

БАЛТИЙСКИЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ им. ИММАНУИЛА КАНТА

И. В. Островерхая

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Пособие содержит теоретический и практический учебный материал для аудиторной и внеаудиторной работы; вводит специальные термины и словосочетания; совершенствует навыки практического владения профессиональным английским языком; способствует развитию творческого потенциала обучающихся.

Адресовано студентам, магистрантам и аспирантам биологических специальностей и направлений, а также преподавателям английского языка.

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ВВЕДЕНИЕ

Учебное пособие по английскому языку «Английский язык для биологов», часть 2, адресовано обучающимся биологических специальностей и направлений. Пособие разработано в соответствии с требованиями Федерального государственного образовательного стандарта высшего образования по направлениям подготовки 06.03.01 «Биология», 19.03.01 «Биотехнология» и 06.05.01 «Биоинженерия и биоинформатика». Его содержание соответствует утвержденным рабочим программам дисциплины «Иностранный язык (английский)».

Основными целями пособия являются совершенствование профессиональной подготовки будущих специалистов в области развития иноязычной компетенции и расширение общекультурного кругозора в процессе получения соответствующей информации на английском языке.

В задачи пособия входят обеспечение обучающихся учебным материалом для аудиторной и внеаудиторной работы, формирование системных знаний профессиональной лексики, выработка умений и навыков чтения и понимания профессионально ориентированных текстов.

Пособие состоит из четырех тематических модулей, которые включают в себя учебные тексты и задания к ним, упражнения на освоение профессиональной лексики, творческие и комбинированные задания. Модули являются самостоятельными учебными единицами и могут изучаться в любой последовательности.

С пожеланиями студентам успехов в освоении профессионального английского языка, а преподавателям — вдохновения для организации полезных и интересных занятий,

автор.

Module 1

FUNGI. ALGAE. LICHENS

1.1. Learn the active vocabulary of Module 1.

1. acid ['æsid]	кислый, кислотный
2. alga ['ælgə]	водоросль
3. algae (<i>pl</i>) ['ældʒi:, 'ælgɪ:]	водоросли
4. algal [ælgəl]	водорослевый
5. alternating [ˌɔ:ltənertɪŋ]	чередующийся
6. aspen mushroom ['æspən 'mʌʃrʊm]	подосиновик
7. basic ['beɪsɪk]	щелочной
8. birch mushroom [bɜ:ʃ 'mʌʃrʊm]	подберезовик
9. cep [sep]	белый гриб
10. champignon [tʃæm'piŋjən]	шампиньон
11. chanterelle [ˌʃɑ:ntə'rel]	лисичка (гриб)
12. crustose ['krʌstəs]	корковый
13. death cap ['deθ kæp]	бледная поганка
14. diatom ['daɪətəm]	диатомея
15. enzyme ['enzaim]	фермент
16. fly agaric [ˌflaɪ 'ægərɪk]	мухомор красный
17. foliose ['fəʊli,əs]	листоватый
18. frond [frɒnd]	таллом
19. fruticose ['frʊtɪ,kəs]	кустистый
20. fuller's earth ['fuləz 'z:θ]	отбеливающая глина
21. fungal ['fʌŋgl]	фунговый, грибной
22. fungi (<i>pl</i>) ['fʌŋgi:, 'fʌŋgaɪ, 'fʌndʒaɪ]	грибы
23. fungus ['fʌŋgəs]	гриб
24. gamete ['gæmi:t]	гамета
25. gametophyte [gə'mi:təʊ ,fart]	гаметофит
26. gill [gɪl]	пластинка гриба

27. gonorrhoea [ˌɡɒnəˈriə]	гонорея
28. holdfast ['həʊldˌfɑːst]	ризид
29. hypha ['haɪfə]	гифа
30. hyphae (pl) ['haɪfi]	гифы
31. kelp [kelp]	ламинария
32. lichen ['laɪkən, 'lɪtʃən]	лишайник
33. lichens (pl) ['laɪkənz, 'lɪtʃənz]	лишайники
34. lichenologist [ˌlaɪkəˈnɒlədʒɪst]	лихенолог
35. lichenology [ˌlaɪkəˈnɒlədʒɪ]	лихенология
36. meningitis [ˌmenɪnˈdʒaɪtɪs]	менингит
37. mould [məʊld]	плесневой гриб
38. mycelium [maɪˈsiːliəm]	мицелий
39. mycobiont [ˌmaɪkəʊˈbaɪɒnt]	микобионт
40. mycologist [maɪˈkɒlədʒɪst]	миколог
41. mycology [maɪˈkɒlədʒɪ]	микология
42. penicillin [ˌpenɪˈsɪlɪn]	пенициллин
43. photobiont [ˌfəʊtəʊˈbaɪɒnt]	фотобионт
44. phycologist [faɪˈkɒlədʒɪst]	фиколог
45. phycology [faɪˈkɒlədʒɪ]	фикология
46. pneumonia [njuːˈmɒniə]	пневмония
47. porcini (pl) [pɔːˈtʃɪːnɪ]	белые грибы
48. porcino [pɔːˈtʃɪːnəʊ]	белый гриб
49. remains (pl) [rɪˈmeɪnz]	остатки
50. rhizine ['raɪzən]	ризина (вырост)
51. saprophyte ['sæprəʊˌfaɪt]	сапрофит
52. seaweed ['siːwiːd]	морская водоросль
53. sporophyte ['spɔːrəʊˌfaɪt]	спорофит
54. staphylococci (pl) [ˌstæfɪləˈkɒkai]	стафилококки
55. stem [stem]	ножка гриба
56. substrate ['sʌbstreɪt]	субстрат
57. thallus ['θæləs]	слоевище
58. thalli (pl) ['θælaɪ]	слоевища
59. toadstool ['təʊdstuːl]	поганка
60. yeast [jiːst]	дрожжи

1.2. Read the text and speak about fungi.

Fungi are eukaryotic organisms that include mushrooms, toadstools, yeast, moulds, and mildew. Most fungi are invisible to the naked eye because of the small size. A fungus with a round cap and a short stem is called a ‘mushroom’. Though fungi grow in the ground, they are not plants because they have no chlorophyll and cannot make food. Some fungi are parasites that live off plants and animals. And some fungi are saprophytes that live off plant and animal remains. Fungi are classified as a separate kingdom.

The discipline that studies fungi is *mycology* or *fungus biology*. Mycologists have identified more than 90,000 fungal species. However, there are countless species more yet to be discovered.

Fungi feed by releasing enzymes. Enzymes are chemicals, which rot away whatever they feed on. Fungi absorb nutrients and minerals from the rotting organism. Fungi are made of hundreds of cotton-like threads called ‘hyphae’, which can digest and absorb the materials they live on. Hyphae usually spread out in a tangled mass through the soil or within the tissues of the plant or animal they live on. Some fungi grow by spreading their hyphae in a mat or mycelium. Others reproduce with the help of spores. A mushroom has a protective cap, under which there are lots of thin sheets called ‘gills’. Gills are covered in spores, and a mature mushroom can produce about 16 billion spores in its brief lifetime. Those fungi that reproduce by spores go through alternating generations. The first generation (gametophytes) gives gametes — male and female sex cells; the second generation (sporophytes) gives spores from which new fungi will grow.

Many mushrooms can be eaten. Edible mushrooms include porcini or ceps, champignons, chanterelles, birch mushrooms, aspen mushrooms, etc. Poisonous mushrooms are called ‘toadstools’ — they are bad to eat, because they can kill. Examples of deadly poisonous toadstools are a harmless looking death cap and a fly agaric having a scarlet cap with white warts.

1.3. Match the basic fungal concepts to their definitions.

Parasite	Mould	Cap
Yeast	Mushroom	Cep
Spore	Mycologist	Mildew
Mycelium	Hyphae	Toadstool
Mycology	Saprophyte	Gill

1. _____ — tiny threads making the mycelium and the fruiting body of a fungus.
2. _____ — a single-celled fungus able to ferment sugars.
3. _____ — fungi developing on the surface of food, fabrics, wallpaper, etc.
4. _____ — a fungus with a capped spore-producing body that is not edible.
5. _____ — an organism that obtains its nutrients from dead organic material.
6. _____ — a thin sheet under the mushroom's cap, covered in spores.
7. _____ — an asexual reproductive body consisting of one or several cells.
8. _____ — the mass of hyphae that form the vegetative part of a fungus.
9. _____ — a top protective layer of a mushroom.
10. _____ — parasitic fungi affecting mainly the leaves of a plant.
11. _____ — an edible or poisonous fungus with a cap and a stem arising from mycelium.
12. _____ — the scientific study of fungi.
13. _____ — an expert in the branch of biology concerned with the study of fungi.
14. _____ — a fungus that lives off plants and animals.
15. _____ — a synonym to porcino that denotes a mushroom that many people consider to be one of the best to eat.

1.4. Fill in the gaps in the story about penicillin.

meningitis	bacteria	vacation
antibiotic	compare	discovery
mould	chance	drug
researchers	share	poisoning
invent	name	production

In 1928, Scottish biologist Alexander Fleming (1881—1955) isolated the (1) _____ substance from the fungus of *Penicillium* genus. He called it ‘penicillin’. Penicillin affects (2) _____ such as staphylococci and gram-positive pathogens (scarlet fever, pneumonia, gonorrhoea, (3) _____, diphtheria). The discovery was made by (4) _____. Fleming worked in St. Mary’s Hospital in London. Once, when he returned from a (5) _____ to Scotland, he found a messy lab bench with a *Staphylococcus* culture plate that was contaminated with a (6) _____. On closer inspection, he noticed that no bacteria grew near the mould. For this (7) _____, Fleming was awarded the Nobel Prize in Physiology or Medicine in 1945, which he shared with the two (8) _____ of the University of Oxford, Sir Howard Florey (1898—1968) and Sir Ernst Boris Chain (1906—1979), who developed the drug for mass (9) _____.

In 1942, Soviet scientist Zinaida Ermolyeva (1897—1974) managed to (10) _____ the first antibiotic in Russia. During the Great Patriotic War, wounded soldiers died from blood (11) _____. An antibiotic was needed. It was already in production in the West, but the “allies” were in no hurry to (12) _____ it with the USSR. Zinaida Ermolyeva worked selflessly day and night and only on the 93rd attempt, she managed to find the mould and develop a (13) _____. She named it *Krustozin* because she got it from the mould *Penicillium crustosum*. Soon the production of an antibiotic was launched, which saved many Soviet soldiers. In 1944, when Sir Howard Florey came to the USSR to (14) _____ the two antibiotics, he called Zinaida Ermolyeva “Madame Penicillin” — the (15) _____ by which she is known in the scientific world.

1.5. Read the text and speak about algae.

Algae were among the first living organisms on the Earth. They provide food for marine animals and oxygen for water life. Algae range from microscopic single-celled organisms (microalgae) measuring as little as 0.2 micrometres to macroscopic, multicellular organisms (macroalgae) like huge fronds of seaweed, which are 60 metres long. Today, there are around 70,000 known species of algae, although researchers estimate the actual number is closer to one million! Many scientists include algae in a separate kingdom called 'Protoctista' or 'Protista'.

Some algae have strong holdfasts to fix on the substrate like rocks and the sea floor. Some algae live in fresh water, some in sea water, some on wet mud, some on damp trees and wooden fences, and some even inside small, transparent animals. Small algae float freely like animals, but others need a place to grow like a plant. The oldest and simplest algae are blue-green algae. They are classified as bacteria, called 'cyanobacteria'.

Most algae are green as they contain chlorophyll. Green algae are found mostly in fresh shallow water. Chlorophyll is green, but algae are not always green. In the bigger seaweeds, green chlorophyll is masked by other pigments, like brown or red. The kelp is the biggest brown seaweed, which grows at depths of 15—20 metres. Red algae grow deeper at 30—60 metres and are found mostly in warm seas. Diatoms are tiny single-celled creatures. They contain yellow-pigmented chlorophyll and live in sea water, in puddles, and on wet mud. Diatoms are too small to be seen singly, but colonies sometimes form a brownish mark. Over millions of years, their silica-based skeletons have formed deposits on the sea floor up to 300 metres thick. This is dug up as fuller's earth, used to clean wool and decolourise oil and gas.

Phycology is the study of algae. Phycologists specialise in studying taxonomy, morphology, physiology, biochemistry, ecological roles in marine and freshwater ecosystems, and economic and industrial applications of algae.

1.6. Match the algae related terms to their definitions.

Seaweeds	Laminaria	Phycologist
Phycology	Red algae	Nori
Chlorophyll	Kelp	Frond
Diatom	Holdfast	Fuller's earth
Substrate	Cyanobacteria	Pigment

1. _____ — a seaweed, also known as kelp, that grows at depths of 15—20 metres under water and is cultivated for food.

2. _____ — any large, brown, cold-water seaweed of the family Laminariaceae, used as food and in various manufacturing processes.

3. _____ — the blue-green algae that are large producers of oxygen.

4. _____ — a long piece of seaweed that looks like one of these leaves.

5. _____ — a scientist studying taxonomy, morphology, physiology, biochemistry, and ecological roles of algae.

6. _____ — the largest and most complex marine algae.

7. _____ — marine algae of the phylum Rhodophyta, in which the chlorophyll is masked by a red or purplish pigment.

8. _____ — the surface on which a living thing grows and feeds.

9. _____ — an edible seaweed often used in Japanese cookery, especially for wrapping sushi or onigiri.

10. _____ — an alga's organ of attachment to the surface.

11. _____ — any of numerous microscopic, unicellular, marine or freshwater algae of the phylum Chrysophyta, having cell walls containing silica.

12. _____ — the scientific study of algae.

13. _____ — a highly absorbent clay used to remove grease from woolen cloth in fulling and to clarify fats and oils.

14. _____ — a substance that gives a particular colour.

15. _____ — the green pigment of photosynthetic algae.

1.7. Read the text and speak about lichens.

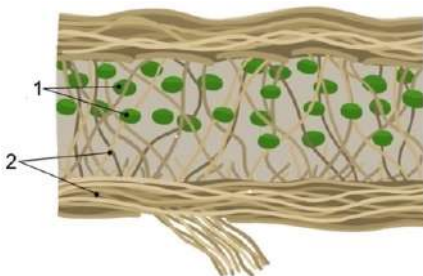


Fig. 1. Lichen:

1 — algal cells; 2 — fungal hyphae

The study of lichens is *lichenology*, and scientists who specialise in studying lichens are known as *lichenologists*.

A lichen is a remarkable partnership between algae and fungi. There are 3 main lichen body types: crustose, fruticose, and foliose.

A thallus is the composite body of a lichen. It is anchored to the substrate by rhizines, the hairlike growths. The basis of the thallus is formed by the fungal hyphae (2). They form the lower and upper layers, determining the shape and colour of the lichen. The fungal partner, called the ‘mycobiont’, holds water and makes a protective layer above and beneath. Algal cells (1) occupy the cavities between the hyphae. The algal partner, called ‘photobiont’, makes the food to feed the fungi.

Lichens live in the Arctic tundra, deserts, and mountains. They grow on rocks, trees, houses, soil, metal, and glass. They can colonise sand dunes and survive in outer space! They come in various shapes, sizes, and colours. Lichens are used as bioindicators to monitor air pollution and climate change. In many ecosystems, lichens are primary producers serving as a source of food for various animals and insects. For example, they provide food for reindeer in the Arctic. Small invertebrates, such as mites and spiders, often make lichens their habitat.

Lichens make about 400 secondary products. One of them is soluble powder called ‘litmus’, used to make litmus paper, which tests the acidity of liquids. The litmus dye turns blue in basic solutions like ammonia, and red in acid solutions like vinegar. Other secondary products of lichens are used to scent soaps and make perfumes.

1.8. Fill in the abstract to the article with the given words.

aim	areas	distribution
species	vicinity	indicator
component	contribution	methods
lichen	number	biodiversity
role	result	study

This article is dedicated to the study of lichen biota as part of the research and conservation of (1) _____ in the Kaliningrad Region. Biological studies of little-known territories are a crucial (2) _____ of the ecologically oriented development of the Kaliningrad Region, especially for (3) _____ with heavily transformed landscapes. Expanding the understanding of the diversity and (4) _____ of lichens plays an important (5) _____ in nature conservation and supporting the biodiversity. The (6) _____ of the study was to examine the lichen biota of the northwestern part of the Krasnoznamensk municipal District (part of the Sheshupe ancient alluvial Plain). This is the first such (7) _____ for the Krasnoznamensk District. Field research was conducted in the (8) _____ of the western part of the Neman Forest and the Velikoe Bog in 2022 and 2023. Laboratory processing of the collected materials with (9) _____ identification was carried out using standard (10) _____. As a (11) _____ of the study, 105 species of lichens and lichenicolous fungi were identified for the northwestern part of the Krasnoznamensk District, 82 of which are reported for the first time for the district. Among the discovered species are rare lichens of the Kaliningrad Region, as well as 117 (12) _____ species of minimally disturbed and old-growth forest communities. These data make a significant (13) _____ to the understanding of lichens in the Kaliningrad Region, filling long-standing gaps in lichen biota research in the area. Consequently, the (14) _____ of known taxa in the lichen biota of the Krasnoznamensk district increased to 131 species. Based on our results, further study of the (15) _____ biota of the Krasnoznamensk District appears promising.

1.9. Fill in the gaps with a derivative of the given word.

1. Mushrooms, often enjoyed in (vary) _____ culinary dishes, (present) _____ just the tip of the iceberg when it comes to fungi.
2. Fungi are responsible for the (composition) _____ of wood.
3. Slime moulds exhibit astonishing (complex) _____ in their behaviours.
4. Fungi hold a critical role as nature's (recycle) _____.
5. Nikolai Klimko was a prominent (mycology) _____, known for his work in fungal infections.
6. Penicillin is a (power) _____ antibiotic, credited with saving (count) _____ human lives.
7. Kelp is the largest (group) _____ of seaweed.
8. These (phycology) _____ study the ecological role of algae in aquatic ecosystems.
9. Kelp knots itself to a spot and spreads into an (water) _____ forest.
10. Colour is a big (differentiate) _____ between seaweed and kelp.
11. A kelp forest provides habitats and (safe) _____ for fish.
12. Studies indicate that kelp may help fight (obese) _____ by reducing fat (absorb) _____.
13. Seaweed is full of nutrients (benefit) _____ to plant life.
14. Seaweed is a (taste) _____ ingredient in (Japan) _____ and (China) _____ dishes.
15. Lichens are a great (indicate) _____ of air quality.
16. The (fungi) _____ component of a lichen provides a stable structure and essential (protect) _____.
17. Local (populate) _____ of lichens are depleted by over-harvesting for commercial purposes.
18. Lichens are very sensitive to air (pollute) _____.
19. Understanding lichens helps us appreciate the complexity and (connect) _____ of nature.
20. Lichens have a big (vary) _____ of shapes and body forms.

1.10. Fill in the gaps with a suitable preposition.

1. Most fungi are invisible _____ the naked eye.
2. Saprophytes live _____ plant and animal remains.
3. Fungi absorb the nutrients _____ the rotting organism.
4. Some fungi grow _____ spreading hyphae in a mycelium.
5. Some fungi reproduce _____ the help _____ spores.
6. Gills are _____ the protective cap of the mushroom.
7. A mushroom produces billions of spores _____ its lifetime.
8. Spore reproducing fungi go _____ alternating generations.
9. New fungi grow _____ spores.
10. Mycologists are experts _____ mycology.
11. A spore may consist _____ one or several cells.
12. Penicillin was discovered _____ chance.
13. Alexander Fleming was awarded the Nobel Prize _____ the discovery _____ penicillin.
14. _____ the scientific world, Zinaida Ermolyeva is known _____ the name "Madame Penicillin".
15. Algae are _____ the first living organisms _____ the Earth.
16. The kelp grows _____ depths _____ more than 15 metres.
17. Green chlorophyll can be masked _____ other pigments.
18. Nori is a dried seaweed used _____ Japanese cuisine.
19. Lichens are a partnership _____ algae and fungi.
20. Lichens come _____ various colours, shapes, and sizes.
21. The litmus dye turns red _____ vinegar.
22. The paper is dedicated _____ lichen biota of the region.
23. Based _____ obtained results, further studies are required.
24. Fungi are responsible _____ decomposition of wood.
25. Lichens are sensitive _____ air pollution.
26. _____ case you do not know if a mushroom is edible, it is advisable not to pick it.
27. *Krustozin* is named _____ the mould *Penicillium crustosum*.
28. Phycologists specialise _____ studying algae.
29. Holdfast is an alga's organ of attachment _____ the surface.

1.11. Read the post and make a post on any suggested topic.



Fig. 2. Puffballs

A common puffball, *Lycoperdon perlatum* in Latin, is met on the Curonian Spit in the Kaliningrad Region. It grows in the first few hours after rain, hence its Russian name is *dozhdevik*, which means a ‘raincoat’. Young puffballs can be eaten. Cooking them is very simple. Just wash them, peel the skin off, cut, and fry in butter.

Warning! Don’t forget that some mushrooms are deadly poisonous. In case you don’t know whether a mushroom is edible or not, it’s reasonable to follow a rule of thumb: *when in doubt, throw it out!* Though, not to destroy the biodiversity, we can paraphrase the rule: *doubt too much, don’t touch!*

Post topics:

1. Bioluminescent fungi.
2. Truffles and truffle hunting.
3. *Lactarius indigo* aka blue milk mushroom.
4. *Amanita phalloides* aka the death cap mushroom.
5. Mycelium eco-leather.
6. Fungi breaking down oil spills.
7. Seaweed in cooking.
8. Kelp forests.
9. Arkhangelsk Seaweed Factory.
10. Lichens surviving in space.
11. *Letharia vulpina* aka wolf lichen.
12. *Cladonia rangiferina* aka reindeer moss.
13. Blue cheese.
14. Free topic.

1.12. Do the test on Module 1: define whether the statements are true or false and then correct the false ones.

1. Fungi are eukaryotic heterotrophic organisms.
2. Fungi are made of cotton-like threads called 'spores'.
3. Mildew, yeast, and moulds belong to algae.
4. Fungi feed by releasing enzymes.
5. Toadstools are edible mushrooms.
6. Fungi can be both saprophytes and parasites.
7. Mycology is the study of algae.
8. Lichenology is the study of fungi.
9. Phycology is the study of lichens.
10. Fungi lack chlorophyll and do not photosynthesise.
11. A mycelium is a mass of thread-like hyphae.
12. Porcini and chanterelles are deadly poisonous mushrooms.
13. Algae are a group of photosynthesising aquatic organisms.
14. The biggest seaweeds are diatoms.
15. Algae provide food for shrimps and whales.
16. The kelp is the brown alga.
17. Blue-green algae are called 'cyanobacteria'.
18. Red algae are found mostly in cold seas.
19. Algae provide oxygen for water life.
20. Cyanobacteria make fuller's earth.
21. Symbiosis between algae and fungi is lichens.
22. Lichens grow well where the air is dirty.
23. Litmus paper tests the acidity of liquids.
24. Algae are used to gel toothpaste.
25. The fungal partner in lichens is called the 'photobiont', while the algal partner is known as the 'mycobiont'.
26. Lichens produce natural dyes to colour fabrics.
27. Lichens do not grow on metal and glass.
28. Scientists who study lichens are known as mycologists.
29. Some lichens can survive in space.
30. Lichens are bioindicators of air pollution.

1.13. Answer the questions on Module 1.

1. What belongs to fungi?
2. What are fungi made of?
3. What do enzymes do?
4. What fungus is called a 'mushroom'?
5. Do fungi belong to plants?
6. What do parasite fungi live off?
7. What do saprophyte fungi live off?
8. What do fungi release to feed?
9. Are toadstools edible?
10. How many spores does a mushroom produce?
11. How do hyphae usually spread out?
12. What is there under the mushroom's cap?
13. What generations do fungi go through?
14. How is sexual generation of fungi called?
15. What are sporophytes?
16. What edible and poisonous fungi do you know?
17. What kingdom do many scientists include algae in?
18. What depths do kelps grow at?
19. What colour-pigmented chlorophyll do diatoms have?
20. What algae are called 'cyanobacteria'?
21. What is fuller's earth?
22. What do several species of algae have to fix on rocks?
23. Why are algae important for water life?
24. What are lichens?
25. What are lichens sensitive to?
26. Whom do lichens provide food for?
27. What is litmus and what is it used for?
28. What are secondary products of lichens used for?
29. Who and why is called "Madame Penicillin"?
30. Who got the Nobel Prize for the discovery of penicillin?
31. What scientific branches study fungi, algae, and lichens?

Module 2

BACTERIA

2.1. Learn the active vocabulary of Module 2.

1. aerobe [eə' rəʊb]	аэроб
2. amoxicillin [ə, mɒksɪ' sɪlɪn]	амоксциллин
3. anaerobe [' ænə rəʊb]	анаэроб
4. anthrax [' æn θræks]	сибирская язва
5. antibiotic [, æntɪ baɪ' rɒtɪk]	антибиотик
6. antimicrobial [, æntɪ maɪ' krəʊ biəl]	антимикробный
7. antitoxin [, æntɪ' tɒksɪn]	антитоксин
8. autoclave [' ɔ: təʊ klɛɪv]	автоклав
9. bacilli (pl) [bæ' sɪlɪ]	бациллы
10. bacillus [bæ' sɪləs]	бацилла
11. bacteria (pl) [bæk' tɪəriə]	бактерии
12. bacterium [bæk' tɪəriəm]	бактерия
13. botulism [' bɒtʃ əlɪzəm]	ботулизм
14. bubonic plague [bju: , bɒnɪk ' pleɪg]	бубонная чума
15. carbohydrate [, kɑ: bəʊ' haɪd reɪt]	углевод
16. Celsius [' selsiəs]	шкала Цельсия
17. cholera [' kɒlə rə]	холера
18. cocci (pl) [' kɒk aɪ]	кокки
19. coccus [' kɒk əs]	кокк
20. commensal [kə' mensl]	комменсальный
21. common cold [ðə , kɒmən ' kəʊld]	ОРВИ
22. contamination [kən , tæmɪ' neɪʃn]	заражение
23. desiccation [, desɪ' keɪʃn]	высушивание
24. detergent [dɪ' tɜ: dʒənt]	моющее средство
25. diphtheria [dɪf' θɪəriə]	дифтерия
26. disinfectant [, dɪsɪn' fektənt]	дезинфектант

27. dormant [ˈdɔːmənt]	дремлющий
28. dysentery [ˈdisəntri]	дизентерия
29. Escherichia coli [ˌeʃəˈrɪkiə ˈkəʊlaɪ]	Эшерихия коли
30. filament [ˈfɪləmənt]	нить
31. flu [fluː]	грипп
32. influenza [ˌɪnfluˈenzə]	грипп
33. inhalation [ˌɪnhəˈleɪʃn]	вдыхание
34. intestine [ɪnˈtestɪn]	кишечник
35. leprosy [ˈleprəsi]	проказа
36. livestock [ˈlaɪvstɒk]	домашний скот
37. lobar [ˈləʊbə]	крупозный
38. malaria [məˈleəriə]	малярия
39. methicillin [ˌmeθɪˈsɪlɪn]	метициллин
40. microscopist [maɪˈkrɒskəpɪst]	микроскопист
41. motility [məʊˈtɪləti]	подвижность
42. oxacillin [ˌɒksəˈsɪlɪn]	оксациллин
43. parasitic [ˌpærəˈsɪtɪk]	паразитический
44. pasteurisation [ˌpæstəraɪˈzeɪʃən]	пастеризация
45. peptidoglycan [ˌpeptɪdəʊˈɡlaɪkæn]	пептидогликан
46. plague [pleɪɡ]	чума
47. pneumococci (pl) [ˌnjuːməʊˈkɒkaɪ]	пневмококки
48. pneumococcus [ˌnjuːməʊˈkɒkəs]	пневмококк
49. pneumonia [njuːˈməʊniə]	пневмония
50. precursor [ˈpriːkɜːsə]	предшественник
51. resistance [rɪˈzɪstəns]	резистентность
52. serum [ˈsɪərəm]	сыворотка
53. silage [ˈsaɪlɪdʒ]	силос
54. spirilla (pl) [spaɪˈrɪlə]	спириллы
55. spirillum [spaɪˈrɪləm]	спирилла
56. syphilis [ˈsɪfɪlɪs]	сифилис
57. tetanus [ˈtetnəs]	столбняк
58. thermophile [ˈθɜːməʊˌfaɪl]	термофил
59. tuberculosis [tjuːˌbɜːkjuˈləʊsɪs]	туберкулез
60. viable [ˈvaɪəbl]	жизнеспособный

2.2. Read the text and speak about bacteria.

Bacteria are microscopic, single-celled prokaryotes. Some bacteria can form groupings, such as clusters, filaments, or chains. Bacteria were first observed by Dutch microscopist Antonie van Leeuwenhoek (1632—1723) in 1676, using a single-lens microscope of his own design. German naturalist Christian Gottfried Ehrenberg (1795—1876) introduced the term ‘bacterium’ in 1828. The word means a ‘rod’ since the first identified bacteria were rod-shaped. Bacterial bodies may be spherical (cocci), rod-shaped (bacilli), or spiral (spirilla). The study of bacteria is known as *bacteriology*, a branch of *microbiology*.

Bacteria thrive in diverse environments including soil, water, acidic hot springs, radioactive waste, and deep layers of the Earth’s crust. Bacteria also live in mutualistic, commensal, and parasitic relationships with plants and animals. The largest number of bacteria in humans live in the gastrointestinal tract, especially in the large intestine. Many bacteria exist on the skin. Temperature, pH, oxygen, salt and sugar concentration, and availability of food affect bacterial growth and metabolism. The optimum growth temperature for bacteria varies from species to species. Thermophiles are heat-loving bacteria that can live in hot springs at 100 degrees Celsius. Most bacteria cannot grow at a low pH and high salt or sugar concentrations.

Some bacteria are aerobes that need oxygen for respiration, and some are anaerobes that do not require oxygen. There are also facultative anaerobes that can respire with or without oxygen. The examples of facultative anaerobic bacteria are *Escherichia coli* (*E. coli*) and *Salmonella*.

Most bacteria are harmless. Some bacteria are beneficial. For example, *Lactobacillus* species are used for fermenting milk to make yoghurt and fermenting grass to make silage. Some bacteria are pathogenic — they cause infectious diseases like cholera, syphilis, anthrax, leprosy, bubonic plague, and tuberculosis.

2.3. Match the bacteria related concepts to their definitions.

Anaerobe	Spirillum	Capsule
Cell wall	Nucleoid	Coccus
Bacillus	Microbiology	Flagella
Bacteriology	Cytoplasm	pH
Thermophile	Microscopist	Pathogen
Ribosome	Bacteriologist	Aerobe

1. _____ — a spherical or nearly spherical bacterium.
2. _____ — a rod-shaped bacterium.
3. _____ — a bacterium with a curved or spirally twisted body.
4. _____ — an organism that requires oxygen for respiration.
5. _____ — an organism that does not require oxygen for respiration.
6. _____ — indicates how acid or alkaline the solution is.
7. _____ — a heat-loving bacterium.
8. _____ — a protective from drying out covering of some species of bacteria that is made up of complex carbohydrates.
9. _____ — gives the bacterium its shape and protects it from the outside environment.
10. _____ — is a gel-like matrix composed of water, enzymes, nutrients, wastes, and gases.
11. _____ — are hairlike structures that provide a means of locomotion for a bacterium.
12. _____ — a region of cytoplasm where the chromosomal deoxyribonucleic acid (DNA) is located.
13. _____ — the scientific study of bacteria.
14. _____ — the branch of biology which is concerned with very small living things and their effects on people.
15. _____ — an organism which can cause disease.
16. _____ — the “protein machinery” of the bacterial cell.
17. _____ — a person engaged in the use of a microscope.
18. _____ — a scientist who specialises in the study of bacteria.

2.4. Fill in the gaps in the text and speak about endospores.

equipment	desiccation	metabolism
contamination	ribosomes	genera
sterelisation	inhalation	cytoplasm
stresses	autoclave	disease
endospore	conditions	peptidoglycan
exposure	state	structures

Some (1) _____ of gram-positive bacteria, such as *Bacillus*, *Clostridium*, *Sporohalobacter*, *Anaerobacter*, and *Heliobacterium*, can form highly resistant, dormant (2) _____ called ‘endospores’. Endospores develop within the (3) _____ of the cell. Generally, a single (4) _____ develops in each cell. Each endospore contains a core of DNA and (5) _____ surrounded by a cortex layer and protected by a multilayer rigid coat composed of (6) _____ and a variety of proteins. Endospores show no detectable (7) _____ and can survive extreme physical and chemical (8) _____, such as high levels of UV light, gamma radiation, detergents, disinfectants, heat, freezing, pressure, and (9) _____. In this dormant (10) _____, these organisms may remain viable for millions of years. Endospores even allow bacteria to survive (11) _____ to the vacuum and radiation of outer space. When (12) _____ return to normal, the endospore germinates. Endospore-forming bacteria can cause serious (13) _____. For example, anthrax can be contracted by the (14) _____ of *Bacillus anthracis* endospores, and (15) _____ of deep puncture wounds with *Clostridium tetani* endospores results in tetanus, while botulism is caused by the endospores of *Clostridium botulinum*. Autoclaving at 120 °C or more destroys endospores. The (16) _____ of glassware and other (17) _____ in laboratories or hospitals is often carried out in autoclaves. The (18) _____ was invented by French microbiologist Charles Chamberland (1851—1908) in 1879. The name comes from Greek *auto*-meaning ‘self’, and Latin *clavis* meaning ‘key’, thus it is a ‘self-locking device’.

2.5. Fill in the gaps with the derivatives of the given words and speak about antibiotic resistance.

Antibiotics are (1. chemistry) _____, produced by some micro-organisms in their (2. nature) _____ habitat to kill off (3. compete) _____. Antibiotics destroy or inhibit the (4. grow) _____ of some bacteria, so they are used to prevent and treat (5. bacterium) _____ infections.

Antibiotics are (6. effective) _____ against viruses, such as influenza and the common cold, that is why doctors do not usually give a (7. prescribe) _____ for antibiotics for a patient who has the flu or a cold.

Antibiotic (8. resist) _____ occurs when some bacteria are no longer killed or inhibited by a particular antibiotic. It is one of the biggest threats to (9. globe) _____ health today. Antibiotic resistance may occur (10. natural) _____ by mutation or by gene transfer between bacteria. But it is accelerated by the (11. use) _____ and (12. use) _____ of antibiotics, poor infection (13. prevent) _____, and poor control. In the past, antibiotics were (14. prescribed) _____ and added to animal feed to boost the (15. weigh) _____ of livestock. If antibiotics become commonplace, resistance becomes widespread too. Patients' (16. fail) _____ to complete a course of antibiotics also result in a (17. survive) _____ of resistant bacteria.

MRSA is a strain of Methicillin-resistant *Staphylococcus aureus* that causes (18. infect) _____ in different parts of the body. It is resistant to some (19. common) _____ used antibiotics. MRSA was first discovered in 1961. Since then, it has been (20. constant) _____ adapting and has become (21. resist) _____ to methicillin, amoxicillin, penicillin, oxacillin, and other antibiotics. Because it is hard to treat, MRSA is called a "super-bug". According to some sources, MRSA caused more than 100,000 deaths worldwide (22. attribute) _____ to antimicrobial resistance in 2019. To prevent the spread of MRSA, you need to wash hands (23. thorough) _____ and regularly using soap or an alcohol-based (24. sanitise) _____.

2.6. Learn 11 facts about French chemist and microbiologist Louis Pasteur and search the internet for the facts about some other famous bacteriologist.

Fact 1: Louis Pasteur (1822—1895) was a French chemist and microbiologist who developed vaccination, microbial fermentation, and pasteurisation. He was the creator of vaccines against anthrax, chicken cholera, and rabies.

Fact 2: He was the third child in the family. In his early years, he was an average student interested in fishing and drawing.

Fact 3: In 1849, he married his research assistant Marie Laurent, the daughter of the rector of the University of Strasbourg. They had 5 children together, but only 3 made it to adulthood.

Fact 4: In 1848, he was named Professor of Chemistry at the University of Strasbourg and named Chair of Chemistry in 1852.

Fact 5: In 1861, he developed the Germ Theory. He proved that bacteria were the source of infection and disease.

Fact 6: In 1868, he suffered a stroke that paralysed the left side of his body, but he was able to continue working.

Fact 7: In 1869, he was elected a Foreign Member of the Royal Society of London.

Fact 8: In 1874, the Royal Society of London presented him the Copley Medal for his work on fermentation. It is the most prestigious UK's award, granted annually only to one person "for sustained, outstanding achievements in any field of science".

Fact 9: In 1895, he won the Leeuwenhoek Medal, granted by the Royal Netherlands Academy of Arts and Sciences every 10 years to the scientist who had made the most significant contribution to microbiology during the preceding decade.

Fact 10: In 1895, he died at the age of 72. His remains rest in the vault of the Pasteur Institute in Paris.

Fact 11: *Pasteurella* is a genus of gram-negative, facultatively anaerobic bacteria named after him, because he was the first who identified the bacterium now known as *Pasteurella multocida* as the agent of chicken cholera.

2.7. Read the text and speak about the famous Russian microbiologist Georgy Gabrichevsky.

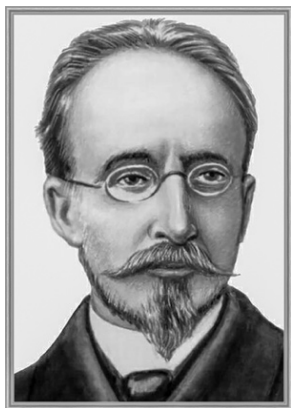


Fig. 3. Georgy Gabrichevsky

Georgy Norbertovich Gabrichevsky (1860—1907) is one of the founders of Russian microbiology. In 1886, he graduated from Moscow University. In 1888, after defending his doctoral dissertation, he received the title of privat-docent. In 1889—1891, he worked in the laboratories of Ilya Mechnikov, Robert Koch, and Paul Ehrlich in Europe. In 1892, he began to deliver the first systematic course in bacteriology for students in Russia at Moscow University.

He organised a bacteriological laboratory, which later grew into Bacteriological Institute (1895). Today, it is Gabrichevsky Moscow Scientific Research Institute of Epidemiology and Microbiology. In 1894, Gabrichevsky organised the production of anti-diphtheria serum. There was no financial support, and the first horse for immunisation was bought with his own funds. His works are devoted to scarlet fever, diphtheria, malaria, plague, and general issues of bacteriology. He proposed a method for cultivating anaerobes in dishes, a new method for determining the active motility of bacteria and developed an antidyentery serum.

His death at 47 was evidence of his selfless devotion to science. While immunising a horse with pneumococci to obtain a therapeutic serum against lobar pneumonia, Gabrichevsky became infected with pneumococcus after which he fell ill with lobar pneumonia. A vaccine against it was created only half a century later, in 1960. Gabrichevsky died on April 5, 1907. He was buried at the Pyatnitskoye Cemetery in Moscow. If you happen to visit the Pushkin State Museum of Fine Arts in Moscow, you will see his bust made by French sculptor Auguste Rodin.

2.8. Insert the given options into the text about the Petri dish.

- A. he was awarded in 1905
- B. used an agar medium
- C. is known as the “Bible of Bacteriology”
- D. may include nutrients
- E. he published in the paper
- F. helped to discover important pathogens
- G. cells of bacteria, fungi, and small mosses can be cultured
- H. is known as ‘inoculation’ or ‘plating’

A Petri dish is a plate for microbiology research. It is a shallow transparent lidded container that holds growth medium in which (1) _____. The dish is partially filled with warm liquid containing agar, and a mixture of specific ingredients that (2) _____, blood, salts, carbohydrates, dyes, indicators, amino acids, and antibiotics. After the agar cools and solidifies, the dish is ready to receive a microbe-laden sample in a process that (3) _____. The Petri dish is named after German bacteriologist Julius Richard Petri (1852—1921), who worked as an assistant to German microbiologist Robert Koch (1843—1910) at Berlin University.

Petri modified the original Koch’s dish which (4) _____. Koch published a precursor dish in a booklet in 1881, whose English title is *Methods for the Study of Pathogenic Organisms*, which (5) _____. Koch demonstrated his plating method at the Seventh International Medical Congress in London in August 1881. There, the renowned French microbiologist Louis Pasteur (1822—1895) exclaimed, “What a great progress, Sir!” It was this method that (6) _____ of tuberculosis (*Mycobacterium tuberculosis*), anthrax (*Bacillus anthracis*), and cholera (*Vibrio cholerae*). The research on tuberculosis brought Robert Koch the Nobel Prize in Physiology or Medicine, which (7) _____.

In 1887, Petri made the final modifications to Koch’s dish and method, which (8) _____, whose English title is *A Minor Modification of the Plating Technique of Koch*.

2.9. Fill in the gaps with a derivative of the given word.

1. The most common fatal bacterial diseases are (respire) _____ infections.
2. Individual bacteria can assume one of three basic shapes: (sphere) _____, rodlike, or curved.
3. The rod-shaped bacilli usually occur (single) _____.
4. The rod-shaped *Escherichia coli* is a normal (inhabit) _____ of the (intestine) _____ tract of humans and animals.
5. Each bacterium grows and divides (independent) _____ of any other bacterium.
6. The (present) _____ of bacteria was first recognised in 1677, when Dutch (microscope) _____ Antonie van Leeuwenhoek saw (microscope) _____ organisms with the primitive microscope.
7. Much of the (know) _____ about bacteria has come from studies of disease-causing bacteria.
8. There are no absolute rules about bacterial (compose) _____.
9. (Bacteriology) _____ investigate morphology, ecology, genetics, biochemistry, phylogenetics, and genomics of bacteria.
10. Bacteria are defined as prokaryotic (cell) _____ entities.
11. French chemist Louis Pasteur demonstrated that food spoils because of contamination by (visible) _____ microorganisms.
12. Tuberculosis is a bacterial (infect) _____ transmitted from person to person through tiny (drop) _____ discharged into the air from the (infect) _____ person by coughing or sneezing.
13. 'Septicemia' is the medical term for (bacterium) _____ blood poisoning.
14. Cholera is a severe diarrheal (ill) _____ caused by *Vibrio cholerae* bacteria infecting the intestine.
15. The (grow) _____ of bacteria in laboratory cultures is the mainstay method used by bacteriologists.
16. Bacterial cells are generally surrounded by two (protect) _____ coverings: an outer cell wall and an inner cell membrane.
17. Anthrax is an (infect) _____ disease caused by bacteria.

2.10. Fill in the gaps with a suitable preposition.

1. Who were bacteria first observed _____?
2. Leeuwenhoek discovered bacteria _____ the help _____ a microscope _____ his own design.
3. Most bacteria _____ humans live _____ the large intestine.
4. The optimum growth temperature _____ bacteria varies _____ species _____ species.
5. Thermophiles live _____ hot springs _____ 100 °C.
6. Aerobes need oxygen _____ respiration.
7. Facultative anaerobes respire _____ or _____ oxygen.
8. Cell walls protect bacteria _____ the outside environment.
9. A microscopist is engaged _____ the use of a microscope.
10. Bacteriologists specialise _____ the study _____ bacteria.
11. Endospores may remain viable _____ millions of years.
12. Endospores survive exposure _____ the vacuum.
13. The wound is contaminated _____ endospores.
14. The name 'autoclave' comes _____ the Greek language.
15. Contamination _____ endospores resulted _____ tetanus.
16. Antibiotic resistance is accelerated _____ misuse or over-use _____ antibiotics.
17. MRSA is resistant _____ some commonly used antibiotics.
18. The Petri dish is named _____ Julius Richard Petri.
19. Louis Pasteur created vaccines _____ anthrax and rabies.
20. Louis Paster died _____ the age _____ 72.
21. Louis Paster was awarded the Copley medal, which is granted annually _____ the Royal Society _____ London.
22. Microbiologist Georgy Gabrichevsky graduated _____ Moscow University _____ 1886.
23. Gabrichevsky delivered the first university course _____ bacteriology for Moscow University's students.
24. Gabrichevsky became infected _____ a massive dose of pneumococcus _____ which he fell ill _____ lobar pneumonia.
25. Life and death of Georgy Gabrichevsky are the evidence _____ his selfless devotion _____ science.

2.11. Read the post and make a post on any suggested topic.



Fig. 4. *Handprint*

One of the most striking examples of bioart is the work of American microbiologist Tasha Sturm called *Handprint*.

In 2015, she simply asked her 8-year-old son, who had returned from a walk in the yard, to leave a handprint on the surface of a Petri dish filled with a nutrient solution of Tryptic Soy Agar (TSA).

She let the culture grow for 2 days, and this was the result — a colourful collection of bacteria, yeasts, and fungi! Tasha's children were very much impressed by the picture and became more motivated to wash hands properly. It's interesting that Tasha's picture is popular with interior designers using it to decorate rooms for teenagers.

Post topics:

1. Extremophiles.
2. Micropia Museum.
3. *Cupriavidus metallidurans* bacterium.
4. *Bifidobacterium*.
5. Agar Art.
6. *Thiomargarita magnifica* bacterium.
7. Bacteria in bioremediation.
8. *Deinococcus radiodurans* bacterium.
9. *Escherichia coli* bacterium.
10. Bacterial infections.
11. The Black Death pandemic.
12. Human microbiome.
13. Pasteurisation.
14. Free topic.

2.12. Do the test on Module 2: define whether the statements are true or false and then correct the false ones.

1. German naturalist Christian Ehrenberg was the first who observed bacteria with the help of the microscope.
2. Spiral bacteria do not exist.
3. Bacilli are spherical bacteria.
4. Bacteria cannot live in acidic hot springs.
5. Thermophiles are cold-loving bacteria.
6. Anaerobes require oxygen for respiration.
7. *Salmonella* and *Escherichia coli* are facultative anaerobes.
8. Beneficial bacteria are used for fermenting milk to make yoghurt and fermenting grass to make silage.
9. Autoclaving cannot destroy endospores.
10. The autoclave was invented by German bacteriologist Julius Petri.
11. Endospores cannot survive exposure to the vacuum and radiation of outer space.
12. Robert Koch's booklet *Methods for the Study of Pathogenic Organisms* is regarded as the "Bible of Bacteriology".
13. French microbiologist Louis Paster was awarded the Nobel prize in 1905.
14. Antibiotics are ineffective against viruses.
15. Georgy Gabrichevsky is one of the founders of Russian microbiology.
16. Georgy Gabrichevsky was the author of the first systematic university course in bacteriology.
17. Louis Pasteur is the author of the Germ Theory.
18. Robert Koch was never awarded the Nobel Prize.
19. While making experiments, Georgy Gabrichevsky fell ill with lobar pneumonia and died.
20. French microbiologist Charles Chamberland developed the precursor of the Petri dish.
21. *Lactobacillus* is called a "superbug".

2.13. Answer the questions on Module 2.

1. Who was the first to see bacteria under a microscope?
2. Who introduced the term 'bacterium' in 1828?
3. What forms do bacterial bodies have?
4. What branch of science studies bacteria?
5. Where do bacteria live?
6. What factors affect bacterial growth and metabolism?
7. What are facultative anaerobes?
8. What are beneficial bacteria used for?
9. What diseases do pathogenic bacteria cause?
10. What does the life cycle of a bacterium consist of?
11. What are endospores?
12. What are autoclaves used for?
13. What is botulism caused by?
14. What extreme stresses can endospores survive?
15. What are antibiotics?
16. Are antibiotics effective against viruses?
17. What is antibiotic resistance?
18. What is MRSA?
19. What must people do to prevent the spread of MRSA?
20. What scientific theory did French microbiologist Louis Paster develop?
21. What is the Leeuwenhoek Medal granted for? How often?
22. What bacterium is named after Louis Paster?
23. What did German microbiologist Robert Koch receive the Nobel Prize in Physiology or Medicine for?
24. What is a Petri dish used for?
25. Who developed the precursor of the Petri dish?
26. Who wrote the scientific work known as the "Bible of Bacteriology"?
27. What are Georgy Gabrichevsky's works devoted to?
28. What institute did Russian microbiologist Georgy Gabrichevsky found?

Module 3

RELATIONSHIPS BETWEEN ORGANISMS

3.1. Learn the active vocabulary of Module 3.

1. allelopathic [ə, li:lə'pæθɪk]	аллелопатический
2. allelopathy [æli'lɒpəθɪ]	аллелопатия
3. amensalism [ei'mensə,lɪzəm]	аменсализм
4. biocenosis [ˌbaɪəʊsɪ'nəʊsɪs]	биоценоз
5. carnivore ['kɑ:nɪvɔ:]	плотоядное
6. carnivorous [kɑ:'nɪvərəs]	плотоядный
7. coexistence [ˌkəʊɪg'zɪstəns]	сосуществование
8. commensalism [kə'mensəlɪzəm]	комменсализм
9. competition [ˌkɒmpə'tɪʃn]	конкуренция
10. competitor [kəm'petɪtə]	соперник
11. consequence ['kɒnsɪkwəns]	последствие
12. consumer [kən'sju:mə]	консумент
13. crown [kraʊn]	крона
14. decomposer [ˌdi:kəm'pəʊzə]	редуцент
15. detritus [dɪ'traɪtəs]	детрит
16. dodder ['dɒdə]	повилика
17. eucalyptus [ˌju:kə'lɪptəs]	эвкалипт
18. groundhog ['graʊndhɒg]	сурок
19. hatchling ['hætʃlɪŋ]	малек (рыбы)
20. haustoria (pl) [hɔ:'stɔ:riə]	гаустории
21. haustorium [hɔ:'stɔ:riəm]	гаустория
22. hawthorn ['hɔ:θɔ:n]	боярышник
23. herbivore ['hɜ:bɪvɔ:]	травоядное
24. herbivorous [hɜ:'bɪvərəs]	травоядный
25. hermit crab ['hɜ:mɪt kræb]	рак-отшельник
26. hoof [hu:f]	копыто

27. inhibit [ɪnˈhɪbɪt]	угнетать
28. interspecific [ˌɪntəspəˈsɪfɪk]	межвидовой
29. intraspecific [ˌɪntrəspəˈsɪfɪk]	внутривидовой
30. juglone [dʒuːˈgləʊn]	юглон
31. lesser burdock [ˌlesəˈbɜːdɒk]	лопух малый
32. mistletoe [ˈmɪsltəʊ]	омела
33. mutualism [ˈmjuːtʃʊəlɪzəm]	мутуализм
34. myrmecochory [ˌmɜːmɪkəʊˈkɔːrɪ]	мирмекохория
35. niche [niːʃ, nɪʃ]	ниша
36. omnivore [ˈɒmnɪvɔː]	всеядное
37. omnivorous [ɒmˈnɪvərəs]	всеядный
38. owl [aʊl]	сова
39. parasite [ˈpærəsəɪt]	паразит
40. parasitic [ˌpærəˈsɪtɪk]	паразитический
41. parasitism [ˈpærəsəɪtɪzəm]	паразитизм
42. poplar [ˈpɒplə]	тополь
43. predation [prɪˈdeɪʃn]	хищничество
44. predator [ˈpredətə]	хищник
45. prey [preɪ]	жертва
46. primary [ˈpraɪməri]	первичный
47. producer [prəˈdjuːsə]	продуцент
48. protective [prəˈtektɪv]	защитный
49. quaternary [kwəˈtɜːnəri]	четвертичный
50. raccoon [rəˈkuːn]	енот
51. remora [ˈremərə]	рыба-прилипала
52. safety [ˈseɪfti]	безопасность
53. sage [seɪdʒ]	шалфей
54. sea anemone [ˈsiː əneməni]	актиния
55. symbiology [ˌsɪmbaɪˈɒlədʒi]	симбиология
56. symbiont [ˌsɪmbaɪˈɒnt, ˈsɪmbɪˌɒnt]	симбионт
57. symbiosis [ˌsɪmbaɪˈəʊsɪs]	симбиоз
58. terpenoid [ˈtɜːpəˌnɔɪd]	терпеноид
59. tertiary [ˈtɜːʃəri]	третичный
60. titmouse [ˈtɪtmaʊs]	синица

3.2. Read the text and speak about symbiosis.

Organisms living in ecosystems can form beneficial, harmful, or neutral relationships. *Symbiosis* is a coexistence of the organisms of different species, in which at least one organism benefits. A symbiont is an organism living in a state of symbiosis. The science of symbiosis is *symbiology*. German scientist Heinrich Anton de Bary (1831—1888) proposed the term *symbiosis* at the end of the 19th century. This term is of Greek origin and means ‘living together’. Symbiosis can be mutual, commensal, and parasitic.

Mutualism is the relationship in which symbionts benefit from each other.

The typical example of mutualism is the relationship between the hermit crab and the sea anemone. The hermit crab protects its soft body using empty shells of other sea creatures.



Fig. 5. Hermit crab and sea anemone

For their own safety, hermit crabs also use protective properties of the sea anemone, which has poisonous tentacles. The sea anemone protects the hermit crab from its enemies and eats food particles, which are left by the hermit crab after eating. When the hermit crab changes the old shell for the new one, it takes the sea anemone to its new “house”.

Commensalism is the relationship in which one organism benefits, and the other organism is neither benefited nor harmed. For example, hatchlings of some fishes find protection under the bell of the jellyfish.

Parasitism is the relationship in which one organism (parasite) benefits at the expense of the other organism (host) that is harmed. For example, the tapeworm lives in the digestive system of other animals.

3.3. Define the type of relationship between the organisms: mutualism, commensalism, or parasitism.

1. The relationship between a **lesser burdock and black bears** is _____. The lesser burdock has prickly heads known as burrs. These burrs attach to the fur of black bears. As the bears travel, the burrs will fall off and will soon germinate, so black bears help to disperse the seeds of the lesser burdock.

2. The relationship between **woolly bats and pitcher plants (*Sarracenia*)** is _____. Pitcher plants are carnivorous plants that contain a slippery substance in their rim to attract their prey. Woolly bats are immune to this substance as they use the pitcher plant as a resting place. The plant then benefits from bats through their feces, which contains nutrients necessary for its survival.

3. The relationship between **clownfish and sea anemones** is _____. Clownfish live safely among the stinging tentacles of tropical sea anemones. The clownfish is protected from predators because it has a special mucus that stops the anemone's stings. In return, the clownfish protects the anemone from other fish that might eat it. Clownfish waste also provides nutrients, and they can even help the anemone to get more oxygen.

4. The relationship between **a dodder (*Cuscuta*) and an acacia tree** is _____. After a dodder attaches itself to an acacia, it wraps its thread-like yellowish or reddish stem around it. The acacia contains food beneficial to the dodder, so the dodder produces haustoria that insert themselves into the vascular system of the acacia and feeds on its juices.

5. The relationship between **a gapeworm and a chicken** is _____. Gapeworms attach themselves to the chicken's trachea, where they feed on blood, lay eggs, and make a blockage in the airflow for the chicken not to be able to breathe.

6. The relationship between **tree frogs and rainforest plants** is _____. Tree frogs use large leafy plants and trees in the rainforest to protect themselves from rain. This does not affect the plants, but it helps the frog to stay safe.

3.4. Read the text and speak about amensalism.

Amensalism is the relationship in which one organism harms another and remains unaffected itself. In other words, it is a non-mutualistic, asymmetric interaction where one species is harmed or killed by the other, and one is unaffected by the other. For example, crowns of trees inhibit the growth of groundling plants and mosses because trees block sunlight access to them. The microbial synthesis of antibiotics that can inhibit or kill other sensitive germs is also a classic example of amensalism. Sheep and cattle trampling grass presents one more obvious example of amensalism. While the presence of grass has little negative consequences on the animal's hooves, the grass is negatively affected by being crushed.

3.5. Match the beginnings of the sentences to their endings to get the correct statements about amensalism.

1. Amensalism often arises as a side effect of an ...
 2. Amensalism plays an essential ...
 3. Amensalism contributes significantly to biodiversity ...
 4. Amensalism is one-sided interaction of organisms that ...
 5. Amensalism helps ...
 6. Amensalism reduces competition by inhibiting ...
 7. Amensalism ensures the long-term health ...
 8. Amensalism is the exact ...
-
- A. ... and stability of the ecosystem.
 - B. ... by creating unique niches for species to thrive.
 - C. ... competitors, fostering a more balanced coexistence.
 - D. ... directs the path of ecosystem development.
 - E. ... opposite of commensalism.
 - F. ... organism's activities without any direct intention to harm or help another.
 - G. ... role in shaping the dynamics of ecosystems.
 - H. ... to manage resource allocation.

3.6. Read the text and speak about allelopathy.

Allelopathy is the phenomenon by which plants, fungi, and microorganisms produce chemicals that inhibit the development of other plants, fungi, and microorganisms. These chemicals, known as allelochemicals, can be found in various parts of the plant like leaves, roots, bark, or even decomposing plant matter.

A vivid example of allelopathy is the black walnut (*Juglans nigra*), which secretes juglone in its roots, walnut shells, and leaves. Juglone destroys herbaceous plants within the black walnut's root zone. It is toxic to many edible plants, like tomatoes, apples, and blueberries. That is why we often see a clear space round a black walnut tree where other plants struggle to grow.

Eucalyptus trees are also famous for their allelopathic powers. They release chemicals from their leaves. When these leaves fall to the ground, the chemicals can stop other plants from sprouting. This helps eucalyptus trees to dominate their environment.

Farmers and gardeners use the allelopathy to keep fields clean from weeds. Instead of using man-made chemicals, they can plant crops that release allelopathic chemicals.

3.7. Fill in the gaps with the given options.

**germination
patterns**

**absorption
material**

**growth
weed**

Sunflowers release several allelochemicals through their roots and decaying plant (1) _____. They negatively affect the germination and (2) _____ of certain weeds and other plant species nearby. Key allelochemicals in sunflowers, that contribute to their allelopathic effects, include phenolic acids that inhibit seed (3) _____ and root growth in various (4) _____ species; flavonoids that impact nutrient (5) _____ in neighboring plants; terpenoids that deter herbivores and affect the growth (6) _____ of competing flora.

3.8. Read the text and speak about competition.

Competition is the struggle between individuals of the same or different species for survival. Intraspecific competition happens between two individuals of the same species. Interspecific competition happens between individuals of different species. Plants compete for light, water, and minerals. Animals compete for food, water, shelter, and mates. For example, barn swallows and martins compete for the same insect food; two male birds compete for one female to become their mate; a tiger and a lion residing in grassland compete for a deer, etc.

3.9. Fill in the gaps with the given options.



survive
survival
compete
compete
competing
competition
competitor
competitors

Fig. 6. A squirrel and a woodpecker

A squirrel and a woodpecker are (1) _____ species. Their relationship is an example of interspecific (2) _____. Both animals (3) _____ for nest cavities and resources. They may wish to occupy a hole in a red oak tree, but they will not share the space, so this makes them (4) _____. The woodpecker is an active (5) _____ — it actively defends the nest from squirrels. The woodpecker may peck at the squirrel, chase it away, and even engage in physical altercations. The woodpecker and the squirrel may also (6) _____ for food as both eat fruit, seeds, and nuts. In times of plenty, this does not present a problem for their (7) _____, but when foods are scarce there may not be enough for both species to (8) _____.

3.10. Read the text and speak about predation and neutralism.

Predation is the relationship between two species, in which one (predator) hunts, kills, and eats the other (prey). Numbers of predators and numbers of prey interdepend. For example, owls eat hares. If there are lots of owls, hare numbers will go down as more get eaten. When there are fewer hares, owl numbers go down as there is not enough food.

Neutralism is the relationship between two species, which do not affect each other directly. For example, the maybug and the brown bear live in the same forest, but they neither benefit nor harm one another.

3.11. Place the pairs of organisms into two groups according to the type of their relationship: predation or neutralism. In case of predation, define the predator and the prey.

1. a woodpecker and a mole
2. a bee and a wolf
3. a spider and a fly
4. a deer and a jaguar
5. a mosquito and a fly
6. a titmouse and a worm
7. a Venus flytrap and a spider
8. a squirrel and an elk
9. a butterfly and a dragonfly
10. a lion and an antelope
11. a fox and a tiger

3.12. Make an electronic eight-slide presentation on different types of relationships between organisms such as mutualism, commensalism, parasitism, amensalism, allelopathy, competition, predation, and neutralism.

3.13. Read the text and speak about food chains.

The food chain shows how each living thing gets food, and how nutrients and energy are passed from creature to creature. *Producers, consumers, and decomposers (reducers)* are distinguished within the food chain. Plants are producers: they make their own food by photosynthesis. Consumers are animals that eat producers or other animals. The animal that eats the producer is called the ‘primary consumer’ or the ‘first order consumer’. The animal that eats the primary consumer is called the ‘secondary consumer’ or the ‘second order consumer’. The animal that eats the secondary consumer is called the ‘tertiary consumer’ or the ‘third order consumer’. There are different types of consumers. Herbivores eat only plants. Carnivores eat only animals. Omnivores eat both animals and plants. Decomposers are organisms such as bacteria and fungi that break down dead organisms and wastes.

3.14. Fill in the gaps with the given words.

primary
detrital
cascading

grazing
critical
trophic

entire
secondary
organic

A (1) _____ level is the position an organism occupies in a food chain. Producers are at the first trophic level, (2) _____ consumers are at the second level, (3) _____ consumers are at the third level, and so on. Each level represents a step in the transfer of energy and nutrients. The two common types of food chains are (4) _____ food chains, which begin with producers (like plants), and (5) _____ food chains, which start with dead (6) _____ matter (detritus). Removing a species from a food chain can have (7) _____ effects. If a keystone species (a species that plays a (8) _____ role in the ecosystem) is removed, the (9) _____ food chain can be disrupted. Populations of prey species may increase dramatically, while populations of predator species may decline.

3.15. Look at the diagram and fill in the gaps in the sentences with the correct options.

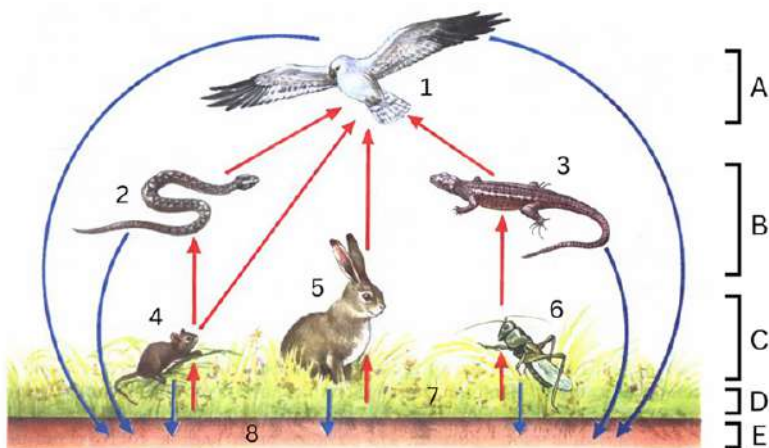


Fig. 7. Food chains in the steppe biocenosis:

- 1 — hawk; 2 — snake; 3 — lizard; 4 — mouse; 5 — rabbit; 6 — grasshopper;
 7 — grass and wild flowers; 8 — microorganisms; A — third order consumer;
 B — second order consumers; C — first order consumers; D — producers;
 E — decomposers / reducers

1. Grass and wild flowers are _____.
2. Microorganisms are _____.
3. The rabbit, the snake, and the hawk are _____.
4. The rabbit, the mouse, and the grasshopper eat _____.
5. The lizard eats the _____.
6. The snake, the rabbit, and the lizard are eaten by the _____.
7. The _____ is eaten by the snake and the hawk.
8. The grasshopper is eaten by _____.
9. The snake and the lizard are the _____ order consumers.
10. The rabbit, the mouse, and the grasshopper are the _____ order consumers.
11. The hawk is the _____ order consumer.

3.16. Fill in the gaps with a derivative of the given word.

1. Poplar trees release chemicals that harm the (grow) _____ of oats under them.
2. A primary (produce) _____ converts sunlight into energy.
3. Primary (consume) _____ eat the grass.
4. A bee and a wolf both live in same (ecology) _____ niche, but do not have any direct (interact) _____ with each other.
5. (Decompose) _____ break down dead organic matter.
6. Disruptions to food chains can lead to (stability) _____ and ecosystem collapse.
7. (Invasion) _____ species can disrupt food chains.
8. Whose (protect) _____ properties do hermit crabs use?
9. A sea anemone has (poison) _____ tentacles.
10. Hatchlings find (protect) _____ under the jellyfish's bell.
11. Eagles, snakes, wolves, and lions are examples of carnivores or (carnivore) _____ animals.
12. Owls are nocturnal (predation) _____.
13. Tapeworms live in the (digest) _____ system of animals.
14. Numbers of predators and prey (depend) _____.
15. Giant pandas and koalas are examples of herbivores or (herbivore) _____ animals.
16. Maybugs and bears do not affect each other (direct) _____.
17. For animals, life is a daily struggle for (survive) _____.
18. Some organisms produce biochemicals that influence the (develop) _____ and (reproduce) _____ of other organisms.
19. The grey rat is more (aggression) _____ and can easily (place) _____ the black one from its home.
20. Intraspecific struggle for (exist) _____ is a struggle between individuals of the same species.
21. Groundhogs and raccoons are examples of omnivores or (omnivore) _____ animals.
22. Sage produces (allelopathy) _____ substances.
23. Symbiosis is a (existence) _____ of the organisms of (differ) _____ species, in which at least one organism benefits.

3.17. Fill in the gaps with a suitable preposition.

1. Competition exists _____ organisms that need the same resources and live _____ the same place.
2. Organisms may compete _____ food, water, and space.
3. Amensalism refers _____ the negative impact that one organism has _____ another.
4. Pollution has negative impacts _____ food chains.
5. A quaternary consumer feeds _____ a tertiary consumer.
6. Juglone is toxic _____ many other plants like tomatoes, blueberries, and apples.
7. The classic food chain begins _____ a primary producer that converts sunlight _____ energy.
8. Disruptions to food chains lead _____ ecosystem collapse.
9. Berries serve _____ the initial energy source, a mouse acts _____ a primary consumer, and an owl preys _____ the mouse completing the food chain.
10. Keystone species play a critical role _____ the ecosystem.
11. Crowns _____ high trees block access _____ sunlight to groundling plants.
12. Hatchlings feel protected _____ the bell of the jellyfish.
13. A parasite benefits _____ the expense _____ its host.
14. Symbionts benefit _____ each other.
15. Different species struggle _____ survival.
16. Aubergines and bell peppers are sensitive _____ juglone.
17. Neutralism is an interspecific interaction _____ biotic factors, _____ which both species have no effect _____ each other.
18. Cheetahs use speed to succeed _____ catching prey.
19. Lions have adapted _____ hunting in packs.
20. Even _____ the wild, herbs, shrubs, and trees form their growing area thanks _____ allelopathic effects.
21. Goats tend _____ consume the same grasses that insects feed _____, resulting _____ an increased food deficit for insects.
22. Food and energy are passed _____ creature _____ creature.
23. Plants make their own food _____ photosynthesis.

3.18. Read the post and make a post on any suggested topic.

The specific feature of Kaliningrad's flora is mistletoe (*Viscum album*). It is a hemiparasite that attaches to the host by the haustorium. Through haustoria, mistletoe extracts water and nutrients from the host trees. *Viscum album* is said to parasitise more than 200 plant species including maple, linden, poplar, birch, hawthorn, etc. Some mistletoe species have recently been recognised as ecological keystone species.



Fig. 8. Mistletoe

Mistletoe is used as Christmas decoration under which lovers kiss. Mistletoe is believed to protect home from witches and demons. Mistletoe is the floral emblem of the American state of Oklahoma. Every year, the British town of Tenbury Wells holds *Mistletoe Festival* and crowns *Mistletoe Queen*.

Post topics:

1. Myrmecochory.
2. Devil's Garden in the Amazon rainforest.
3. Brood parasitism.
4. Hyperparasites.
5. Remora.
6. The Meguro Parasitological Museum.
7. *Rafflesia arnoldii* aka the corpse flower.
8. Biopesticides.
9. Crown shyness.
10. Free topic.

3.19. Do the test on Module 3: define whether the statements are true or false and then correct the false ones.

1. Commensalism and parasitism are types of predation.
2. Parasitism is the relationship in which one organism benefits at the expense of the other organism that is harmed.
3. Amensalism is the relationship between two species, in which one hunts, kills, and eats the other.
4. The relationship between the hermit crab and the sea anemone is mutualism.
5. Competition is the struggle between individuals of the same or different species for survival.
6. Neutralism is the relationship in which one organism harms another organism and remains unaffected itself.
7. The essential components of a food chain are producers, consumers, and decomposers.
8. A tertiary consumer preys on a secondary consumer.
9. Hawk is the quaternary consumer in the following food chain: Grass → Grasshopper → Frog → Snake → Hawk.
10. Herbivores eat both animals and plants.
11. Mistletoe has been recognised as a keystone species.
12. Decomposers break down dead organisms and wastes.
13. A hare is a predator, and an owl is a prey.
14. Relationship between barn swallows and martins is an example of neutralism.
15. Animals compete for food, water, shelter, and mates.
16. Secondary consumers feed on primary consumers.
17. Quaternary consumer feeds on the tertiary consumer.
18. Mistletoe attaches to the host by haustoria.
19. Relationship between a Venus flytrap and a spider is an example of competition.
20. Intraspecific competition happens between two individuals of the same species.
21. Symbiosis can be mutual, commensal, and parasitic.

3.20. Answer the questions on Module 3.

1. What relationships can organisms form in ecosystems?
2. What is symbiosis?
3. What is an organism living in a state of symbiosis called?
4. What is the scientific study of symbiosis called?
5. Who proposed the term *symbiosis*?
6. What is mutualism? Give an example.
7. What is commensalism? Give an example.
8. What is parasitism? Give an example.
9. What is amensalism? Give an example.
10. What is allelopathy? Give an example.
11. What is competition? Give an example.
12. What is predation? Give an example.
13. What is neutralism? Give an example.
14. What is a food chain?
15. What is the role of decomposers in a food chain?
16. What are the two main types of food chains?
17. What is a trophic level?
18. What are keystone species?
19. What are producers?
20. What are primary consumers?
21. What are the second order consumers?
22. What are the tertiary consumers?
23. What are the quaternary consumers?
24. What are herbivores? Give an example.
25. What are carnivores? Give an example.
26. What are omnivores? Give an example.
27. What mistletoe species is found in Kaliningrad?
28. What is the haustorium?
29. What plants does mistletoe parasitise?
30. How is mistletoe used in culture?

Module 4

THE HUMAN BODY

4.1. Learn the active vocabulary of Module 4.

1. adrenal gland [ə'dri:nl glænd]	надпочечник
2. alveolus [ælvɪ'əʊləs]	альвеола
3. alveoli (<i>pl</i>) [ælvɪ'əʊləɪ]	альвеолы
4. artery ['ɑ:təri]	артерия
5. blood vessel ['blʌd vesl]	кровеносный сосуд
6. bone marrow ['bəʊn mæɹəʊ]	костный мозг
7. bronchus ['brɒŋkəs]	бронх
8. bronchi (<i>pl</i>) ['brɒŋkaɪ]	бронхи
9. capillary [kə'pɪləri]	капилляр
10. cardiovascular [ˌkɑ:diəʊ'væskjələ]	сердечно-сосудистый
11. cartilage ['kɑ:tlɪdʒ]	хрящ
12. endocrine ['endəʊkrɪn]	эндокринный
13. esophagus [i'sɒfəgəs]	пищевод
14. fallopian tube [fə'ləʊpiən tju:b]	маточная труба
15. gall bladder ['gɔ:l blædə]	желчный пузырь
16. large intestine ['lɑ:dʒ ɪn'testɪn]	толстая кишка
17. larynx ['læɪŋks]	гортань
18. ligament ['lɪgəmənt]	связка
19. liver ['lɪvə]	печень
20. locomotive [ˌləʊkə'məʊtɪv]	опорно-двигательный
21. lung [lʌŋ]	легкое (орган)
22. lymph node ['lɪmf nəʊd]	лимфатический узел
23. mouth [maʊθ]	рот

24. ovary ['əʊvəri]	яичник
25. pancreas ['pæŋkriəs]	поджелудочная железа
26. penis ['pi:nɪs]	половой член
27. pharynx ['færiŋks]	глотка
28. pineal gland [paɪ'ni:əl glænd]	шишковидная железа
29. pituitary gland [pi'tju:ɪtəri glænd]	гипофиз
30. prostate gland ['prɒsteɪt glænd]	предстательная железа
31. respiratory [rə'spɪrətəri, 'respərətəri]	дыхательный
32. salivary gland ['sælɪvəri glænd]	слюнная железа
33. scrotum ['skrɒtəm]	мошонка
34. small intestine ['smɔ:l ɪn'testɪn]	тонкая кишка
35. spermat duct ['spɜ:mə,dʌkt]	семявыносящий проток
36. spinal cord ['spaɪnl kɔ:d]	спинной мозг
37. spleen [spli:n]	селезенка
38. stomach ['stʌmək]	желудок
39. tendon ['tendən]	сухожилие
40. testicle ['testɪkl]	яичко
41. thymus ['θaɪməs]	вилочковая железа
42. thyroid gland ['θaɪrɔɪd glænd]	щитовидная железа
43. tongue [tʌŋ]	язык
44. tonsil ['tɒnsɪl]	миндалевидная железа
45. trachea [trə'ki:ə]	трахея
46. ureter [ju'ri:tə, 'jʊərɪtə]	мочеточник
47. urethra [ju'ri:θrə]	мочеиспускательный канал
48. urinary ['jʊərɪnəri]	мочевой
49. urinary bladder ['jʊərɪnəri blædə]	мочевой пузырь
50. urogenital [ˌjʊərəʊ'dʒenɪtl]	мочеполовой
51. uterus ['ju:tərəs]	матка
52. vagina [və'dʒaɪnə]	вагина
53. vulva lips ['vʌlvə lɪps]	половые губы

4.2. Read the text and speak about the organ systems.

The human body is like an amazing machine that helps us live, move, and think! The body is made up of interdependent organ systems. Each system plays a vital role in maintaining the body's homeostasis, ensuring optimal function and survival.

The digestive system breaks down food to provide energy for the body. It includes mouth, teeth, tongue, salivary glands, pharynx, esophagus, stomach, pancreas, liver, gall bladder, small intestine, and large intestine.

The cardiovascular system pumps blood throughout the body. It consists of heart and blood vessels (arteries, veins, capillaries).

The respiratory system takes oxygen and removes carbon dioxide. It includes nose, pharynx, larynx, trachea, and lungs. Lungs consist of bronchi and alveoli.

The locomotive system protects the organs and helps the body to move. It includes bones, muscles, cartilages, ligaments, and tendons.

The urogenital system combines urinary and reproductive organs. Urinary organs remove the wastes from the body and maintain water balance. They include kidneys, ureters, urinary bladder, and urethra. The function of reproductive organs is reproduction. Male reproductive organs are testicles, spermaducts, prostate gland, penis, and scrotum. Female reproductive organs are ovaries, fallopian tubes, uterus, vagina, and vulva lips.

The immune system protects the body against antigens and fights off disease. It consists of bone marrow, thymus, tonsils, lymph nodes, lymph vessels, and spleen.

The nervous system regulates the body's responses to internal and external stimuli. It consists of brain, spinal cord, and nerves.

The endocrine system helps to maintain growth and homeostasis within the body. It includes pituitary gland, pineal gland, thyroid gland, thymus, and adrenal glands.

Sense organs perform functions of touch, taste, smell, sight, hearing, and balance. They include skin, tongue, nose, eyes, and ears.

4.3. Fill in the gaps with the given options. Each option is used more than once.

digestive
cardiovascular
immune

respiratory
locomotive
nervous

urinary
reproductive
endocrine

1. The _____ system consists of brain, spinal cord, and nerves.
2. The function of _____ organs is to remove the wastes from the body and maintain water balance.
3. The _____ system takes in oxygen and removes carbon dioxide from the body.
4. The _____ system pumps blood throughout the body.
5. The _____ system helps the body to move.
6. The _____ system maintains growth and homeostasis.
7. The function of _____ organs is reproduction.
8. The _____ system protects the body against antigens and fights off disease.
9. The _____ system breaks down food to provide energy.
10. The _____ system regulates the body's responses to internal and external stimuli.
11. Pituitary gland, pineal gland, thyroid gland, thymus, and adrenal glands belong to the _____ system.
12. Fallopian tubes, ovaries, vagina, and uterus are female _____ organs.
13. Tongue, pharynx, esophagus, stomach, pancreas, liver, and gall bladder are the organs of the _____ system.
14. Thymus, tonsils, and spleen belong to the _____ system.
15. Nose, pharynx, larynx, trachea, and lungs belong to the _____ system.
16. Heart and blood vessels are the organs of the _____ system.
17. Ligaments and tendons belong to the _____ system.
18. Scrotum and testicles are male _____ organs.
19. Kidneys, ureters, urinary bladder, and urethra are the _____ organs.

4.4. Read the text and develop an electronic infomap *Human Body in Numbers*.

Do you know how wonderful you are?

Your heart beats from 30 to 200 times a minute. With every beating your heart pumps about 240 grams of blood into circulation. That is about 13 litres a minute. If you live to 75, your heart will pump 200 million litres of blood. Blood races through the arteries at a speed of 1 metre per second. There are 60,000 kilometres of capillaries in your body. If laid side by side, the length of your blood vessels would circle the world more than twice. For 2 hours, your heart generates enough energy to lift a weight of 65 tons 30 centimetres into the air. About 10 million red-blood cells are destroyed and replaced each second in a human body. Your brain has about 12 billion cells.

You breathe about 25,920 times a day, inhaling about 13 cubic metres of air. Your lungs would be as big as a tennis court if opened out and laid flat.

Even if you do not sleep, you spend about 5 minutes of each hour with your eyes shut, because you blink your eyes about 25 times a minute and each blink takes one-fifth of a second. Your eye has 125 million rods and 7 million cones. Human eyes can distinguish more than 150 shades in the spectrum of solar light. The cornea of the eye is a unique part of the body that does not have blood vessels.

During normal activity a man moves 750 muscles. All the muscles in your body could lift a heavy lorry if they are pulled together. Humans can make up to 7,000 different facial expressions.

Your fingernails grow about 0.09 millimetres longer a day, and your hair — 0.4 millimetres. A dark-haired person has on his head about 120,000 hairs, a blond has about 150,000 hairs, and a red-haired person has only about 90,000 hairs.

A man weighing 63 kilograms contains enough fat for 7 pieces of soap, carbon for 9,000 pencils, phosphorus for 2,200 match heads, and iron for 1 medium-sized nail.

4.5. Match the beginnings of the sentences to their endings.

1. A dark-haired person has fewer hairs on his head ...
2. A dark-haired person has more hairs on his head ...
3. Each eye blink takes ...
4. About 10 million red-blood cells ...
5. Blood races through the arteries ...
6. Your heart can beat up to ...
7. In a minute, your heart pumps ...
8. With every beating, your heart pumps ...
9. The length of capillaries in your body is ...
10. The human eye has ...
11. You blink your eyes about ...
12. There are about 7 million ...
13. A man has an ability to make up to ...
14. Your hair grow faster ...
15. You inhale about ...
16. The human brain has about ...

- A. ... 12 billion cells.
- B. ... 125 million rods.
- C. ... 13 cubic metres of air a day.
- D. ... 200 times a minute.
- E. ... 25 times a minute.
- F. ... 7,000 different facial expressions.
- G. ... about 13 litres of blood.
- H. ... about 240 grams of blood.
- I. ... about 60,000 kilometres.
- J. ... are destroyed and replaced each second.
- K. ... at a speed of 1 metre per second.
- L. ... cones in your eye.
- M. ... one-fifth of a second.
- N. ... than a blond.
- O. ... than a red-haired person.
- P. ... than your fingernails.

4.6. Fill in the gaps with the given words. Prepare an electronic infomap about the role of water in the human body.

body
baby
brain
dehydration
enough
fluid

head
headache
joints
lungs
nutrients
organs

oxygen
rule
temperature
role
total
vital



Fig. 9. Water in the body

Water is the elixir of life. Drinking water is absolutely (1) _____ to the human health. The amount of water in the human body depends on the person's age, sex, and size of the (2) _____. A foetus is 100 % water, a newly born (3) _____ is 80 % water, an average adult is 70 %, and an elderly person is 50 %. A (4) _____ of thumb is that two thirds of the human body consist of water.

The (5) _____ amount of water in the body of an average adult is about 37 litres. Human tissues and (6) _____ are mainly made up of water: muscle consists of 75 % water; (7) _____ consists of about 80 % water; bone consists of 22 % water; blood consists of nearly 83 % water. Water plays a critical (8) _____ in all physiological functions. Water transports nutrients and (9) _____ into cells; moisturises the air in our (10) _____; helps with metabolism; protects vital organs; helps organs to absorb (11) _____ better; regulates body (12) _____; detoxifies; protects and moisturises our (13) _____. Water is indispensable for our survival. Every cell in our body needs water from (14) _____ to toe. That is why it is so important to drink enough (15) _____. If we do not supply (16) _____ water to our body, then, for example, our brain, which consists of 80 % water, will not function well, and we will get (17) _____ or migraine. It may be the sign of (18) _____ when you feel fatigue and headache next time.

4.7. Learn 12 facts about Russian physiologist Ivan Pavlov and search for the facts about other famous physiologists.

Fact 1: Ivan Petrovich Pavlov (1849—1936) is a famous Russian physiologist known for his discovery of classical conditioning through his experiments with dogs.

Fact 2: Even though his father was a priest, he himself was an atheist. In 1870, he began learning natural science at the University of Saint Petersburg.

Fact 3: In 1875, he received the degree of Candidate of Natural Sciences.

Fact 4: In 1879, he graduated from the Medical Military Academy with a gold medal for his research work.

Fact 5: In 1883, he earned his doctor's degree for his work on nerves affecting the heart.

Fact 6: From 1884 to 1886, he studied with famous scientists in Germany.

Fact 7: In 1891, he started the Department of Physiology at the Institute of Experimental Medicine in St. Petersburg.

Fact 8: In 1904, he won the Nobel Prize in Physiology or Medicine for his work on the physiology of digestion.

Fact 9: In 1915, he got the Royal Society's Copley Medal.

Fact 10: In 1925, he founded the Institute of Physiology, which was named after him following his death.

Fact 11: The lunar crater *Pavlov* was named after him.

Fact 12: In the Kaliningrad Region, there are 3 monuments dedicated to him — in Kaliningrad, Svetlogorsk, and Sovetsk.



Fig. 10. Monument to Ivan Pavlov in Svetlogorsk

4.8. Fill in the gaps with a derivative of the given word.

1. Liver has the capacity to (generate) _____.
2. Individual stomachs vary in levels of (acid) _____.
3. The table shows the average human (high) _____ by region of the world.
4. The skin (new) _____ itself every 28 days.
5. The heart is a (power) _____ muscle that pumps blood throughout the body.
6. The (continue) _____ work of the heart keeps people (live) _____.
7. A woman's heart (typical) _____ beats faster than a man's.
8. The skin is the (protect) _____ shield of the human body.
9. Fingerprints are unique to each person — even (identity) _____ twins have (differ) _____ fingerprints.
10. The stomach produces about 2 liters of gastric juice (day) _____ to aid in (digest) _____.
11. People (breath) _____ through their nostrils.
12. Skin can comprise 15 % of a person's total (weigh) _____.
13. The human body is a complex structure of (connect) _____ and (depend) _____ systems that work together to support life.
14. Heart disease, (include) _____ coronary artery disease and heart attacks, is one of the leading causes of (die) _____ globally.
15. Arteries carry (oxygen) _____ blood away from the heart.
16. A human's microbiome impacts pain perception, neural (develop) _____, brain chemistry, and (emotion) _____ behaviour.
17. Serotonin helps to reduce (depress) _____, regulate (anxious) _____, and facilitate sleeping, eating, and (digest) _____.
18. Muscles support (body) _____ functions, such as digestion and (circulate) _____.
19. Our stomach lining (place) _____ itself every few days to protect against (digest) _____ acids.
20. (Laugh) _____ has positive effects on heart health, including stress (reduce) _____ and blood flow (improve) _____.

4.9. Fill in the gaps with a suitable preposition.

1. Human hair is resistant _____ various types _____ chemicals and acids.
2. The main function _____ the stomach is to digest the food that is consumed _____ human beings.
3. The person's gut is referred _____ as the "second brain", because it is the organ _____ its own independent nervous system.
4. Humans have an immense number _____ bacteria _____ the gut that are collectively referred _____ as a microbiome.
5. Blushing is caused _____ a rush _____ adrenaline.
6. The music you listen _____ can cause physiological changes _____ your blood pressure, heart rate, and respiration.
7. The human body consists _____ numerous interdependent systems that work together to support life.
8. The heart is responsible _____ pumping blood _____ the circulatory system.
9. Physiology focuses _____ the systems and organs of the human body and their functions.
10. The heart rate can vary depending _____ factors such as emotions, physical activity, and even the time _____ day.
11. _____ proper care, the human heart can continue to beat _____ decades.
12. Ivan Pavlov got the Nobel Prize _____ Physiology or Medicine _____ his work _____ the physiology _____ digestion.
13. Asteroid *1007 Pawlowia* was named _____ the famous Russian physiologist Ivan Pavlov.
14. Each hand is home _____ 27 bones, along _____ 34 muscles and 123 ligaments.
15. After birth, a baby mostly sees _____ black and white.
16. People have tongue prints, which vary _____ one person _____ another due to both shape and texture.
17. _____ average, redheads have fewer hair strands overall compared _____ blonds and brunettes.

4.10. Read the post and make a post on any suggested topic.

In the Friedrichsburg Gate, the branch of the Museum of the World Ocean located in Kaliningrad, you can see the dental armchair used by Peter the Great, the Tsar of all Russia and the first Emperor of all Russia, for pulling the people's teeth. Dentistry was one of Peter the Great's hobbies, so he would have pulled your tooth with great joy in the distant 18th century! But you must be prepared that the procedure was carried out without anesthesia.



Fig. 11. Dental armchair

If you happen to visit Peter the Great Museum of Anthropology and Ethnography (*Kunstkamera*) of the Russian Academy of Sciences in Saint Petersburg, you will see the collection of 73 teeth pulled by Emperor Peter the Great himself!



Fig. 12. Teeth pulled by Peter the Great

Post topics:

1. Ivan Sechenov — the “Father of Russian Physiology”.
2. The Kunstkamera.
3. The Anatomic Hermitage in Saint Petersburg.
4. Russia team on medicine.
5. The human body in arts.
6. Healthy lifestyle.
7. Free topic.

4.11. Do the test on Module 4: define whether the statements are true or false and then correct the false ones.

1. Salivary glands belong to the endocrine system.
2. Urinary bladder belongs to the digestive system.
3. The respiratory system includes nose, pharynx, larynx, trachea, and lungs.
4. Bones, muscles, cartilages, ligaments, and tendons belong to the locomotive system.
5. Kidneys, ureters, urinary bladder, and urethra are urinary organs.
6. Reproduction is the function of reproductive organs.
7. Ovaries, fallopian tubes, uterus, vagina, and vulva lips are male reproductive organs.
8. The immune system includes skin, tongue, nose, eyes, and ears.
9. Spinal cord, brain, and nerves belong to the nervous system.
10. Tongue and ears belong to sense organs.
11. Skin is not an organ.
12. Thymus belongs to the endocrine system.
13. The respiratory system pumps blood throughout the body.
14. The urogenital system combines urinary and reproductive organs.
15. Scrotum is a female reproductive organ.
16. The immune system helps the body to fight disease.

17. Blondes have fewer hairs on their heads than red-haired people.

18. Human hair grows slower than fingernails.

19. A human body is two thirds water.

20. A human body does not contain iron.

21. Physiologist Ivan Pavlov never won the Nobel Prize.

22. Ivan Pavlov's doctor's degree work was on nerves of the pancreas.

23. One of Peter the Great's hobbies was dentistry.

4.12. Answer the questions on Module 4.

1. What is the function of the digestive system?

2. What does the cardiovascular system consist of?

3. What do lungs consist of?

4. What does the locomotive system do?

5. What is the function of urinary organs?

6. What organs does the urogenital system of the human body combine?

7. What are male reproductive organs?

8. What are female reproductive organs?

9. What does the immune system protect the human body against?

10. What does the nervous system regulate?

11. What does the endocrine system help to maintain?

12. What functions do sense organs perform?

13. What organs do sense organs include?

14. How much blood does a heart pump with every beating?

15. What speed does the blood race through the arteries at?

16. Do people spend any time with their eyes shut when they do not sleep?

17. How many times a minute do your eyes blink?

18. How much time does each blink take?

19. How many rods and how many cones does an eye have?

20. How many shades in the spectrum of solar light do human eyes distinguish?
21. How many cells are there in the human brain?
22. How many muscles does a man move during normal activity?
23. How long do your fingernails grow a day?
24. How long does your hair grow a day?
25. Does a dark-haired or red-haired person have more hairs on the head?
26. What part of the human body does not have blood vessels?

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