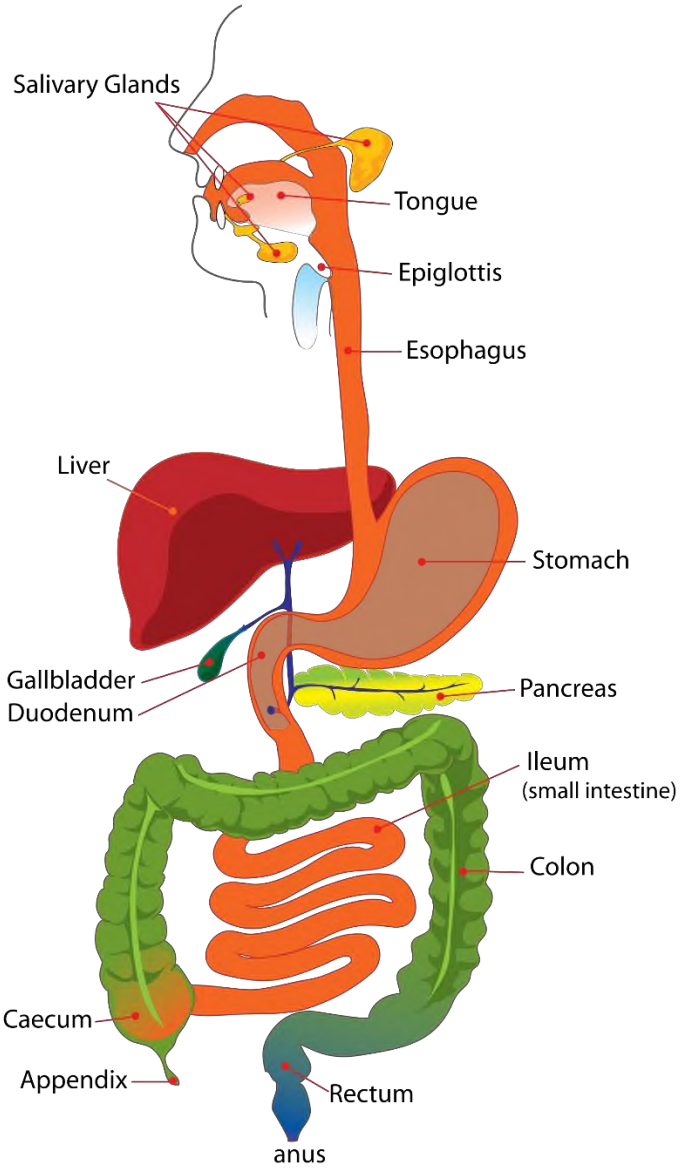

Figure 9. *The digestive system (http://anatomybody101.com).*

Ingestion.

The first function of the digestive system is ingestion, or the intake of food. The mouth is responsible for this function, as it is the orifice through which all food enters the body. The mouth and stomach are also responsible for the storage of food as it is waiting to be digested. This storage capacity allows the body to eat only a few times each day and to ingest more food than it can process at one time.

Secretion.

In the course of a day, the digestive system secretes around 7 liters of fluids. These fluids include saliva, mucus, hydrochloric acid, enzymes, and bile. Saliva moistens dry food and contains salivary amylase, a digestive enzyme that begins the digestion of carbohydrates. Mucus serves as a protective barrier and lubricant inside of the GI tract. Hydrochloric acid helps to digest food chemically and protects the body by killing bacteria present in our food. Enzymes are like tiny biochemical machines that disassemble large macromolecules like proteins, carbohydrates, and lipids into their smaller components. Finally, bile is used to emulsify large masses of lipids into tiny globules for easy digestion.

Mixing and Movement.

The digestive system uses 3 main processes to move and mix food:

Swallowing. Swallowing is the process of using smooth and skeletal muscles in the mouth, tongue, and pharynx to push food out of the mouth, through the pharynx, and into the esophagus.

Peristalsis. Peristalsis is a muscular wave that travels the length of the GI tract, moving partially digested food a short distance down the tract. It takes many waves of peristalsis for food to travel from the esophagus, through the stomach and intestines, and reach the end of the GI tract.

Segmentation. Segmentation occurs only in the small intestine as short segments of intestine contract like hands squeezing a toothpaste tube. Segmentation helps to increase the absorption of nutrients by mixing food and increasing its contact with the walls of the intestine.

Digestion.

Digestion is the process of turning large pieces of food into its component chemicals. Mechanical digestion is the physical breakdown of large pieces of food into smaller pieces. This mode of digestion begins with the chewing of food by the teeth and is continued through the muscular mixing of food by the stomach and intestines. Bile produced by the liver is also used to mechanically

break fats into smaller globules. While food is being mechanically digested it is also being chemically digested as larger and more complex molecules are being broken down into smaller molecules that are easier to absorb. Chemical digestion begins in the mouth with salivary amylase in saliva splitting complex carbohydrates into simple carbohydrates. The enzymes and acid in the stomach continue chemical digestion, but the bulk of chemical digestion takes place in the small intestine thanks to the action of the pancreas. The pancreas secretes an incredibly strong digestive cocktail known as pancreatic juice, which is capable of digesting lipids, carbohydrates, proteins and nucleic acids. By the time food has left the duodenum, it has been reduced to its chemical building blocks—fatty acids, amino acids, monosaccharides, and nucleotides.

Absorption.

Once food has been reduced to its building blocks, it is ready for the body to absorb. Absorption begins in the stomach with simple molecules like water and alcohol being absorbed directly into the bloodstream. Most absorption takes place in the walls of the small intestine, which are densely folded to maximize the surface area in contact with digested food. Small blood and lymphatic vessels in the intestinal wall pick up the molecules and carry them to the rest of the body. The large intestine is also involved in the absorption of water and vitamins B and K before feces leave the body.

Excretion.

The final function of the digestive system is the excretion of waste in a process known as defecation. Defecation removes indigestible substances from the body so that they do not accumulate inside the gut.

➢ *Fill in the gaps using the words:* digestion, food, intake, storage, absorb, absorption, blocks, complex, building, vessels, molecules, barrier.

1. The first function of the digestive system is ingestion, or the _____ of food.

2. The mouth and stomach are also responsible for the _____ of food as it is waiting to be digested.

3. Mucus serves as a protective _____ and lubricant inside of the GI tract.

4. Bile is used to emulsify large masses of lipids into tiny globules for easy _____.

5. The digestive system uses 3 main processes to move and mix _____.

6. While food is being mechanically digested it is also being chemically digested as larger and more _____ molecules are being broken down into smaller molecules that are easier to _____.

7. By the time food has left the duodenum, it has been reduced to its chemical _____ blocks—fatty acids, amino acids, monosaccharides, and nucleotides.

8. Once food has been reduced to its building _____, it is ready for the body to absorb.

9. Small blood and lymphatic _____ in the intestinal wall pick up the _____ and carry them to the rest of the body.

10. The large intestine is also involved in the _____ of water and vitamins B and K.

➢ *Give definitions to the following notions, using the text:*

– ingestion of food;
– secretion of fluids and digestive enzymes;
– digestion of food;
– mechanical digestion;
– chemical digestion;
– absorption of nutrients;
– swallowing;
– peristalsis;
– segmentation;
– enzymes.

➢ *Make a plan of the text.*

Lesson 12. The pharynx and Its Sections

Glossary.

conventionally	условно
nasopharynx	носоглотка
oropharynx	ротоглотка
laryngopharynx	гортаноглотка
vocalization	вокализация, применение голоса
pharyngeal muscles	глоточная мускулатура
lumen	просвет
soft palate	мягкое небо
internal nares	внутренние полости носа
pharyngeal tonsils	глоточные миндалины
congestion	заложенность
auditory tube	слуховая труба
ambient atmosphere	окружающая среда, внешняя атмосфера
uvula	язычок
hyoid bone	подъязычная кость
palatine tonsils	небные миндалины
epiglottis	надгортанник
pyriform sinus	грушевидные пазухи
pharyngeal wall	стенка глотки
innervate	иннервировать, возбуждать

➢ *Read and translate the text.*

The pharynx (plural: pharynges) is the part of the throat that is behind the mouth and nasal cavity and above the oesophagus and the larynx, or the tubes going down to the stomach and the lungs.

The pharynx is the part of the digestive system and also of the conducting zone of the respiratory system. The conducting zone also includes the nose, larynx, trachea, bronchi, and bronchioles, and their function is to filter, warm, and moisten air and conduct it into the lungs. The pharynx makes up the part of the throat situated immediately behind the nasal cavity, behind the mouth and above the esophagus and larynx. The human pharynx is conventionally divided into three sections: the nasopharynx, the oropharynx and the laryngopharynx. It is also important in vocalization (Figure 10).

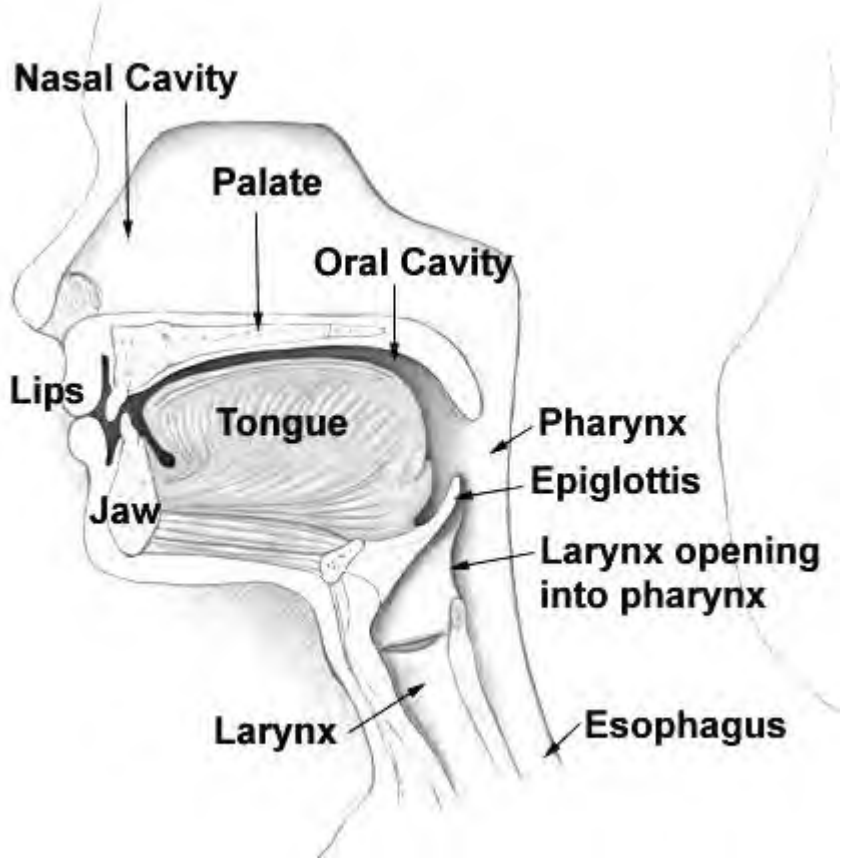

Figure 10. *The pharynx and its sections (http://slideplayer.com)*

There are two sets of pharyngeal muscles that form the pharynx, determining the shape of its lumen. These are arranged as an inner layer of longitudinal muscles and an outer circular layer.

The upper portion of the pharynx, the **nasopharynx**, extends from the base of the skull to the upper surface of the soft palate. It includes the space between the internal nares and the soft palate and lies above the oral cavity. The

adenoids, also known as the pharyngeal tonsils, are lymphoid tissue structures located in the posterior wall of the nasopharynx.

Polyps or mucus can obstruct the nasopharynx, as can congestion due to an upper respiratory infection. The auditory tube, which connect the middle ear to the pharynx, opens into the nasopharynx at the pharyngeal opening of the auditory tube. The opening and closing of the auditory tubes serves to equalize the barometric pressure in the middle ear with that of the ambient atmosphere.

The **oropharynx** lies behind the oral cavity, extending from the uvula to the level of the hyoid bone. It opens anteriorly into the mouth, while in its lateral wall, between the palatoglossal arch and the palatopharyngeal arch, is the palatine tonsil. The anterior wall consists of the base of the tongue and the epiglottic vallecula; the lateral wall is made up of the tonsil, tonsillar fossa, and tonsillar pillars; the superior wall consists of the inferior surface of the soft palate and the uvula. Because both food and air pass through the pharynx, a flap of connective tissue called the epiglottis closes over the glottis when food is swallowed to prevent aspiration. The oropharynx is lined by non-keratinised squamous stratified epithelium.

The **laryngopharynx**, also known as hypopharynx, is the caudal part of the pharynx; it is the part of the throat that connects to the esophagus. It lies inferior to the epiglottis and extends to the location where this common pathway diverges into the respiratory (larynx) and digestive (esophagus) pathways. At that point, the laryngopharynx is continuous with the esophagus posteriorly. The esophagus conducts food and fluids to the stomach; air enters the larynx anteriorly. During swallowing, food has the "right of way", and air passage temporarily stops. Corresponding roughly to the area located between the 4th and 6th cervical vertebrae, the superior boundary of the laryngopharynx is at the level of the hyoid bone. The laryngopharynx includes three major sites: the pyriform sinus, postcricoid area, and the posterior pharyngeal wall. Like the oropharynx above it, the laryngopharynx serves as a passageway for food and

air and is lined with a stratified squamous epithelium. It is innervated by the pharyngeal plexus.

➢ *Translate the following words and phrases into Russian*: pharynges, nasal cavity, conducting zone, to moisten air, to make up, inner layer, the base of the skull, lymphoid tissue structures, to obstruct, connective tissue, path-ways, posteriorly, swallowing, cervical vertebrae.

➢ *Answer the questions on the text.*

1. The pharynx is the part of the throat, isn't it?
2. The pharynx is the part of the digestive system, isn't it?
3. The pharynx is the part of the respiratory system, isn't it?
4. Where is the pharynx situated?
5. What are the functions of the pharynx?
6. What are the three conventional parts of the pharynx?
7. Is pharynx important in vocalization?
8. What are the characteristic features of the nasopharynx?
9. What are the characteristic features of the oropharynx?
10. What are the characteristic features of the laryngopharynx?

➢ *Make a plan of the text.*

Lesson 13. Esophagus, the Structure and Functions

Glossary.

peristaltic contractions	перистальтические сокращения
fibromuscular	фиброзно-мышечный
uppermost	верхний, самый верхний, высший
tilt	наклонять, опрокидывать; откидывать
bud	почка
mediastinum	средостение
cricoid cartilage	перстневидный хрящ
cardia of the stomach	кардия желудка

squamous	плоскоклеточный
muscularis	мышечный
mucosae	слизистые оболочки
submucosa	подслизистая оболочка
lamina propria	собственная пластинка
sphincter	сфинктер, запирательная мышца, сжиматель
bolus	кусок, комок (пищи), болюс

➢ *Read and translate the text.*

The esophagus (American English) or oesophagus (British English), commonly known as the food pipe or gullet, is an organ in vertebrates through which food passes, aided by peristaltic contractions, from the pharynx to the stomach. The esophagus is a fibromuscular tube, about 25 centimetres long in adults, which travels behind the trachea and heart, passes through the diaphragm and empties into the uppermost region of the stomach. During swallowing, the epiglottis tilts backwards to prevent food from going down the larynx and lungs.

The esophagus is one of the upper parts of the digestive system. There are taste buds on its upper part. It begins at the back of the mouth, passing downwards through the rear part of the mediastinum, through the diaphragm, and into the stomach. In humans, the esophagus generally starts around the level of the sixth cervical vertebra behind the cricoid cartilage of the trachea, enters the diaphragm at about the level of the tenth thoracic vertebra, and ends at the cardia of the stomach, at the level of the eleventh thoracic vertebra. The esophagus is usually about 25 cm (10 in) in length.

The human esophagus has a mucous membrane consisting of a tough stratified squamous epithelium without keratin and a muscularis mucosae. The epithelium of the esophagus has a relatively rapid turnover, and serves a protective function against the abrasive effects of food. There are two types of glands, with mucus-secreting esophageal glands being found in the submucosa, and esophageal cardiac glands, similar to cardiac glands of the stomach, located in

the lamina propria and most frequent in the terminal part of the organ. The mucus from the glands gives a good protection to the lining. The submucosa also contains the submucosal plexus, a network of nerve cells that is part of the enteric nervous system.

Functions of the esophagus.

- Swallowing.

Food is ingested through the mouth and when swallowed passes first into the pharynx and then into the esophagus. The esophagus is thus one of the first components of the digestive system and the gastrointestinal tract. After food passes through the esophagus, it enters the stomach. When food is being swallowed, the epiglottis moves backward to cover the larynx, preventing food from entering the trachea. At the same time, the upper esophageal sphincter relaxes, allowing a bolus of food to enter. Peristaltic contractions of the esophageal muscle push the food down the esophagus. These rhythmic contractions occur both as a reflex response to food that is in the mouth, and also as a response to the sensation of food within the esophagus itself. Along with peristalsis, the lower esophageal sphincter relaxes.

- Reducing gastric reflux.

The stomach produces gastric acid, a strongly acidic mixture consisting of hydrochloric acid (HCl) and potassium and sodium salts to enable food digestion. Constriction of the upper and lower esophageal sphincters help to prevent reflux (backflow) of gastric contents and acid into the esophagus, protecting the esophageal mucosa. In addition, the acute angle of His and the lower crura of the diaphragm helps this sphincteric action.

➢ *Translate the following words and phrases from English into Russian*: hydrochloric acid, potassium, sodium, gastric reflux, esophageal mucosa, gastrointestinal tract, reflex response, food pipe, gullet, the uppermost region of the stomach, taste buds, a mucous membrane, mucus-secreting esophageal glands, the terminal part.

➢ *Are the statements true or false?*

1. The esophagus is an organ through which food passes.
2. The esophagus is a fibromuscular tube about 10 centimetres long in adults.
3. There are taste buds along the esophagus.
4. The esophagus generally starts around the level of the eleventh thoracic vertebra.
5. There is only types of glands in the esophagus mucus-secreting esophageal glands.
6. The mucus from the glands gives a good protection to the lining.
7. Food is ingested through the mouth and when swallowed passes first into the esophagus and then into the pharynx.
8. The esophagus is one of the first components of the gastrointestinal tract.
9. The upper esophageal sphincter relaxes, allowing a bolus of food to enter.
10. Peristaltic contractions of the esophageal muscle push the food up the esophagus.

➢ *Write an abstract of the text.*

Lesson 14. Stomach- the food storage tank

Glossary.

hollow	полый, пустотелый
duodenum	двенадцатиперстная кишка
crescent-shaped	в форме полумесяца
ruga	морщина, складка
accommodate	размещать
grip	захватывать, сжимать
cardia	кардия
dome	купол
fundus	дно (органа)

funnel shaped	воронкообразной формы
pylorus	привратник желудка, пилорус
stretch	растягивать(ся)
overeating	переедание
chyme	химус, пищевая кашица
absorption	поглощение, абсорбция, всасывание
conversion	преобразование
subunit	субъединица
Gastric lipase	липаза желудка

➢ *Read and translate the text.*

The stomach is the main food storage tank of the body (Figure 11). If it were not for the stomach's storage capacity, we would have to eat constantly instead of just a few times each day. The stomach also secretes a mixture of acid, mucus, and digestive enzymes that helps to digest and sanitize our food while it is being stored.

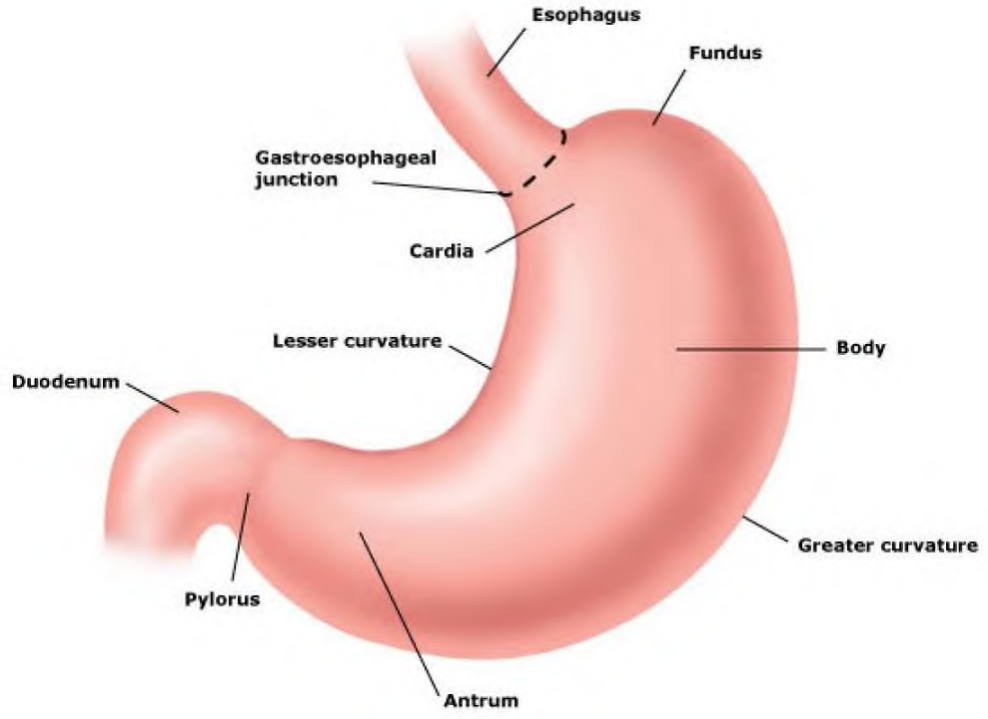

Figure 11. *The stomach is the main food storage tank of the body (http://www.days-eye.com)*

The stomach is a rounded, hollow organ located just inferior to the diaphragm in the left part of the abdominal cavity. Located between the esophagus and the duodenum, the stomach is a roughly crescent-shaped enlargement of the gastrointestinal tract. The inner layer of the stomach is full of wrinkles known as rugae (or gastric folds). Rugae both allow the stomach to stretch in order to accommodate large meals and help to grip and move food during digestion.

The stomach can be divided into four regions based on shape and function:

1. The esophagus connects to the stomach at a small region called the *cardia*. The cardia is a narrow, tube-like region that opens up into the wider regions of the stomach. Within the cardia is the lower esophageal sphincter, a band of muscle tissue that contracts to hold food and acid inside of the stomach.

2. The cardia empties into the *body* of the stomach, which forms the central and largest region of the stomach.

3. Superior to the body is a dome shaped region known as the *fundus*.

4. Inferior to the body is a funnel shaped region known as the *pylorus*. The pylorus connects the stomach to the duodenum and contains the pyloric sphincter. The pyloric sphincter controls the flow of partially digested food (known as *chyme*) out of the stomach and into the duodenum.

In the mouth, we chew and moisten solid food until it becomes a small mass known as a *bolus*. When we swallow each bolus, it then passes through the esophagus to the stomach where it is stored along with other boluses and liquids from the same meal.

The size of the stomach varies from person to person, but on average it can comfortably contain 1–2 liters of food and liquid during a meal. When stretched to its maximum capacity by a large meal or overeating, the stomach may hold up to 3–4 liters. Distention of the stomach to its maximum size makes

digestion difficult, as the stomach cannot easily contract to mix food properly and leads to feelings of discomfort.

After the stomach has been filled with food from a meal, it stores the food for about 1–2 hours. During this time, the stomach continues the digestive process that began in the mouth and allows the intestines, pancreas, gallbladder, and liver to prepare to complete the digestive process.

At the inferior end of the stomach, the pyloric sphincter controls the movement of food into the intestines. The pyloric sphincter is normally closed to keep food and stomach secretions within the stomach. Once chyme is ready to leave the stomach, the pyloric sphincter opens to allow a small amount of chyme to pass into the duodenum. This process, known as *gastric emptying*, slowly repeats over the 1–2 hours that food is stored in the stomach. The slow rate of gastric emptying helps to spread out the volume of chyme being released from the stomach and maximizes the digestion and absorption of nutrients in the intestines.

Digestion in the stomach can be divided into 2 classes: mechanical digestion and chemical digestion. Mechanical digestion is the physical division of a mass of food into smaller masses while chemical digestion is the chemical conversion of larger molecules into smaller molecules.

- The mixing action of the stomach walls allows mechanical digestion to occur in the stomach. The smooth muscles of the stomach produce contractions known as mixing waves that mix the boluses of food with gastric juice. This mixing leads to the production of the thick liquid known as chyme.
- While food is being physically mixed with gastric juice to produce chyme, the enzymes present in the gastric juice chemically digest large molecules into their smaller subunits. Gastric lipase splits triglyceride fats into fatty acids and diglycerides. Pepsin breaks proteins into smaller amino acids. The chemical digestion begun in the stomach will not be completed until chyme reaches the intestines, but the stomach prepares hard-to-digest proteins and fats for further digestion.

➢ *Insert prepositions and conjunctions:*

instead ____, located just inferior ____ the diaphragm, known ____ rugae, in order ____, divided ____, the esophagus connects ____ the stomach ____ a small region, empties ____ the body of the stomach, superior ____ the body of the stomach, inferior ____ the body of the stomach, it then passes ____ the esophagus ____ the stomach, ____ average, the stomach may hold ____ ____ 3-4 liters, to spread ____ the volume of chime, absorption ____ nutrients ____ the intestines.

➢ *Give definitions to the following notions using the text:*

– stomach;
– rugae of the stomach;
– cardia;
– body of the stomach;
– fundus of the stomach;
– pylorus;
– chyme;
– bolus;
– gastric emptying;
– mechanical digestion;
– chemical digestion.

➢ *Make a summary of the text.*

Lesson 15. Liver and Its Anatomy

Glossary.

traffic	движение, поток, трафик
hepatocyte	печеночная клетка, клетка печени, гепатоцит
bile duct	желчный проток

gland	железа
glandular	железистый
alkaline	щелочной
hepatic	печеночный
canaliculus (pl. canaliculi)	каналец
merge	соединять(ся), слияние
cystic duct	пузырный проток
portal vein	воротная вена
interconvert	взаимно превращаться
pyruvate	пируват
lactate	лактат, соль молочной кислоты
detergent	очищающее или моющее средство, детергент, слабительное
notably	в частности
senescent	стареющий, увядающий
bilirubin	билирубин
biliverdin	биливердин, зеленый желчный пигмент
breakdown	распад, разрушение, распределение
reticuloendothelial	ретикулоэндотелиальный
sieve	решето

➢ *Read and translate the text.*

The liver is a large organ positioned in the upper region of the abdominal cavity, below the diaphragm. Since most compounds absorbed by the intestine pass through the liver, it functions as a control center that integrates various metabolic processes, regulating the traffic of fuel molecules (such as, carbohydrates, fats, and proteins) used in energy metabolism.

Hepatocytes (liver cells) comprise about 60 percent of liver tissue; they participate in numerous metabolic and secretory functions. A second class of cells, called Kupffer cells, line the vascular networks; their primary role is to recycle red blood cells that are no longer functional. The liver is also shot through with bile ducts and blood vessels.

In the vertebrate body, the liver is the largest gland (i.e., a cell, tissue, or organ that excretes a chemical substance). One of its important glandular functions is the secretion of bile, an alkaline compound that aids in the digestion of lipids. Additional roles include the synthesis of blood-clotting factors (for example, blood proteins found in plasma); removal of waste and other toxic materials; and destruction of worn-out red blood cells.

The liver is the heaviest organ in the body: An adult human liver normally weighs between 1.7-3.0 kilograms (3.5-6.5 pounds). Soft, pinkish-brown, and boomerang-shaped, the liver is the second largest organ in the body (after the skin), and the largest internal organ.

Located on the right side of the upper abdomen below the diaphragm, the liver lies to the right of the stomach and makes a kind of bed for the gallbladder (which stores bile).

The liver is connected to two distinct blood supplies. The hepatic artery, which contributes about 25 percent of blood flow to the liver, conveys oxygenated blood to the liver. The other 60-80 percent comes from the portal vein, which transports nutrient-filled blood from the stomach and the intestines. At any given moment, the liver contains about one pint of blood or approximately 13 percent of the body's total blood supply.

The bile produced in the liver is collected in bile canaliculi, which merge to form bile ducts. Bile can either drain directly into the duodenum via the common bile duct, or it can be temporarily stored in the gallbladder via the cystic duct.

The central area where the common bile duct, portal vein, and hepatic artery enter the liver is called the *hilum* or *porta hepatis*. The duct, vein, and ar-

tery divide into left and right branches, and the portions of the liver supplied by these branches constitute the functional left and right lobes (Figure 12).

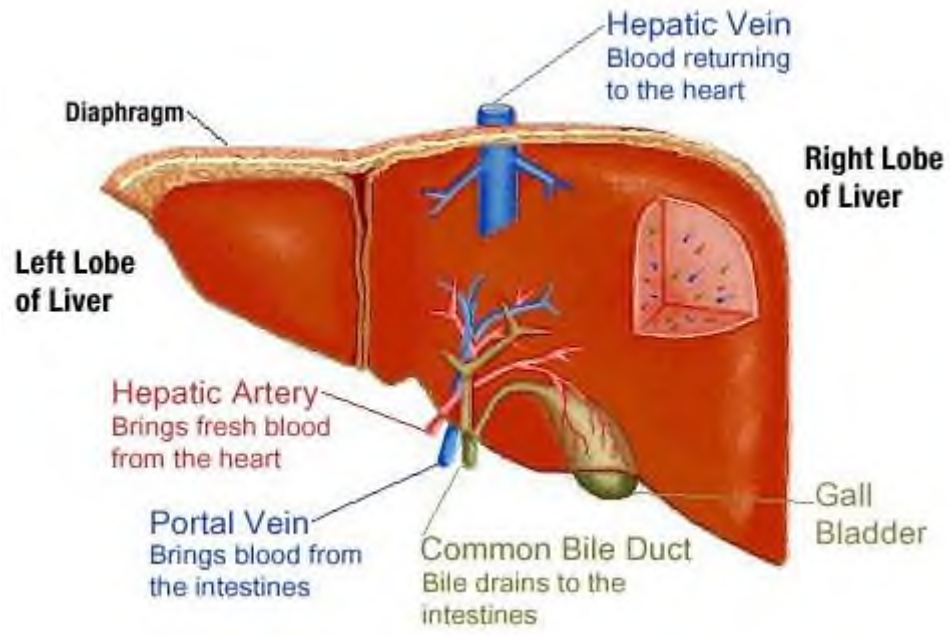

Figure 12. *The liver and its anatomy (http://desireeabecassis.com)*

The liver regulates the level of many metabolites in the blood.

The liver has the capacity to interconvert fuel molecules; for example, it can convert certain amino acids, and some other molecules like pyruvate and lactate, into glucose (a process called gluconeogenesis).

While the nutrient molecule glucose is abundant in the circulatory system, the liver can store it in the form of glycogen; when the available supply of glucose in the bloodstream diminishes, the liver returns glucose to the blood. Thus, the liver plays a crucial role in the regulation of blood glucose levels.

The liver also performs several roles in lipid metabolism, including cholesterol synthesis and the production of triglycerides (fats).

The liver secretes bile, a digestive fluid.

The liver produces and excretes bile, a greenish liquid that acts to some extent as a detergent, helping to emulsify fats (increasing surface area to help enzyme action), and thus aiding in their absorption in the small intestine. Bile also helps in the absorption of certain fat-soluble vitamins, notably vitamins A,D, E, and K.

Additional roles include detoxification and storage.

Other important functions performed by the liver include:

- The synthesis of plasma proteins from circulating amino acids. The liver produces the coagulation factors I (fibrinogen), II (prothrombin), V, VII, IX, X and XI, as well as protein C, protein S and antithrombin.
- The breakdown of hemoglobin from senescent (worn-out) red blood cells, creating metabolites that are added to bile as the pigments bilirubin and biliverdin.
- The breakdown of toxic substances and most medicinal products in a process called drug metabolism.
- The conversion of ammonia to urea.
- Storage of a multitude of substances, including glucose (in the form of glycogen), vitamin B12, iron, and copper.
- Immunological effects. The reticuloendothelial system of the liver contains many immunologically active cells, acting as a "sieve" for antigens carried to the liver via the portal system.

➢ *Make a plan of the text. Then speak on different functions of the liver.*

➢ *Translate the following words and phrases from English into Russian*: the upper region of the abdominal cavity, a control center, vascular network, glandular functions, blood-clotting factors, red blood cells, pinkish-brown, blood flow, oxygenated, bile ducts, the portions of the liver, amino acids, gluconeogenesis, blood glucose level, triglycerides, greenish, fat-soluble vitamins, fibrinogen, prothrombin, antithrombin, antigen.

Lesson 16. Functions of the Liver

Glossary

cancerous tumor	раковая опухоль
triangular	треугольный
descend	спуск, спускаться, сходить, происходить

caudate	хвостатый
quadrate	квадрат
hepatocyte	гепатоцит
cholecystokinin	холецистокини
emulsify	эмульсировать, делать эмульсию
Kupffer cells	Купфера клетки
heme	гем
stercobilin	стеркобилин
portal vein	воротная вена
converted	преобразованный, переделанный
gluconeogenesis	глюконеогенез
ammonia	аммиак
metabolize	метаболизировать, усваивать
inactive	неактивный, бездействующий, недействующий
albumin	альбумин
isotonic	изотонический
sinusoid	синусоид, синусоидальный
capturing	захват
worn-out	изношенный

➢ *Read and translate the text.*

Weighing in at around 3 pounds, the liver is the body's second largest organ; only the skin is larger and heavier. The liver performs many essential functions related to digestion, metabolism, immunity, and the storage of nutrients within the body. These functions make the liver a vital organ without which the tissues of the body would quickly die from lack of energy and nutrients. Fortunately, the liver has an incredible capacity for regeneration of dead or damaged tissues; it is capable of growing as quickly as a cancerous tumor to restore its normal size and function.

The liver is a roughly triangular organ that extends across the entire abdominal cavity just inferior to the diaphragm. Most of the liver's mass is located on the right side of the body where it descends inferiorly toward the right

kidney. The liver is made of very soft, pinkish-brown tissues encapsulated by a connective tissue capsule. This capsule is further covered and reinforced by the peritoneum of the abdominal cavity, which protects the liver and holds it in place within the abdomen.

The liver consists of 4 distinct lobes – the left, right, caudate, and quadrate lobes.

- The left and right lobes are the largest lobes and are separated by the falciform ligament. The right lobe is about 5 to 6 times larger than the tapered left lobe.
- The small caudate lobe extends from the posterior side of the right lobe and wraps around the inferior vena cava.
- The small quadrate lobe is inferior to the caudate lobe and extends from the posterior side of the right lobe and wraps around the gallbladder.

Digestion.

The liver plays an active role in the process of digestion through the production of bile. Bile is a mixture of water, bile salts, cholesterol, and the pigment bilirubin. Hepatocytes in the liver produce bile, which then passes through the bile ducts to be stored in the gallbladder. When food containing fats reaches the duodenum, the cells of the duodenum release the hormone cholecystokinin to stimulate the gallbladder to release bile. Bile travels through the bile ducts and is released into the duodenum where it emulsifies large masses of fat. The emulsification of fats by bile turns the large clumps of fat into smaller pieces that have more surface area and are therefore easier for the body to digest.

Bilirubin present in bile is a product of the liver's digestion of worn out red blood cells. Kupffer cells in the liver catch and destroy old, worn out red blood cells and pass their components on to hepatocytes. Hepatocytes metabolize hemoglobin, the red oxygen-carrying pigment of red blood cells, into the components *heme* and *globin*. Globin protein is further broken down and used as an energy source for the body. The iron-containing heme group cannot be

recycled by the body and is converted into the pigment bilirubin and added to bile to be excreted from the body. Bilirubin gives bile its distinctive greenish color. Intestinal bacteria further convert bilirubin into the brown pigment stercobilin, which gives feces their brown color.

Metabolism.

The hepatocytes of the liver are tasked with many of the important metabolic jobs that support the cells of the body. Because all of the blood leaving the digestive system passes through the hepatic portal vein, the liver is responsible for metabolizing carbohydrate, lipids, and proteins into biologically useful materials.

Our digestive system breaks down carbohydrates into the monosaccharide glucose, which cells use as a primary energy source. Blood entering the liver through the hepatic portal vein is extremely rich in glucose from digested food. Hepatocytes absorb much of this glucose and store it as the macromolecule glycogen, a branched polysaccharide that allows the hepatocytes to pack away large amounts of glucose and quickly release glucose between meals. The absorption and release of glucose by the hepatocytes helps to maintain homeostasis and protects the rest of the body from dangerous spikes and drops in the blood glucose level. Fatty acids in the blood passing through the liver are absorbed by hepatocytes and metabolized to produce energy in the form of ATP. Glycerol, another lipid component, is converted into glucose by hepatocytes through the process of gluconeogenesis. Hepatocytes can also produce lipids like cholesterol, phospholipids, and lipoproteins that are used by other cells throughout the body. Much of the cholesterol produced by hepatocytes gets excreted from the body as a component of bile.

Dietary proteins are broken down into their component amino acids by the digestive system before being passed on to the hepatic portal vein. Amino acids entering the liver require metabolic processing before they can be used as an energy source. Hepatocytes first remove the amine groups of the amino acids and convert them into ammonia and eventually urea. Urea is less toxic than

ammonia and can be excreted in urine as a waste product of digestion. The remaining parts of the amino acids can be broken down into ATP or converted into new glucose molecules through the process of gluconeogenesis.

Detoxification.

As blood from the digestive organs passes through the hepatic portal circulation, the hepatocytes of the liver monitor the contents of the blood and remove many potentially toxic substances before they can reach the rest of the body. Enzymes in hepatocytes metabolize many of these toxins such as alcohol and drugs into their inactive metabolites. And in order to keep hormone levels within homeostatic limits, the liver also metabolizes and removes from circulation hormones produced by the body's own glands.

Storage.

The liver provides storage of many essential nutrients, vitamins, and minerals obtained from blood passing through the hepatic portal system. Glucose is transported into hepatocytes under the influence of the hormone insulin and stored as the polysaccharide glycogen. Hepatocytes also absorb and store fatty acids from digested triglycerides. The storage of these nutrients allows the liver to maintain the homeostasis of blood glucose. Our liver also stores vitamins and minerals - such as vitamins A, D, E, K, and B12, and the minerals iron and copper - in order to provide a constant supply of these essential substances to the tissues of the body.

Production.

The liver is responsible for the production of several vital protein components of blood plasma: prothrombin, fibrinogen, and albumins. Prothrombin and fibrinogen proteins are coagulation factors involved in the formation of blood clots. Albumins are proteins that maintain the isotonic environment of the blood so that cells of the body do not gain or lose water in the presence of body fluids.

Immunity.

The liver functions as an organ of the immune system through the function of the Kupffer cells that line the sinusoids. Kupffer cells are a type of fixed macrophage that form part of the mononuclear phagocyte system along with macrophages in the spleen and lymph nodes. Kupffer cells play an important role by capturing and digesting bacteria, fungi, parasites, worn-out blood cells, and cellular debris. The large volume of blood passing through the hepatic portal system and the liver allows Kupffer cells to clean large volumes of blood very quickly.

➢ *Find the English equivalents for the following words and phrases:* обмен веществ, регенерация, холецистокинин, билирубин, гепатоцит, гемоглобин, пигмент, печеночный, углевод, жир, белок, моносахарид, глюкоза, гликоген, гомеостаз, глицерол, холестерин, фосфолипид, липопротеин, аминокислота, токсин, гормон, инсулин, триглицерид, железо, медь.

➢ *Answer the questions on the text.*

1. What is the largest organ of the body?
2. What is the weight of the liver?
3. What are the 4 lobes of the liver?
4. What role does the liver play in the process of digestion?
5. Why is the liver responsible for metabolizing carbohydrate, lipids, and proteins into biologically useful materials?
6. What is responsible for production of cholesterol, phospholipids, and lipoproteins?
7. How does the liver detoxify the blood?
8. What does the liver store?
9. What components of blood does the liver produce?
10. How does the liver function as an organ of the immune system?

➢ *Make a plan of the text on the topic:* “The liver is the only human internal organ that actually can regenerate itself to a significant extent”.

Lesson 17. Spleen: Anatomy and physiology

Glossary.

recycle	перерабатывать
antibody	антитело
reticuloendothelial	ретикулоэндотелиальной
whereby	в результате
underlies	лежать в основе
vent one's spleen	срывать свою злобу
predisposition	предрасположенность
measure	мера
mesenchyme	мезенхима
mesentery	брыжейка, мезентерий
granular	гранулированный, зернистый
splenic sinuses	селезеночные синусы
accessory	добавочный, дополнительный
junction	соединение, связка
splenic vessel	селезеночный сосуд
peritoneal	перитонеальный
ligament	связка
gastrolienal ligament	желудочно-селезеночная связка
lienorenal ligament	почечно- селезеночная связка
phrenicocolic ligament	опора селезёнки
splenomegaly	спленомегалия
malaria	малярия
sarcoidosis	саркоидоз

infectious mononucleosis	инфекционный мононуклеоз
blood count	анализ крови
assessment	оценка
Epstein-Barr virus	Вирус Эпштейн-Барра
cytomegalovirus	цитомегаловирус
Sickle-cell disease	Серповидно-клеточная анемия
asplenia	аспленизм
rupture	разрыв
hemorrhage	кровоизлияние

➢ *Read and translate the text.*

The spleen is a vascular lymphoid organ found in most vertebrates, normally close to the stomach in the abdominal cavity, and that functions in various activities related to the circulatory system and the immune system. The spleen is involved in filtering blood of foreign invaders and old red blood cells (erythrocytes), destruction of old red blood cells and recycling hemoglobin, storing blood and holding a reservoir of red blood cells, producing lymphocytes, sometimes serving as a center for forming red blood cells, and possibly forming antibodies. It is regarded as one of the centers of activity of the reticuloendothelial system (part of the immune system).

As with other parts of the body (cells, tissues, other organs, and organ systems), the spleen provides larger benefit to the body and likewise is dependent on other organs, as well as cells, tissues, and organ systems, for its own proper functioning. This principle whereby each body part provides some benefit to the whole and to other body parts, while also receiving benefit, underlies the complex coordination and harmony seen in organisms.

Until recently, the purpose of the spleen was not known. Historically, it was considered the seat of passion or emotion, and thus its expression in the modern English phrase "vent one's spleen."

It is increasingly recognized that its absence leads to a predisposition to certain infections.

The human spleen is located in the upper left part of the abdomen, behind the stomach and just below the diaphragm. In normal individuals, this organ measures about 125 by 75 by 50 millimeters (5 by 3 by 2 inches) in size, with an average weight of 150 grams.

The spleen is the largest organ derived from mesenchyme and lying in the mesentery. It consists of masses of lymphoid tissue of granular appearance located around fine terminal branches of veins and arteries. These vessels are connected by modified capillaries called splenic sinuses (Figure 13).

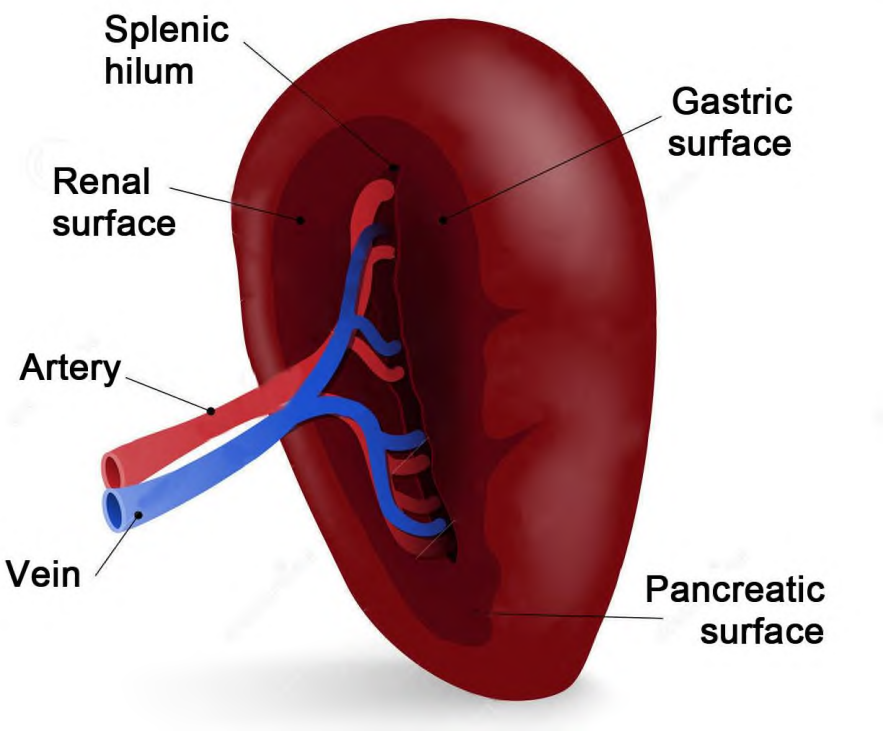

Figure 13. *The spleen is a vascular lymphoid organ (http://anatomystructure.net)*

Approximately ten percent of people have one or more accessory spleens. They may form near the hilum of the main spleen, the junction at which the splenic vessels enter and leave the organ.

There are several peritoneal ligaments that support the spleen:

– gastrolienal ligament (gastrosplenic) - connects stomach to spleen;

– lienorenal ligament (splenorenal) - connects spleen to kidney;

– phrenicocolic ligament - connects left colic flexure to the thoracic diaphragm.

Enlargement of the spleen is known as splenomegaly. It may be caused by malaria, sarcoidosis, infectious mononucleosis, bacterial endocarditis, leukemia, pernicious anemia, Gaucher's disease, leishmaniasis, or Hodgkin's disease. Splenomegaly diagnosis involves a complete blood count with differential, platelet count, and reticulocyte and atypical lymphocyte counts to exclude hemolytic anemia and leukemia. Assessment of IgM antibodies to viral capsid antigen (a rising titer) is indicated to confirm Epstein-Barr virus or cytomegalovirus. Other infections should be excluded if these tests are negative.

Sickle-cell disease can cause a functional asplenia (lack of normal spleen function) or autosplenectomy (when a disease causes lack of normal spleen function, as if removed surgically) by causing infarctions of the spleen during repeated sickle-cell crises.

The spleen may be removed surgically (known as a splenectomy), and indeed often is. For example, it may be removed following abdominal injuries with rupture and hemorrhage of the spleen, or in the treatment of certain blood diseases (Idiopathic thrombocytopenic purpura, hereditary spherocytosis, etc.), certain forms of lymphoma or for the removal of splenic tumors or cysts.

- *Insert prepositions and conjunctions:*

found ____ most vertebrates, related ____ the circulatory system, involved ____, serving ____ a center, regarded ____, benefit ____ the body, dependent ____ other organs, a predisposition ____ certain infections, ____ normal individuals, derived ____, connected ____ modified capillaries, connects stomach ____ spleen, caused ____, lack ____ normal spleen function.

- *Are the following statements are true or false?*

1. The spleen is a vascular lymphoid organ.
2. The spleen functions in various activities related to the circulatory system and the immune system.

3. The spleen is independent of other organs.
4. Historically, the spleen was considered the seat of wit.
5. It is considered that absence of the spleen leads to a predisposition to certain infections.
6. The spleen is the largest organ in the human organism.
7. Approximately ten percent of people have one or more accessory spleens.
8. Lienorenal ligament connects spleen to kidney.
9. Enlargement of the spleen is known as autosplenectomy.
10. Sickle-cell disease can cause a functional asplenia.

- *Make an abstract of the text.*

Lesson 18. Pancreas: Function, Location & Diseases

Glossary.

oblong	продолговатый
primary	основной
glucagon	глюкагон
store	хранить, сохранять, запасать
fatty acid	жирные кислоты
amino acid	аминокислоты
release	выпускать, освобождать
sufficient	достаточный
maintain	поддерживать
exocrine	экзокринный, внешнесекреторный
pancreatic juice	панкреатический сок; поджелудочный сок
taper	конус, уклон, конусообразный, заострять
uncinate	крючковатый, крючковидный
bend	сгибаться, наклоняться

underneath	под
pancreatitis	панкреатит
pancreatic cancer	рак поджелудочной железы
diabetes	сахарный диабет
Intense	интенсивный, напряженный, сильный
acute	острый
jaundice	желтуха
itchy skin	зуд кожи
cystic fibrosis	кистозный фиброз; муковисцидоз
autoimmune disorders	аутоиммунные нарушения

➢ *Read and translate the text.*

The pancreas is an abdominal organ that is located behind the stomach and is surrounded by other organs, including the spleen, liver and small intestine. The pancreas is about 6 inches (15.24 centimeters) long, oblong and flat. The pancreas plays an important role in digestion and in regulating blood sugar (*Figure 14*).

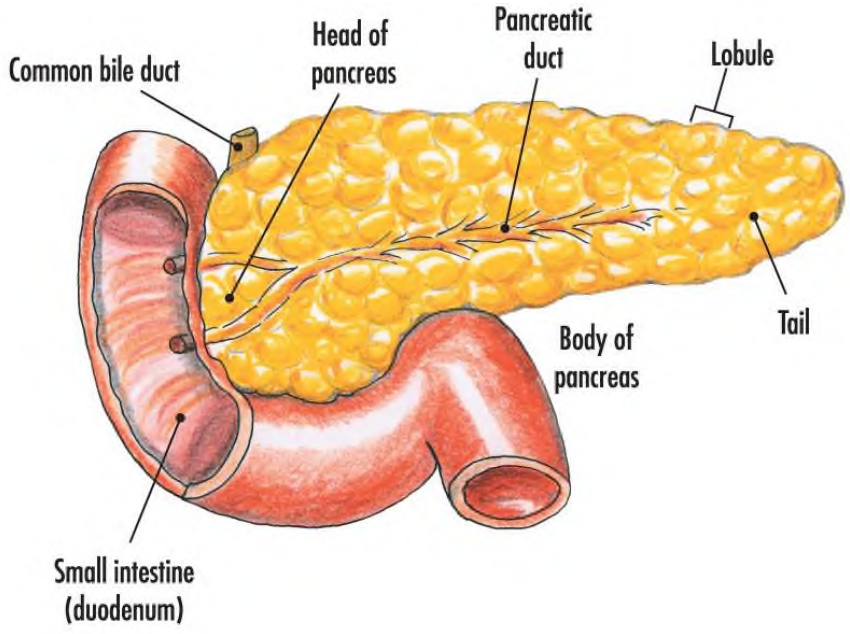

Figure 14. *The pancreas plays an important role in digestion (http://dxline.info/img/new_ail/the-pancreas_2.jpg)*

Function of the pancreas.

The pancreas serves two primary functions: it makes enzymes to digest proteins, fats, and carbs in the intestines and produces the hormones insulin and glucagon.

A well-known effect of insulin is to decrease the concentration of glucose in blood. This lowers blood sugar levels and allows the body's cells to use glucose for energy.

Insulin also allows glucose to enter muscle and other tissue, works with the liver to store glucose and synthesize fatty acids, and stimulates the uptake of amino acids. Insulin is released after eating protein and especially after eating carbohydrates, which increase glucose levels in the blood. If the pancreas does not produce sufficient insulin, type 1 diabetes will develop.

Unlike insulin, glucagon raises blood sugar levels. The combination of insulin and glucagon maintains the proper level of sugar in the blood.

The pancreas' second, exocrine function is to produce and release digestive fluids. After food enters the stomach, digestive enzymes called pancreatic juice travel through several small ducts to the main pancreatic duct and then to the bile duct. The bile duct takes the juice to the gallbladder, where it mixes with bile to aid in digestion.

Location of the pancreas.

The pancreas is located in the upper abdomen behind the stomach. The right end of the pancreas is wide and called the head. From the head, the organ tapers to the left. The middle sections are called the neck and body, while the narrow end on the left side of the body is called the tail.

The portion of the pancreas called the uncinate process bends backward from the head and underneath the body.

Diseases of the pancreas.

Three diseases associated with the pancreas are pancreatitis, pancreatic cancer and diabetes. Intense pancreatic pain is usually associated with acute pancreatitis. It can be hard to identify pancreas pain and evaluate pancreas dis-

eases because the organ sits deep in the abdomen. Other signs that the pain may be pancreatic include jaundice, itchy skin and unexplained weight loss. If you are experiencing pancreas pain, consult your doctor.

Chronic pancreatitis is a persistent inflammation (greater than three weeks) of the pancreas that causes permanent damage. Its causes may be cystic fibrosis, high levels of calcium or fat in the blood and autoimmune disorders. Symptoms include upper abdominal pain, nausea, vomiting, weight loss.

Chronic pancreatitis requires dietary modifications including a low-fat diet and cessation of alcohol intake and smoking. Chronic pancreatitis does not heal and tends to worsen with time.

There may be a link between chronic pancreatitis and pancreatic cancer. According to the University of California Los Angeles Center for Pancreatic Diseases, "Recent studies reveal a 2-5 times increase in the incidence of pancreatic cancer in patients with chronic pancreatitis from a variety of causes."

➢ *Find the English equivalents for the following words and phrases:* расположенный за желудком, включая, играть важную роль, сахар крови, пищеварительные соки, попадать в желудок, синтезировать, углеводы, сахарный диабет 1 типа, развиваться, признаки, необъяснимая потеря веса, хронический панкреатит, острый панкреатит, изменение диеты, ухудшаться, вылечивать, последние исследования, у пациентов, иметь тенденцию.

➢ *Read the statements. Find sentences in the text that can make them more extended.*

1. The pancreas is an abdominal organ that is located behind the stomach.
2. The pancreas is long, oblong and flat.
3. The pancreas serves two primary functions.
4. Insulin decreases the concentration of glucose in blood.
5. Glucagon raises blood sugar levels.
6. The pancreas produces and releases digestive fluids.

7. Three diseases associated with the pancreas.

8. Intense pancreatic pain is usually associated with acute pancreatitis.

9. Chronic pancreatitis is a persistent inflammation of the pancreas.

10. There may be a link between chronic pancreatitis and pancreatic cancer.

➢ *Write an essay on the topic:* "Insulin and glucagon in the human organism".

Lesson 19. Gallbladder and Bile

Glossary.

inferior	нижний, низший
posterior	задний, последующий
gallstone	камень в желчном пузыре
innermost	внутренний
microvillus (pl. microvilli)	микроворсинка
dilute	разбавленный, разведенный, ослабленный
lamina propria mucosae	собственная пластинка слизистой оболочки
anchor	закреплять
muscularis	мышечный
cystic duct	пузырный проток
reinforce	укреплять
serosa	серозная оболочка
slick	гладкий
peristalsis	перистальтика
cholecystokinin	холецистокинин
ampulla of Vater	фатерова ампула
merge	сливаться, соединяться, поглощать
pancreatic lipase	панкреатическая липаза
blockage	закупорка

cholecystitis	холецистит
jaundice	желтуха
life-threatening condition	угрожающее жизни состояние
cholecystectomy	холецистэктомия
removal	удаление

➢ *Read and translate the text.*

The gallbladder is a small storage organ located inferior and posterior to the liver. Though small in size, the gallbladder plays an important role in our digestion of food. The gallbladder holds bile produced in the liver until it is needed for digesting fatty foods in the duodenum of the small intestine. Bile in the gallbladder may crystallize and form gallstones, which can become painful and potentially life threatening.

Gross Anatomy.

Hollow, muscular and pear-shaped, the gallbladder is a small organ – only about 3 inches in length and 1.5 inches in width at its widest point. The larger end of the gallbladder extends inferiorly and to the right while the tapered end points superiorly and medially. The tapered end of the gallbladder narrows into a small bile duct known as the cystic duct. The cystic duct connects to the common hepatic duct that carries bile from the liver. These ducts merge to form the common bile duct that extends to the wall of the duodenum.

Microscopic Anatomy.

The mucosa, which forms the innermost layer of the gallbladder, lines the gallbladder with simple columnar epithelial tissue. The columnar epithelial tissue contains microvilli on its surface, increasing the surface area and allowing the lining to absorb water and concentrate the dilute bile.

Beneath the columnar tissue is a thin lamina propria layer made of connective tissue and capillaries that support and anchor the epithelial layer.

Deep to the lamina propria is the muscularis layer that contains smooth muscle tissue. Contraction of the muscularis pushes bile out of the gallbladder and into the cystic duct.

Surrounding the muscularis is a thin layer of fibrous connective tissue that helps to reinforce and strengthen the wall of the gallbladder.

Finally, the serosa forms the outermost layer of the gallbladder. The serosa is an epithelial layer that forms part of the peritoneum, or lining of the abdominal cavity. The serosa gives the gallbladder a smooth, slick surface to prevent friction between moving organs (Figure 15).

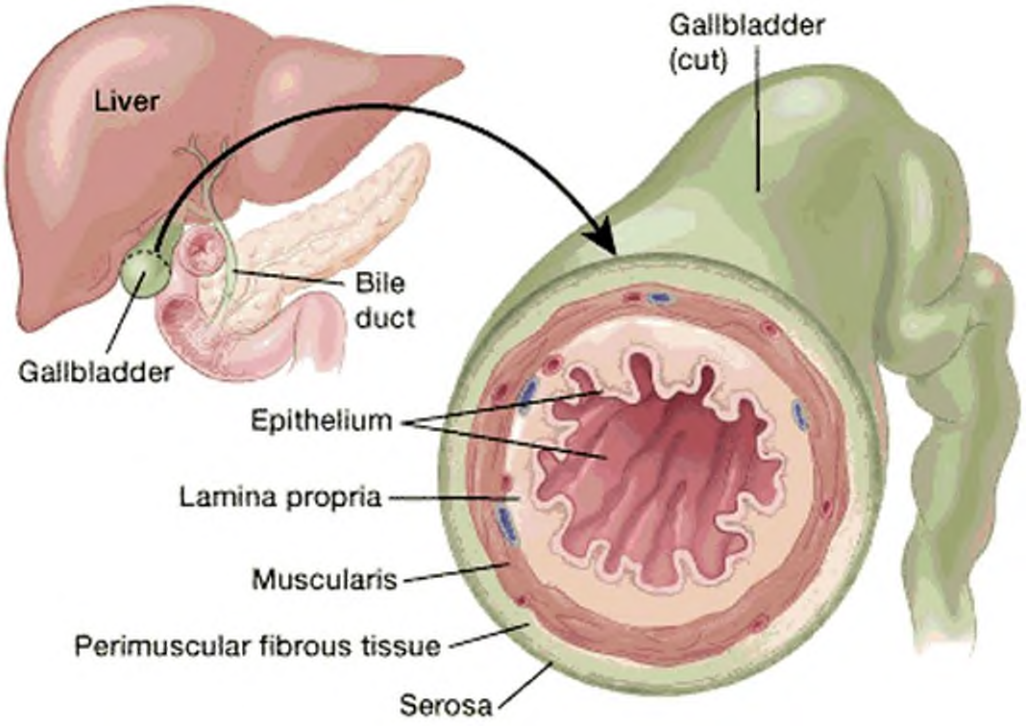

Figure 15. *The gallbladder: Microscopic Anatomy (https://healthjade.com)*

Physiology of gallbladder.

- *Storage.* The gallbladder acts as a storage vessel for bile produced by the liver. Bile is produced by hepatocytes cells in the liver and passes through the bile ducts to the cystic duct. From the cystic duct, bile is pushed into the gallbladder by peristalsis (muscle contractions that occur in orderly waves). Bile is then slowly concentrated by absorption of water through the walls of the

gallbladder. The gallbladder stores this concentrated bile until it is needed to digest the next meal.

- *Stimulation.* Foods rich in proteins or fats are more difficult for the body to digest when compared to carbohydrate-rich foods. The walls of the duodenum contain sensory receptors that monitor the chemical makeup of chyme (partially digested food) that passes through the pyloric sphincter into the duodenum. When these cells detect proteins or fats, they respond by producing the hormone cholecystokinin (CCK). CCK enters the bloodstream and travels to the gallbladder where it stimulates the smooth muscle tissue in the walls of the gallbladder.

- *Secretion*. When CCK reaches the gallbladder, it triggers the smooth muscle tissue in the muscularis layer of the gallbladder to contract. The contraction of smooth muscle forces bile out of the gallbladder and into the cystic duct. From the cystic duct, bile enters the common bile duct and flows into the ampulla of Vater, where the bile ducts merge with the pancreatic duct. Bile then flows from the ampulla of Vater into the duodenum where it breaks the fats into smaller masses for easier digestion by the enzyme pancreatic lipase.

Gallstones.

Gallstones are hard masses of bile salts, pigments, and cholesterol that develop within the gallbladder. These solid masses form when the components of bile crystallize. Growing slowly over many years as more crystallization occurs, gallstones may reach up to an inch in diameter.

Most gallstones remain in the gallbladder and are harmless, but they can be pushed out of the gallbladder along with bile and potentially block the neck of the gallbladder or one of the bile ducts. Blockage of the gallbladder or cystic duct may result in cholecystitis, a painful inflammation of the gallbladder. Even worse, blockage of the common bile duct may result in jaundice and liver damage, while blockage of the ampulla of Vater can lead to pancreatitis. Both liver damage and pancreatitis are potentially life-threatening conditions.

Gallstones are most often treated by a cholecystectomy, the surgical removal of the gallbladder.

➢ *Insert prepositions where necessary.*

posterior _____ the liver, small _____ size, holds_____ bile, needed _____ digesting _____ fatty foods, 1.5 inches _____ width _____ its widest point, connects _____ the common hepatic duct, extends _____ the wall _____ the duodenum, microvilli _____ its surface, made _____ connective tissue, anchor _____ the epithelial layer, deep _____ the lamina propria, pushes bile _____ _____ the gallbladder, a storage vessel _____ bile, bile is produced _____ hepatocytes cells _____ the liver, muscle contractions occur _____ orderly waves, foods rich _____ proteins, difficult _____ the body to digest, respond _____ producing the hormone cholecystokinin, smooth muscle tissue _____ the muscularis layer _____ the gallbladder, forces bile _____ _____ the gallbladder and _____ the cystic duct, gallstones may reach _____ _____ an inch _____ diameter.

➢ *Make the following statements more detailed using the text.*

1. The gallbladder is a small storage organ.
2. The gallbladder holds bile.
3. Bile in the gallbladder may crystallize and form gallstones.
4. The mucosa lines the gallbladder.
5. Bile is produced by hepatocytes cells.
6. Foods rich in proteins or fats are more difficult for the body to digest.
7. The contraction of smooth muscle forces bile out of the gallbladder and into the cystic duct.
8. Gallstones are hard masses of bile salts, pigments, and cholesterol.
9. Most gallstones remain in the gallbladder and are harmless.
10. Gallstones can be pushed out of the gallbladder along with bile and potentially block the neck of the gallbladder or one of the bile ducts.

➢ *Make a plan of the text.*

UNIT 5. IMMUNE SYSTEM

Lesson 20. The Defense system

Glossary.

comprise	включать, содержать, охватывать, заключать в себе
pathogen	возбудитель, патоген
distinguish	различать
humoral immunity	гуморальный иммунитет
cell-mediated immunity	клеточный иммунитет
evolve	развиваться, эволюционировать
unicellular	одноклеточные
bacteriophage	бактериофаг, бактериальный вирус
eukaryote	эукариот, эукариотный организм
descendant	потомок
antimicrobial peptides	антимикробные пептиды
acquire	приобретать, получать, овладевать
initial	начальный, первоначальный
enhance	повышать, усиливать, увеличивать
response	ответ
subsequent	последующие
encounter	встреча
inflammatory diseases	воспалительные заболевания
recurring	повторяющиеся
immunosuppressive medication	иммуносупрессивные лекарства
breach barriers	нарушать барьеры
innate immune system	врожденная иммунная система
retain	сохранять, удерживать

eliminate	устранять, исключать
mount	устанавливать, расти

➢ *Read and translate the text.*

The immune system is a host defense system comprising many biological structures and processes within an organism that protects against disease. To function properly, an immune system must detect a wide variety of agents, known as pathogens, from viruses to parasitic worms, and distinguish them from the organism's own healthy tissue. In many species, the immune system can be classified into subsystems, such as the innate immune system versus the adaptive immune system, or humoral immunity versus cell-mediated immunity. In humans, the blood–brain barrier, blood–cerebrospinal fluid barrier, and similar fluid–brain barriers separate the peripheral immune system from the neuroimmune system, which protects the brain.

Pathogens can rapidly evolve and adapt, and thereby avoid detection and neutralization by the immune system; however, multiple defense mechanisms have also evolved to recognize and neutralize pathogens. Even simple unicellular organisms such as bacteria possess a rudimentary immune system in the form of enzymes that protect against bacteriophage infections. Other basic immune mechanisms evolved in ancient eukaryotes and remain in their modern descendants, such as plants and invertebrates. These mechanisms include phagocytosis, antimicrobial peptides called defensins, and the complement system. Jawed vertebrates, including humans, have even more sophisticated defense mechanisms, including the ability to adapt over time to recognize specific pathogens more efficiently. Adaptive (or acquired) immunity creates immunological memory after an initial response to a specific pathogen, leading to an enhanced response to subsequent encounters with that same pathogen. This process of acquired immunity is the basis of vaccination.

Disorders of the immune system can result in autoimmune diseases, inflammatory diseases and cancer. Immunodeficiency occurs when the immune

system is less active than normal, resulting in recurring and life-threatening infections. In humans, immunodeficiency can either be the result of a genetic disease such as severe combined immunodeficiency, acquired conditions such as HIV/AIDS, or the use of immunosuppressive medication. In contrast, autoimmunity results from a hyperactive immune system attacking normal tissues as if they were foreign organisms. Common autoimmune diseases include Hashimoto's thyroiditis, rheumatoid arthritis, diabetes mellitus type 1, and systemic lupus erythematosus. Immunology covers the study of all aspects of the immune system.

The immune system protects organisms from infection with layered defenses of increasing specificity. In simple terms, physical barriers prevent pathogens such as bacteria and viruses from entering the organism. If a pathogen breaches these barriers, the innate immune system provides an immediate, but non-specific response. Innate immune systems are found in all plants and animals. If pathogens successfully evade the innate response, vertebrates possess a second layer of protection, the adaptive immune system, which is activated by the innate response. Here, the immune system adapts its response during an infection to improve its recognition of the pathogen. This improved response is then retained after the pathogen has been eliminated, in the form of an immunological memory, and allows the adaptive immune system to mount faster and stronger attacks each time this pathogen is encountered.

Both innate and adaptive immunity depend on the ability of the immune system to distinguish between self and non-self molecules. In immunology, self molecules are those components of an organism's body that can be distinguished from foreign substances by the immune system. Conversely, non-self molecules are those recognized as foreign molecules. One class of non-self molecules are called antigens (short for antibody generators) and are defined as substances that bind to specific immune receptors and elicit an immune response (Figure 16).

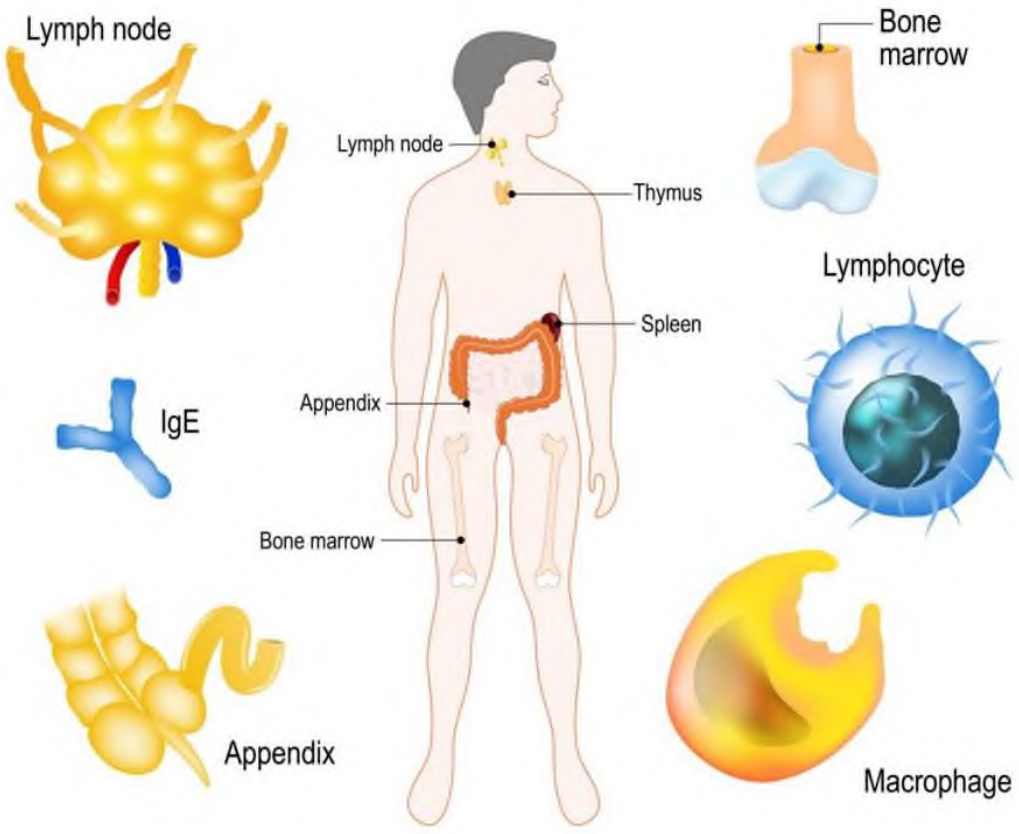

Figure 16. *The immune system (https://media.istockphoto.com)*

➢ *Find the English equivalents for the following words and phrases:* система обороны, биологические структуры, защищать от болезней, должным образом, паразитические черви, гуморальный иммунитет, периферическая иммунная система, нейтрализация, иммунные механизмы, древний, современный, сложный, иммунологическая память, расстройства, аутоиммунные заболевания, иммунодефицит, генетическое заболевание, ВИЧ/СПИД, многоуровневая защита, неспецифический ответ, распознавание патогена.

➢ *Answer questions on the text.*

1. What is the immune system?
2. How does the immune system function?
3. What are the subclasses of the immune system in humans?
4. Can pathogens avoid detection and neutralization by the immune system?
5. Do bacteria possess an immune system?

6. What process of acquired immunity is the basis of vaccination?
7. What diseases can be caused by immune system disorders?
8. Can immunodeficiency be the result of a genetic disease?
9. Does autoimmunity result from a hyperactive immune system?
10. How does the immune system protect organisms from infection with layered defenses?

➢ *Make a summary of the text.*

Lesson 21. Innate immune system

Glossary.

pattern	шаблон, образец
conserve	сохранять, сберегать
host	хозяин
eject	выбрасывать, изгонять
irritant	раздражающий
flushing	смывающий, очищающий
expel	выгонять
lysozyme	лизоцим
commensal flora	комменсальная флора
target	цель, целиться
microbial population	популяция микробов
bowel	кишечник
post-surgical infection	послеоперационная инфекция
swelling	отек
eicosanoids	эйкозаноиды
cytokines	цитокины
dilation	дилатация, расширение, растяжение
recruit	набирать

complement	дополнять
cascade	каскад, ступень
amplification	усиление
sequential	последовательный
proteolytic	протеолитический
protease	протеаза
dendritic cell	дендритная клетка
engulf	поглощать, заваливать
vesicle	везикул, пузырек, полость
versatile	универсальный, разносторонний
reside	проживать, населять
scavenger	сборщик, мусорщик
tumor	опухоль
histocompatibility	гистосовместимость, тканевая совместимость
viral infection	вирусная инфекция

➢ *Read and translate the text.*

Microorganisms or toxins that successfully enter an organism encounter the cells and mechanisms of the innate immune system. The innate response is usually triggered when microbes are identified by pattern recognition receptors, which recognize components that are conserved among broad groups of micro-organisms, or when damaged, injured or stressed cells send out alarm signals, many of which (but not all) are recognized by the same receptors as those that recognize pathogens. Innate immune defenses are non-specific, meaning these systems respond to pathogens in a generic way. This system does not confer long-lasting immunity against a pathogen. The innate immune system is the dominant system of host defense in most organisms.

Surface barriers.

Several barriers protect organisms from infection, including mechanical, chemical, and biological barriers. The waxy cuticle of many leaves, the exoskeleton of insects, the shells and membranes of externally deposited eggs, and skin are examples of mechanical barriers that are the first line of defense against infection. However, as organisms cannot be completely sealed from their environments, other systems act to protect body openings such as the lungs, intestines, and the genitourinary tract. In the lungs, coughing and sneezing mechanically eject pathogens and other irritants from the respiratory tract. The flushing action of tears and urine also mechanically expels pathogens, while mucus secreted by the respiratory and gastrointestinal tract serves to trap and entangle microorganisms.

Chemical barriers also protect against infection. The skin and respiratory tract secrete antimicrobial peptides such as the β-defensins. Enzymes such as lysozyme and phospholipase A2 in saliva, tears, and breast milk are also antibacterials. In the stomach, gastric acid and proteases serve as powerful chemical defenses against ingested pathogens.

Within the genitourinary and gastrointestinal tracts, commensal flora serves as biological barriers by competing with pathogenic bacteria for food and space and, in some cases, by changing the conditions in their environment, such as pH or available iron. As a result of the symbiotic relationship between commensals and the immune system, the probability that pathogens will reach sufficient numbers to cause illness is reduced. However, since most antibiotics non-specifically target bacteria and do not affect fungi, oral antibiotics can lead to an "overgrowth" of fungi. There is good evidence that re-introduction of probiotic flora, such as pure cultures of the lactobacilli normally found in unpasteurized yogurt, helps restore a healthy balance of microbial populations in intestinal infections in children and encouraging preliminary data in studies on bacterial gastroenteritis, inflammatory bowel diseases, urinary tract infection and post-surgical infections.

Inflammation.

Inflammation is one of the first responses of the immune system to infection. The symptoms of inflammation are redness, swelling, heat, and pain, which are caused by increased blood flow into tissue. Inflammation is produced by eicosanoids and cytokines, which are released by injured or infected cells. Eicosanoids include prostaglandins that produce fever and the dilation of blood vessels associated with inflammation, and leukotrienes that attract certain white blood cells (leukocytes). Common cytokines include interleukins that are responsible for communication between white blood cells; chemokines that promote chemotaxis; and interferons that have anti-viral effects, such as shutting down protein synthesis in the host cell. Growth factors and cytotoxic factors may also be released. These cytokines and other chemicals recruit immune cells to the site of infection and promote healing of any damaged tissue following the removal of pathogens.

Complement system.

The complement system is a biochemical cascade that attacks the surfaces of foreign cells. It contains over 20 different proteins and is named for its ability to "complement" the killing of pathogens by antibodies. Complement is the major humoral component of the innate immune response. Many species have complement systems, including non-mammals like plants, fish, and some invertebrates.

In humans, this response is activated by complement binding to antibodies that have attached to these microbes or the binding of complement proteins to carbohydrates on the surfaces of microbes. This recognition signal triggers a rapid killing response. The speed of the response is a result of signal amplification that occurs following sequential proteolytic activation of complement molecules, which are also proteases. After complement proteins initially bind to the microbe, they activate their protease activity, which in turn activates other complement proteases, and so on. This produces a catalytic cascade that amplifies the initial signal by controlled positive feedback. The cascade results in the

production of peptides that attract immune cells, increase vascular permeability, and opsonize (coat) the surface of a pathogen, marking it for destruction. This deposition of complement can also kill cells directly by disrupting their plasma membrane.

Cellular barriers.

A scanning electron microscope image of normal circulating human blood. One can see red blood cells, several knobby white blood cells including lymphocytes, a monocyte, a neutrophil, and many small disc-shaped platelets (Figure 17).

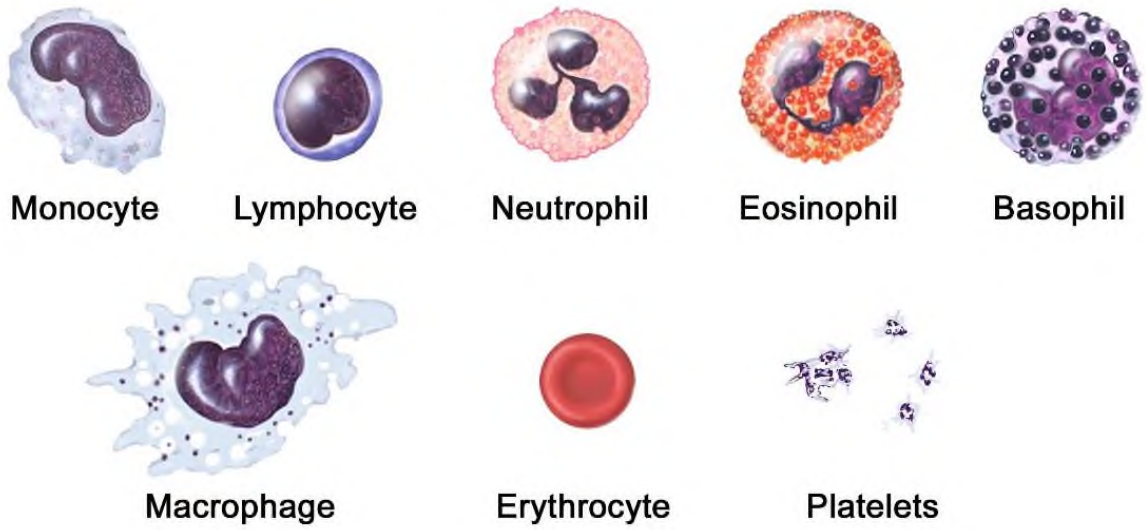

Figure 17. *Blood cells defensing an organism (https://www.cancer.gov)*

Leukocytes (white blood cells) act like independent, single-celled organisms and are the second arm of the innate immune system. The innate leukocytes include the phagocytes (macrophages, neutrophils, and dendritic cells), innate lymphoid cells, mast cells, eosinophils, basophils, and natural killer cells. These cells identify and eliminate pathogens, either by attacking larger pathogens through contact or by engulfing and then killing microorganisms. Innate cells are also important mediators in lymphoid organ development and the activation of the adaptive immune system.

Phagocytosis is an important feature of cellular innate immunity performed by cells called 'phagocytes' that engulf, or eat, pathogens or particles.

Phagocytes generally patrol the body searching for pathogens, but can be called to specific locations by cytokines. Once a pathogen has been engulfed by a phagocyte, it becomes trapped in an intracellular vesicle called a phagosome, which subsequently fuses with another vesicle called a lysosome to form a phagolysosome. The pathogen is killed by the activity of digestive enzymes or following a respiratory burst that releases free radicals into the phagolysosome. Phagocytosis evolved as a means of acquiring nutrients, but this role was extended in phagocytes to include engulfment of pathogens as a defense mechanism. Phagocytosis probably represents the oldest form of host defense, as phagocytes have been identified in both vertebrate and invertebrate animals.

Neutrophils and macrophages are phagocytes that travel throughout the body in pursuit of invading pathogens. Neutrophils are normally found in the bloodstream and are the most abundant type of phagocyte, normally representing 50 % to 60 % of the total circulating leukocytes. During the acute phase of inflammation, particularly as a result of bacterial infection, neutrophils migrate toward the site of inflammation in a process called chemotaxis, and are usually the first cells to arrive at the scene of infection. Macrophages are versatile cells that reside within tissues and: produce a wide array of chemicals including enzymes, complement proteins, and cytokines, while they can also act as scavengers that rid the body of worn-out cells and other debris, and as antigen-presenting cells that activate the adaptive immune system.

Dendritic cells (DC) are phagocytes in tissues that are in contact with the external environment; therefore, they are located mainly in the skin, nose, lungs, stomach, and intestines. They are named for their resemblance to neuronal dendrites, as both have many spine-like projections, but dendritic cells are in no way connected to the nervous system. Dendritic cells serve as a link between the bodily tissues and the innate and adaptive immune systems, as they present antigens to T cells, one of the key cell types of the adaptive immune system.

Mast cells reside in connective tissues and mucous membranes, and regulate the inflammatory response. They are most often associated with allergy and anaphylaxis. Basophils and eosinophils are related to neutrophils. They secrete chemical mediators that are involved in defending against parasites and play a role in allergic reactions, such as asthma. Natural killer (NK cells) cells are leukocytes that attack and destroy tumor cells, or cells that have been infected by viruses.

Natural killer cells.

Natural killer cells, or NK cells, are a component of the innate immune system which does not directly attack invading microbes. Rather, NK cells destroy compromised host cells, such as tumor cells or virus-infected cells, recognizing such cells by a condition known as "missing self." This term describes cells with low levels of a cell-surface marker called MHC I (major histocompatibility complex) – a situation that can arise in viral infections of host cells. They were named "natural killer" because of the initial notion that they do not require activation in order to kill cells that are "missing self." For many years it was unclear how NK cells recognize tumor cells and infected cells. It is now known that the MHC makeup on the surface of those cells is altered and the NK cells become activated through recognition of "missing self". Normal body cells are not recognized and attacked by NK cells because they express intact self MHC antigens. Those MHC antigens are recognized by killer cell immunoglobulin receptors (KIR) which essentially put the brakes on NK cells.

➢ *Make a scheme of the barriers that protect the human organism from infection. Mark the most important features of the barriers.*

➢ *Are the following statements true or false?*

1. Microorganisms or toxins that successfully enter an organism encounter the mechanisms of the innate immune system.
2. Organisms can be completely sealed from their environments.
3. Tears can mechanically expels pathogens.

4. Oral antibiotics can lead to an "overgrowth" of bacteria.
5. Lysozyme is contained in saliva, tears, and breast milk.
6. Inflammation is one of the first responses of the immune system to infection.
7. The complement system is a biochemical cascade that attacks the surfaces of host cells.
8. Innate cells are also important mediators in lymphoid organ development and the activation of the adaptive immune system.
9. Neutrophils are macrophages that travel throughout the body in pursuit of invading pathogens.
10. Basophils and eosinophils secrete chemical mediators that are involved in defending against parasites and play a role in allergic reactions.

Lesson 22. Adaptive Immune System

Glossary.

adaptive immune system	адаптивная иммунная система, приобретенный иммунитет
immune response	иммунный ответ
tailor	приспосабливать; предназначать для определённой цели
maintain	поддерживать
eliminate	устранять, удалять
B cells	В-клетки
T cells	Т-клетки
derive	получать, выводить, происходить, извлекать
hematopoietic	кроветворный
stem cell	стволоая клетка
bone marrow	костный мозг
humoral	гуморальный

cell-mediated	клеточно-опосредованный
subtype	подтип
killer T cell	Т-киллеры
modulate	модулировать, понижать частоту
couple	пара
minor	незначительный, малый
intact	нетронутый
antigen processing	обработка антигена
lineage	происхождение
tightly	плотно
cytotoxic activity	цитотоксическая активность
matching	соответствие, соответствующий
release	освобождение, выпускать, отпускать
offspring	потомство
interfere	вмешиваться

➢ *Read and translate.*

The adaptive immune system evolved in early vertebrates and allows for a stronger immune response as well as immunological memory, where each pathogen is "remembered" by a signature antigen. The adaptive immune response is antigen-specific and requires the recognition of specific "non-self" antigens during a process called antigen presentation. Antigen specificity allows for the generation of responses that are tailored to specific pathogens or pathogen-infected cells. The ability to mount these tailored responses is maintained in the body by "memory cells". Should a pathogen infect the body more than once, these specific memory cells are used to quickly eliminate it.

Lymphocytes. The cells of the adaptive immune system are special types of leukocytes, called lymphocytes. B cells and T cells are the major types of

lymphocytes and are derived from hematopoietic stem cells in the bone marrow. B cells are involved in the humoral immune response, whereas T cells are involved in cell-mediated immune response.

Both B cells and T cells carry receptor molecules that recognize specific targets. T cells recognize a "non-self" target, such as a pathogen, only after antigens (small fragments of the pathogen) have been processed and presented in combination with a "self" receptor called a major histocompatibility complex (MHC) molecule. There are two major subtypes of T cells: the killer T cell and the helper T cell. In addition there are regulatory T cells which have a role in modulating immune response. Killer T cells only recognize antigens coupled to Class I MHC molecules, while helper T cells and regulatory T cells only recognize antigens coupled to Class II MHC molecules. These two mechanisms of antigen presentation reflect the different roles of the two types of T cell. A third, minor subtype are the γδ T cells that recognize intact antigens that are not bound to MHC receptors.

In contrast, the B cell antigen-specific receptor is an antibody molecule on the B cell surface, and recognizes whole pathogens without any need for antigen processing. Each lineage of B cell expresses a different antibody, so the complete set of B cell antigen receptors represent all the antibodies that the body can manufacture.

Killer T cells.

Killer T cells are a sub-group of T cells that kill cells that are infected with viruses (and other pathogens), or are otherwise damaged or dysfunctional. As with B cells, each type of T cell recognizes a different antigen. Killer T cells are activated when their T cell receptor (TCR) binds to this specific antigen in a complex with the MHC Class I receptor of another cell. T cell activation is tightly controlled and generally requires a very strong MHC/antigen activation signal, or additional activation signals provided by "helper" T cells.

Helper T cells.

Helper T cells regulate both the innate and adaptive immune responses and help determine which immune responses the body makes to a particular pathogen. These cells have no cytotoxic activity and do not kill infected cells or clear pathogens directly. They instead control the immune response by directing other cells to perform these tasks.

B lymphocytes and antibodies.

A B cell identifies pathogens when antibodies on its surface bind to a specific foreign antigen. This antigen/antibody complex is taken up by the B cell and processed by proteolysis into peptides. The B cell then displays these antigenic peptides on its surface MHC class II molecules. This combination of MHC and antigen attracts a matching helper T cell, which releases lymphokines and activates the B cell. As the activated B cell then begins to divide, its offspring (plasma cells) secrete millions of copies of the antibody that recognizes this antigen. These antibodies circulate in blood plasma and lymph, bind to pathogens expressing the antigen and mark them for destruction by complement activation or for uptake and destruction by phagocytes. Antibodies can also neutralize challenges directly, by binding to bacterial toxins or by interfering with the receptors that viruses and bacteria use to infect cells.

➢ *Insert prepositions where necessary:*

allows _____ a stronger immune response; requires _____ the recognition; antigen specificity allows _____ the generation _____ responses; the adaptive immune system evolved _____ early vertebrates; tailored _____ specific pathogens; major types _____ lymphocytes; derived _____ hematopoietic stem cells _____ the bone marrow; bound _____ MHC receptors; _____ contrast; need _____ antigen processing each type _____ T cell; antibodies _____ its surface bind _____ a specific foreign antigen; binding _____ bacterial toxins; interfering _____ the receptors.

➢ *Make the following statements more detailed using the text.*

1. The adaptive immune response is antigen-specific.
2. Antigen specificity allows for the generation of responses.
3. The cells of the adaptive immune system are special types of leukocytes.
4. B cells and T cells are the major types of lymphocytes.
5. B cells are involved in the humoral immune response.
6. T cells are involved in cell-mediated immune response.
7. There are two major subtypes of T cells.
8. Killer T cells are a sub-group of T cells.
9. Helper T cells regulate both the innate and adaptive immune responses.
10. A B cell identifies pathogens.

➢ *Make a plan of the text.*

Lesson 23. Antibodies. Their functions and types

Glossary.

antibody	антитело
interchangeable	взаимозаменяемый
diversity	разнообразие, многообразие, различие
differentiate	дифференцировать, отличный
stunning	потрясающий, ошеломляющий, великолепный
sacrifice	жертва, жертвовать
refer	относиться, ссылаться, обращаться
bind	связывать, привязывать
primary	основной, первоначальный
exert	прилагать
isotype	изотип
monomeric	мономерный

chain	цепь
fetus	плод
complement	дополнение, комплект, дополнять
opsonization	опсонизация
opsonin	опсонин
mature	зрелый
currently	в настоящее время, теперь
hypersensitivity	гиперчувствительность
labile	лабильный, неустойчивый, колеблющийся

➢ *Read and translate the text.*

An antibody, or immunoglobulin, is a Y- shaped protein used by the immune system to identify and neutralize foreign pathogens, like bacteria, parasites, and viruses (Figure 18). The terms antibody and immunoglobulin generally are used interchangeably.

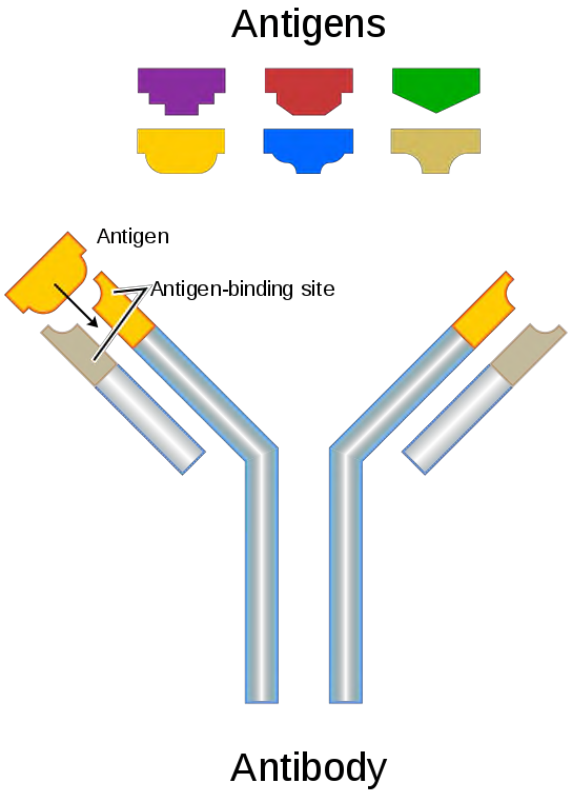

Figure 18. *Schematic of antibody binding to an antigen (https://upload.wikimedia.org)*

The immune system can recognize and defend against a great number and diversity of invading organisms. Indeed, the immune system is capable of recognizing millions of molecular features, and when working properly differentiates between foreign invaders, which are to be neutralized, and parts of the body, which should not be attacked.

The antibody-based immune system represents a stunning harmony between an antigen and the antibody that is produced for that specific antigen. As well, it reflects the principle of dual purposes, whereby an antibody's individual purpose harmonizes with the higher purpose of neutralizing foreign invaders and protection of the body, sacrificing itself in the fulfillment of that task.

Production of antibodies and associated processes are referred to as the humoral immune system. The humoral immune response is one of two main mechanisms of the immune system; the other being the cell-mediated immune system, involving T cells.

Antibodies actually are synthesized and secreted by plasma cells that are derived from the B cells of the immune system. B cells are activated upon binding to their specific antigen and multiply and transform into plasma cells.

Antibodies have two primary functions:

They bind antigens.

They combine with different immunoglobulin receptors specific for them and exert effector functions. These receptors are isotype-specific, which gives great flexibility to the immune system, because different situations require only certain immune mechanisms to respond to antigens.

According to differences in their heavy chain constant domains (γ, α, μ, δ, and ε), immunoglobulins are grouped into five classes, or isotypes: IgG, IgA, IgM, IgD, and IgE. Ig is short for immunoglobulin.

IgG is a monomeric immunoglobulin, built of two heavy chains γ and two light chains. Each molecule has two antigen binding sites. It is the most abundant immunoglobulin (75 percent of the plasma antibody in adults) and is approximately equally distributed in blood and in tissue liquids. IgG is the only

isotype that can pass through the placenta, thereby providing protection to the fetus in its first weeks of life before its own immune system has developed.

IgG can bind to many kinds of pathogens, like viruses, bacterium, and fungi. It protects the body against such pathogens by complement activation, opsonization for phagocytosis (engulfing and absorbing of waste materials), and neutralization of their toxins.

IgA represents about 15 percent to 20 percent of immunoglobulins in the blood; however, it is primarily found in external secretions of the body.

IgA immunoglobulin helps to fight against pathogens that contact the body surface, are ingested, or are inhaled. It does not activate complement, but does weakly activate opsonins, which are proteins that coat pathogens and make them more visible targets to the immune system.

IgM is associated with the antibodies that react to blood group antigens and is therefore involved in the primary immune response. The primary immune response occurs when the body is exposed to a certain pathogen for the first time.

IgD makes up about 1 percent of proteins in the plasma membranes of mature naive B-lymphocytes, which are cells that have yet to encounter antigen. IgD's function is currently unknown. It may function as a regulatory antigen receptor.

IgE is a monomeric immunoglobulin with the heavy chain ε. IgE plays a role in immediate hypersensitivity and allergeric reactions. When IgE combines with with mast cell receptors and antigen, mast cell degranulation results with the release of histamine. IgE also helps with defense against parasites, such as worms. It does not activate complement and is the only isotype that is heat labile, or constantly undergoing change and instability.

➢ *Translate the following words and phrases from Russian into English:*чужеродные патогены, в общем, защита от вторжения организмов, гармония между антигеном и антителом, двойное назначение, в результате, выполнение задачи, связанные процессы, клетки плазмы, размножать-

ся, связывать антигены, осуществлять функции, сгруппировать в пять классов, коротко, образовывать из двух цепей, проходить через плаценту, тем самым, защищать организм от, поглощать отходы, внешняя секреция, покрывать, воздействие на организм определенного возбудителя, мономерный иммуноглобулин, претерпевать изменения.

➢ *Answer the following questions.*

1. Are the terms antibody and immunoglobulin interchangeable?
2. What neutralizes bacteria, parasites, and viruses?
3. Is there a harmony between an antigen and the antibody?
4. In what way does the antibody-based immune system realizes the principle of dual purposes?
5. What is the humoral immune system?
6. How are antibodies synthesized?
7. What are the two functions of antibodies?
8. What are the two types of antibodies?
9. What is the most abundant immunoglobulin?
10. When does the primary immune response occur?

➢ *Write an essay on the topic:* "Antibodies: the guardians of health".

Lesson 24. Antigens and their classification

Glossary.

notion	понятие, идея
generation	поколение
encompass	включать
cell-mediated	клеточно-опосредованный, клеточный
symbiotic	симбиотический, симбиозный
foreign	чужеродный, иностранный
misguided	неправильный, введённый в заблуждение

detrimental	причиняющий ущерб, вред; вредный, пагубный
tolerogen	толерогенный фактор, толероген
invoke	вызывать
origin	происхождение
exogenous	экзогенный, исходящий извне, идущий с поверхности внутрь
endogenous	эндогенный, глубинного происхождения
histocompatibility	гистосовместимость, тканевая совместимость
endocytosis	эндоцитоз
lysis	лизис
apoptosis	апоптоз
thymus	тимус, зобная или вилочковая железа
tumor cell	опухолевые клетки
proliferate	размножаться

➢ *Read and translate the text.*

An antigen is a molecule that stimulates a response from the immune system, such as bacteria, viruses, foods, toxins, and foreign cells. The word originated from the notion that antigens can stimulate antibody generation. It is now known that the immune system does not consist only of antibodies. The modern definition of antigen encompasses all substances that can be recognized by the adaptive immune system, which includes both the antibody-based humoral immune system and a system that does not utilize antibodies, the cell-mediated immune system.

The basis of the adaptive immune system lies in the capacity of immune cells to distinguish between proteins produced by the body's own cells (those of the original organism), and proteins produced by invaders or cells under control

of a virus (what is not recognized as the original organism). The immune system is one of great complexity, adaptability, and coordination. An antigen can be innumerable different kinds of foreign invaders. Yet, the immune system can recognize these millions of different antigens and neutralize or destroy them, while at the same time allowing helpful, symbiotic bacteria, such as E. coli, to become established within the human body. Even though all the various white blood cell types have a different responsibility, they all function together in the recognizing, attacking, and destroying of bacteria, viruses, cancer cells, and all substances seen foreign.

On the other hand, an allergen is a substance that induces an allergic reaction, an abnormally high or misguided reaction by the immune system to a specific antigen that is normally harmless. This typically detrimental reaction may result after exposure via ingestion, inhalation, injection, or contact with skin.

A tolerogen is an antigen that invokes a specific immune non-responsiveness to subsequent doses due to its molecular form. If its molecular form is changed, a tolerogen can become an immunogen.

Antigens can be classified by their origins.

Exogenous antigens.

Exogenous antigens are antigens that have entered the body from the outside, for example by inhalation, ingestion, or injection. By endocytosis or phagocytosis, these antigens are taken into the antigen-presenting cells (APCs) and processed into fragments. APCs then present the fragments to T helper cells (CD4+) by the use of class II histocompatibility molecules on their surface. Some T cells are specific for the peptide: MHC complex. They become activated and start to secrete cytokines. Cytokines are substances that can activate cytotoxic T lymphocytes (CTL), antibody-secreting B cells, macrophages, and other particles.

Endogenous antigens.

Endogenous antigens are antigens that have been generated within the cell, as a result of normal cell metabolism, or because of viral or intracellular bacterial infection. The fragments are then presented on the cell surface in the complex with class I histocompatibility molecules. If activated cytotoxic CD8+ T cells recognize them, the T cells begin to secrete different toxins that cause the lysis or apoptosis of the infected cell. In order to keep the cytotoxic cells from killing cells just for presenting self-proteins, self-reactive T cells are deleted from the repertoire as a result of central tolerance (also known as negative selection, which occurs in the thymus). Only those CTL that do not react to self-peptides that are presented in the thymus in the context of MHC class I molecules are allowed to enter the bloodstream.

There is an exception to the exogenous/endogenous antigen paradigm, called cross-presentation.

Autoantigens.

An autoantigen is usually a normal protein or complex of proteins (and sometimes DNA or RNA) that is recognized by the immune system of patients suffering from a specific autoimmune disease. These antigens should under normal conditions not be the target of the immune system, but due to mainly genetic and environmental factors the normal immunological tolerance for such an antigen has been lost in these patients.

Tumor antigens.

Tumor antigens are those antigens that are presented by the MHC I molecules on the surface of tumor cells. These antigens can sometimes be presented only by tumor cells and never by the normal ones. In this case, they are called tumor-specific antigens (TSAs) and typically result from a tumor specific mutation. More common are antigens that are presented by tumor cells and normal cells, called tumor-associated antigens (TAAs). Cytotoxic T lymphocytes that recognize these antigens may be able to destroy the tumor cells before they proliferate or spread to other parts of the body.

Tumor antigens can also be on the surface of the tumor. For example, in the form of a mutated receptor, in which case they will be recognized by B cells.

➢ *What does the following abbreviations mean?*

– E. coli
– APCs
– CD4+
– CTL
– MHC
– DNA
– RNA
– TSAs
– TAAs

➢ *Make the statements more detailed.*

1. An antigen is a molecule.
2. The modern definition of antigen encompasses all substances that can be recognized by the adaptive immune system.
3. The immune system is one of great complexity, adaptability, and coordination.
4. An allergen is a substance that induces an allergic reaction.
5. Antigens can be classified by their origins.
6. A tolerogen can become an immunogen.
7. Exogenous antigens are antigens that have entered the body from the outside.
8. Endogenous antigens are antigens that have been generated within the cell.
9. An autoantigen is usually a normal protein or complex of proteins.
10. Tumor antigens are those antigens that are presented by the MHC I molecules on the surface of tumor cells.

➢ *Make a summary of the text.*

Lesson 25. Allergens and their types

Glossary.

vigorous	сильный; бодрый; энергичный
fight off	бороться с отбить, отогнать, выгонять
otherwise	иначе, в противном случае, иным образом
hypersensitivity	гиперчувствительность
mount	устанавливать, расти, подниматься
hereditary	наследственный
predisposition	предрасположенность
atopy	атопия
peanuts	арахис
shellfish	моллюски
sulfite	сульфит
exposure	выдержка, подвергание, незащищенность
sesame seeds	семена кунжута
mustard	горчица
celery	сельдерей
resin	смола
cardboard	картон
sawdust	опилки
asthma	астма
skin rash	сыпь на коже
pet dander	перхоть домашних животных
wasp	оса
fire ant	огненный муравей
bee stings	укусы пчел

anaphylaxis	анафилактическая реакция, анафилаксия
foreign serum	чужеродная сыворотка; инородная сыворотка

➢ *Read and translate the text.*

An **allergen** is a type of antigen that produces an abnormally vigorous immune response in which the immune system fights off a perceived threat that would otherwise be harmless to the body. Such reactions are called allergies.

In technical terms, an allergen is an antigen capable of stimulating a type-I hypersensitivity reaction in atopic individuals through Immunoglobulin E (IgE) responses. Most humans mount significant Immunoglobulin E responses only as a defense against parasitic infections. However, some individuals may respond to many common environmental antigens. This hereditary predisposition is called atopy. In atopic individuals, non-parasitic antigens stimulate inappropriate IgE production, leading to type I hypersensitivity.

Sensitivities vary widely from one person (or other animal) to another. A very broad range of substances can be allergens to sensitive individuals.

Types of allergens.

Allergens can be found in a variety of sources, such as dust mite excretion, pollen, pet dander or even royal jelly. Food allergies are not as common as food sensitivity, but some foods such as peanuts (a legume), nuts, seafood and shellfish are the cause of serious allergies in many people (Figure 19).

Officially, the United States Food and Drug Administration does recognize eight foods as being common for allergic reactions in a large segment of the sensitive population. These include peanuts, tree nuts, eggs, milk, shellfish, fish, wheat and their derivatives, and soy and their derivatives, as well as sulfites (chemical based, often found in flavors and colors in foods) at 10ppm and over. See the FDA website for complete details. It should be noted that other countries, in view of the differences in the genetic profiles of their citizens and different levels of exposure to specific foods due to different dietary habits, the

"official" allergen list will change. Canada recognizes all eight of the allergens recognized by the US, and also recognizes sesame seeds, and mustard. The European Union additionally recognizes celery.

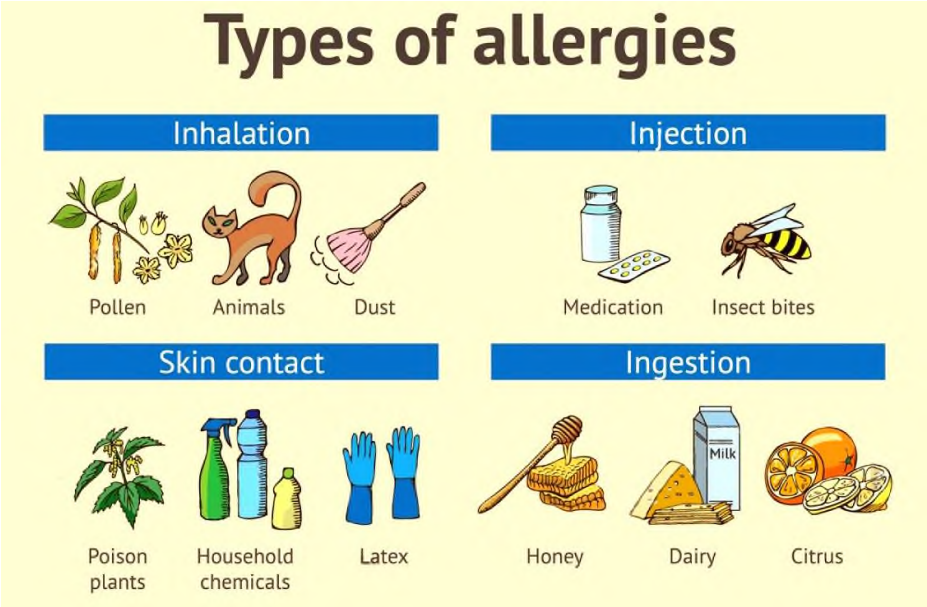

Figure 19. *Types of allergies (https://yandex.ru)*

Another type of allergens are urushiol, a resin produced by poison ivy and poison oak, which causes the skin rash condition known as urushiol-induced contact dermatitis by changing a skin cell's configuration so that it is no longer recognized by the immune system as part of the body. Various trees and wood products such as paper, cardboard, MDF etc. can also cause mild to severe allergy symptoms through touch or inhalation of sawdust such as asthma and skin rash.

An allergic reaction can be caused by any form of direct contact with the allergen—consuming food or drink one is sensitive to (ingestion), breathing in pollen, perfume or pet dander (inhalation), or brushing a body part against an allergy-causing plant (direct contact). Other common causes of serious allergy are wasp, fire ant and bee stings, penicillin, and latex. An extremely serious form of an allergic reaction is called anaphylaxis. One form of treatment is the administration of sterile epinephrine to the person experiencing anaphylaxis, which suppresses the body's overreaction to the allergen, and allows for the patient to be transported to a medical facility.

Common allergens.

In addition to foreign proteins found in foreign serum (from blood transfusions) and vaccines, common allergens include:

Animal products:

– Fel d 1 (Allergy to cats);

– fur and dander;

– cockroach calyx;

– wool;

– dust mite excretion;

– Drugs;

– penicillin;

– sulfonamides;

– salicylates (also found naturally in numerous fruits).

Foods:

– celery and celeriac;

– corn or maize;

– eggs (typically albumen, the white);

– fruit;

– pumpkin, egg-plant;

– legumes;

– beans;

– peas;

– peanuts;

– soybeans;

– milk;

– seafood;

– sesame;

– soy;

– tree nuts;

– pecans;

– almonds;

– wheat.

Insect stings:

- bee sting venom;
- wasp sting venom;
- mosquito stings.

➢ *Make a scheme of different types of allergens, give example of these types from the text.*

➢ *Match the words and phrases from the text and their definitions.*

1. Immune response.
2. Atopy.
3. Asthma.
4. Antigen.
5. Hypersensitivity.
6. Serum.
7. Ingestion.
8. Inhalation.
9. Immune system.
10. Anaphylaxis.

a) a bodily response to an antigen that occurs when lymphocytes identify the antigenic molecule as foreign and induce the formation of antibodies and lymphocytes capable of reacting with it and rendering it harmless;

b) the bodily system that protects the body from foreign substances, cells, and tissues by producing the immune response and that includes especially the thymus, spleen, lymph nodes, special deposits of lymphoid tissue (as in the gastrointestinal tract and bone marrow), macrophages, lymphocytes including the B cells and T cells, and antibodies;

c) a probably hereditary allergy characterized by symptoms (such as asthma, hay fever, or hives) produced upon exposure especially by inhalation to the exciting environmental antigen;

d) abnormally susceptible physiologically to a specific agent (such as a drug or antigen);

e) any substance (such as an immunogen or a hapten) foreign to the body that evokes an immune response either alone or after forming a complex with a larger molecule (such as a protein) and that is capable of binding with a product (such as an antibody or T cell) of the immune response;

f) the act or an instance of inhaling; *specifically*: the action of drawing air into the lungs by means of a complex of essentially reflex actions that involve changes in the diaphragm and in muscles of the abdomen and thorax which cause enlargement of the chest cavity and lungs resulting in production of relatively negative pressure within the lungs so that air flows in until the pressure is restored to equality with that of the atmosphere;

g) a chronic lung disorder that is marked by recurring episodes of airway obstruction (as from bronchospasm) manifested by labored breathing accompanied especially by wheezing and coughing and by a sense of constriction in the chest, and that is triggered by hyperreactivity to various stimuli (such as allergens or rapid change in air temperature);

h) the act of taking (something, such as food) into your body**:** to swallow (something);

i) hypersensitivity (as to foreign proteins or drugs) resulting from sensitization following prior contact with the causative agent;

j) the part of blood that is like water and that contains substances (called antibodies) that fight disease.

Lesson 26. Allergens and seasonal allergy

Glossary.

seasonal	сезонные
pollinate	опыляться
link	ссылка, связь, соединение; связывать, соединять, компоновать
hay fever	сенная лихорадка
itchy	зудящий, вызывающий зуд
tickle	щекотать
rhinitis	ринит
allergic conjunctivitis	аллергический конъюнктивит
wheezing	тяжелое дыхание, одышка, сопение, хрип
irritability	раздражительность, возбудимость, раздражимость
pollen	пыльца
drift	относиться, перемещаться, изменять состояние, плыть по течению
mast cell	тучная клетка, мастоцит
slew	множество, поворот, поворачиваться, вращать
scratchy throat	першение в горле
cross-react	перекрестную реакцию
mold	плесень
protease	протеаза, протеолитический фермент
cleave	раскалывать, рассекать, прилипать
trigger	инициировать, вызывать, дать начало, приводить в действие
allergist	аллерголог

imaging test	тест визуализации
nasal smear	назальный мазок
radioallergosorbent test	радиоаллергосорбентный тест
enzyme allergosorbent tests	энзимоаллергосорбентный тест
implement	выполнять, осуществлять; претворять, проводить в жизнь
ambiguous	неясный, нечёткий; неопределённый, неоднозначный
irregularity	неравномерность, неправильность, неровность
unresponsive	не отвечающий, не реагирующий, неотзывчивый, невосприимчивый

- *Read and translate the text.*

Seasonal allergy symptoms are commonly experienced part of the year, usually during spring, summer or fall when certain trees or grasses pollinate. This depends on the kind of tree or grass. For instance, some trees such as oak, elm, and maple pollinate in the spring, while grasses such as Bermuda, timothy and orchard pollinate in the summer.

Grass allergy is generally linked to hay fever because their symptoms and causes are somehow similar to each other. Symptoms include rhinitis, which causes sneezing and a runny nose, as well as allergic conjunctivitis, which includes watering and itchy eyes. Also an initial tickle on the roof of the mouth or in the back of the throat may be experienced.

Also, depending on the season, the symptoms may be more severe and people may experience coughing, wheezing, and irritability. A few people even become depressed, lose their appetite, or have problems sleeping. Moreover, since the sinuses may also become congested, some people experience headaches.

If both parents suffered from allergies in the past, there is a 66% chance for the individual to suffer from seasonal allergies, and the risk lowers to 60%

if just one parent had suffered from allergies. The immune system also has strong influence on seasonal allergies, since it reacts differently to diverse allergens like pollen. When an allergen enters the body of an individual that is predisposed to allergies, it triggers an immune reaction and the production of antibodies. These allergen antibodies migrate to mast cells lining the nose, eyes and lungs. When an allergen drifts into the nose more than once, mast cells release a slew of chemicals or histamines that irritate and inflame the moist membranes lining the nose and produce the symptoms of an allergic reaction: scratchy throat, itching, sneezing and watery eyes. Some symptoms that differentiate allergies from a cold include:

- no fever;
- mucous secretions are runny and clear;
- sneezes occurring in rapid and several sequences;
- itchy throat, ears and nose;
- these symptoms usually last longer than 7–10 days.

Among seasonal allergies, there are some allergens that fuse together and produce a new type of allergy. For instance, grass pollen allergens cross-react with food allergy proteins in vegetables such as onion, lettuce, carrots, celery and corn. Besides, the cousins of birch pollen allergens, like apples, grapes, peaches, celery and apricots, produce severe itching in the ears and throat. The cypress pollen allergy brings a cross reactivity between diverse species like olive, privet, ash and Russian olive tree pollen allergens. In some rural areas there is another form of seasonal grass allergy, combining airborne particles of pollen mixed with mold. Recent research has suggested that humans might develop allergies as a defense to fight off parasites. According to Yale University Immunologist Dr Ruslan Medzhitov, protease allergens cleave the same sensor proteins that evolved to detect proteases produced by the parasitic worms. Additionally, a new report on seasonal allergies called “Extreme allergies and Global Warming”, have found that many allergy triggers are worsening due to climate change. 16 states in the United States were named as “Allergen

Hotspots" for large increases in allergenic tree pollen if global warming pollution keeps increasing. Therefore, researchers on this report claimed that global warming is bad news for millions of asthmatics in the United States whose asthma attacks are triggered by seasonal allergies. Indeed, seasonal allergies are one of the main triggers for asthma, along with colds or flu, cigarette smoke and exercise. In Canada, for example, up to 75% of asthmatics also have seasonal allergies.

Based on the symptoms seen on the patient, the answers given in terms of symptom evaluation and a physical exam, doctors can make a diagnosis to identify if the patient has a seasonal allergy. After performing the diagnosis, the doctor is able to tell the main cause of the allergic reaction and recommend the treatment to follow. 2 tests have to be done in order to determine the cause: a blood test and a skin test. Allergists do skin tests in one of two ways: either dropping some purified liquid of the allergen onto the skin and pricking the area with a small needle; or injecting a small amount of allergen under the skin.

Alternative tools are available to identify seasonal allergies, such as laboratory tests, imaging tests and nasal endoscopy. In the laboratory tests, the doctor will take a nasal smear and it will be examined microscopically for factors that may indicate a cause: increased numbers of eosinophils (white blood cells), which indicates an allergic condition. If there is a high count of eosinophils, an allergic condition might be present.

Another laboratory test is the blood test for IgE (immunoglobulin production), such as the radioallergosorbent test (RAST) or the more recent enzyme allergosorbent tests (EAST), implemented to detect high levels of allergen-specific IgE in response to particular allergens. Although blood tests are less accurate than the skin tests, they can be performed on patients unable to undergo skin testing. Imaging tests can be useful to detect sinusitis in people suffering from chronic rhinitis, and they can work when other test results are ambiguous. There is also nasal endoscopy, wherein a tube is inserted through the nose with a small camera to view the passageways and examine any irregu-

larities in the nose structure. Endoscopy can be used for some cases of chronic or unresponsive seasonal rhinitis.

- *Make a list of allergens that cause seasonal allergy.*
- *Make a list of symptoms of seasonal allergy.*
- *Match the words and phrases from the text and their definitions.*

1. Pollen.
2. Histamine.
3. Antibody.
4. Fever.
5. Coughing.
6. Conjunctivitis.
7. Rhinitis.
8. Laboratory test.
9. Blood test.
10. Skin test.

a) inflammation of the mucous membrane of the nose marked especially by rhinorrhea, nasal congestion and itching, and sneezing; *also*: any of various conditions characterized by rhinitis;

b) inflammation of the conjunctiva that is typically marked by pinkness or redness of the sclera and by itching, burning, irritation, discharge, or excessive tearing of the eye and that is typically caused by pathogenic microorganisms (such as bacteria or viruses), allergens, or irritants;

c) a sudden, sharp-sounding expulsion of air from the lungs acting as a protective mechanism to clear the air passages or as a symptom of pulmonary disturbance;

d) a mass of male spores in a seed plant appearing usually as a fine dust;

e) any of a large number of proteins of high molecular weight that are produced normally by specialized B cells after stimulation by an antigen and act specifically against the antigen in an immune response, that are produced

abnormally by some cancer cells, and that typically consist of four subunits including two heavy chains and two light chains;

f) a compound C5H9N3 especially of mammalian tissues that causes dilation of capillaries, contraction of smooth muscle, and stimulation of gastric acid secretion, that is released during allergic reactions, and that is formed by decarboxylation of histidine;

g) an abnormal bodily state characterized by increased production of heat, accelerated heart action and pulse, and systemic debility with weakness, loss of appetite, and thirst;

h) a test of the blood; specifically: a laboratory test in which a sample of blood is withdrawn from the body to analyze the level of substances or cells (such as glucose, hemoglobin, or white blood cells) that indicate the presence or probable development of a particular disease or medical condition (such as diabetes, cardiovascular disease, or cancer) or serve to indicate the degree of function of a specific organ (such as the liver or kidney);

i) a test (as a scratch test or a tuberculin test) for an allergic or immune response to a substance that is performed by administering the substance to or through the skin and is used especially in detecting allergic hypersensitivity;

j) a test (such as a blood test or urinalysis procedure) performed by a medical laboratory on a specimen taken from a patient.

UNIT 6. FIGHTING DISEASES

Lesson 27. Antibiotics and their types

Glossary.

fungus (pl fungi)	гриб, грибок, плесень
coin	монета; чеканить, придумывать, штамповать
mold	плесень
sulfur	серы
strychnine	стрихнин
arsenic	мышьяк
bactericidal	бактерицидный
bacteriostatic	бактериостатическое
intravenous	внутривенно
administer	применять, использовать
topically	местно
ointment	мазь
sensitivity	чувствительность
accessibility	доступность
whereas	тогда как, в то время как, принимая во внимание, поскольку

➢ *Read and translate the text.*

An antibiotic is a drug that kills or prevents the growth of bacteria. Antibiotics have no effect on viruses, fungi, or parasites. They compose one class within the larger group called antimicrobials. (Antimicrobials include anti-viral, anti-fungal, and anti-parasitic drugs as well.) Antibiotics are relatively harmless to the host, and therefore can be used to treat infections.

The term “antibiotic,” coined by Selman Waksman, originally described only those antibiotics derived from living organisms, in contrast to "chemother-

apeutic agents," which are purely synthetic. For example, there are antibiotics that are derived from mold, such as the penicillin class. Currently, the term "antibiotic" is also applied to synthetic antimicrobials, such as the sulfa drugs (drugs containing sulfur). Human creativity is expressed in the ability to identify and process natural agents and synthesize new antibiotics.

Antibiotics are generally small molecules with a molecular weight less than two thousand.

Unlike previous treatments for infections, which included poisons such as strychnine and arsenic, antibiotics were labeled "magic bullets": drugs which targeted disease without harming the host.

Individual antibiotics vary widely in their effectiveness on various types of bacteria. The effectiveness varies with the location of the infection, the ability of the antibiotic to reach the site of infection, and the ability of the bacteria to resist or inactivate the antibiotic. Some antibiotics actually kill the bacteria (bactericidal), whereas others merely prevent the bacteria from multiplying (bacteriostatic) so that the host's immune system can overcome them.

Oral antibiotics are the simplest approach when effective, with intravenous antibiotics reserved for more serious cases. Antibiotics may sometimes be administered topically, as with eye drops or ointments.

Antibiotics can be categorized based on their target specificity: "Narrow-spectrum" antibiotics target particular types of bacteria, such as Gram-negative or Gram-positive bacteria, while "broad-spectrum" antibiotics affect a larger range of bacteria. Gram-positive and Gram-negative refer to whether the bacteria retain dye in the Gram staining protocol: Gram-positive retain dye and Gram-negative do not. Whether or not dye is retained is due to structural differences in the cell wall.

Antibiotics can also be classified by the organisms against which they are effective and by the type of infection for which they are useful. The latter depends on the sensitivities of the organisms causing the infection and the accessibility of the affected tissue to the antibiotic.

At the highest level, antibiotics can be classified as either bactericidal or bacteriostatic. Bactericidals kill bacteria directly whereas bacteriostatics prevent them from dividing. However, these classifications are based on laboratory behavior; in practice, both of these will end a bacterial infection.

➢ *What is the plural form of the following words:* antibiotic, bacterium, virus, fungus, parasite, antimicrobial, ointment, spectrum, dye, sensitivity, bactericidal, bacteriostatic.

➢ *How can antibiotics be classified?* Make schemes showing the types of antibiotics.

➢ *Are the following statements true or false?*

1. An antibiotic is a drug that kills viruses, fungi, or parasites.
2. Antimicrobials include anti-viral, anti-fungal, and anti-parasitic drugs.
3. The term “antibiotic” originally described only those antibiotics derived from living organisms.
4. Currently, the term "antibiotic" is applied only to synthetic antimicrobials.
5. Antibiotics were called "magic bullets" because drugs which targeted disease did the host harm.
6. Individual antibiotics vary widely in their effectiveness on various types of bacteria.
7. Antibiotics that kill the bacteria are called bactericidals.
8. Antibiotics that prevent the bacteria from multiplying are called bacteriostatic.
9. Antibiotics are never administered topically.
10. Bacteriostatic antibiotics can never end a bacterial infection on their own.

Lesson 28. Misuse of antibiotics

Glossary.

misuse	злоупотребление, неправильное использование
prescribe	назначать, предписывать

eradicate	искоренять, уничтожать
resistant	стойкий, прочный, сопротивляющийся
abbreviate	сокращать, использовать сокращения, урезать
inappropriate	неуместный, несоответствующий, неподходящий
common cold	простуда
prophylactic	профилактический
emergence	появление, возникновение
strain	штамм
rescind	аннулировать, отменять
fluoroquinolone	фторхинолон
poultry	птицы
phasing	фазировка, фазирование, фазирующий
endorse	поддерживать, одобрять, подтверждать
excessive	чрезмерный, излишний

➢ *Read and translate the text.*

A common form of antibiotic misuse is failure to take the entire prescribed course of the antibiotic, usually because the patient feels better, but before the infecting organism is completely eradicated. In addition to treatment failure, these practices can result in bacterial resistance to the antibiotics, when some resistant bacteria survive the abbreviated treatment.

Taking antibiotics in inappropriate situations is another common form of antibiotic misuse. Common examples of this would be the use of antibacterials for viral infections, such as the common cold.

Currently, it is estimated that greater than 50 percent of the antibiotics used in the U.S. are given to food animals (e.g. chickens, pigs, and cattle) for

prophylactic treatment in the absence of disease. Antibiotic use in food animal production has been associated with the emergence of antibiotic resistant strains of bacteria, including Salmonella, Campylobacter, E. coli, and Enterococcus among others. There is substantial evidence from the United States and the European Union that these resistant bacteria cause antibiotic resistant infections in humans.

The American Society for Microbiology (ASM), the American Public Health Association (APHA), and the American Medical Association (AMA) have called for substantial restrictions on antibiotic use in food animal production, including an end to all non-therapeutic uses. The food animal and pharmaceutical industries have fought hard to prevent new regulations that would limit the use of antibiotics in food animal production. For example, in 2000 the U.S. Food and Drug Administration (FDA) announced their intention to rescind approval for fluoroquinolone (a broad-spectrum antibiotic) use in poultry production because of substantial evidence linking it to the emergence of fluoroquinolone resistant Campylobacter (a type of bacteria) infections in humans. The final decision to ban fluoroquinolones from use in poultry production was not made until five years later because of challenges from the food animal and pharmaceutical industries. Some federal bills aimed at phasing out non-therapeutic antibiotics in U.S. food animal production have been endorsed by various public health and medical organizations, including the American Nurses Association (ANA), the American Academy of Pediatrics (AAP), and the American Public Health Association (APHA).

Excessive use of prophylactic (preventive) antibiotics in travelers may also be classified as misuse.

➢ *Fill in prepositions where necessary:*

prescribed course _____ the antibiotic, _____ addition _____, result _____, resistance _____ the antibiotics, survive _____ the abbreviated treatment, form _____ antibiotic misuse, the use _____ antibacterials _____ viral infections _____ the absence _____ disease, antibiotic use _____ food

animal production, called _____ substantial restrictions _____ antibiotic use _____ food animal production, an end _____ all non-therapeutic uses, limit _____ the use, _____ example, use _____ poultry production, aimed _____, use _____ travelers.

➢ *Answer the following questions on the text.*

1. What is a common form of antibiotic misuse?
2. Why does failure to take the entire prescribed course of the antibiotic happen?
3. What can cause the bacterial resistance to the antibiotics?
4. Antibacterials should be used for viral infections, should not they?
5. What contributed to the emergence of antibiotic resistant strains of bacteria?
6. What have ASM, APHA, AMA called for in food animal production? Why? Did they succeed?
7. In what way do travelers misuse antibiotics?

➢ *Write an essay on the topic*: "Antibiotics: advantages and disadvantages of their use".

Lesson 29. Bacteriophage

Glossary.

bacteriophage	бактериофаг, бактериальный вирус
hull	корпус, остов, каркас
capsid	капсида, капсула вируса
ubiquitous	повсеместно
virion	вирион
lipopolysaccharide	липополисахарид
teichoic acid	тейхоевые кислоты
flagellum (pl. flagella)	жгутик
random	случайный

syringe	шприц, спринцовка
inject	впрыснуть, вводить
discontinue	прекратить
species	вид, разновидность
strain	штамм
applicable	применимый
relevance	актуальность
trial	попытка

➢ *Read and translate the text.*

A bacteriophage (from "bacteria" and Greek phagein, "to eat") is a virus that infects bacteria. The term is commonly used in its shortened form, phage.

Like viruses that infect eukaryotes (plants, animals, and fungi), phages vary greatly in structure and function. Typically, they consist of an outer protein hull, or capsid, enclosing genetic material. The genetic material can be either RNA, but is usually double-stranded DNA. The phage genome varies in size from between 2 to 200 kilo base pairs per strand of nucleic acid (Figure 20).

As harmful as many viruses are for the human body, the specificity of phages offers some promise as potential agents to destroy disease-causing bacteria (known as phage therapy).

Phages are ubiquitous and can be found in many reservoirs populated by bacteria, such as soil or animal intestines. One of the densest natural sources for phages and other viruses is sea water, where up to 109 virions, or complete virus particles, per milliliter have been found at the surface. Up to 70 percent of marine bacteria may be infected by phages.

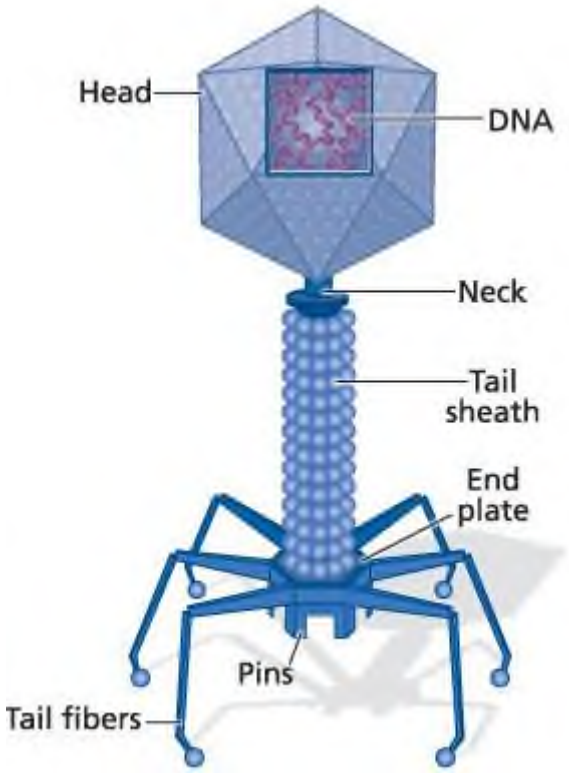

Figure 20. *Structural overview of a complex bacteriophage (https://biologyteksbylauryncarter.weebly.com)*

Attachment and penetration.

To enter a host cell, bacteriophages attach to specific receptors on the surface of bacteria, including lipopolysaccharides, teichoic acids, proteins, or even flagella. This "lock-and-key" specificity means that a bacteriophage can only infect certain bacteria bearing receptors that they can bind to. As phage virions do not move actively, they must rely on random encounters with the right receptors when in solution, such as blood or sea water.

Complex bacteriophages, such as the T-even phages—T2, T4, and T6—are thought to use a syringe-like motion to inject their genetic material into the cell. After making contact with the appropriate receptor, the tail fibers bring the base plate closer to the surface of the cell. Once attached completely, conformational changes cause the tail to contract, possibly with the help of ATP present in the tail. The genetic material may be pushed through the cell membrane, or it may be deposited on the surface. Other bacteriophages may use different methods to insert their genetic material.

The empty capsid of the phage is left outside the host cell as a "ghost," empty of genetic material.

Phage therapy.

Phages were tried as anti-bacterial agents after their discovery. However, antibiotics, upon their discovery, proved to be more practical. Research on phage therapy was largely discontinued, but phage therapy has been used since the 1940s in the former Soviet Union as an alternative to antibiotics for treating bacterial infections.

The evolution of bacterial strains through natural selection that are resistant to multiple drugs has led some medical researchers to re-evaluate phages as alternatives to the use of antibiotics. Unlike antibiotics, phages adapt along with the bacteria, as they have done for millions of years, so a sustained resistance is unlikely. Additionally, when an effective phage has been found, it will continue to kill bacteria of that type until they are all gone from the body.

A specific type of phage often infects only one specific type of bacterium (ranging from several species, to only certain subtypes within a species), so one has to make sure to identify the correct type of bacteria, which takes about 24 hours. Sometimes mixes of several strains of phage are used to create a broader spectrum cure. An added advantage is that no other bacteria are attacked, making it work similarly to a narrow spectrum antibiotic. However, this is a disadvantage concerning infections with several different types of bacteria, which is often the case. Another problem with bacteriophages is that they are attacked by the body's immune system.

Phages work best when in direct contact with the infection, so they are best applied directly to an open wound. This is rarely applicable in the current clinical setting where infections occur systemically. Despite individual success in the former USSR where other therapies had failed, many researchers studying infectious diseases question whether phage therapy will achieve any medical relevance. There have been no large clinical trials to test the efficacy of

phage therapy yet, but research continues because of the rise of antibiotic resistance.

➢ *Find the English equivalents for the following words and phrases:* заражать бактерии, сокращенная форма, различаться по структуре и функциям, РНК, двунитевый, ДНК, нуклеиновые кислоты, болезнетворные бактерии, фаговая терапия, населенный бактериями, заражение фагами, прсоединение, проникновение, рецепторы на поверхности бактерии, привязать к, полагаться на, генетический материал, возможно, осаждаться на поверхности, анти-бактериальный агент, оказаться более практичным, альтернатива антибиотикам, устойчивый ко многим лекарственным препаратам, пересматривать, широкий спектр лечения, дополнительное преимущество, узкий спектра действия, открытая рана, сомневаться, клиническое испытание, устойчивость к антибиотикам.

➢ *Are the following statements true of false?*

1.A bacteriophage is a virus that infects bacteria.
2.Phages are harmful for viruses.
3.Phages can be found in soil.
4.One of the densest natural sources for phages and other viruses is sea water.
5.Up to 20 percent of marine bacteria may be infected by phages.
6.A bacteriophage can infect any bacteria in a human organism.
7.Phage virions do not move actively.
8.Phages has been widely used as anti-bacterial agents since their discovery.
9.USSR researches succeeded in phage therapy.
10.Bacteriophages are attacked by the body's immune system.

➢ *Make an abstract of the text.*

TEST YOURSELF

Choose the right translation of the following sentences.

1. A BONE IS A RIGID ORGAN THAT CONSTITUTES PART OF THE VERTEBRAL SKELETON

1) кость – это прочный орган, который является составной частью позвоночного столба
2) кость – это прочный орган, который является составной частью вертикального столба
3) кость – это особый орган, который является составной частью позвоночного столба
4) кость – это прочная ткань, которая является составной частью позвоночного столба

2. MOST SKELETAL MUSCLES ARE ATTACHED TO TWO BONES THROUGH TENDONS

1) много мышц скелета присоединяются к двум костям посредством связок
2) большинство мышц скелета присоединяются к двум костям через связки
3) большинство мышц скелета касаются двух костей посредством связок
4) большинство мышц скелета присоединяются к двум костям посредством связок

3. THE HEART IS A MUSCULAR ORGAN WHICH PUMPS BLOOD THROUGH THE BLOOD VESSELS OF THE CIRCULATORY SYSTEM

1) сердце – это мускулистый орган, который качает кровь через кровеносные сосуды сердечно-сосудистой системы
2) сердце – это мышечный орган, который качает кровь через кровеносные сосуды сердечно-сосудистой системы
3) сердце – это мышечный орган, который отправляет кровь через кровеносные сосуды сердечно-сосудистой системы
4) сердце – это мышечный орган, который качает кровь через систему кровеносных сосудов

4. IN THE COURSE OF A DAY, THE DIGESTIVE SYSTEM SECRETES AROUND 7 LITERS OF FLUIDS

1) в течении дня пищеварительная система выделяет около 7 литров жидкости

2) в течении дня пищеварительная система выделяет около 7 литров жидкостей
3) в дневном курсе пищеварительная система выделяет около 7 литров жидкостей
4) в течении дня пищеварительная система поглощает около 7 литров жидкости

5. THE SIZE OF THE STOMACH VARIES FROM PERSON TO PERSON, BUT ON AVERAGE IT CAN CONTAIN 1-2 LITERS OF FOOD AND LIQUID DURING A MEAL

1) объем желудка отличается у разных людей, но в среднем он может вместить 1-2 литра пищи и жидкости во время приема пищи
2) размер желудка отличается у разных людей, но в целом он может составить 1-2 литра пищи и жидкости во время приема пищи
3) размер желудка отличается у разных людей, но в среднем он может составить 1-2 литра жидкости во время приема пищи
4) размер желудка отличается у разных людей, но в среднем он может вместить 1-2 литра пищи и жидкости во время приема пищи

Fill in the gaps with appropriate words.

6. AFTER THE STOMACH HAS BEEN FILLED WITH FOOD FROM A MEAL, IT STORES THE _____ FOR ABOUT 1-2 HOURS

1) bile
2) water
3) food
4) hydrochloric acid

7. THE PHARYNX IS THE PART OF THE DIGESTIVE SYSTEM AND ALSO OF THE CONDUCTING ZONE OF THE _____ SYSTEM

1) respiratory
2) circulatory
3) muscular
4) digestive

8. DURING SWALLOWING, THE _____ TILTS BACKWARDS TO PREVENT FOOD FROM GOING DOWN THE LARYNX AND LUNGS

1) pharinx
2) gullet
3) sphincter
4) epiglottis

9. DIGESTION IN THE STOMACH CAN BE DIVIDED INTO 2 CLASSES: MECHANICAL DIGESTION AND _____ DIGESTION

1) physical
2) chemical
3) salivary
4) intestinal

10. THE HUMAN SPLEEN IS LOCATED IN THE UPPER LEFT PART OF THE _____, BEHIND THE STOMACH AND JUST BELOW THE DIAPHRAGM

1) abdomen
2) chest
3) vertebrate
4) organism

Find the English equivalents for the following phrases.

11. ОБРАЗОВЫВАТЬ ЖЕЛЧНЫЕ КАМНИ

1) found gallstones
2) build gallstones
3) form gallstones
4) form gall stones

12. НАРУШАТЬ БАРЬЕРЫ

1) breach barriers
2) interfere barriers
3) disturb barriers
4) dislocate barriers

13. ВОСПАЛИТЕЛЬНЫЕ ЗАБОЛЕВАНИЯ

1) inflammatory sickness
2) inflammatory diseases
3) inflammatory diceases
4) inflammation diseases

14. КЛЕТОЧНЫЙ ИММУНИТЕТ

1) cell immunity
2) cell-related immunity
3) cell-connected immunity
4) cell-mediated immunity

15. ПОСЛЕОПЕРАЦИОННАЯ ИНФЕКЦИЯ

1) after-surgery infection
2) post-surgical infection
3) upon-surgical infection
4) after-operational infection

Find antonyms for the following words used in the texts you read.

16. HARMLESS

1) dangerous
2) safe
3) friendly
4) difficult

17. VIGOROUS

1) energetic
2) vigorous
3) indecisive
4) damaging

18. COMMON

1) overall
2) single
3) typical
4) unusual

19. USELESS

1) useful
2) using
3) usage
4) used

20. SENSITIVE

1) unsensitive
2) insensitive
3) senseless
4) sensitively

Find the translation of the following words and phrases used in the texts you read.

21. GENERATION

1) поколение

2) генерация
3) обобщение
4) абстракция

22. SYMBIOTIC
1) симбиотический
2) символический
3) симметричный
4) характерный

23. ORIGIN
1) оригинальность
2) неординарность
3) снисхождение
4) происхождение

24. PROLIFERATE
1) нравиться
2) размножаться
3) ранжировать
4) занимать место

25. PREDISPOSITION
1) расположение
2) расстановка
3) распоряжение
4) предрасположенность

Choose the correct form of the verb to complete the sentence.

26. LEUKOCYTES (WHITE BLOOD CELLS) _____ LIKE INDEPENDENT, SINGLE-CELLED ORGANISMS AND ARE THE SECOND ARM OF THE INNATE IMMUNE SYSTEM
1) acts
2) act
3) are acted
4) acted

27. PHAGOCYTES GENERALLY PATROL THE BODY SEARCHING FOR PATHOGENS, BUT CAN _____ TO SPECIFIC LOCATIONS BY CYTOKINES
1) to be called

2) are called
3) be called
4) be call

28. BASOPHILS AND EOSINOPHILS _____ TO NEUTROPHILS

1) is related
2) are relate
3) are relating
4) are related

29. ANTIGEN SPECIFICITY ALLOWS FOR THE GENERATION OF RESPONSES THAT _____ TO SPECIFIC PATHOGENS OR PATHOGEN-INFECTED CELLS.

1) are tailored
2) were tailored
3) was tailored
4) will be tailored

30. T CELLS RECOGNIZE A "NON-SELF" TARGET, SUCH AS A PATHOGEN, ONLY AFTER ANTIGENS (SMALL FRAGMENTS OF THE PATHOGEN) _____ IN COMBINATION WITH A "SELF" RECEPTOR CALLED A MAJOR HISTOCOMPATIBILITY COMPLEX (MHC) MOLECULE

1) have been processed and presented
2) has been processed and presented
3) had been processed and presented
4) have processed and presented

Fill in the gaps with appropriate pronouns.

31. HELPER T CELLS REGULATE BOTH THE INNATE AND ADAPTIVE IMMUNE RESPONSES AND HELP DETERMINE WHICH IMMUNE RESPONSES THE BODY MAKES TO A PARTICULAR PATHOGEN. _____ CELLS HAVE NO CYTOTOXIC ACTIVITY AND DO NOT KILL INFECTED CELLS OR CLEAR PATHOGENS DIRECTLY

1) these
2) those
3) this
4) these

32. A B CELL IDENTIFIES PATHOGENS WHEN ANTIBODIES ON ITS SURFACE BIND TO A SPECIFIC FOREIGN ANTIGEN. _____ ANTIGEN/ANTIBODY COMPLEX IS TAKEN UP BY THE B CELL AND PROCESSED BY PROTEOLYSIS INTO PEPTIDES

1) these
2) those
3) this
4) these

33. THE B CELL THEN DISPLAYS _____ ANTIGENIC PEPTIDES ON ITS SURFACE MHC CLASS II MOLECULES

1) these
2) those
3) this
4) these

34. _____ COMBINATION OF MHC AND ANTIGEN ATTRACTS A MATCHING HELPER T CELL, WHICH RELEASES LYMPHOKINES AND ACTIVATES THE B CELL

1) these
2) those
3) this
4) these

35. _____ MUSCLES, LIKE THE TIBIALIS ANTERIOR, ARE NAMED AFTER THE PART OF THE BONE (THE ANTERIOR PORTION OF THE TIBIA) THAT THEY ARE ATTACHED TO

1) some
2) any
3) no
4) this

Give synonyms to the words from the texts you read.

36. DISEASE

1) pain
2) treatment
3) health
4) illness

37. MEDICINE

1) drug
2) treatment
3) chemical
4) disease

38. ACHE

1) pain
2) treatment
3) health
4) illness

39. CANCELLOUS

1) cortical
2) spongy
3) marrow
4) fuse

40. STATIONARY

1) maintenance
2) location
3) flexible
4) motionless

Fill in the correct article.

41. THE MUSCULAR SYSTEM IS RESPONSIBLE FOR ____ MOVEMENT OF THE HUMAN BODY

1) a
2) an
3) the
4) –

42. MUSCLE TISSUE IS ALSO FOUND INSIDE OF ___ HEART, DIGESTIVE ORGANS, AND BLOOD VESSELS

1) a
2) an
3) the
4) –

43. ANOTHER FUNCTION RELATED TO MOVEMENT IS ____ MOVEMENT OF SUBSTANCES INSIDE THE BODY

1) a
2) an
3) the
4) –

44. _____ MUSCLES MOVE BY SHORTENING THEIR LENGTH, PULLING ON TENDONS, AND MOVING BONES CLOSER TO EACH OTHER

1) a
2) an
3) the
4) –

45. CARDIOVASCULAR DISEASES (CVD) ARE THE MOST COMMON CAUSE OF DEATH GLOBALLY AS OF 2008, ACCOUNTING FOR 30% OF _____DEATHS

1) a
2) an
3) the
4) –

46. SPECIALISTS WHO FOCUS ON DISEASES OF THE HEART ARE CALLED _____ CARDIOLOGISTS

1) a
2) an
3) the
4) –

47. TWO ADDITIONAL SEMILUNAR VALVES SIT AT ____ EXIT OF EACH OF THE VENTRICLES

1) a
2) an
3) the
4) –

48. THE THICKNESS OF BLOOD VESSEL WALLS ALSO VARIES ENORMOUSLY, BEING LARGEST IN THE LARGE ARTERIES, MUCH LESS IN VEINS OF COMPARABLE DIAMETER, AND ONLY _____SINGLE CELL THICK IN THE CAPILLARIES

1) a

2) an
3) the
4) –

49. ARTERIOLES ARE THE VESSELS AT THE END OF THE ARTERIAL TREE AND HAVE _____ DIAMETER OF 20 TO 30 MM

1) a
2) an
3) the
4) –

50. BLOOD RETURNS FROM THE TISSUES TO THE HEART ALONG ____ VEINS

1) a
2) an
3) the
4) –

Choose the right way to translate the underlined words and phrases.

51. BLOOD RETURNS FROM THE TISSUES TO THE HEART ALONG VEINS

1) клетки
2) ткани
3) полотно
4) материал

52. PRESSURE IN THE PULMONARY ARTERY IS TYPICALLY 25/12 MM HG (SYSTOLIC/DIASTOLIC) COMPARED WITH 120/80 MM HG IN THE AORTA AND ITS MAIN BRANCHES

1) типично
2) печатно
3) поверхностно
4) обычно

53. HEMOGLOBIN IS THE MOST EFFICIENT OXYGEN-CARRIER KNOWN

1) наиболее
2) наибольший
3) большой
4) частый

54. DECREASED LEVELS OF HEMOGLOBIN, WITH OR WITHOUT AN ABSOLUTE DECREASE OF RED BLOOD CELLS, LEADS TO SYMPTOMS OF ANEMIA

1) повышенный
2) пониженный
3) средний
4) заболевший

55. OUR BODIES REQUIRE OXYGEN IN ORDER TO SURVIVE

1) потому что
2) из-за того
3) чтобы
4) в порядке

56. THE HUMAN ESOPHAGUS HAS A MUCOUS MEMBRANE CONSISTING OF A TOUGH STRATIFIED SQUAMOUS EPITHELIUM WITHOUT KERATIN AND A MUSCULARIS MUCOSAE

1) человеческий
2) гуманный
3) гуманитарный
4) живой

57. MEDICAL TEXTBOOKS SUGGEST THAT THE NORMAL RESPIRATORY RATE FOR ADULTS IS ONLY 12 BREATHS PER MINUTE AT REST

1) уровень дыхания
2) респираторный рейтинг
3) респираторный показатель
4) частота дыхания

58. SOME PRACTITIONERS OF COMPLEMENTARY AND ALTERNATIVE MEDICINE BELIEVE THAT PARTICULAR KINDS OF BREATHING THEY IDENTIFY AS DIAPHRAGM BREATHING CAN BE USED TO BRING ABOUT HEALTH BENEFITS

1) складывают
2) доверяют
3) называют
4) считают

59. THE DIGESTIVE SYSTEM IS RESPONSIBLE FOR TAKING WHOLE FOODS AND TURNING THEM INTO ENERGY AND NUTRIENTS TO ALLOW THE BODY TO FUNCTION, GROW, AND REPAIR ITSELF

1) питающие средства
2) питательные вещества
3) съедобные продукты
4) нужные компоненты

60. THE UPPER PORTION OF THE PHARYNX, THE NASOPHARYNX, EXTENDS FROM THE BASE OF THE SKULL TO THE UPPER SURFACE OF THE SOFT PALATE

1) основание школы
2) основание скульптуры
3) основание черепа
4) основа черепа

Choose the plural form of the nouns.

61. ESOPHAGUS

1) esophagi
2) esophaguses
3) esophagum
4) esophagi

62. MUCOSA

1) mucoses
2) mucos
3) mucosea
4) mucosae

63. EPITHELIUM

1) epitheliums
2) epithelis
3) epithelia
4) epitheliae

64. GLAND

1) gland
2) glands
3) glandes
4) glandum

65. PLEXUS

1) plexus
2) plexuses
3) plexi
4) plexum

Choose the correct form of an adjective and abverbs.

66. MUSCLES MOVE BY SHORTENING THEIR LENGTH, PULLING ON TENDONS, AND MOVING BONES _____ TO EACH OTHER.

1) close
2) closer
3) closest
4) most close

67. THE _____ BONE IN THE BODY IS THE THIGH-BONE (FEMUR) AND THE _____ IS THE STAPES IN THE MIDDLE EAR

1) large, small
2) larger, smaller
3) largest, smallest
4) most large, most small

68. THE HEART HAS FOUR CHAMBERS, TWO _____ ATRIA, THE RE-CEIVING CHAMBERS, AND TWO _____ VENTRICLES, THE DIS-CHARGING CHAMBERS

1) up, low
2) upper, lower
3) uppest, lowest
4) more up, more low

69. THE CARDIAC SKELETON IS MADE OF _____ CONNECTIVE TISSUE AND THIS GIVES STRUCTURE TO THE HEART

1) dense
2) denser
3) densest
4) more dense

70. THE MUSCLES RESPONSIBLE FOR THE BODY'S POSTURE HAVE THE _____ ENDURANCE OF ALL MUSCLES IN THE BODY

1) great
2) greater

3) greatest
4) most great

Match the terms and their definitions.

71. A RIGID ORGAN THAT CONSTITUTES PART OF THE VERTEBRAL SKELETON

1) muscle
2) tendon
3) joint
4) bone

72. A TOUGH BAND OF DENSE REGULAR CONNECTIVE TISSUE WHOSE STRONG COLLAGEN FIBERS FIRMLY ATTACH MUSCLES TO BONES

1) muscle
2) tendon
3) joint
4) bone

73. A MUSCULAR ORGAN IN HUMANS AND OTHER ANIMALS, WHICH PUMPS BLOOD THROUGH THE BLOOD VESSELS OF THE CIRCULATORY SYSTEM

1) heart
2) atrium
3) ventricle
4) valve

74. THE SYSTEM OF BRANCHING AND CONVERGING TUBES WHICH CONVEY BLOOD FROM THE HEART TO ALL THE VARIOUS PARTS OF THE BODY AND BACK AGAIN, AND FROM THE HEART TO THE LUNGS AND BACK

1) capillaries
2) veins
3) arteries
4) blood vessels

75. THE VESSELS AT THE END OF THE ARTERIAL TREE AND HAVE A DIAMETER OF 20 TO 30 MM

1) capillaries
2) arterioles
3) arteries
4) blood vessels

76. A PAIR OF LARGE, SPONGY ORGANS OPTIMIZED FOR GAS EXCHANGE BETWEEN OUR BLOOD AND THE AIR

1) kidneys
2) right and left heart
3) lungs
4) bronchi

77. DOUBLE-LAYERED SEROUS MEMBRANES THAT SURROUND EACH LUNG

1) pleura
2) mucus
3) plexus
4) layer

78. THE SMALLEST AIR TUBES IN THE LUNGS THAT TERMINATE AT THE ALVEOLI OF THE LUNGS

1) terminal bronchi
2) terminal bronchioles
3) terminal alveoli
4) terminal artetioles

79. THE PART OF THE THROAT THAT IS BEHIND THE MOUTH AND NASAL CAVITY AND ABOVE THE OESOPHAGUS AND THE LARYNX, OR THE TUBES GOING DOWN TO THE STOMACH AND THE LUNGS

1) larynx
2) esophagus
3) pharynx
4) epiglottis

80. A VASCULAR LYMPHOID ORGAN FOUND IN MOST VERTEBRATES, NORMALLY CLOSE TO THE STOMACH IN THE ABDOMINAL CAVITY, AND THAT FUNCTIONS IN VARIOUS ACTIVITIES RELATED TO THE CIRCULATORY SYSTEM AND THE IMMUNE SYSTEM

1) kidney
2) pancreas
3) liver
4) spleen

Match the abbrevations used in the texts you read and the terms.

81. CVD
    1) chemical vapor deposition
    2) countervailing diseases
    3) compact video disc
    4) cardiovascular diseases

82. ECG
    1) export credits guarantee
    2) error correction guide
    3) electrocardiography
    4) electronic control governor

83. APC
    1) antigen-presenting cell
    2) activated protein C
    3) anaphase-promoting complex
    4) adenomatosis polyposis coli

84. CTL
    1) central
    2) cytotoxic T lymphocytes
    3) coal to liquids technology
    4) transmission control protocol

85. TSA
    1) transport security association
    2) trade securities association
    3) tumor-specific antigen
    4) tube support assembly

Fill in correct prepositions.

86. THEY COMBINE ___ DIFFERENT IMMUNOGLOBULIN RECEPTORS SPECIFIC FOR THEM AND EXERT EFFECTOR FUNCTIONS
    1) with
    2) to
    3) on
    4) in

87. IgG IS THE ONLY ISOTYPE THAT CAN PASS ___ THE PLACENTA.
    1) through

2) with
3) to
4) in

88. ANTIGENS CAN BE CLASSIFIED ___ THEIR ORIGINS

1) with
2) through
3) in
4) by

89. ____ ATOPIC INDIVIDUALS, NON-PARASITIC ANTIGENS STIMULATE INAPPROPRIATE IgE PRODUCTION, LEADING TO TYPE I HYPERSENSITIVITY

1) at
2) for
3) in
4) of

90. IN ADDITION ____ FOREIGN PROTEINS FOUND IN FOREIGN SERUM (FROM BLOOD TRANSFUSIONS) AND VACCINES

1) for
2) by
3) in
4) to

91. GRASS ALLERGY IS GENERALLY LINKED ___ HAY FEVER BECAUSE THEIR SYMPTOMS AND CAUSES ARE SOMEHOW SIMILAR TO EACH OTHER

1) to
2) for
3) by
4) in

92. IF BOTH PARENTS SUFFERED _____ ALLERGIES IN THE PAST, THERE IS A 66% CHANCE FOR THE INDIVIDUAL TO SUFFER FROM SEASONAL ALLERGIES, AND THE RISK LOWERS TO 60% IF JUST ONE PARENT HAD SUFFERED FROM ALLERGIES

1) with
2) through
3) in
4) from

93. ALTERNATIVE TOOLS ARE AVAILABLE _____ IDENTIFY SEASONAL ALLERGIES, SUCH AS LABORATORY TESTS, IMAGING TESTS AND NASAL ENDOSCOPY

1) with
2) to
3) to
4) in

94. ANTIBIOTICS CAN BE CATEGORIZED BASED _____ THEIR TARGET SPECIFICITY

1) in
2) upon
3) on
4) by

95. _____ THE HIGHEST LEVEL, ANTIBIOTICS CAN BE CLASSIFIED AS EITHER BACTERICIDAL OR BACTERIOSTATIC

1) on
2) upon
3) at
4) over

Choose one phrase to complete the sentence.

96. A COMMON FORM OF _____ _____ IS FAILURE TO TAKE THE ENTIRE PRESCRIBED COURSE OF THE ANTIBIOTIC, USUALLY BECAUSE THE PATIENT FEELS BETTER, BUT BEFORE THE INFECTING ORGANISM IS COMPLETELY ERADICATED.

1) antibiotic misuse
2) antibiotic use
3) antibiotic usage
4) antibiotic disuse

97. EXCESSIVE USE OF _____ _____ IN TRAVELERS MAY ALSO BE CLASSIFIED AS MISUSE.

1) preventive vitamins
2) prophylactic means
3) prophylactic bacteriophages
4) preventive antibiotics

98. AS HARMFUL AS MANY VIRUSES ARE FOR THE HUMAN BODY, THE SPECIFICITY OF PHAGES _____ _____ AS POTENTIAL AGENTS TO DESTROY DISEASE-CAUSING BACTERIA

1) suggests some way
2) provides some means
3) offers some promise
4) proposes some solution

99. THE EMPTY CAPSID OF THE PHAGE IS LEFT OUTSIDE THE _____ _____ AS A "GHOST," EMPTY OF GENETIC MATERIAL

1) host cage
2) host cell
3) host tissue
4) owner cell

100. THERE HAVE BEEN NO LARGE CLINICAL TRIALS TO TEST THE EFFICACY OF PHAGE THERAPY YET, BUT RESEARCH CONTINUES BECAUSE OF THE RISE OF _____ _____.

1) antibiotic relevance
2) antibiotic misuse
3) antibiotic resistance
4) bacteriophage resistance

KEYS

1. 1	**2.** 4	**3.** 2	**4.** 2
5. 4	**6.** 3	**7.** 1	**8.** 4
9. 3	**10.**3	**11.**3	**12.**1
13.2	**14.**1	**15.**2	**16.**1
17.3	**18.**4	**19.**1	**20.**2
21.1	**22.**1	**23.**4	**24.**2
25.4	**26.**2	**27.**3	**28.**4
29.1	**30.**1	**31.**1	**32.**3
33.1	**34.**3	**35.**1	**36.**4
37.1	**38.**1	**39.**2	**40.**4
41.3	**42.**3	**43.**3	**44.**4
45.4	**46.**4	**47.**3	**48.**1
49.1	**50.**4	**51.**2	**52.**4
53.1	**54.**2	**55.**3	**56.**1
57.4	**58.**4	**59.**2	**60.**3

61.1	**62.**4	**63.**3	**64.**2
65.2	**66.**2	**67.**3	**68.**2
69.1	**70.**3	**71.**4	**72.**2
73.4	**74.**4	**75.**2	**76.**3
77.1	**78.**2	**79.**3	**80.**4
81.4	**82.**3	**83.**1	**84.**2
85.3	**86.**1	**87.**1	**88.**4
89.3	**90.**4	**91.**1	**92.**4
93.2	**94.**3	**95.**3	**96.**1
97.4	**98.**3	**99.**2	100. 3

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