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Н.К. Яшина

# БИОЛОГИЯ

Учебное пособие
по обучению чтению на английском языке

Издание 2-е, стереотипное

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Основная цель данного пособия – сформировать у обучающихся умение читать и переводить оригинальную литературу по специальности. Тексты подобраны из оригинальных источников.

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# ПРЕДИСЛОВИЕ

Данное пособие предназначается для студентов II курса специальности «Биология» и ставит целью подготовить их к чтению оригинальной литературы на английском языке по данной теме.

Пособие построено по тематическому принципу и включает следующие темы: биология как наука, клеточная теория строения вещества, теория эволюции и естественный отбор, основы генетики, царство грибов, растений и животных, позвоночные и беспозвоночные, хордовые, приматы и человек, связь биологии и экологии и др.

В пособии использована оригинальная зарубежная литература. Тексты подобраны с учетом их познавательной ценности, актуальности и воспитательного значения.

Пособие состоит из 14 тематических циклов-уроков, включающих текст А - для изучающего чтения и текст Б - для ознакомительного чтения. Каждый цикл открывается тематическим списком слов для активного усвоения и понимания текста А, предтекстовых и послетекстовых упражнений к нему, которые предусматривают работу с терминологическим словарем пособия, а также проверку понимания прочитанного. Текст Б также снабжен упражнениями, способствующими выработке навыка обобщения и понимания текста.

## Unit I

## SCIENCE OF BIOLOGY

***I. Remember the following words and word combinations from the text.***

1. realm of fungi – царство грибов
2. fruit flies – дрозофила (плодовая мушка)
3. DNA (deoxyribonucleic acid) – ДНК (дезоксирибонуклеиновая кислота)
4. relevant subject – необходимый (уместный)
5. living mammals – млекопитающие
6. conscious beings – сознательные существа
7. to maintain life – поддерживать жизнь
8. to make daily choice – делать ежедневный выбор
9. finely tuned biological entity – высокоорганизованное биологическое существо
10. cancer – рак
11. AIDS (acquired immune deficiency syndrome) – СПИД (синдром приобретенного иммунодефицита)
12. heart attack – сердечный приступ
13. developments – разработки
14. gene splicing – сращивание генов
15. solid background – прочная (тщательная) подготовка
16. allied health professions – профессии, связанные со здоровьем
17. a fascinating subject – очаровательный (интересный) предмет
18. genetic screen – генетическое экранирование (просеивание)
19. to reproduce – размножаться

    reproduction – размножение

20.to be available in the future – быть доступным (перспективным, популярным) в будущем

## *II. Give English equivalents for the following Russian words and word combinations.*

Различные экологические пояса, изучение биологии, удивляться, стареть, поддерживать здоровье, механизм сна, влияние курения, жизненные процессы, состояние болезни, принятие решения, род занятий, терять равновесие.

## *III. Fill in the blanks in the following sentences with the proper words and word combinations from the text.*

1. We humans are ……
2. Biology is …… science.
3. Studying biology allows us to understand our place ……
4. As finely tuned biological entitles we sometimes …… and become ill.
5. Understanding the mechanism of health and disease improves our …… as medical consumers.
6. In fact, biology is one of the most …… subjects in a modern university.
7. A course of biology helps us understand …… of eating, sleeping, exercising and other activities.

## *IV. Match each word in A with its synonym in B.*

A. Modern, zone, consumers, background, important, choice, to maintain, effect, state, disease, component.

B. Selection, training, users, influence, area, illness, significant, up-to-date, condition, constituent, to support.

***V. Translate the following sentences into Russian. Define the types of Subordinate Clauses.***

1. Students sometimes wonder why they should work hard to study and understand biology.
2. If you are reading this, you are alive.
3. Each of us decides what to eat, how much to sleep, smoke or not to smoke and so on.
4. This just shows how important biology is to a college student in today's world.
5. We are conscious beings because we make daily choices how to maintain our own life.

***VI. Read the text below carefully to find out what science of biology is.***

Text 1A

**WHY STUDY BIOLOGY?**

Through the animal and vegetable kingdoms nature has scattered the seeds of life abroad with the most profuse and liberal hand. She has been comparatively sparing in the room and the nourishment necessary to rear them.

*Thomas Malthus (1798)*

Students sometimes wonder how life science – the realm of fungi, fruit flies and DNA – relates to them and why they should work hard to study and understand it. In fact, biology is one of

the most relevant subjects in a modern university. Here are just a few of the reasons why.

1. If you are reading this, you are alive! We humans are living mammals: we are born, we eat, we grow, we have sex, we reproduce, we age and we die. We live in a range of different earth's ecological zones and studying biology allows us understand our place in the earth's environment.
2. As conscious beings, we make daily choices about how to maintain our own life and health. Each of us decides what to eat; then how much to sleep; how much and what types of exercise we need; whether smoke or not to smoke, drink or use birth control and so on. A course of biology helps us understand the basic mechanisms and effects of eating, sleeping, exercising, smoking and other common activities.
3. As finally tuned biological entities, we sometimes get out of balance and become ill. Biology focuses not only on normal life processes, but also on disease states such as cancer, AIDS, heart attack. Understanding the mechanism of health and disease improves our decision making as medical consumers and as citizens of our society. With our knowledge of biology, significant developments such as gene splicing and genetic screening would become positive tools for medicine, agriculture and scientific research.
4. Finally, a solid background in life science is required for many careers, including work in the allied health service professions, agriculture, food, service, parks and recreation and education. What's more, occupations with scientific and technological component will be increasingly available in the future.

This just shows how important biology is to a college student in today's world. And beyond all these reasons, it is simply a fascinating subject.

Let's dig in and see.

*Notes:*

1. in fact - фактически, на самом деле
2. finally - в конечном счете, в конце концов
3. what's more - вдобавок, больше того
4. increasingly - все больше и больше
5. beyond all these reasons - кроме этих соображений

***VII. Answer the following questions about the text.***

1. What kind of science is biology?
2. Why are humans living mammals?
3. What do we do as conscious beings?
4. What does biology help us understand?
5. What does biology focus on?
6. In what fields is a solid background in life science required?
7. Biology is a fascinating subject, isn't it?

***VIII. Read the sentences which follow and decide whether they are true or false. Use the following phrases to express your agreement or disagreement.***

| *Agreement* | *Disagreement* |
|---|---|
| I think so | I don't think so |
| I believe so | I'm afraid not |
| I agree on this point | I don't agree on this point |
| That's right | That's wrong |

1. Biology is the realm of fungi, fruit flies and DNA.
2. We humans are non-living mammals.
3. A course of biology helps us understand the mechanisms of eating, sleeping, exercising and so on.
4. Biology focuses on normal life processes.
5. Understanding the mechanism of health doesn't improve our decision making as medical consumers.
6. Biology is a fascinating subject.

***IX. Read the text; try to get it as a whole.***

Text 1B

## HOW BIOLOGICAL SCIENCE CAN HELP SOLVE WORLD PROBLEMS

Anyone who reads a daily newspaper is well acquainted with world problems: overpopulation, famine, violent crime, territorial aggression, drugs addiction, AIDS, cancer, heart disease, ozone depletion, acid rain, changes in climate, species extinction. These problems have both social and biological roots. That is why people can benefit from the understanding of the biological bases of the world's problems.

Many of our most vexing problems stem from our enormous and burgeoning population. Five billion people are currently straining our planet's environmental resources. Some observers believe that our future security and quality of life are threatened less by war among than by the burden we place on natural system and resources with the crush of humanity.

Take, for example, the plight of Madagascar, an island about 1000 miles long off the southeast coast of Africa. In the past 35 years, half of Madagascar's forests have been leveled to provide fuel and farmland for impoverished and rapidly growing population. This has led to serious erosion of

the rich topsoil. In the place of mature trees, farmers have planted clove trees seedlings as a crash crop to help satisfy the world's appetite for vanilla ice cream, cola drinks, and other foods that contain extracts from clove buds. Yet their own children go hungry because cloves are not an adequate food source.

The increase in Madagascar's human population and the destruction of native forests also caused the loss of hundreds of species, including plants that produce potentially lifesaving drugs. One such plant is a pink-pleated periwinkle flower discovered in Madagascar's forests and exported to pharmaceutical companies in Europe and North America to make drugs for children with leukemia. Many observers fear that plants like this will perish along with Madagascar's tropical forests.

Two decades ago, one might have predicted a similar fate for the Central American nation of Costa Rica, but by replanting deforested hillsides with fast-growing tropical harwood trees, growing nutritionally Costa Ricans improved food crops setting aside up to 15 per cent of their land as natural preserves for their tropical species. In this way they are helping to save their land and their people. Their success is a hopeful sign for the future: biological solutions for social problems of biological origin.

We are, in fact, in the midst of a revolution in the biological sciences, with exciting new information about the fight against cancer, heart disease, AIDS, infertility and obesity. Researchers are making rapid advances in gene manipulation to create new drugs, crops and farm animals; in sports physiology to improve human performance; in the diagnosis of genetic diseases; and in transplantation of organs, including brain tissue. Across all frontiers of biological science, at all levels of life's organization from molecules to the biosphere scientists are learning the most profound secrets of how living things use energy to overcome disorganization and reproduce to overcome death. In studying the living world you are embarking on an adventure of discovery that

will not only excite your imagination and enrich your appreciation of the natural world, but will provide a basis on which you can contribute intelligently to the different choices society must make in the future.

### *X. Find answers to the following questions in the text:*

1. What are world problems?
2. What roots do they have?
3. What do many of our problems stem from?
4. How many people are currently using planet's environmental resources?
5. Why has the half of Madagascar's forests been leveled?
6. What were the consequences of this?
7. How are Costa Ricans helping save their land and their people?
8. In what way can social problems be solved by means of biology?

### *XI. Find information concerning the following statements in the text:*

1. World problems of social and biological roots;
2. The number of people using currently environmental resources;
3. The event that took place in Madagascar in the past 35 years;
4. The consequences of this event for the children of Madagascar;
5. The reasons of the loss of hundreds of species;
6. The successes achieved by Costa Ricans to save their land and their people;
7. Fields of rapid advances made by researchers.

### *XII. Think and find arguments to prove that:*

1. Exciting world problems have both social and biological roots.
2. Future security and quality of life are threatened by the burden we place on natural systems and resources.

3. A pink-pleated periwrinkle flower discovered in Madagascar’s forests is very valuable.
4. Social problems can be solved by means of biology.

## Unit II

## THE STUDY OF LIFE

***I. Remember the following words and word combinations from the text.***

1. to bend toward light – тянуться к свету
2. to produce eggs – откладывать яйца
3. to give birth = to beget – родить
4. to exhibit tendency – проявлять склонность
5. dried-out-seeds – высушенные семена
6. virus – вирус
7. to put boundaries – ставить границы
8. to take in energy – потреблять энергию
9. to show variations – проявлять изменения
10. heredity – наследственность
11. to be adapted to one's environment – приспосабливаться к окружающей среде
12. to be responsive – быть чувствительным
13. intricacy of form – сложность формы
14. to break down – разрушаться
15. to fall into disrepair – приходить в плохое состояние
16. nutrient molecules – молекулы питательного вещества
17. metabolism – метаболизм (обмен веществ)
18. fertilized egg cell – оплодотворенная яйцеклетка
19. hatching – вылупление
20. courtship – ухаживание
21. mating – спаривание
22. internal incubation – внутриутробное развитие

23. to pull away – отдергивать
24. offspring – потомство

## *II. Translate the following word combinations into Russian.*

To convert energy, to beget alike organism, to release energy, inside a shell, to result in variations, to generate offspring, the entire organism, non-living things, complex organization, life activities, dried-out seeds, organized arrangement, to derive from the sun, to develop into a hen, to be suited to the way of life.

## *III. Find the English equivalents for the following Russian words and word combinations in the right column.*

| | |
|---|---|
| 1. живые организмы | 1. life activity |
| 2. проявлять склонность | 2. to beget alike organism |
| 3. сложность формы | 3. to generate offspring |
| 4. наследственность | 4. internal incubation |
| 5. жизнедеятельность | 5. responsiveness |
| 6. внутриутробное развитие | 6. living things |
| 7. родить подобный организм | 7. to increase in mass and size |
| 8. эволюционное изменение | 8. to exhibit tendency |
| 9. чувствительность | 9. to release energy |
| 10. выделять энергию | 10. nutrient molecules |
| 11. увеличиваться по массе и размеру | 11. heredity |
| 12. молекулы питательного вещества | 12. evolutionary change |
| 13. давать потомство | 13. intricacy of form |

## *IV. Match each word in A with its synonym in B.*

A. To develop, to be suited, various, boundaries, to take in, things, events, to give birth, variations, to construct, maintenance, to break down.

B. To build, support, to beget, to evolve, frontiers, different, to destroy, process, to absorb, changes, to be adapted, organisms.

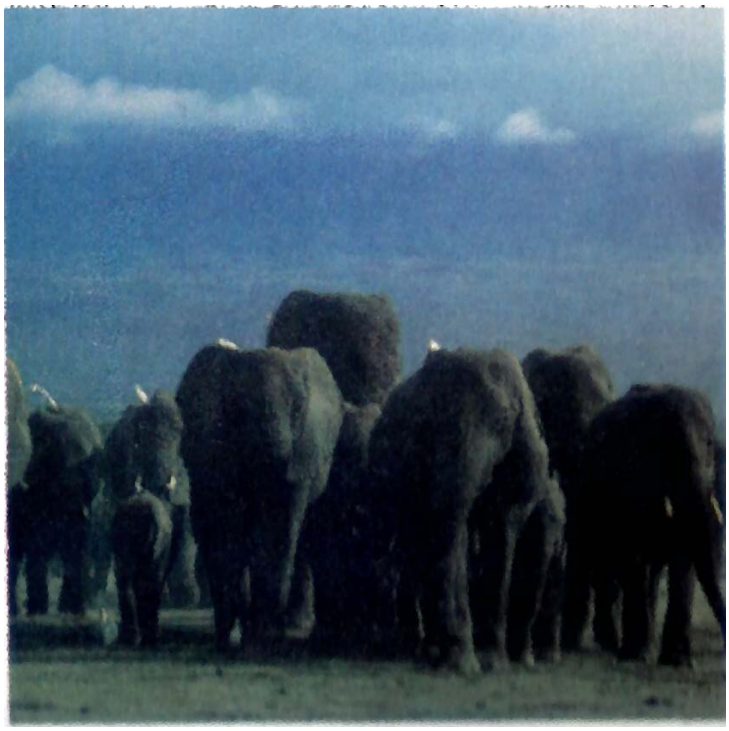
## *V. Translate the following sentences with the Passive Voice into Russian.*

1. To survive an organism must be specifically suited to its environment.
2. In plants solar energy is converted into chemical energy.
3. In all organisms energy from the nutrients is released and used for various life activities.
4. Organisms have an intricacy of form that is not found in the non-living world.
5. Living organisms gradually fall into disrepair unless their organized arrangement is maintained.

## *VI. Read the text below carefully to find out what life is.*

Text 2A

### WHAT IS LIFE?



Sit down before fact as a little child, be prepared to give up every preconceived notion, follow humbly wherever and whatever abyss nature leads, or you shall learn nothing.

*Thomas H.Huxley, Letter (September, 1860)*

What exactly is “life”? Everyone has an intuitive sense about “what living things do”. Many living things move: fish swim, birds fly, and plants bend toward light. Most grow taller, wider and heavier. Most produce eggs or seeds or give birth to live young. Obviously, pieces of wood fail to exhibit such tendencies and we consider them to be non-living. But what about dried-out seeds or virus particles? One way to answer this question is to construct a list of characteristics that put some boundaries around this elusive concept we call life.

Living things have a complex organization.

Living things take in and use energy.

Living things grow and develop.

Living things reproduce.

Living things show variations based on heredity.

Living things are adapted to their environment and ways of life.

Living things are responsive.

Most contemporary biologists define life as a particular set of processes that result from the organization of matter.

Living things have a complex organization. Organisms have an intricacy of form – from the levels of atoms and molecules to those of cells tissues, and entire organisms – that is not found in the non-living world.

Living things take in and use energy. Like elevators, sports cars and other complex entities, living organisms tend to break down and gradually fall into disrepair unless their organized arrangement of substances is maintained. That maintenance depends absolutely on energy. So the organism must take in energy, most of which derives from the sun’s light and heat. In plants, solar energy is converted into chemical energy and stored as nutrient molecules. In all organisms, including plants, energy from such nutrients is released and used for maintenance and various life activities during a series of chemical events called metabolism.

Living things grow and develop. One of the most important activities supported by metabolism is growth, an increase in mass, size or organization. Organisms also develop: they become more complex and take a series of new forms such as when a fertilized egg cell develops into a chick inside a shell and then, after hatching, continues to develop into a hen.

Living things reproduce. All types of organisms generate offspring in a process called reproduction. Organisms can simply divide in two or can carry out a more elaborate process that includes courtship, mating, fertilization, unternal incubation and live birth. In every case, however, an organism begets alike organism.

Living things show variations. A basic feature of reproduction is that it results in variation, the offspring always differ in various ways from one or both parents.

Living things are adapted to their environment. To survive an organism must be specifically suited to its environment and way of life. Such adaptation is the result of evolutionary change.

Living things are responsive. Flowers bend toward the sun. A baby pulls its hand away from a hot radiator. These are examples of responsiveness, the ability to detect and adjust to certain features of the environment.

**Notes:**

1. intuitive sense – интуитивное (по догадке) чувство
2. obviously – очевидно
3. to fail to exhibit – не могут проявлять
4. unless – если не

### *VII. Answer the following questions about the text.*

1. What do living things do?
2. What characteristics do they possess?

3. How do modern biologists define life?
4. How are living things organized?
5. What does the maintenance of life depend on?
6. What process is called reproduction?
7. Are living things adapted to their environment?
8. What is the responsiveness?

***VIII. Think and say about:***

1. characteristics of living things;
2. metabolism;
3. reproduction;
4. adaptation of living things to their environment.

***IX. Read the text; try to get it as a whole.***

Text 2B

**LIFE ON EARTH**

A Brief History. Biologists usually depict an evolutionary history of life forms as a branching tree, with the more complex modern groups at the ends of branches and the simpler groups. This treelike picture of evolutionary history is based on fossil evidence, precise anatomies, comparisons of genetic blueprints of different organisms and scientific studies of how life originated on earth. For many centuries, however, people's day-to-day observations led them to attribute the origin of life to spontaneous generation.

The belief in spontaneous generation existed before the era of the Greek and Roman Scholars, when an Italian named Francesco Redi published refutation based on direct tests. He suspected that the maggots in meat actually arise from the eggs of flies that land on the spoiling food. To test this theory, Redi put fresh pieces of fish, veal, eels and snakes in glass flasks, leaving some

open and sealing others carefully. Flies visited the open flasks, and worms soon appeared on the meat; but in the sealed flasks, worms never developed. Redi concluded that maggots come only from eggs, and he generalized further that life forms originated only once and that all living organisms are direct descendants of preexisting individuals.

Despite Redi's well-founded arguments, the idea of spontaneous generation did not die gracefully. It was not until the mid-nineteenth century that French scientist Louis Pasteur finally laid the old idea to rest, Pasteur observed that the microscopic organisms living in a solution of food molecules (sugars, proteins and water) can be killed by boiling the broth and will fail to reappear as long as the opening to the flask is heated (to sterilize it) and then sealed tightly. Pasteur showed that the broth in sealed flasks could remain uncontaminated for 18 months. If the flasks are open to the air, however, the solutions inside will teem with bacteria within a day or two. To Pasteur it proved that microbes floating on dust particles in the air must enter the newly opened flasks and begin to multiply.

In a brilliant move that finally defeated opposing theories about a "life-giving force" in the air, Pasteur designed a special type of flask with a long, downward-curving neck that allows air to reach the solution but traps dust particles and microbes in its lower part. He showed that a solution boiled in such a flask remains free of organisms despite the free exchange of air. Yet when the neck of the flask is removed, allowing dust to enter the solution the growth of organisms becomes apparent within a matter of hours.

Pasteur's experiments proved that all life comes from preexisting life. However the unbroken chain of organisms had some beginning, somewhere at some time. One area of modern biological research is concerned with the origin of life and relies on data from paleontology, geology, astronomy, physics, and other fields.

A modern View of the origin of life. In our solar system, the earth seems to be a uniquely hospitable place for life. The size of our planet and its distance from the sun dictate that gravitational force will hold on an atmosphere near the surface. The atmosphere not only screens out much damaging ultraviolet light, but also helps maintain surface temperatures on earth within a range of about $0^0$ – $100^0$C. Within this range the major constituent of most living organisms – water – is a liquid, not a gas or a solid. At temperatures below $0^0$C and above $100^0$C, most life processes as we know them cannot take place.

Life's origins are interwinded with the history of the earth. About four billion years ago, our planet passed through a stage during which energy from the sun and from the heat of the earth's molten core helped complex chemicals form from simple atoms and molecules. Meteors bombarding the earth for millions of years in its early history may have delivered more such chemicals.

Regardless of the source, those complex materials became the building blocks of living things. Biologists believe that aggregations of those building block chemicals led to the organized systems with the characteristics of life. These first cells, the fundamental units of all living things could produce copies of themselves. However, imperfections in this hereditary process led to inevitable variations among the generations of cells that followed and set the stage for new kinds of organisms. Eventually, over vast spans of time, the major and minor branches on life's evolutionary tree arose. Through this process of hereditary variation, the first organisms to appear – various kinds of primitive bacteria – acquired new properties. Certain water-dwelling bacteria, for instance, began to release oxygen as a by-product of their metabolism, and over the course of hundreds of millions of years, huge quantities of oxygen accumulated in the atmosphere, blocking out deadly ultraviolet light from the sun. This protective covering allowed organisms to live near surface of the sea and even began a process of interrelated change that continues today.

***X. Find answers to the following questions in the text.***

1. How do biologists depict the evolutionary history of life?
2. When did the belief in spontaneous generation exist?
3. What tests did an Italian Fransecko Redi do to disprove this belief?
4. What did Paster do?
5. What did Paster's experiments prove?
6. Why is our solar system a hospitable place for life?
7. In what way are life's origins interwinded with the history of earth?
8. What are the fundamental units of all living things?
9. What were the first organisms to appear on earth through the process of hereditary variation?

***XI. Find information confirming the following statements.***

1. Belief in spontaneous generation prevailed for many centuries.
2. Suspicions of Redi in relation to the idea of spontaneous generation of life.
3. Louis Pasteur laid the idea of spontaneous generation to rest.
4. Pasteur's experiments proved that all life comes from preexisting life.
5. Complex chemicals became the building blocks of living things.

***XII. Say which of the following statements are true according to the text.***

1. Evolutionary history of life is a branching tree.
2. Treelike picture is not based on fossil evidence.
3. Francesco Redi published refutation based on direct tests.
4. Redi's well-founded arguments about spontaneous generation died gracefully.
5. Life's origins are interwinded with the history of the earth.
6. Cells are fundamental units of all living things.

## Unit III

## EVOLUTION AND NATURAL SELECTION

***I. Remember the following words and word combinations from the text.***

1. creatures – живые существа
2. descendants – потомки
3. venture – рискованное предприятие, затея
4. to arise from – возникать
5. ancestors – предки
6. to diverge – распадаться
7. to contribute – способствовать
8. to underlie – лежать в основе
9. to cite an evidence – приводить доказательство
10. burro – ослик
11. plow horse – пашущая лошадь
12. watchdog – сторожевой пес
13. breed – порода
14. breeding – разведение, выращивание
15. immutable – немутабельный
16. lineage – родословная
17. to reason – делать заключение
18. to be disconcerning – быть неинтересным
19. to share characteristics – разделять общие свойства
20. ventigial structures – рудиментарные (остаточные) органы
21. dangling toes – соблазнительные пятачки
22. non-purposeful way – неумышленный (непреднамеренный), способ, образ

***II. Match each word in A with its synonym in B.***

**A.** to accept, descendants, immense, to propose, permanently, to change, to improve, evidence, to reason, to show, array

**B.** to adopt, to conclude, a great number, to display, proof, offspring, to suggest, great, to make better, constantly, to alter

***III. Give the Russian equivalents for the following English words and word combinations:***

Lineage of animals and plants, natural farmer, contemporaries, physical adaptations, to show great variations, historical reasons, important concept of biology, better-adapted individuals, generation, human history.

***IV. Give the English equivalents for the following Russian words and word combinations in the right column.***

1. одноклеточные предки
2. менее приспосабливаемый организм
3. выращивание сельскохозяйственных животных
4. наилучший производитель молока
5. происхождение людей
6. огромное разнообразие
7. разводить животных в домашних условиях
8. улучшать породу
9. множество наблюдений
10. естественный отбор
11. единство жизни
12. убеждать

1. the best milk producer
2. to domesticate animals
3. an array of facts
4. people’s origin
5. unity of life
6. to convince
7. single-celled ancestors
8. less-adapted organisms
9. natural selection
10. immense variety
11. breeding of farm animals
12. to improve the breed

***V. Translate the following sentences into Russian paying particular attention to Participles and Gerunds.***

1. The theory of evolution, proposed by Charles Darwin changed the way people think of their origin.
2. The farmer could slowly "improve" the breed for a desired characteristic by allowing a chosen pair of prize animals not others – to mate.
3. But if a farmer could act as an "artificial selector" causing a lineage of animals to "evolve" in a certain way, then Darwin reasoned there is a "natural farmer" that selects certain animals for successful breeding.
4. Modern biologists use the theory of evolution to understand many facts including physical adaptations of organisms to their environment.
5. Showing great variation and evolution gives us historical reasons for such vestigial structures as pig's dangling toes.

***VI. Read the text below carefully to find out what evolution and natural selection mean for biologists.***

Text 3A

**A THEORY THAT CHANGED BIOLOGY AND HUMAN THOUGHT**

Biology has been fortunate in discovering within the span of one hundred years two great and seminal ideas. One was Darwin's and Wallace's theory of evolution by natural Selection. The other was the discovery by our contemporaries of how to express the cycles of life in a chemical form that links them with nature as a whole.

*Jacob Bronowsky*

*The Ascent of Man (1974)*

Most educated people accept the idea that today's creatures are descendants of yesterday's organisms. The idea that one group gives rise to another over time, however, was not always popular. ***One of the great intellectual adventures of human history led to our understanding that the immense variety of living things arose from simple single-celled ancestors and that each new species was adapted to its particular habitat and way of life.***

The theory of evolution, proposed independently by the English naturalists Charles Darwin and Alfred Russell Wallace during the mid-nineteenth century, permanently changed the way people think of their origin and their place in the scheme of nature. It is, without a doubt, the most important concept in biology.

Charles Darwin offered two related theories: 1) the theory of evolution which states that ***all living things have evolved from a common ancestor that diverged into millions of species by means of a gradual process of change and variation***; and 2) the theory of natural selection which states that ***natural events "select" organisms in such a way that the better-adapted individuals tend to survive and reproduce whereas the less-adapted ones tend not to contribute to later generations.*** Darwin and Wallace both proposed that natural selection is the mechanism underlying evolution.

Darwin cited important evidence from the selective breeding of farm animals. Since people began domesticating animals more than 10,000 years ago they have selected the best milk producer, the best egg layer, the strongest burro or plow horse, the best watchdog. The farmer could slowly "improve" the breed for a desired characteristic by allowing a chosen pair of prize animals – but not others – to mate. This evidence alone convinced Darwin that a given kind of organism is not physically immutable. But if a farmer could act as an "artificial selector" causing a lineage of animals or plants to "evolve" in a certain way, then, perhaps, Darwin reasoned there is a "natural farmer" that selects in a non-

purposeful way certain plants and animals – but not others – for successful breeding. He called this hypothetical process ***natural selection.***

While Darwin's ideas were disconcerning for the most of his nineteenth-century contemporaries, modern biologists use the theory of evolution to understand and organize an incredible array of facts and observations, including the obvious physical adaptations that all organisms show to their environments. Evolution explains both the unity and diversity of life – why all organisms share many characteristics while at the same time showing great variation and evolution gives us historical reasons for such vestigial structures as the pig's dangling toes.

**Notes:**

1. independently – независимо, самостоятельно
2. without a doubt – вне (без) сомнения
3. primarily – первоначально
4. perhaps – возможно
5. at the same time – одновременно, в одно и то же время

***VII. Answer the following questions about the text:***

1. What does the variety of living things arise from?
2. Who proposed the theory of evolution?
3. What theories did Darwin offer?
4. What mechanism is underlying evolution?
5. What did Darwin cite important evidence from?
6. How could the farmer "improve" the breed?
7. What did Darwin reason?
8. What do modern biologists use the theory of evolution for?
9. What does evolution explain?

***VIII. Read the sentences which follow and decide whether they are true or false. Use the following phrases to express their agreement or disagreement.***

| *Agreement* | *Disagreement* |
|---|---|
| I think so. | I don't think so. |
| I believe so. | I'm afraid not. |
| I agree on this point. | I don't agree on this point. |
| That's right. | That's wrong. |

1. Charles Darwin did not propose any theories.
2. Charles Darwin and Alfred Wallace changed the way people think of their origin.
3. Darwin and Wallace proposed that natural selection is not the mechanism primarily underlying evolution.
4. The farmer could not act as an "artificial selector".
5. Darwin's ideas were disconcerning for the most of his nineteenth-century contemporaries.

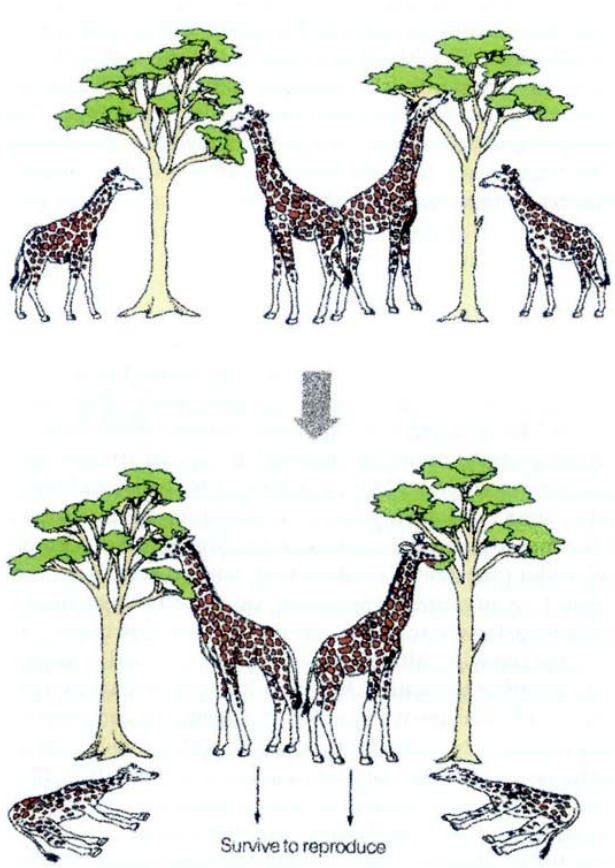
***IX. Read the text; try to get it as a whole.***

Text 3B

**NATURAL SELECTION: A MECHANISM OF EVOLUTION**

The graceful, towering giraffe is one of nature's magnificent products, and its extremely long neck and legs have been the objects of human curiosity for several centuries. Early naturalists noted that the giraffe's long neck allows it to browse on leaves from high branches that are inaccessible to wild beasts, zebras, elephants, and other inhabitants of the African savanna. We know today that these adaptations help the giraffe overcome disorder by collecting energy and materials and that the world's tallest animal evolved from shorter ancestors.

At the turn of the nineteenth century, however, curious biologists could only speculate about how the giraffe got its wondrous neck and legs.




In 1809 French naturalist Jean Baptiste Lamarck suggested that early giraffes must have stretched their necks trying to graze on the leaves of high branches and that the long neck that an individual acquired through such stretching was passed along to its young. Experiments eventually showed that Lamarck's theory, the so-called inheritance of acquired characteristics, is incorrect and is not the mechanism underlying evolution. Consider just one example that clearly disproves Lamarck's idea: Many human families have for thousands of years and hundreds of generations removed the foreskins of infant males. Despite the deliberate alteration, however, every baby boy in each new generation is born with foreskin-clear evidence that the acquired characteristic is not inherited.

In 1830s, young Charles Darwin sailed around the world, investigating nature's diversity. Darwin agreed with Lamarck and others that evolution occurs, but remained dissatisfied with existing explanations for how species change over time. Eventually, Darwin drew together two indisputable facts based on his own observations and synthesized a far-reaching conclusion:

**Fact 1**. Individuals in a population vary in many ways, and some of these variations are heritable.

**Fact 2**. Populations have the inherent ability to produce many more offspring than the environment's food space, and other assets can possibly support. As a consequence, individuals of the same population complete with each other for limited resources.

**Darwin's conclusion**: Individuals equipped with traits that allow them to cope efficiently with the local environment leave more offspring than individuals with less adaptive traits. As a result, certain heritable variations become more common in succeeding generations.

Darwin used the term "natural selection" to describe the greater reproductive success of those individuals with adaptive characteristics as compared with members of the same species lacking the adaptations. He chose this term because nature "selects" the parents for the next generation.

The principle of natural selection, now widely accepted as a main mechanism behind evolution in nature explains adaptations such as the long necks of giraffes and brilliant colour of strawberry frogs. If we begin with a population of giraffes browsing on trees in the savanna many thousands of years ago we can imagine how some of the giraffes would have long necks and others short necks just as some people have longer necks than others. The hereditary units called genes help determine neck length in both giraffes and people, now, if on the savanna there were too few low-hanging leaves to feed all the giraffes in the population, then the long-necked giraffes could reach more food, harvest more energy and materials, and survive to produce offspring – many, like their parents, possessing the genes for long necks. With proportionally more long-necked genes around, the average neck length in the giraffe population would increase over time to present-day lengths. It is important to note, however, that natural selection is not the cause for variations within the population. Short necks, long necks, and other variations preexist in the population as a result of

gene mutations. Natural selection simply chooses the best-adapted, best-competing individuals to be parents for the next generation.

***X. Find answers for the following questions in the text:***

1. What animal is one of nature's magnificent products?
2. What did early naturalists note about giraffe's long neck?
3. What do these adaptations help giraffe do?
4. What did French naturalist Jean Baptiste Lamarck suggest?
5. How was Lamarck's theory called?
6. What example disproves Lamarck's idea?
7. Did Darwin agree with Lamarck about evolution and the existing explanations for how species change over time?
8. What two facts did he give and what conclusion did he make?
9. What did Darwin use the term "natural selection" for?
10. What does natural selection explain?
11. What units help determine neck length in giraffes and people?
12. What does natural selection choose?

***XI. Find sentences characterizing the following:***

1. giraffes as objects of human curiosity for several centuries;
2. suggestions about early giraffes by French naturalist Jean Baptiste Lamarck in 1809;
3. far-reaching conclusion of Darwin in relation to explanations how species change over time;
4. essence of natural selection according to Darwin;
5. the principle of natural selection;
6. units determining neck length in giraffes and people;

***XII. Think and find arguments to prove that:***

1. Giraffe has certain adaptations to their environment;
2. Lamarck's theory of inheritance of acquired characteristics is incorrect;
3. Darwin agreed on with Lamarck that evolution occurs but disagreed on explanations for how species change over time;
4. The hereditary units called genes help determine neck length in both giraffes and people.

## Unit IV
## FROM ATOMS TO CELLS

### *I. Remember the following words and word combinations from the text.*

1. to have a profound and permanent effect – оказывать глубокое и постоянное влияние
2. to recognize – узнавать
3. to stem from – происходить, возникать
4. to emerge – появляться
5. to decompose – разлагаться, распадаться на составные части
6. to symbolize – изображать символом
7. identical particles – одинаковые частицы
8. ingot – слиток
9. makeup – структура, строение
10. subset – серия, ряд
11. earth crust – земная кора
12. to predominate – преобладать
13. trace amounts – небольшие количества
14. to be certain – быть уверенным
15. to be composed of – состоять
16. characteristic property – характерное свойство
17. to turn out – оказываться

### *II. Match each word in A with its synonym in B.*

A. to be composed of, amount, particles, to occur, profound, types, to combine, different, subset, identical, to turn out, matter

B. quantity, to meet, the same, to make up, deep, various, to unite, to prove to be, units, substance, kinds, range

## *III. Give the Russian equivalents for the following English words and word combinations.*

A brick of pure gold, metallic nature, individual atoms, atomic architecture, living organisms, to arrange atoms, diversity of life, the basic principles of chemistry, to be decomposed by chemical processes, the same elements, different proportions.

## *IV. Find the English equivalents for the following Russian words and word combinations in the right column.*

| | |
|---|---|
| 1. небольшие количества | 1. the study of biology |
| 2. основываться на строении атома | 2. simple substances |
| 3. наименьшие частицы вещества | 3. to interact |
| 4. химическое строение | 4. naturally occurring elements |
| 5. изучение биологии | 5. chemical makeup |
| 6. простые вещества | 6. a lump of carbon |
| 7. элементы, встречающиеся в природе | 7. to be based on structure of an atom |
| 8. кусок углерода | 8. trace amounts |
| 9. взаимодействовать | 9. the smallest units |

## *V. Translate the following sentences into Russian. Define the tenses.*

1. Each element is composed of identical particles called atoms.
2. There are 92 chemical elements in nature and 13 more have been created in the laboratory.
3. A natural question arose from the pioneering work of Lavoisier and Dalton.

4. Elements occur in different proportions in the earth's crust.
5. All matter living and non-living is made up of elements, substances that cannot be decomposed by chemical processes into simpler substances.

## *VI.* ***Read the text carefully to find out how atomic structure of matter relates to life on earth.***

Text 4A

### ATOMS, MOLECULES AND LIFE

> The sameness of composition (encounted in all living beings from bacteria to man) is one of the most striking illustrations of the fact that the prodigious diversity of microscopic structures of living beings rests in fact on profound and less remarkable unity of microscopic makeup.
>
> *Jacques Monod,*
> *Chance and Necessity (1972)*

Eighteenth-century chemists proved that all matter, living and nonliving, is composed of particles called atoms, and this discovery had a profound and permanent effect on the study of biology. In the decades that followed biologists recognized that every organism contains the same two dozen types of atoms arranged in different ways. The glorious diversity of life on our planet – the millions of kinds of plants, animals, fungi, and microbes – could now be seen to stem from the myriad ways that specific atoms combine and interact.

Two basic principles of chemistry emerged from the work of French chemist Antoine Lavoisier, English chemist John Dalton, and others in the late 1700s and early 1800s.

1. **All matter living and nonliving, is made up of elements, substances that can not be decomposed by chemical processes into simpler substances.** There are 92 chemical elements in nature, and 13 more have been created in the laboratory. Some examples of elements are hydrogen (symbolized H), oxygen (O), sulfur (S), gold (Au), iron (Fe), and carbon (C).

**2. Each element is composed of identical particles called atoms, the smallest units of matter that still display the characteristic properties of the element.** All the atoms in a brick of pure gold, for example, are identical to one another but different from all the atoms in a lump of carbon, an ingot of iron or samples of other elements. The properties of an element, such as the dense, shiny, metallic nature of gold or the dull black quality of carbon, are based on the structure of its individual atoms.

**The elements of life.** A natural question arose from the pioneering work of Lavoisier and Dalton: are all living things made up of the same elements as rocks, planets and stars, or is our chemical makeup different? Living things, it turns out, display a special subset of the 92 naturally occurring elements in the earth's crust, but the elements occur in very different proportions. Fully 98 percent of the atoms in the earth's crust are the elements oxygen, silicon (Si), aluminium (Al), iron, calcium (Ca), sodium (Na), potassium (K), and magnesium (Mg), with the first three predominating. In a typical organism, however 99 percent of the atoms are the markedly different subset of carbon, hydrogen, nitrogen (N), and oxygen, with sodium, calcium, phosphorus (P), and sulfur making up most of the remaining 1 percent plus a few other elements present in trace amounts.

Biologists are not certain why the chemical subsets of living and nonliving things are so different, but they do know that atomic architecture determines the physical properties of elements and, in turn, the properties of living organisms.

***Notes:***

1. myriad ways – несметное количество способов
2. markedly – заметно (очень)
3. in turn – по очереди
4. pioneering work – работа первооткрывателя

***VII. Answer the following questions about the text:***

1. What did eighteenth-century chemists prove?
2. What effect did this discovery have on biology?
3. What principles of chemistry emerged from the work of Lavoisier and Dalton?
4. What are the properties of an element based on?
5. What is the percentage of elements in the earth's crust?
6. How many percent of atoms are in a typical organism?
7. What are biologists certain about?

***VIII. Think and say about***

1. the discovery made up by eighteenth-century chemists;
2. two basic principles of chemistry emerged from the work of Lavousier and Dalton;
3. the elements of life.

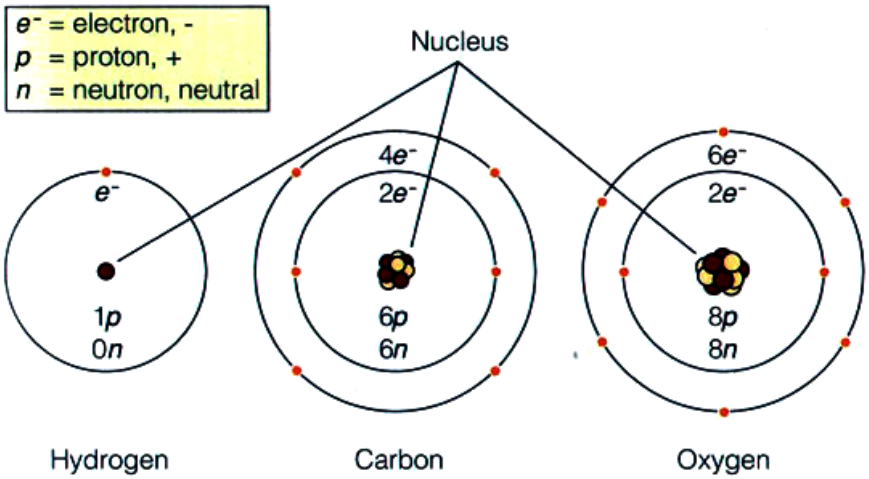
***IX. Read the text, try to get it as a whole.***

Text 4B

**ATOMIC STRUCTURE**

Atoms are extremely small: about 3 million atoms sitting side by side would probably cover the period at the end of this sentence. Physicist Gerald Feinberg once calculated that there are more atoms in the human body than there

are stars in the known universe. Although minuscule in size, each atom is made up of three types of subatomic particles: protons, neutrons, and electrons. *Protons* have a positive (+) charge; *neutrons* have no electrical charge (they are neutral); and *electrons* have a negative (-) charge. Since these subatomic particles are only parts of atoms, none of them display properties of elements.




The protons and neutrons are clustered in a small dense body at the centre of the atom called the nucleus (the diameter of an atom is about 100,000 times larger than that of the nucleus). The outer limits of the atom are defined by the paths of its electrons, which continuously race about the nucleus in cloudlike orbits. Electrons, protons, and neutrons are themselves made up of a dozen or more smaller subatomic particles held together by special forces.

**Protons and Neutrons: The Nucleus.** The atoms of each element have a unique number of protons in their nuclei: carbon has six, for example, and oxygen has eight. The unique number of protons is called *the atomic number* of the element. Under normal conditions, each atom of an element usually has approximately the same number of protons and neutrons in its nucleus. Since each proton carries a positive charge and neutrons have no electrical charge, the atom's nucleus has positive charge equal in magnitude to the number of protons it contains; thus, the nucleus of a carbon atom has a charge of 6, and the nucleus of oxygen atom has a charge of 8. Each proton and neutron has a mass of about 1 unit, called an atomic mass unit. The sum of an atom's neutrons and protons is called its *atomic mass*. Therefore, hydrogen, with

one proton and no neutrons, has the atomic number 1 and atomic mass of 1. While carbon, with six protons and six neutrons, has an atomic number of 6 and an atomic mass of 12. The *atomic weight* is used synonymously with atomic mass.

As uncharged particles, neutrons do not affect the chemical behavior of atoms. However, neutrons do impart a property of atoms that scientists have found particularly useful. Whereas the number of protons in atoms of a particular element remains the same, the number of neutrons can vary. Most natural samples of elements are, in fact, mixtures of atoms that contain identical numbers of protons but different numbers of neutrons. These atoms have the same atomic number but different atomic weights and are called isotopes of an element. One familiar isotope is carbon-14 (written $^{14}C$) which contains eight neutrons, not six giving it an atomic weight of 14 instead of 12. Some isotopes, including $^{14}C$, are radioactive; they emit energy that can be detected.

**Molecules and Compounds**. In nature, atoms link up with other atoms in numerous ways. Two or more atoms bound together form a *molecule*. The bound atoms can be identical to each other, as in $O_2$ and $N_2$ we breathe in the air or the carbon molecules found in the extremely hard crystal we call a diamond. Dissimilar atoms also can combine, however, as carbon and oxygen do to form the poisons gas carbon monoxide (CO). Chemical *compounds*, such as CO or $CO_2$ (carbon dioxide), contain atoms of more than one element and can be decomposed into these elements. Molecules and compounds display properties not found in the consistent elements; thus, the gases hydrogen and oxygen form the compound water ($H_2O$), with its unique characteristics.

### *X. Find the answers to the following questions in the text.*

1. What is the size of an atom?
2. What particles is each atom made of?

3. What are characteristics of protons, electrons and neutrons?
4. How many protons are there in a nucleus of every atom?
5. What is the atomic number of an element?
6. What magnitude is called the atomic mass?
7. What unique property do neutrons impart to an atom?
8. What is an isotope?
9. What forms a molecule?
10. What do chemical compounds contain?

### *XI. Find information concerning the following statements in the text:*

1. calculation of atoms in the human body made up by physicist Gerald Feinberg;
2. atomic structure;
3. composition of the nucleus;
4. definitions of atomic number, atomic weight of an element, isotopes;
5. examples of molecules and compounds.

### *XII. Think and find arguments to prove that:*

1. each atom is made up of three types of subatomic particles;
2. atom's nucleus has a positive charge equal in magnitude to the number of protons it contains;
3. a number of neutrons can vary in an atom;
4. molecules and compounds are aggregates of atoms.

## Unit V

## CELLS: THEIR PROPERTIES, SURFACES AND INTERCONNECTIONS

***I. Remember the following words and word combinations from the text.***

1. to gaze in fascination – смотреть с удивлением
2. amateur botanist – ботаник-любитель
3. dried cork – кора пробкового дерева
4. hollow honey-comb chambers – полые камеры, похожие на медовые соты
5. creature – живое существо
6. amoebae – амебы
7. algae – морские водоросли
8. outcome – результат
9. cell theory – клеточная теория
10. a set of statements – ряд положений
11. to encapsulate – соединять воедино
12. to weave the ideas and observations – объединять представления и наблюдения
13. attribute – характерная черта
14. particulate nature of matter – карпускулярная природа вещества
15. to be alive – быть живым
16. highly ordered assemblages – высокоупорядоченные группы
17. to pose questions – ставить вопросы
18. dissimilar molecules – неоднородные молекулы
19. single-celled species of bacteria – одноклеточные разновидности бактерий
20. protozoa – простейшие животные

***II. Match each word in A with its synonym in B.***

A. fascination, primitive, tiny, outcome, attributes, to call, research, modern, to construct, to remind

B. small, features, to recall, to build, investigation, wonder, result, to name, simple, up-to-date

***III. Match adjectives in A with nouns in B and translate phrases into Russian.***

A. basic, primitive, living, natural, single-celled, important, building, specific, profound, major

B. people, units, cells, outcome, blocks, microscope, questions, organism, selection, answers

***IV. Find the English equivalents for the following Russian words and word combinations in the right column.***

| | |
|---|---|
| 1. сосредотачивать | 1. building blocks |
| 2. исследовать ткани | 2. the origin of life |
| 3. характерные черты | 3. particulate matter |
| 4. происхождение жизни | 4. modern cell theory |
| 5. строительные элементы | 5. multi-cellular organisms |
| 6. многоклеточные организмы | 6. attributes |
| 7. естественный отбор | 7. to pose questions |
| 8. макрочастицы | 8. to focus |
| 9. ставить вопросы | 9. natural selection |
| 10. современная клеточная теория | 10. to examine tissues |

***V. Translate the following sentences into Russian. Define the types of Subordinate Clauses.***

1. Other microscopists who later examined living plants and animal tissues found that every creature they studied consisted of cells.
2. Perhaps the most important outcome of the three centuries of cell research that began with Robert Hooke is the modern cell theory.
3. The tiny, hollow honeycomb chambers he saw through the microscope reminded him of small rooms or cells that monks inhabited in monasteries.
4. No organism has ever been found on earth that shows the attributes of life.
5. His subject was a thin sheet of tissue that was sliced from dried cork.

***VI. Read the text below carefully to find out properties and interconnections of cells.***

Text 5A

CELLS AND THEIR PROPERTIES

The living cell is to biology what the electron and the proton are to physics. Apart from cells and from aggregates of cells there are no biological phenomena.

*Alfred North Whitehead*

*Science and the Modern World (1925)*

In 1665 Robert Hooke, a 30-year-old physicist and amateur botanist, gazed in fascination through the lens of a primitive microscope. His subject was a thin sheet of tissue sliced from died cork. The tiny, hollow honey-comb chambers he saw through the microscope reminded him of small rooms, or cells, that monks inhabited in monasteries.

Other microscopists who later examined living plant and animal tissues found that every creature they studied consisted of what Hooke called cells. Some organisms such as bacteria, amoebae and certain algae are free-living single cells.

Perhaps the most important outcome of the three centuries of cell research that began with Robert Hooke is the modern ***cell theory***, a set of statements that incapsulates the essential characteristics of cells. German biologists Lorenz Oken, Mattias Schleiden, Theodor Schwann and Rudolf Virchow wove old ideas and observations about cells into a new synthesis, contributing the following ideas to the modern theory.

1. **Cells are basic units of life on earth.** No organism has ever been found on earth that shows the attributes of life and yet is not composed of cells.

2. **All organisms are constructed of cells.** Every living thing on earth is either a single cell or a population of cells.

3. **Except of the origin of life itself, all cells arise from preexisting cells.** Cells arise only by division of living cells, never by aggregation of cell parts and cell chemicals ("from life comes life").

Like the theory of evolution by natural selection and the theory of particulate nature of matter, the cell theory is a cornerstone of science. And ***just as the basic units of matter are atoms, the basic units of life are cells***. But cells are not simply building blocks of life, as atoms and molecules, the cells themselves are ***what is alive in organisms***. The cell theory marked a major turning point for biology: by focusing on cells biologists could begin to pose specific questions about how life operates and discover some profound answers.

So cells are the most highly ordered assemblages of dissimilar molecules on earth – perhaps in the universe. They can exist as discrete, free-living, single-celled species of bacteria, protozoa and algae or as subunits of multi-cellular organisms – the fungi, plants and animals.

*Notes:*

1. cornerstone – краеугольный камень
2. just as – также как
3. turning point – поворотный пункт

***VII. Answer the following questions about the text:***

1. What did Robert Hook see through the microscope in 1665?
2. What did other microscopists find?
3. What did German biologists do?
4. What are basic units of life on earth?
5. What is every living thing on earth?
6. How do cells arise?
7. What theory is a cornerstone of science?
8. What did the cell theory mark?
9. How can cell exist?

VIII. ***Read the sentences that follow and decide whether they are true or false. Use the following phrases to express your agreement or disagreement.***

| *Agreement* | *Disagreement* |
|---|---|
| I think so. | I don't think so. |
| I believe so. | I'm afraid not. |
| I agree on this point. | I don't agree on this point. |
| That's right. | That's wrong. |

1. Robert Hooke saw hollow honey-comb chambers in a thin sheet of tissue sliced from dried cork.
2. Cells are not basic units of life on earth.

3. The modern cell theory is the most important outcome of the three centuries of cell research.
4. Cells do not arise from preexisting cells.
5. The cell theory is a major turning point for biology.

## *IX. Read the text; try to get it as a whole.*

Text 5B

LINKAGE AND COMMUNICATION BETWEEN CELLS

In addition to outer walls, cells have specialized structures on those surfaces that hold them firmly together in tissues, allow cells to communicate with one another and the environment, and prevent fluid leakage in certain tissues. ***Several types of junctions hold cells together and provide channels for intercellular communication***: zonulae adherens, desmosomes, tight junctions, gap junctions, and plasmodesmata. Populations of animal epithelial cells provide an excellent place to study most of these junctions.

Zonulae adherens and desmosomes serve mainly to bind cells together. ***Zonulae adherens*** ("zones of adhesion") are sites of firm physical contact between cells. They are beltlike bands that run around most epithelial cells. In addition to linking adjacent cells, zonulae help control cell shape and serve as sites for insertion of important scaffolding filaments of the cytoskeleton.

***Desmosomes*** are anologous to tiny spot welds, rivets or buttons between cells. These small junctions are made up of unidentified molecules that apparently glue together adjacent plasma membranes. Desmosomes are particularly abundant in tissues subjected to mechanical stress, such as the outer layers of the human skin.

***Tight junctions*** are seals that encompass the lateral surfaces of cells in epithelia and act a bit like rubber seals, forming barriers to fluid leakage. The

outer lipid layers of the plasma membranes of adjacent cells actually appear in the electron microscope to touch at tight junctions.

The primary communication junction between animal cells is the ***gap junction***, a perforated channel that permits easy exchange of small molecules, ions and electric currents across cell membranes and thus allows cells to communicate in the molecular, ionic and electrical language they "speak". These channels pass through the center of protein complexes called ***connexous*** that span both layers of the plasma membrane. The movement of ions and molecules between cells may help coordinate various cellular activities.

Biologists believe that many kinds of plant cells engage in intercellular exchange more easily than can animal cells. Bridges of cytoplasm called plasmodesmata (singular – plasmodesma) connect adjacent plant cells. These bridges normally arise as a plant cell divides; the two new cells fail to separate completely.

Recent studies of animal and plant tissue cells linked by gap junctions and plasmodesmata have led to a modification of the traditional cell theory. Biologists used to regard cells as units that are independent in structure and function. However when linked by gap junctions, all the cells in a population, not the individual cells alone, become the unit of response and function. Thus a regulatory molecule acting on one cell may trigger responses in adjacent cells because the "message" is passed through gap junctions. This remarkable property helps to explain the coordination of cellular activity that is so essential in tissues or organisms made up of millions of cells.

### *X. Find the answers to the following questions in the text.*

1. What holds cells firmly together?
2. What provides channels for intercellular communication?
3. What do zonulae adherens and desmosomes serve for?

4. What do desmosomes consist of?
5. What are tight junctions?
6. What is the primary communication junction between animal cells?
7. How do plant cells engage in intercellular exchange as compared to the animal cells?
8. What have recent studies of animal and plant tissue cells linked by gap junctions and plasmodesmata led to?
9. How do biologists regard cells?

### *XI. Find information concerning the following statements:*

1. cell have specialized structures on the surfaces that hold them together in tissues;
2. there are several types of junctions that provide channels for intercellular communication;
3. zonulae adherens serve to bind cells together;
4. desmosomes are small junctions that serve to glue together adjacent plasma membranes;
5. tight junctions act as rubber seals forming barriers to fluid leakage;
6. gap junction allows cells to communicate in the molecular, ionic and electrical language;
7. biologists regard cells as units that are independent in structure and function.

### *XII. Find sentences characterizing the following:*

1. types of junctions allowing cells to communicate with each other;
2. two types of junctions that bind cells together;
3. junctions that are made up of unidentified molecules;
4. gap junction as the primary communication junction between cells;
5. the reason for a modification of the traditional cell theory.

## Unit VI

## LIFE'S FUNDAMENTALS

### *I. Remember the following words and word combinations from the text.*

1. pharaoh – фараон
2. sarcophagus – саркофаг
3. tomb – могила
4. digestive enzymes – ферменты, способствующие пищеварению
5. intestines – кишки
6. mediator – посредник
7. condensation – реакция конденсации
8. hydrolysis reaction – реакция гидролиза
9. complex chains – сложные цепи
10. to weave – сплетаться, соединяться
11. to dismantle – распадаться
12. reactants – реагенты
13. to convert – превращаться
14. to involve – включать
15. energy of motion – энергия движения
16. rushing water – стремительно несущаяся вода
17. a rolling rock – катящийся камень
18. stored energy – накопленная энергия
19. to poise – держать равновесие
20. capacity to do work – способность совершать работу
21. to infer – заключать
22. afterlife – загробная жизнь
23. to break down – разрушать

***II. Translate the following English word combinations into Russian:***

biological change, a set of molecules, chemical reaction, potential energy, dipeptide molecules, chemical bonds, transformation of energy, significant amount, light energy, everyday life, amino acids, to be converted into products, familiar forms of energy.

***III. Find the English equivalents for the following Russian words and word combinations in the right column.***

| | |
|---|---|
| 1. накопленная энергия | 1. stomach |
| 2. химические связи | 2. fluctuations within cells and tissues |
| 3. кинетическая энергия | 3. cellulose molecule |
| 4. реакция гидролиза | 4. chemical bonds |
| 5. молекула целлюлозы | 5. stored energy |
| 6. классический посредник | 6. to break down food molecules |
| 7. желудок | 7. to weave into complex chains |
| 8. разлагать молекулы пищи | 8. classic mediator |
| 9. отклонения в клетках и тканях | 9. kinetic energy |
| 10. соединяться в сложные цепи | 10. hydrolysis reaction |

***IV. Match each word in A with its synonym in B.***

A. to break down, changes, to convert, familiar, to generate, capacity, specific, case, completely, adjustment

B. known, concrete, alterations, to destroy, to transform, fully, regulation, to create, ability, event.

## *V. Translate the following sentences into Russian with the Passive Voice.*

***1.*** When the Egyptian pharaoh Tutankhamen was inferred in his gold sarcophagus in an underground tomb, slaves laid out a sumptuous ritual breakfast for the pharaoh's passage into afterlife.

2. When the tomb was opened the breakfast was still there.
3. As a result of the reactions of hydrolysis and condensation molecules are woven from simpler units.
4. In a hydrolysis reaction reactants are converted into products.
5. Molecules are transformed during the reactions of condensation and hydrolysis.

## *VI. Read the text below to find out what life's fundamentals are.*

Text 6A

CHEMICAL REACTIONS, ENZYMES, AND METABOLISM

Laws of Thermodynamics:

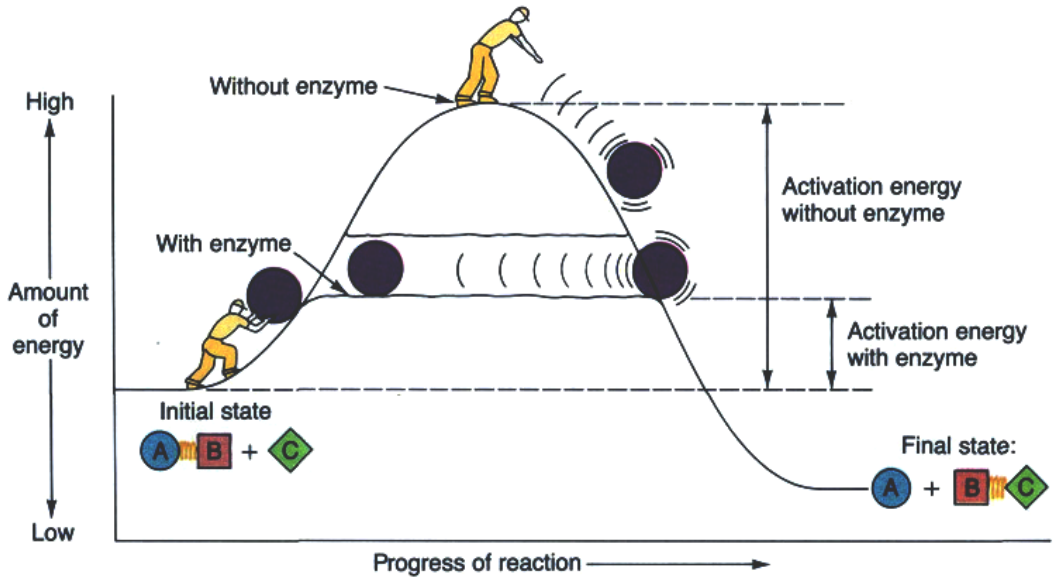
1. You cannot win.
2. You cannot break even.
3. You cannot get out of the game.

*Anonymous*

When the Egyptian pharaoh Tutankhamen was inferred in his gold sarcophagus in an underground tomb, slaves laid out a sumptuous ritual breakfast for the pharaoh's passage into the afterlife; 33 centuries later, when the tomb was opened, the breakfast was still there – completely dried out but still recognizable. Had Tutankhamen been alive to eat that breakfast when it was prepared, the digestive enzymes in his mouth, stomach and intestines would have broken down the food molecules by lunchtime. **Enzymes are the classic mediators of biological change, the change is central to life** – change within

atoms and molecules, fluctuations and adjustments within cells and tissues; and alterations in the organism itself. Except in a few rare cases, the organism that is no longer changing is no longer living.

***Underlying every change in the living world are chemical reactions, transformations of sets of molecules into other kinds of molecules.*** Condensation reaction and hydrolysis reactions are examples; molecules are transformed during these reactions, and as a result, complex chains are woven from simpler units or dismantled piece by piece.




During a chemical reaction molecules react in a specific way. In a hydrolysis reaction, for example, reactants, such as a dipeptide molecule and a water molecule, interact with each other and are converted into ***products***, such as two amino acids, by means of the breaking and making of chemical bonds. Regardless of type, all chemical reactions involve the transformation of energy from one of its many forms to another. ***Light energy***, ***heat energy*** and ***electrical energy*** are familiar forms from everyday life. ***Kinetic energy*** is the energy of motion, such as the energy generated by rushing water, a rolling rock or moving molecules. ***Potential energy*** is ***stored energy*** – the capacity to do work later.

Water stored in a tank on top of a building, or a rock poised at the top of the hill, has potential energy. ***Chemical energy*** is the energy stored in atoms and molecules and their bonds, so it is a kind of potential energy. The cellulose molecules in wood store significant amounts of chemical energy.

**Notes:**

1. no longer – больше не
2. regardless – независимо от
3. by means of – при помощи, посредством
4. as a result – в результате, в конце концов

***VII. Answer the following questions about the text.***

1. Why was the breakfast in Tutankhomen sarcophagus still there 33 centures after his death?
2. What are enzymes?
3. How do they function?
4. What factors underlie every change?
5. What are the examples of chemical reactions?
6. What do molecules do during chemical reactions?
7. What do chemical reactions involve?
8. What forms of energy do you know?
9. What is kinetic, potential and chemical energy?

***VIII. Think and say about***

1. enzymes as classic mediators of biological change;
2. condensation and hydrolysis reactions;
3. familiar types of energy.

## *IX. Read the text; try to get it as a whole.*

Text 6B

ENZYMES AND HOW THEY WORK

Biological catalysts are called ***enzymes***; most enzymes are globular protein molecules. **Enzymes – and their catalytic activities – are essential for life because the bonds that hold together most biological molecules are very stable and cannot be ruptured unless high activation energies are overcome.** If organisms employed relatively unstable molecules that could react at low activation energies, their bonds would break spontaneously, and the result would be molecular chaos in the cell. Instead most of the bonds in amino acids, lipids, sugars and nucleic acid, bases are stable, the macromolecules they make up are relatively stable, and chemical reactions involving the molecules can be mediated and controlled by enzymes.

The study of enzymes began more than a century and a half ago. In 1822 William Beaumont, an army surgeon, treated a Canadian soldier for a severe gunshot wound to the abdomen. The man survived and the wound healed but it left a gaping hole in his upper abdomen. Through this "window", Beaumont was able to obtain samples of stomach fluids and to observe the secretion of digestive juices containing enzymes, noting their activity on foods. Seventy years later, researchers showed that enzymes from yeast cells could break down sugars even after the yeast cells had been disrupted. They coined the word enzyme during this experiment; to these researchers, an enzyme was simply a substance derived, from the Greek for "leavened" or "in yeast". Since then biologists have learned a great deal more about the roles of enzymes in living cells and about enzyme structure and function, including two unique characteristics. First, ***enzymes are specific***. A given enzyme can act on only one type of compound or pair of reacting compounds, which is called its substrate;

and it usually can catalyze only one type of reaction, such as condensation or hydrolysis. Second, enzymes can be controlled by the presence or absence of critical compounds.

How do enzymes lower the activation energy barrier between reacting molecules? **Enzymes function as catalysts by (1) forming complexes with the reacting molecules; (2) changing their own shapes slightly to improve the fit between enzyme and substrate; (3) increasing the local concentrations of the molecules; (4) orienting the molecules correctly so that the reaction can take place most efficiently; and (5) distorting the shape of the substrate molecules slightly, as well, thereby helping them reach the transition state.**

Just as other molecules must collide before they can react, reactants must collide with enzymes before a reaction can be catalyzed. The collision allows them to form the enzyme substrate (ES) complex, a complex held together by weak bonds, and this complex is the essential first step in enzyme catalysis. In the ES complex the substrates are positioned close together and in just the right orientation so as to lower the activation energy barrier and facilitate the reaction between them, leading to the formation of products.

Thousands of chemical reactions, all going at once, support the activities that characterize and sustain life: growth, development, energy use, and responsiveness among others. These chemical reactions take place in orderly, interrelated patterns that are controlled by enzymes. ***The combination of simultaneous, interrelated chemical reactions taking place at any given time in a cell is referred to as metabolism.***

### *X. Find answers to the following questions in the text:*

1. What substances are called enzymes?
2. Why are enzymes essential for life?
3. When did the study of the enzymes begin?

4. What are we indebted to William Beamount for?
5. What does the word enzyme mean?
6. What are two unique characteristics of enzymes?
7. How do enzymes function?
8. What must reactants do before a reaction can be catalyzed?
9. What does the collision allow them to form?
10. What activities characterize and sustain life?
11. What is metabolism?

## *XI. Prove the following statements by the information from the text:*

1. if organisms employed unstable molecules there would be molecular chaos in the cell;
2. William Beamount observed the activity of enzymes on food;
3. enzymes can catalyze only one type of reaction;
4. enzymes can function as catalysts;
5. the collision of reactants with enzymes forms the enzyme substrate complex.

## *XII. Find information concerning the following statements in the text:*

1. the reason for the chaos in the cell;
2. the conclusion of Beamont after observing the secretion of digestive juices containing enzymes;
3. the mechanism of lowering the activation energy barrier between reacting molecules by enzymes;
4. the example of orderly interrelated pattern of chemical reaction controlled by enzymes.

## Unit VII

## FOUNDATIONS OF GENETICS

***I. Remember the following words and word combinations from the text.***

1. similarity – сходство
2. to breed crop plants – выращивать культурные растения
3. livestock – домашний скот
4. casual – случайный
5. to afford – позволить
6. a proficient plant breeder – умелый растениевод
7. to encounter – встречаться, столкнуться
8. encouragement – поддержка, одобрение
9. particulate nature of heredity – карпускулярная природа наследственности
10. to acknowledge – признавать
11. strain – штамм (линия)
12. trait – признак
13. tree-breeding strains – древовидные штаммы
14. genetics – генетика
15. self-fertilizing plant – самоопыляющееся растение
16. male and female productive organs – мужские и женские продуктивные органы
17. pollen grains – зерна пыльцы
18. petal – лепесток
19. stigma – рыльце
20. anther – пыльник
21. pod – стручок
22. seed – семя

## *II. Match each word in A with its synonym in B.*

A. to afford, to encounter, to be made up, encouragement, to demonstrate, to accept, distinct, to acknowledge, to make experiments, identical, to focus, heredity

B. support, the same, to recognize, to meet, to carry out experiments, to be composed of, to show, to allow oneself, to adopt, to concentrate, specific, inheritance.

## *III. Translate the following English word combinations into Russian:*

To study genetics, seed color, plant height, a bright student, centre of scientific thought, a proficient plant breeder, a series of carefully planned experiments, new field of statistics, particulate nature of matter, plant physiology.

## *IV. Find the English equivalents for the following Russian words and word combinations in the right column.*

1. человеческая цивилизация
2. университетское образование
3. форма стручка
4. отличительные признаки
5. представить результаты эксперимента
6. самоопыляемое растение
7. высота растения
8. изучать генетику
9. наследственность
10. древовидные штаммы

1. plant height
2. self-fertilizing plant
3. university education
4. inheritance
5. tree-breeding strains
6. human civilization
7. to study genetics
8. pod shape
9. distinct traits
10. to present the results of the experiments

## *V. Change the sentences into the Present or Past Simple Passive.*

*Model:* In 1851, Napp sent Mendel to study physics, mathematics, and chemistry at the University of Vienna.

In 1851, Mendel was sent to the Vienna University to study physics, mathematics and chemistry.

1. In 1866 Mendel presented the results of his experiments on the nature of inheritance to the Brünn Society for Natural History.
2. Gregor Mendel discovered the basic mechanism of heredity.
3. Atoms and molecules make up all substances.
4. Mendel's experiments demonstrated the particulate nature of heredity.
5. The female structure receives the pollen.

## *VI. Read the text below carefully to learn about foundations of genetics.*

Text VIIA

GREGOR MENDEL AND THE BIRTH OF GENETICS

> As a consequence of the application of Mendel's principles that vast medley seemingly capricious facts, which have been recorded as to heredity and variation, is rapidly being shaped into an orderly and consistent whole. A new world of intricate order previously undreamt of is disclosed. We are thus endowed with an instrument of particular range, and precision, and we reach to certainty in problems of physiology which we might have supposed destined to continue for ages inscrutable.
>
> *William Bateson,*
>
> *Mendel's Principles of Heredity (1909)*

Since the beginning of human civilization, people have observed similarities between parents and offspring and have domesticated and selectively bred crop plants, pets and livestock. Ten centuries of casual observations about heredity, however, failed to produce more than imaginative explanations for how it operates. Not until the mid-1800s did an extraordinary monk named Gregor Mendel discover the basic mechanism of heredity.

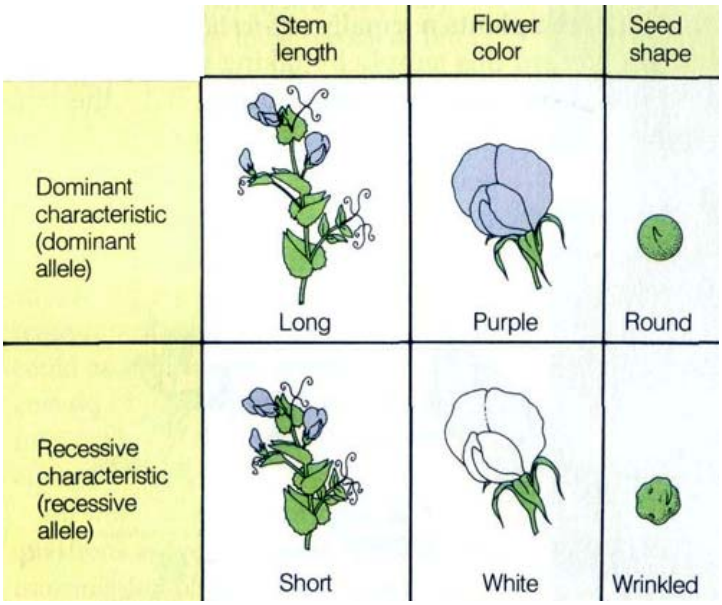
Gregor Johann Mendel was born in 1822 in a small Austrian village. Although a bright student Mendel came from a poor family and was unable to afford a university education. Instead, in 1843, he joined the Augustinian monastery in Brünn (now Brno). The Brünn monastery had long been a center of scientific thought owing mainly to the efforts of Abbot Cyrill Napp, a proficient plant breeder as well as the leader of church affairs.

In 1851, Napp sent Mendel to study physics, mathematics, (including the new field of statistics), chemistry, and botany and plant physiology at the University of Vienna. There Mendel encounted theories about the particulate nature of matter – the idea that all substances are made up of molecules and atoms. With Abbot Napp's encouragement, ***Mendel returned to the monastery and began a series of carefully planned experiments that eventually demonstrated the particulate nature of heredity***.

In 1866, Mendel presented the results of his experiments on the nature of inheritance to the Brünn Society for Natural History. However his ideas were neither accepted nor understood in his lifetime. He died in 1884, convinced that it would not be long before the whole world acknowledges his discovery.

Mendel carried out his experiments with garden pea. He obtained 34 distinct strains in peas from farmers and raised generations to select only tree-breeding strains those, in which for a given trait, each offspring is identical to the parent.

Mendel was the first to study genetics through plant breeding experiments. It was easy for him to select and maintain tree-breeding strains because the pea is self-fertilizing. That is each single pea flower has both male and female productive organs enclosed by the delicate petals. Pollen grains, the sites of sperm nuclei, are formed in anthers. The anthers are near the stigma, the female structure that receives the pollen. Because the pea flower does not open fully, pollen usually reaches the stigma within the same flower and does not pass from one flower to another.




Mendel focused on the inheritance of several distinct traits – flower color, pod shape and plant height, for example – rather than on that of the parents.

**Notes:**

1. however – однако
2. although – хотя
3. instead – вместо, взамен
4. neither...nor – ни… ни
5. long before – задолго до
6. not until the mid-1800s – и лишь только в середине 1800-тых

***VII. Answer the following questions about the text:***

1. What have people observed since the beginning of human civilization?
2. What did Gregor Mendel discover in the mid-1800-s?

3. When was he born?
4. Did he acquire University education?
5. Why had the Brünn Monastery been a centre of scientific thought?
6. Where did Mendel study plant physiology?
7. What did he do when he returned to the monastery?
8. What did Mendel present to the Brünn Society for Natural History?
9. What did Mendel obtain while carrying out his experiments with garden peas?
10. Mendel was the first to study genetics through planting experiments, wasn't he?

***VIII. Read the sentences that follow and decide whether they are true or false. Use the following phrases to express your agreement or disagreement.***

| *Agreement* | *Disagreement* |
|---|---|
| I think so. | I don't think so. |
| I believe so. | I'm afraid not. |
| I agree on this point. | I don't agree on this point. |
| That's right. | That's wrong. |

1. Gregor Mendel was born in Australia.
2. In 1843 he joined the Augustinian monastery in Brünn.
3. In 1851, Napp sent Mendel to study physics, mathematics, chemistry, botany at the University of Vienna.
4. There Mendel did not encounter any theories about the particulate nature of matter.
5. Mendel carried out his experiment with beans.
6. Mendel was the first to study genetics through plant-breeding experiments.

## *IX. Read the text; try to get it as a whole.*

Text 7B

THE SEARCH OF THE CHEMISTRY OF THE GENE

Modern genetists know that a gene, a hereditary factor that regulates a specific aspect of an individual's looks, behaviour, or biochemistry, determines each pair of trials such as green or yellow seed color or wrinkled, or round seed

shape. Each alternative form of a gene is called an allele, such as the yellow allele of the seed color gene or the wrinkled allele of the seed shape gene.

The study of nucleic acids had its start in 1869, when a young Swiss physician named Johann Friederich Miescher began to collect human white blood cells from the pus on discarded bandages and to dissolve the cells proteins with pepsin, a protein-digesting enzyme. Curiously most of the contents of each cell nucleus remained intact during this enzymatic attack suggesting that it was not a protein; Miescher called the material "nuclein". Others isolated nuclein from additional cell types, and by 1900, Miescher's compound was being called nucleic acid.

The first real insight into the structure of genes came in 1928, when a British bacteriologist named Frederick Griffith was attempting to develop a vaccine against pneumococcus, the bacterium that causes pneumonia. In his work, Griffith discovered a substance that could change one form of bacterium into another form with hereditary traits – a strange but obvious sign of genetic activity.

In that era before the advent of penicillin and other antibiotics, pneumonia claimed thousands of lives each year. A vaccine seemed like the major hope for preventing these deaths, and Griffith studied two strains of pneumococci to try to develop such a vaccine. The virulent, or disease – causing, strain of pneumococci secrets a polysackaride coat called a capsule

around its cell wall. The capsule protects the bacterium from destruction by the host animal's immune system. Virulent pneumococci form large smooth, glistening colonies and are designated S, for "smooth". The other strain Griffith studied lacks a capsule and is nonvirulent. These harmless cells form small, rough colonies and are designated R, for "rough".

When Griffith injected mice with live S-type pneumococci they died from pneumonia while those he injected with live R-type bacteria survived, as did those he injected with S-strain pneumococci that had been heat-killed. Curiously, though, Griffith found an unexpected fourth pattern in his well-designed controls: When injected with a mixture of dead S-strain and live R-strain bacteria the mice died of pneumonia. He found the tissues of the dead mice to be teeming with live, virulent S-strain pneumococci. How could this be? The live R-strain bacteria were harmless, but the dead S-strain bacteria certainly could not have come back to life. **Griffith hypothesized that some material – perhaps hereditary material – from the dead S-strain cells must have transformed the harmless R-strain cells into the virulent S-strain.** Researchers soon found that an extract of the fluid surrounding the dead cells is sufficient to transform nonvirulent into virulent bacteria.

In 1944 Oswald T. Avery, Colin MacLeod and Maclyn MrCarty at Pockfeller University set out to identify the substance in the extract. They gradually removed one chemical compound after another – first the proteins, then the carbohydrates, next the lipids – each time testing the ability of the material to transform nonvirulent pneumococci into virulent pneumococci. Finally there was virtually nothing left in the extract but a fine, clear viscous thread that Avery could pick up on a glass-stirring rod. When dissolved, this thread-like substance could transform R-strain into S-strain bacteria. **Chemical analysis showed the viscous substance to be millions of molecules of a nucleic acid called deoxyribonucleic acid, or DNA.**

## *X. Find answers to the following questions in the text:*

1. What does a gene, a hereditary factor regulate?
2. How is each form of a gene called?
3. When did the study of gene begin?
4. How did Miescher discover nucleic acid?
5. Who made the first attempt to penetrate into the structure of genes?
6. What did Griffith discover?
7. What did he study to develop a vaccine?
8. What was his hyposesis?
9. What did Avery, MacLeod and MrCarty at Rockfeller University do?
10. What did they find?

## *XI. Find sentences characterizing the following:*

1. the experiment made by Swiss physician named Johann Friederich Miescher to obtain “nuclein”;
2. the studies carried out by Griffith to develop a new vaccine;
3. Griffith’s hypothesis;
4. the discoveries of other researchers confirming Griffith’s hypothesis;
5. the experiment made up by Avery, MacLeod and MrCarty at Rockfeller University.

## *XII. Think and find arguments to prove that:*

1. a gene regulates specific aspects of an individual;
2. a British bacteriologist Griffith was attempting to develop a vaccine against pneumococcus, the bacterium that causes pneumonia;
3. a vaccine seemed like the major hope for preventing millions of deaths;
4. Griffith found an unexpected fourth pattern in his well-designed controls;

5. the procedure that Avery, MacLeod and MrCarty followed to begin to identify the substance in the extract.

## Unit VIII

## LIFE'S VARIETY

***I. Remember the following words and word combinations from the text.***

1. single-celled decomposer – одноклеточный деструктор (организм, разлагающий органические вещества)
2. mold – плесень
3. puffball – дождевик
4. earth's major decomposers – главные биоредукторы на земле
5. saprobes – сапробиенты (обитатели загрязненной органическими веществами среды
6. reducing old buildings – разрушающиеся старые здания
7. crumbled ruin – обвалившиеся развалины
8. to attack humans – воздействовать на человека
9. root-fungi associations – грибковые ассоциации
10. producers – продуценты, производители (организмы, являющиеся производителями органического вещества в экосистеме)
11. carbohydrates – углеводы
12. boxcars – товарные вагоны
13. to generate organic nutrients – производить органические питательные вещества
14. to anchor the plant – скреплять растение
15. solar collector – солнечный собиратель
16. to capture sunlight – захватывать солнечный свет
17. to dismantle carbohydrates – расщеплять углеводы
18. hypha (syn), hyphae (pl) – гифа (нити, из которых состоит грибница или мецелий грибов)

19. topsoil – верхний пахотный слой почвы
20. to show the trends – показывать направления

## *II. Translate the following English word combinations into Russian:*

Familiar mushrooms, decomposing bacteria, parasitic organisms, plant diseases, to attack crops, athlete's foot infections, to be interdependent with, to break down plant matter, great producers, crumbled ruin, amount of carbohydrates, fallen wood, dead animals.

## *III. Find the English equivalents for the following Russian words and word combinations in the right column:*

| | |
|---|---|
| 1. сообщество грибов | 1. to produce through photosynthesis |
| 2. грибы-паразиты | 2. to anchor the plant |
| 3. производить через фотосинтез | 3. fungal hyphae |
| 4. многоклеточные организмы | 4. to absorb water |
| 5. производить органические вещества | 5. collective activity |
| 6. скреплять растение | 6. root-fungi associations |
| 7. поглощать воду | 7. multicellular organisms |
| 8. расщеплять углеводы | 8. parasitic fungi |
| 9. совокупная деятельность | 9. to generate organic nutrients |
| 10. грибные гифы | 10. to dismantle carbohydrates |

## *IV. Match each word in A with its antonym in B.*

A. familiar, decomposers, directly, to include, dead, living, cause, to generate, organic, to absorb, simple

B. non-living, reason, to destroy, alive, indirectly, inorganic, unfamiliar, to exclude, producers, complex, to release.

***V. Translate the following sentences into Russian. Define the types of Subordinate Clauses.***

1. Biologists believe that fungi arose from single-celled decomposers.
2. Other types of parasitic fungi include the species that attack humans and other animals.
3. People and most other organisms live directly or indirectly on carbohydrates that plants produce.
4. The life cycles of fungi and plants show what is unique about these groups.
5. They also show how specific kinds of organisms reproduce – one of the major tasks of any living things.

***VI. Read the text below to learn about life's diversity.***

Text 8A

PLANTS AND FUNGI: PRODUCERS AND DECOMPOSERES

Yeasts, molds, mushrooms, mildews, and the other fungi pervade over world. They work great good and terrible evil. Upon them, indeed, hangs the balance of life, for without their presence in the cycle of decay and regeneration neither man nor any other living thing could survive.

*Lucy Kavaler.*

*Mushrooms, Molds and miracles (1965)*

Biologists believe that fungi arose from single-celled decomposers as much as 900 million years ago. Today's fungi include the familiar mushrooms, molds and puffballs. Along with the various decomposing bacteria fungi are the earth's major decomposers. Most fungi decompose non-living organic matter, such as fallen wood and leaves and dead animals, called saprobes, such fungi

will constitute everything from leather and cloth to paper, wood, paint, and other materials, slowly reducing old buildings, books and shoes to crumbled ruin. Some fungi, however, are parasites, organisms that attack living things. Today, parasitic fungi are the main cause of plant diseases, attacking crops in fields, gardens and orchards. Other types of parasitic fungi attack humans and other animals and include the species that cause athlete's foot infections.

Fungi are also highly interdependent with plants. Most fungi survive by breaking down plant matter, and some 90 per cent of all plants that live on land have the kind of root-fungi associations which plants depend on.

In contrast to the decomposers, plants are great producers. Each year the earth's plants collectively produce, through photosynthesis, 150 billion tons of carbohydrates, an amount that could fill the boxcars of 100 trains, each long enough to stretch from earth to the moon. People and most other organisms live directly or indirectly on carbohydrates that plants produce.

Plants are multicellular organisms that generate their organic nutrients through photosynthesis. Most plants have leaves (or equivalent structures) that act as solar collectors, and roots (or similar structures) that anchor the plant and absorb water and nutrients. So as producers plants capture sunlight and use its energy in the building of carbohydrates. As decomposers fungi dismantle carbohydrates and other organic molecules, use some of the nutrients, and release more into the soil and air where other life forms – including plants – can use them once again. It is the collective activity of the tons of fungal hyphae in each acre of topsoil. The life cycles of fungi and plants show what is unique about these groups; they also show the trends from simpler to more complex processes, revealing evolutionary directions, and how specific kinds of organisms reproduce – one of the major tasks of any living thing.

*Notes:*

1. as much as – столько (сколько)
2. along with – вместе с
3. in contrast to – в противоположность
4. each long enough – каждый достаточно длинный, чтобы
5. through – через, посредством

***VII. Answer the following questions about the text:***

1. What did fungi arise from?
2. What do fungi include?
3. Who do fungi decompose?
4. Why are some of fungi parasites?
5. Fungi are highly interdependent with plants, aren't they?
6. Why are fungi great producers?
7. What kinds of organisms are plants?
8. What functions do leaves of plants perform?
9. What is the role of their roots?
10. What do life cycles of fungi and plants show?

***VIII. Think and say about***

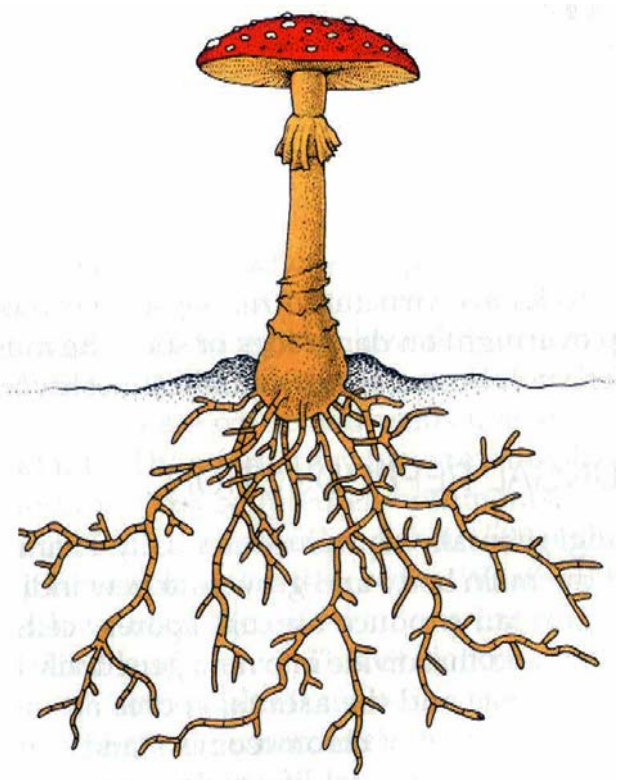
1. the occurrence of fungi in nature;
2. fungi as the earth's major decomposers;
3. interdependence of fungi with plants;
4. plants as great producers;
5. plants as multicellular organisms generating their organic nutrients through photosynthesis.

## *IX. Read the text; try to get it as a whole.*

Text 8B

FUNGAL INTERACTIONS WITH PLANTS

Fungi are distinguishable from other kingdoms by the way they obtain nutrients and by their unique physical structure. Fungi obtain organic nutrients by secreting enzymes that break down organic matter and then absorbing the released nutrients through their cell membranes.



Despite the damage that they cause each year, fungi as a group are more beneficial than harmful.

It is easy to imagine the earth becoming buried by a deep layer of dead wood and fallen leaves were it not for the activity of fungi, since only they can decompose cellulose and lignin, the hard substances in wood. Also, out of sight, below the soil surface, fungi and plant roots interact in important and mutually beneficial ways. These associations between roots and fungi are called “fungus roots” (mycorrhizae). It wasn’t always clear that such fungal infections would benefit plants, but experiments showed that they do.

In many woody plants, hairlike fungi associated with cells of the plant’s roots expand the surface for uptake of water and minerals. Infected trees can take in ten times more phosphorus and other nutrients than they could without the fungal symbionts. In exchange for augmenting the plant nutrition, the fungus gets a home and probably other benefits not yet understood.

A second important type of fungus-plant interaction can be found in licheus: grey, orange or greenish crusts that grow on bark, soil, or rocks. A lichen is an association between fungus and an alga, with the fungus forming a dense Ryphae mat around the algal cells. The fungus lives off the alga's photosynthetic products while the alga receives protection and supply of water from the fungus. Lichens take few nutrients from the rock or tree to which they are attached, and they are often rock or tree to which they are attached, and they are often the first organisms to inhabit lava flows or other newly exposed rocks. While lichens can survive in hostile environments, they are particularly sensitive to some industrial pollutants. Therefore, they have recently been used as early indicators of polluted environments.

Fossils reveal that fungi grew on land about 500 million years ago – long before plants left oceans. What's more, fossilized fungi have been identified among the roots of the oldest fossilized land plants. This evidence suggests that "fungus roots" helped plants make the transition to land. Without fungus – plant interactions, plants might have evolved in very different ways.

So we may say that plant roots need fungi for maximum absorption and nutrient recycling, and fungi need plant and animal matter for energy.

### *X. Find answers for the following questions in the text:*

1. In what way are fungi distinguished from other kingdoms?
2. How do they obtain organic nutrients?
3. Are fungi more beneficial than harmful and why?
4. How do fungi act in exchange for increasing plants nutrition?
5. What is the second important type of fungus-plant interaction?
6. What is lichen?
7. How do fungi and lichens interact?

8. Why have lichens recently been used as early indicators of polluted environments?
9. What do fossils reveal about fungi?
10. What do plant roots need for maximum absorption and nutrient recycling?

***XI. Find information concerning the following statements in the text:***

1. fungi and plant roots interact in important and mutually beneficial ways;
2. infected trees can take in ten times more phosphorus than they could without fungi;
3. a lichen is an association between fungus and an alga;
4. lichens are particularly sensitive to some industrial pollutants;
5. fungi grew on land long before plants left the oceans.

***XII. Think and find arguments to prove that:***

1. fungi obtain organic nutrients by secreting enzymes;
2. a second important type of fungus-plant interaction can be found in lichens;
3. the fungus lives off the alga's photosynthetic products;
4. lichens can survive in hostile environments but they have been used as indicators of polluted environments.

## Unit IX
## ANIMALS AND EVOLUTION

***I. Remember the following words and word combinations from the text:***

1. to be distinct from – отличаться
2. heterotrophs – гетеротрофы (организмы, использующие в качестве углерода готовые органические вещества)
3. to search for – искать
4. mode of reproduction – способ размножения
5. distinct stages of development – отдельные стадии развития
6. complete fossil record – полная ископаемая летопись
7. soft-bodied animals – мягкотелые животные
8. burrow – нора
9. impressions – отпечатки, вдавливания
10. protists – протисты (одноклеточные организмы)
11. hard parts – жесткие части
12. shell – скорлупа
13. scale – чешуя
14. overall result – общий результат
15. great radiation – эволюционная радиация
16. invertebrates – беспозвоночные (животные)
17. worms – черви
18. to crawl – ползать
19. giant dragon flies – огромные стрекозы
20. to avoid danger – избегать опасность

21. primordial forest – примордиальный лес (с листьями и деревьями, имеющими форму бугорков, выступов, формирующихся снизу вверх)
22. leather-winged pterosaurs and mastodons – птерозауры и мастодоны с крыльями, покрытыми кожей
23. ground sloths – земные ленивцы
24. phylum (sin) - phylar (pl) – тип - типы

## *II. Translate the following word combinations into English:*

Основной способ размножения животных, полный цикл, содержание энергии, поиск пищи и самки, избегать опасности, многоклеточный организм, мягкотелые животные, горные породы возрастом в 580 миллионов лет, первые черви, которые ползали по земле, десятки типов животных, общий результат человеческих превращений, земные ленивцы.

## *III. Fill in the blanks in the following sentences with the proper words and word combinations from the text:*

1. Unlike plants animals eat … because they cannot manufacture their own food.
2. Animals have a long evolutionary history because they have left a more … than most members of their kingdoms.
3. Many zoologists believe that animals arose from … .
4. The fossil record shows that the overall result of geological change and continued evolution was a … of the animal kingdom.
5. Animals' primary … is sexual.
6. The earliest fossils of … are burrows traits and impressions found in Southern Australia.

***IV. Match each word in A with its synonym in B.***

A. distinct, to manufacture, to search for, each, stage, to believe, to arise from, to start, to break down, entire, development, quite.

B. To decompose, whole, to begin, evolution, to appear, to look for, to think, different, step, to produce, every, absolutely.

***V. Each sentence is the answer to the question. Make the question with the interrogative word suggested.***

*Model: Animals are quite distinct from the members of other kingdoms because they have many cells. (What)*

*What are animals quite distinct from other kingdoms?*

1. The largest animal a giraffe has trillions of cells. (How many)
2. Animals eat other living things because they cannot manufacture their own food. (Why)
3. Animals' primary mode of reproduction is sexual. (What)
4. Many zoologists believe that animals arose from animal-like protists. (What)
5. The earliest fossils of hard structures were found in 580 million-year-old rocks. (When)

***VI. Read the text below carefully to learn about animals and evolution.***

Text 9A

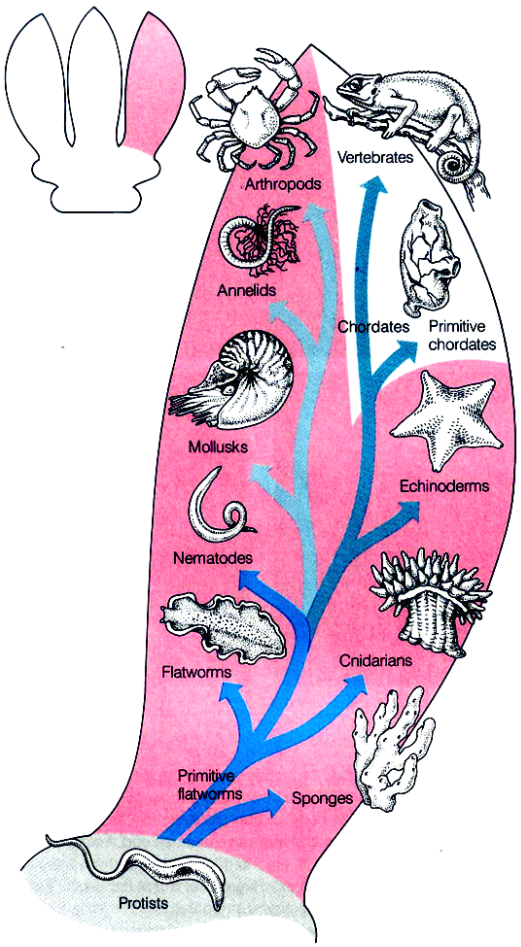
ANIMAL KINGDOM

There is no part of the future foetus actually in the egg, but yet all parts of it are in it potentially. …The perfect animals are made up of Epigenesis, or superaddition of parts.

*William Harvey, De Generatione Animation (1651)*

Animals are quite distinct from the members of the other kingdoms. Unlike the single-celled monerans and protists, ***animals have many cells***. In fact, some of the largest animals – an elephant, say, or giraffe – have trillions of cells. And unlike plants, ***animals eat other living things*** because they cannot manufacture their own food and instead must eat it and break it down (digest it) for its energy content. Unlike most fungi, which are also multicellular heterotrophs, animals can move about at some point in their life cycle – to search for food and mates and to avoid danger. Finally, animals' primary mode of reproduction is sexual, and because each individual grows and changes from a single fertilized egg to a multicellular organism, it passes through various distinct stages of development.

As a group, animals have a long and interesting evolutionary history and because they have left a more complete fossil record than most members of other kingdoms, that history is better understood. The earliest fossils of soft-bodied animals are burrows, trails and impressions found in 700-million-year-old rocks in Southern Australia. Many zoologists (biologists who study animals) believe that ***animals arose from animal-like protists***. Soft-bodied animals existed for at least 120 million years before other species started generating hard parts (shells, scales, teeth, and bones); The earliest fossils of these hard structures were found in 580 million-year-old rocks.



The fossil record shows that the overall result of geological change and continued evolution was a great radiation of the animal kingdom. All the animals that ever existed – including invertebrates, such as the first worms to crawl on land and the giant dragon flies of primordial forests, and invertebrates, such as the leather-winged pterosaurs and mastodons and ground sloths of the last ice age – were products of the great radiation. Dozens of phyla evolved, animals in a phylum share have living members and they include more than a million individual species, of which 95 percent are invertebrates.

*Notes:*

1. quite – совершенно
2. unlike – в отличие
3. throughout – повсюду, везде
4. that ever existed – которые когда-либо существовали

### *VII. Answer the following questions about the text:*

1. What are animals distinct from the members of the other kingdoms by?
2. What do animals eat?
3. Why is animals' mode of reproduction sexual one?
4. What evolutionary history do animals have and why?
5. What do many zoologists think about animals?
6. What does the fossil record show?
7. How many percent of invertebrates does the phylum of animals include?

### *VIII. Find information confirming the following statements from the text:*

1. animals are quite distinct from the members of the other kingdoms;
2. animals eat other living things;
3. animals can move about at some point in their life cycle to search for food, mates and to avoid danger;

4. animals have a long and interesting evolutionary history;
5. the fossil record shows the overall result of geological change and continued evolution was a great radiation of animal kingdom.

***IX. Read the text; try to get it as a whole.***

Text 9B

SELF-PROTECTING TERMITES

Termites built towering, hard earthen mounds that like very tall, burrowed monuments. Inside, millions of jostling white insects live in complex societies safeguarded by an amazing arsenal of self-defenders that keeps most potential enemies at bay. For example, some termites species have a caste of soldiers that protect the workers, queen and others in the colony. At the first sign of an intruder each soldier rushes forward and squirts an irritating gluey substance from its conical head. A hungry anteater is just as likely to retard with a painful tongue as to collect a meal. Termites and the anteaters that devour them as animals, multicellular "other feeders" (heterotrophs) that move themselves about at some point in their life cycle. When you think of the animal kingdom, you probably envision organisms such as goldfish, horses, eagles, or people. All these animals are vertebrates: animals with backbones, like termites, earth worms and oysters.

As we survey the colourful, strange and sometimes fantastic invertebrates, we will follow certain trends that led to the basic physical features most animals share. ***The first trend was away from a circular body plan toward a saclike body with mirror-image right and left halves and a head***. The head, with centralized regions for detecting and responding to external cues such as light and sound, provided many advantages, including more ways of interacting with other organisms and the environment.

***In another trend, invertebrates moved away from a saclike body with a single opening at one end toward a longer body containing a food-digesting tube with openings at both ends; the tube eventually became suspended in a fluid-filled body cavity.*** This trend in the evolution of body structures led to a more complete breakdown and use of food and in turn the release of more energy that could power rapid movements.

***Yet another trend was toward segmentation***, the development of a series of body units. The series of vertebrae you can feel as you run your fingers up your spine is a reflection of segmentation.

While these trends conferred certain advantages they were not prerequisites for survival; some animals survive today without one or more of them.

### *X. Find answers to the following questions in the text:*

1. What do termites build?
2. How do they live?
3. Who safeguards them?
4. What phylum of animals do termites belong to?
5. What was the first physical feature that most animals share?
6. What was another trend in the evolution of body structure of invertebrates?
7. What was the final trend in the development of a series of body units?
8. Do these trends provide certain advantages for survival of animals?

### *XI. Prove the following statements by the information from the text:*

1. termites houses are like very tall burrowed monuments;
2. they live safeguarded by an amazing arsenal of self-defenders;
3. termites and the anteaters are multicellular “other feeders” (heterotrophs);
4. such animals as goldfish, horses, eagles or people are vertebrates;

5. advantages of vertebrates like right and left halves and a head enable them to interact with other organisms and the environment.

### *XII. Find sentences characterizing the following:*

1. a caste of soldiers that protects the workers, queen and other termites in the colony;
2. organisms that phylum of invertebrates includes;
3. the main trends in the evolution of body structure of vertebrates;
4. advantages that all these trends confer.

## Unit X

## THE CHORDATES

***I. Remember the following words and word combinations from the text.***

1. fleet animals – морские животные
2. to trace evolutionary roots to – восходить корнями в развитии к
3. bottom-dwelling sea creatures – морские организмы, населяющие дно
4. tunicates – оболочники
5. lancelets – ланцетники
6. bilateral symmetry – билатеральная (двухсторонняя) симметрия
7. gut tube – кишечный тракт
8. body segmentation – членистость тела
9. aquatic – водный
10. evolutionary innovation – эволюционное обновление
11. notochord – спинная струна (хорда)
12. stiff and flexible rod – жесткий и гибкий стержень
13. hollow nerve cord – полый нервный тяж
14. spinal cord – спинной мозг
15. nerve tissue – нервная ткань
16. to integrate the body's movements and sensations – объединять органы движения и чувства
17. gill slits – жаберные щели
18. to filter food – фильтровать пищу
19. tail – хвост
20. anus – анус (заднепроходное отверстие)
21. vertebrae column – позвоночный столб

22. muscle blocks – мускульные блокады (миотомы)
23. ancestral echinoderm – анцестральные иглокожие
24. to give rise to – давать начало чему-либо

***II. Translate the following word combinations into Russian:***

diverse vertebrates, to run the length of the animal, filtering food, certain amphibians, internal support, sea creatures, sign of segmentation, the earliest vertebrates, muscle layers ancestral echinoderms.

***II. Find the English equivalents for the following Russian words and word combinations in the right column:***

| | |
|---|---|
| 1. спинная струна | 1. myotomes |
| 2. эволюционное обновление | 2. gut tube |
| 3. морские существа, населяющие дно | 3. spinal cord |
| 4. оболочники | 4. flexible rod |
| 5. древние водные беспозвоночные | 5.ancient aquatic invertebrates |
| 6. гибкий стержень | 6. to occur |
| 7. кишечный тракт | 7. bottom-dwelling sea creatures |
| 8. спинной мозг | 8. signs of segmentation |
| 9. встречаться | 9. tunicates |
| 10. миотомы | 10. notochord |
| 11. признаки членистости | 11. evolutionary innovation |

***III. Match each word in A with its synonym in B:***

A. bilateral, opening, to evolve, a number of, to integrate, certain, to occur, signs, common, major, to extend, single.

B. Separate, to meet, a range, general, to unite, to project, two-sided, to develop, traits, hole, main, definite.

***IV. Answer the questions using the words suggested (use the Present Perfect Tense).***

*Model: What substances have become higher chordates that trace their evolutionary roots to small bottom-dwelling creatures? (Diverse vertebrates).*

*Diverse vertebrates have become higher chordates that trace their evolutionary roots to small bottom-dwelling aquatic invertebrates.*

1. What organisms have all chordates evolved from? (ancient aquatic invertebrates)
2. What important evolutionary innovations have been found in chordates? (notochord, hollow nerve cord and spinal cord)
3. In what way have young fish and certain amphibians obtained oxygen? (using gill slits)
4. What role has the tail played for all chordates? (as the internal support of notochord)
5. What has the single ancestral echinoderm given rise to? (chordates without backbones and to the earliest vertebrates)

***V. Read the text below carefully to find out chordate characteristics.***

Text 10A

CHORDATE CHARACTERISTICS

Among the vertebrates as a whole-fishes, amphibians, reptiles, and mammals – there is some variation in cell type, but the key to the different organization of all these forms does not lie in how

these basic building units are arranged in space during development.

*Lewis Wolpert, "Pattern Formation in Biological Development"*
*Scientific American (October 1978)*

The diverse vertebrates – including many graceful, powerful, and fleet animals on land, sea and air – are higher chordates that trace their evolutionary roots to the small, bottom-dwelling sea creatures without vertebrate called tunicates and lancelets. ***All chordates display bilateral symmetry, a head, a body cavity, a one-way gut tube, and a body segmentation – traits that first emerged in the invertebrates***; indeed, the chordates almost certainly evolved from ancient aquatic invertebrates. But chordates, both with and without vertebrate, also share a number of new structures – important evolutionary innovations not found in their invertebrate relatives.

One of these new structures is notochord a stiff but flexible rod that provides internal support and runs the length of the animal. A second new structure is the hollow nerve cord or spinal cord which is a tube of nerve tissue that also runs the length of the animal, just above the notochord, and which serves to integrate the body's movements and sensations.

Chordates also have gill slits, pairs of openings that penetrate the back of the mouth from the inside to the outside. Tunicates and lancelets employ gill slits for filtering food. Young fish and certain amphibians obtain oxygen using gill slits. In most reptiles, birds, and mammals, gill slits occupy only in the embryo or develop into other structures.

All chordates have a tail that extends beyond the anus at some point of their development. The tail has the internal support of a notochord or vertebrae column, and it moves by means of yet a fifth chordate trait, muscle blocks (myotomes). Muscle blocks, which occur along the length of the body behind

the head, are the major signs of segmentation in chordates. When you eat fish, you can easily see these stacked muscle layers in the “flaky” white or pink meat. Most chordates have a tail throughout life, but in some chordates including humans, the tail appears only briefly in the embryo.

Many biologists agree that the evolution of the chordates began with some common ancestral echinoderm related to the sea stars. This single ancestral echinoderm may have given rise to the chordates without backbones and to the earliest vertebrates.

*Notes:*

1. indeed – в самом деле, действительно
2. certainly – несомненно
3. beyond – за
4. flaky white meat – слоистое белое мясо

***VI. Answer the following questions about the text:***

1. What organisms do vertebrates include?
2. What symmetry do all chordates display?
3. What new structures do they share?
4. What organ provides the internal support for the body of the chordates?
5. What is the second new structure which serves to integrate the body’s movements and sensations?
6. What do tunicates and lancelets employ for filtering food?
7. Do all chordates have a tail?
8. What do many biologists think about the evolution of chordates?

***VII. Read the sentences that follow and decide whether they are true or false. Use the following phrases to express your agreement or disagreement.***

| *Agreement* | *Disagreement* |
|---|---|
| I think so. | I don't think so. |
| I believe so | I'm afraid not. |
| I agree on this point. | I don't agree on this point. |
| That's right. | That's wrong. |

1. All chordates display bilateral symmetry.
2. A notochord doesn't run the length of the animal.
3. Young fish and certain amphibians obtain oxygen using gill slits.
4. All chordates do not have a tail.
5. Muscle blocks are the major signs of segmentation.

***VIII. Read the text; try to get it as a whole.***

Text 10B

AMPHIBIANS: FIRST VERTEBRATES TO LIVE ON LAND

Fossils show that during the Age of Fishes (roughly 400 million years ago), the vertebrate lineage that included air-breathing, lobe-finned fishes produced the amphibians: vertebrates that can live both on land and in water (amphi means "both", bios means "live"). Modern amphibians include the frogs, toads, and salamanders – animals whose ancestors overcame the formidable problems of life on land and evolved means of walking, breathing air, and staying moist. Early amphibians had front and hind legs containing strong bones and powerful muscles. Extending sideways from the body, the legs supported the animal's weight far better than lobed fins, and with two pairs of legs, the animal could move about on land-debeit slowly and clumsily – for greater distances even without water's buoyant support.

Laborious walking, however, would have required a great deal of energy from food, and large quantities of oxygen would have been needed for aerobic

respiration. Fossil evidence reveals that early amphibians had fully functioning lungs, or air sacs, that provided a site for gas exchange. Air was probably pumped in by swallowing movements, much as it is in modern frogs and toads. Moreover specializations arose in the heart and circulatory system that tended to separate oxygenated blood en route to the body tissues, from unoxygenated blood bound for the lungs – a separation that became complete in the birds and mammals. Finally, an amphibian's smooth, moist skin could absorb about half of the necessary oxygen and release most of the carbon dioxide.

These innovations provided sufficient oxygen but did not solve the problem of drying out. Since the amphibian skin had to remain moist for gas exchange (to supplement the lungs); the animals were restricted to life near the water's edge. In addition amphibians lay eggs with a clear, jellylike coating that must also stay most, lest the embryos die before the fishlike tadpoles emerge. Because their eggs require water, amphibians must return to the water to reproduce, and in this sense, they are analogous to the first land plants whose sperm required standing water to swim from one plant organ to another.

Today frogs, toads, salamanders, and a few relatives are the only remaining members of the class Amphibia and continue to display ***evolutionary innovations of the amphibian lineage: legs, fully functioning lungs and partial separation of oxygenated and deoxygenated blood***. These generally small vertebrates are very common in freshwater environments and show a range of interesting specializations. In some, the moist skin has become brightly colored, attracting potential mates and warning would be predators of poison skin and glands. And in others, the skin is dry and adopted to life in dry habitats. The nervous system of many amphibians, protected by the vertebral column and bony skull, has become well developed and accompanied by keen senses of sight and hearing. What's more, rapid-fire nervous reactions enable these animals to catch flies by flipping out their long tongues. And amphibian limbs

are often specialized with webbed feet for efficient swimming and with thick muscles for hopping or running on land.

### *IX. Find answers to the following questions in the text:*

1. What organisms produced the amphibians?
2. What do modern amphibians include?
3. What organs did modern amphibians have?
4. What would laborious walking have required from early amphibians?
5. What does fossil evidence reveal?
6. What role does the moist skin of amphibians play?
7. Do amphibians' eggs require water? What for?
8. In what way are amphibians analogous to the first land plants?
9. What are the only remaining members of the class of amphibians today?
10. What interesting specialization do amphibians show now?

### *XI. Find information confirming the following statements:*

1. 400 million years ago air-breathing, lobe-finned fishes produced the amphibians;
2. early amphibians had front and hind legs, containing strong bones and powerful muscles;
3. fossil evidence reveals that early amphibians had fully functioning lungs or air sacs that provided a site for gas exchange;
4. the animals were restricted to live near the water's edge.

## Unit XI

## INVERTEBRATES

### *I. Remember the following words and word combinations from the text:*

1. fine food particles – мелкие частицы пищи
2. phylum porifera – тип пористых животных
3. protozoa – протозойное, простейшее (животное) вещество
4. to resemble – быть похожим, напоминать
5. clusters of tubes – пучки трубок
6. flattened cells – разглаженные клетки
7. collar cells (choanocytes) – воротничковые клетки (хаонациты)
8. flagellum – жгутик
9. gelatinous filling – студенистое наполнение
10. wandering cells – миграционные клетки
11. amoebocytes – амебоциты
12. water current – поток воды
13. to differentiate – видоизменяться
14. gametes – гаметы (половые клетки)
15. scaffolding – скелет, костяк
16. predators – хищники
17. bath sponges – туалетные губки
18. tough fibrous skeletons – вязкие волокнистые скелеты
19. to harvest the animals – собирать животных
20. to trample – топтать
21. to decay – разлагаться
22. to split – отделяться

23. line – генеалогическая линия

24. inner lining – внутренняя выстилка

## *II. Match each word in A with its synonym in B:*

A: to resemble, shape, tiny, organization, sandwich, layer, inner, constant, to differentiate, scaffolding, to split.

B: permanent, to change, arrangement, flaky, internal, to be alike, skeleton, coating, small, to separate, form.

## *III. Match adjectives in A with nouns in B and translate the phrases into Russian:*

A. early, simple, tiny, gelatinous, constant, irregular, fibrous, different, central, fine

B. organization, sponges, animals, organisms, particles, skeletons, opening, holes, filling, heating.

## *IV. Find the English equivalents for the following Russian words and word combinations in the right column.*

1. постоянное нагревание
2. простая организация клеток
3. студенистое наполнение
4. внутренняя выстилка
5. виды губок
6. пучки неправильной формы
7. поток воды
8. соединения кальция
9. высокоорганизованные группы клеток

1. irregular-shaped clusters
2. species of sponges
3. inner lining
4. history of animal evolution
5. water current
6. incurrent pores
7. calcium compounds
8. simple organization of cells
9. constant heating

| | |
|---|---|
| 10.эволюционная история животных | 10.gelatinous filling |
| 11.вклинивающиеся поры | 11.highly organized cell groups |

***V. Each sentence is the answer to a question. Make the question with the interrogative word suggested.***

*Model: The simplest sponges resemble vases. (What)*

*What do the simplest sponges resemble?*

1. Most sponges have a simple organization of cells. (What organization of cells)
2. The sponge's cells are supported by a protein "scaffolding" (What… by)
3. The different cell types in sponges act independently. (How)
4. Sponges consume fine food particles, bacteria from water. (What)
5. 5000 species of sponges live attached to rock, pilings, sticks in oceans, rivers and lakes. (How many)
6. Biologists believe that sponges probably split from the line leading to all other animal groups very early in the history of animal evolution. (Who)

***VI. Read the text below carefully to learn about sponges as the simplest animals.***

Text 11A

SPONGES: THE SIMPLEST ANIMALS

From protozoans to sea stars, from squid to insects, invertebrates represent the essential diversity of animal life itself.

*Robert H.Barth and Robert E. Broshears*

*The invertebrate World (1982)*

Sponges are simple animals in the phylum Pozifera ("organisms with pores") that filter and consume fine food particles, bacteria, or protozoa from the water. The 5000 or so species of sponges live attached to rocks, pilings, sticks, or other animals in oceans, rivers, and lakes.

The simplest sponges resemble vases or irregular shaped clusters of tubes. Each "container" has a central cavity, a large central opening, and hundreds of tiny holes or pores (incurrent pores) through the body wall.

***Most sponges are not symmetrical, have a simple organization of cells.*** The sponge's body wall is a thin "sandwich" with a protective layer of flattered cells (choanocytes), each with a long flagellum surrounded by a delicate collar; and a gelatinous filling containing wandering cells called amoebocytes. The constant heating of the collar cells' flagella draws the water current in through the body. The embedded amoebocytes help digest food particles and differentiate into gametes. The sponge's cells are supported by a protein "scaffolding" and may contain tiny pointed spikes made of silicon or calcium compounds, which help protect the sponge from predators. The irregular, tan bath sponges sometimes sold commercially are the tough fibrous skeletons that remain after people harvest the animals, trample them, leave them to decay, then process their "scaffolding".

The different cell types in sponges act fairly independently and are much less highly organized than cell groups in other animals. For this reason biologists believe that sponges probably split from the line leading to all other animal groups very early in the history of animal evolution.

*Notes:*

1. attached to – прикрепленный к
2. embedded – вкрапленные
3. fairly – довольно, весьма, в известной степени

4. much less – гораздо менее
5. for this reason – по этой причине

### *VII. Answer the following questions about the text:*

1. What kinds of animals are sponges?
2. What phylum do they belong to?
3. Where do they live?
4. What are sponges composed of?
5. What organization of cells do they have?
6. What are sponge's cells supported by?
7. What helps protect the sponge from predators?
8. What are bath sponges sold commercially?
9. In what way do the different cell types in sponges act?
10. What do biologists think about them?

### *VIII. Think and say about:*

1. sponges as simple animals in the phylum Porifera;
2. their composition;
3. sponge role in filtering and consuming fine food particles.

### *IX. Read the text; try to get it as a whole.*

Text 11B

INSECTS

***Insects belong to the largest class of animals on earth.*** Most insects are terrestrial animals living in habitats from the tropics to the poles but a few are aquatic. Many zoologists attribute insects' success to the general arthropod traits but also to the insects' small size.

Specific body parts also help account for the insects success. Many insects have organs for smelling, touch, reception, tasting, seeing and hearing in various parts of the body. An insect's head bears one pair of antennae; two pairs of wings; and its abdomen is usually free of appendages. A series of modified segments, the mouth-parts, enables the insect to feed effectively. Some, like mosquitoes, have superb pointed stylets for piercing and sucking. Others, like locusts and grasshoppers, have chewing mouth-parts that can quickly decimate foliage.

Insects have evolved various ways to grow, despite the confining exoskeletons, and various ways to thrive, despite the changing seasons. In some insects like grasshoppers and cockroaches, the embryo becomes a miniature version of the adult without wings or mature reproductive organs. This organism feeds, grows, and molts five or six times until it reaches adult size, then does not molt again. In most insects, however, including butterflies, flies, and beetles, the embryo develops into a immature form, or larva, eats voraciously, then forms a transitional stage, or pupa, sometimes inside a cocoon. A complete change, or metamorphosis, takes place in the body within the pupae exoskeleton. Finally, a nonmolting reproductively mature adult emerges. In insects that metamorphose, the larvae and adults are adapted to very different foods and environmental conditions – a successful evolutionary solution to surviving in a changing climate.

Perhaps the most fascinating of the arthropods are the ***social insects***: the termites, ants, wasps, and bees. Most species of these insects live in large colonies with labor divided among castes, or subgroups, that differ in appearance and behaviour. Termites have the most complex social life of all the insects. There is a sexual caste of kings and queens, a worker caste with oterile males and females, and a soldier caste. Some soldiers have huge biting mouthparts, and others have the conical, bazooka-shaped heads for squirting

defensive chemicals on intruders. Such insect colonies are highly evolved and function, in a sense, as a single well coordinated organism with the capacity to simultaneously build homes and cities, defend their own harvest food, and reproduce. When you consider that the roots of the animal kingdom lie in creatures no more complicated than sponges, radial animals, and flatworms, the complex social insects like termites demonstrate vividly the great evolutionary distance the invertebrates travelled.

### *X. Find the answers to the following questions in the text:*

1. What class of animals do insects belong to?
2. What do many zoologists attribute their success to?
3. What organs do they have?
4. What organs do mosquitoes have?
5. What does embryo become in some insects like grasshoppers and cockroaches?
6. What does grasshopper do before it reaches adult size?
7. What is a successful evolutionary solution to insects surviving in a changing climate?
8. What are the most fascinating insects among anthropods?
9. How do these insects live?
10. What insects have the most complex social life?
11. How do termites colonies function?
12. What do complex social insects like termites demonstrate?

### *XI. Find sentences characterizing the following:*

1. the habitats most insects live in;
2. the organs many insects possess;
3. the development of embryo in grasshoppers and cockroaches;

4. the development of embryo in butterflies, flies and beetles;
5. the process of metamorphosis;
6. social insects: the termites, ants, wasps and bees as the most fascinating of the arthropods;
7. the evolution and functioning of termites colonies.

***XII. Think and find arguments to prove that:***

1. many zoologists attribute insects' success to the general arthropod traits;
2. a series of modified systems enables the insect to feed effectively;
3. insects have evolved various ways to grow;
4. in insects a successful evolutionary solution to surviving in a changing climate is metamorphose;
5. termites demonstrate the great evolutionary distance the invertebrates travelled.

## Unit XII

## EVOLUTION OF PRIMATES, INCLUDING HUMANS

***I. Remember the following words and word combinations from the text:***

1. requisite traits – необходимые признаки
2. vertebrate subphylum – подвид позвоночных (животных)
3. mammary glands – молочные железы
4. placenta – плацента (орган, образующийся в процессе беременности из оболочек, покрывающих зародыш, и кровеносных сосудов слизистой оболочки матки)
5. behavioral abilities – поведенческие способности
6. to dominate the environment – доминировать в окружающей среде
7. primate order – отряд приматов
8. humanlike – человекообразный
9. tree-dwelling animals – животные, живущие на деревьях
10. tarsiers – долгопяты
11. hallmark – отличительный знак
12. opposable thumb – противодействующий большой палец руки
13. an ape – обезьяна
14. complex social behavior – сложное социальное поведение
15. background – предпосылка
16. to possess vision – обладать зрением
17. fluttering leaves – развивающиеся на ветру листья
18. to climb – лазить по деревьям
19. to swing – качаться
20. to communicate – общаться
21. to cooperate – взаимодействовать
22. brain – мозг

***II. Give Russian equivalents for the following English words and word combinations:***

Intriguing question, human beings, placental subclass, spoken and written language, extensive tool use, fossil evidence, lineage leading to chimpanzees, naked apes, tree-dwelling animals, later primates, several specializations, grassy, savannas, human physical features.

***III. Fill in the blanks in the following sentences with proper words and word combinations from the text:***

1. One of the most intriguing questions in modern biology is, How did … evolve?
2. Unique combination of … has allowed human beings to dominate the environment like no other animals before them.
3. One animal behaviorist has called humans "…".
4. Prosimians include small … such as lemurs and tarsiers.
5. Primates form … for human physical features.
6. Acute vision and ability to communicate and cooperate all depended on large …

***IV. Match each word in A with its synonym in B.***

A. unique, requisite, class, to dominate, evidence, sense, keen, weight, to allow, modern, to lead, to include

B. necessary, group, to permit, up-to-date, acute, the only one of its kind, to prevail, to comprise, to result in, feeling, proof, mass.

***V. Translate the following sentences into Russian. Define the tenses.***

1. Human beings are obviously members of the mammalian class.
2. One animal behaviorist has called humans "naked apes".

3. Primates evolved several specializations for living in trees.
4. These specializations have added to the success of primates as a group.
5. During the evolution of life in the trees, keen vision was accompanied by the development of powerful arms.

## *VI. Read the text below carefully to learn about primates.*

Text 12A

PRIMATES

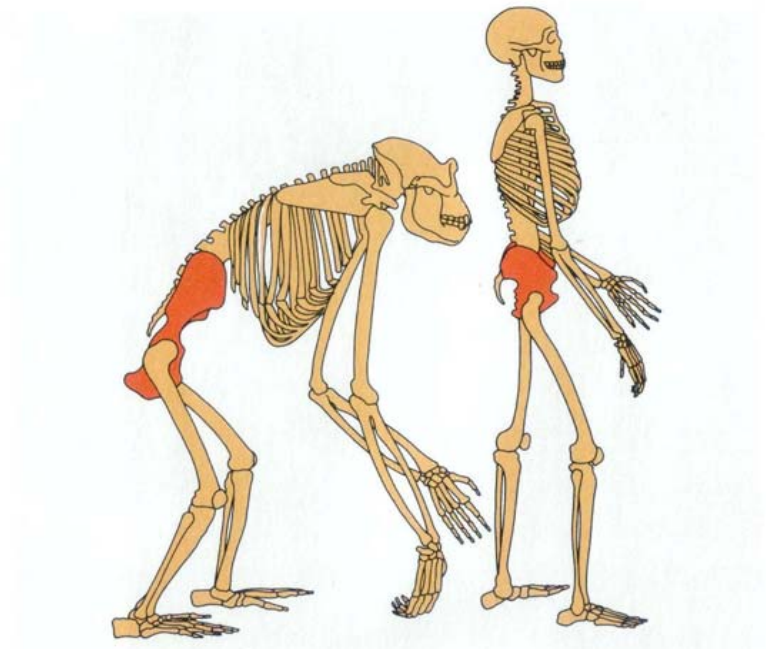
We are the products of editing,
rather than of autorship.

*George Wald*

One of the most intriguing questions in modern biology is, How did human beings evolve? We have all the requisite traits for membership in the chordate phylum and vertebrate subphylum and with our warm blood, mammary glands, placenta to support the developing embryo, and body hair, we are obviously members of the mammalian class and the placental subclass. But our unique combination of behavioral abilities – including spoken and written language, agriculture, and extensive tool use – has allowed us to dominate the environment like no other animals before us. Despite this, there is ample evidence today – both fossil and genetic – that humans are simply one branch of the primate order and that our branch separated no more than 6 million years ago from the lineage leading to chimpanzees. One animal behaviorist has called humans “naked apes”, and so, it seems, we are. There are several dozens species in the order Primates divided into two suborders: the prosimians (which means “before monkeys”) and anthropoids (literally meaning “humanlike”). Prosimians include small, tree-dwelling animals, such as lemurs and tarsiers. They have two hallmarks of later primates: the opposable thumb (a first digit that can touch each of the others) and an acute sense of light.

Anthropoids include the Old and New World monkeys and the apes as well as humans. The apes, our closest relatives, are large, tailless animals characterized by long arms, a large brain, and complex social behaviour.

Primates evolved several specializations for living in trees (and later, on grassy savannas) that have added to their success as a group and that form the background for human physical features.



Primates possess vision. Life in trees is rich with visual information, such as fluttering leaves, moving spots of sunlight and shades. During the evolution of life in the trees, keen vision was accompanied by the development of powerful arms that allowed climbing and swinging movements. The primates also evolved complex social systems. This vision and ability to communicate and cooperate all depended on large brains. Prosimians have fairly large brains for animals of their size and body weight; monkeys have proportionally larger brains than prosimians; the apes and humans have the most complex brains of any mammals.

*Notes:*

1. like no other animals – как ни одному другому животному
2. it seems – видимо
3. closest relatives – самые близки родственники

***VII. Answer the following questions about the text:***

1. What requisite traits do human beings have to be the members of the chordate phylum?
2. What behavioral abilities do humans have?
3. What proves that humans are simply one branch of the primate order?
4. What suborders is the order Primates divided into?
5. What species do prosimians include?
6. What animals do anthropoids include?
7. What specializations did primates evolve?
8. What is life in trees rich with?
9. What was keen vision accompanied by during the evolution of life in trees?
10. What did the vision and ability to communicate and cooperate all depend on?

***VIII. Find information confirming the following statements from the text:***

1. human beings are obviously members of the mammalian class and the placental subclass;
2. humans are simply one branch of the primate order;
3. there are two suborders in the order Primates;
4. anthropoids include the Old and New World monkeys, the apes and humans;
5. primates evolved several specializations for living in trees that form the background for human physical features.

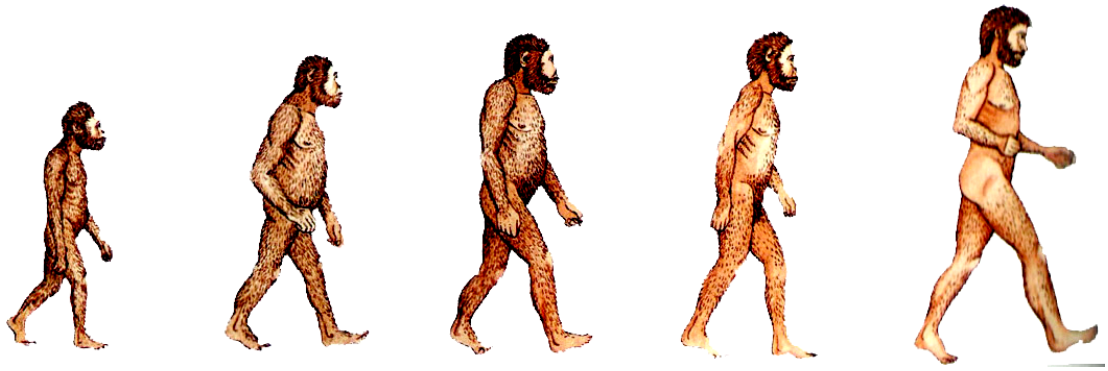
***IX. Read the text; try to get it as a whole.***

Text 12B

HOMO SAPIENS

During the million years that early humans inhabited the Old World, their faces and teeth slowly decreased in size, and their brains enlarged from a volume of 800cc around 1.5 million years ago to 1200cc by 500,000 years ago.

Two groups of humans have occupied the earth in the millenia since that time: archaic Homo Sapiens (including Neanderthals and others) and modern Homo Sapiens (including the Cro-Magnons and all the current races of people). Archaic humans dominated the Old World from about 400,000 years ago until they were superseded by modern humans between 30,000 and 100,000 years ago.



Neanderthal fossils first discovered in Germany's Neander Valley in 1856 were the first hominid remains to be studied scientifically. Living in Europe and Middle East, Neanderthals were short, stocky, powerfully built people able to move with a strength and speed surpassing that of today's best Olympic athletes. They had large protruding faces and characteristic projecting brow ridges. Their brains were similar in organization to a modern humans, but larger (1400cc) on average.

Modern humans did not descend from Neanderthals but rather arose elsewhere (fossil evidence suggests Africa), migrated northward, and eventually outcompeted the archaic on their own turf. The two types may have coexisted for thousands of years but by 34,000 years ago the Neanderthals had died out.

The Cro-Magnos looked distinctly different from their archaic cohorts. ***Their faces were smaller, flatter, and less projecting than the Neanderthals, the heavy brow ridges had all but disappeared, and their skulls were higher and rounder. Their limbs wee slender*** (but still stoutly athletic compared to our

own), ***their teeth were smaller***, and most important; ***their culture was vastly more complex***.

Their tool kits contained knives, chisels, spear heads, axes, and tools for shaping other tools of rock, bone, and ivory. They left dozens of cave paintings, engravings, and sculptures, suggesting a major development of symbolic forms of communication, probably accompanied by increased language abilities. Their living sites and shelters became larger and more complex, and human burials became more common and elaborate, indicating the establishment of religion.

The success of these cultural developments spurred a population expansion. Modern humans followed the herds of mammoths, wooly rhinoceroses, reindeer, and other game into the arctic regions of Eurasia and across the Bering land bridge, into America. They also built boats to carry them across uncharted waters to New Guinea and Australia. By 15,000 to 20,000 years ago, people had occupied virtually all the inhabitable regions of the earth.

Anthropologists have debated whether Homo sapiens arose at a single site and later spread across the world, or whether ***Homoerectus*** which was already widely distributed, transformed into ***Homo sapiens*** at the same time in different places. Both fossil and genetic evidence support the single-origin model. Interesting data come from analyzing the DNA of mitochondria. Since animals inherit their mitochondria only from their mother via the egg cell, the data suggest to some scientists that all living people can trace their ancestry through their mothers, grandmothers, and the great-grandmothers back to a single female who lived about 200,000 years ago, most likely in Africa. The media have dubbed this woman “Mitochondria Eve”. Males of other families may have contributed genes in cell nuclei, but this one African woman may have been mother of us all. It was her descendants who left Africa and in a series of major migrations, eventually populated the globe.

## *X. Find answers to the following questions in the text:*

1. Did the faces and teeth of the early humans slowly decrease during the million years?
2. What two groups of humans have occupied the earth in the millennia?
3. When did archaic humans live?
4. What humans were they superseded by?
5. What were the first hominid remains studied scientifically?
6. How did the Neanderthals look like?
7. Where did modern humans descend from?
8. How did Cro-Magnons look like?
9. What did their tool kits contain?
10. What did they leave?
11. What did modern humans follow?
12. What have anthropologists debated about?
13. What data come from analyzing the DNA of mitochondria?
14. What woman may have been mother of humans?

## *XI. Prove the following statements by the information from the text:*

1. the brains of early humans enlarged;
2. archaic Homo Sapiens dominated the Old World from about 400,000 years ago;
3. Neanderthal fossils were first discovered in Germany;
4. the brains of Neanderthals were similar to a modern humans;
5. modern humans did not descend from Neanderthals;
6. both fossil and genetic evidence support the single-origin model;
7. all living people can trace their ancestry through their mothers, grandmothers, and the great-grandmothers back to a single female who lived about 200,000 years ago, most likely in Africa.

***XII. Think and find arguments to prove that:***

1. modern humans lived between 30,000 and 100,000 years ago;
2. Neanderthal fossils were the first hominid remains that were studied scientifically;
3. Neanderthals move with the speed surpassing that of today's best Olympic athletes;
4. modern humans arose elsewhere;
5. the Cro-Magnos looked distinctly different from their archaic cohorts;
6. the tool kits of Cro-Magnons contained knives, chisels, spear heads and axes.

## Unit XIII
## PLANT KINGDOM

### *I. Remember the following words and word combinations from the text:*

1. 1. to be rice powered – находиться во власти риса (зависеть от производства риса)
2. to plague – досаждать
3. afflicted plants – пораженные растения
4. to flow over – перевертываться
5. seedling – проросток
6. gibberellin – гиббереллин
7. to isolate – выделять
8. to cause – вызывать
9. internal growth regulators – внутренние регуляторы роста
10. external growth regulators – наружные регуляторы роста
11. to control weeds – контролировать сорняки
12. to increase food production – увеличивать производство продуктов питания
13. to adjust to changing environmental conditions – приспосабливаться к изменяющимся условиям окружающей среды
14. to move away – удаляться
15. in response to – в ответ на
16. to promote – стимулировать
17. to inhibit growth – задерживать рост
18. to induce cell division – вызывать деление клеток
19. enlargement – увеличение
20. cell maturation – созревание клеток

## *II. Translate the following words and word combinations into Russian:*

To be called after the fungus, to occur naturally, plant harmones, healthy bean plant, to cultivate rice, to become spindy and weak, to flow over in a wind, to infect rice plants, foolish seedling disease, external growth regulators, agricultural researchers, changes in plant shape and function, to induce cell enlargement.

## *III. Match each word in A with its synonym in B:*

A. to isolate, to breed, spindy, to plague, researchers, to occur, to study, a way, through, production, to promote, to act.

B. Manufacture, to encounter, investigators, to contribute, to function, to cultivate, longer, to suffer, to liberate, method, via, to investigate.

## *IV. Find the English equivalents for the following Russian words and word combinations in the right column:*

| | |
|---|---|
| 1. внутренний регулятор роста | 1. plant harmones |
| 2. химикаты, вызывающие болезни | 2. to breed improved varieties of rice |
| 3. деятельность человека | 3. to be called after fungus |
| 4. факторы окружающей среды | 4. to induce cell division |
| 5. созревание клеток | 5. internal growth regulator |
| 6. приспосабливаться к изменяющимся условиям окружающей среды | 6. human activity |
| 7. гормоны растений | 7. to adjust to changing environmental conditions |
| 8. стимулировать деление клетки | 8. cell maturation |
| 9. быть названным именем гриба | 9. environmental factors |
| 10. выращивать улучшенные сорта риса | 10. disease-causing chemicals |

***V. Translate the following sentences into Russian. Define the types of Subordinate Clauses.***

1. The symptoms of disease are caused by chemicals that a fungus releases when it infects rice plants.
2. Soon it became clear that the chemicals are plant growth regulators that occur naturally in many plants.
3. We will see that a plant's growth, development, and survival depend on internal regulators.
4. As we consider internal and external plant growth regulators we will encounter three unifying principles.
5. So many people on this planet depend on rice that 20 percent of all human activity is rice powered.

***VI. Read the text below carefully to find out how plants grow.***

Text 13A

HOW PLANTS GROW

> Of the theory of vegetables, or of the growth, propagation and nutriment of vegetables, our knowledge is only slight and superficial. A close inspection into the structure of plants affords the best ground for reasoning on this subject, and, indeed, every thing beyond it is little better than mere fancy or conjecture.
>
> *George Le Clerc de Buffon,*
>
> *Natural History (1821)*

So many people on this planet depend on rice that 20 percent of all human activity is rice powered! Asians began cultivating rice in Thailand nearly

6000 years ago; and Japanese farmers, in particular, began very early on, to breed improved varieties of the rice plant (oryra sativa) and to record and study its diseases.

One disease that has plagued rice growers for hundreds of years causes affected plants to grow far taller and faster than normal and in the process to become spindy and weak and blow over in the wind and die. The name for this disease is fitting: foolish seedling disease. The symptoms of disease are caused by chemicals that infect rice plants. These disease-causing chemicals are called gibberellings, after the fungus.

In the mid 1950s, researchers were surprised when they isolated these chemicals from a healthy bean plant. Soon it became clear that the chemicals are plant growth regulators or hormones that occur naturally in many plants. The fungus had simply evolved a way to make and release the hormones in quantities that can cause the rice plants to grow themselves to death.

We will see that a plant's growth, development, and survival depend on ***internal regulators*** – primarily plant hormones such as gibberellins and ***external regulators*** including temperature, light, gravity, and the number of daylight hours. Agricultural researchers have used their knowledge of these regulators to control weeds and increase food production for the rapidly expanding world population.

As we consider internal and external plant growth regulators, we will encounter three unifying principles. First, ***plants generally adjust to changing environmental conditions via growth***. A plant cannot move away from an environmental problem, but it can grow toward high light levels, grow a shorter or longer stem as needed, or send roots deeper into soil.

Second, changes in plant shape or function are often regulated by plant hormones produced in response to environmental factors such as temperature, light or gravity. For example, plant hormones can promote or inhibit growth,

depending on season. Third, plant hormones act at the level of cells to induce cell division, enlargement, or cell maturation.

*Notes:*

1. every yearly on – очень рано
2. to be rice powered – находиться во власти риса, зависеть от производства риса

***VII. Answer the following questions about the text:***

1. When did Asians begin cultivating rice?
2. What disease has plagued rice growers for hundreds of years?
3. What are symptoms of disease caused by?
4. How are these disease-causing chemicals called?
5. How did researchers isolate these chemicals?
6. What did the fungus evolve?
7. What do the plant's growth, development and survival depend on?
8. What three unifying principles will someone encounter in plants?

***VIII. Think and say about:***

1. the beginning of cultivating rice;
2. the disease that has plagued rice growers for hundreds of years;
3. the discovery of researchers in the mid 1950s;
4. three unifying principles in plants.

***IX. Read the text, try to get it as a whole.***

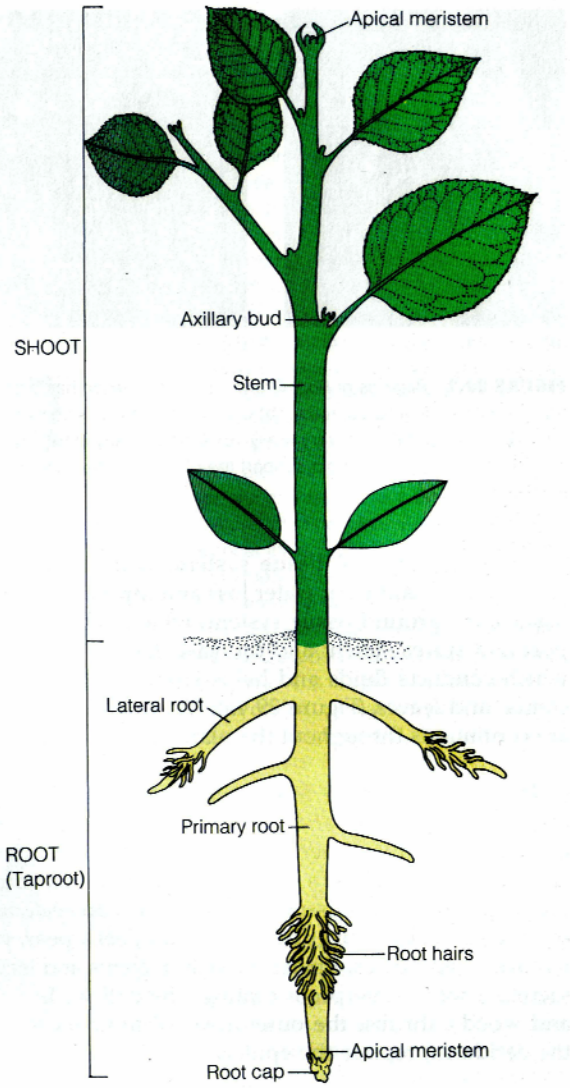
Text 12B

HOW PLANTS TAKE IN AND RETAIN WATER

Over the course of summer, each tomato plant in a typical backyard garden will consume about 32 gal. of water, which is over half the water

gardener will require! The explanation for this apparently insatiable "thirst" lies a fundamental difference between your body and a plant's body: In most animals, fluids tend to recycle, through a circulatory system, while in plants, water travels in a one-way path from roots through stems to leaves, then out into the environment again. A steady supply of water enables a plant to carry out photosynthesis, to remain crisp and erect with water-filled cells to stay cool despite a baking sun on outstretched leaves and stems, and to transport substances through the plant.

A garden plant such as a tomato absorbs water from the soil into the roots. Soil is a combination of organic matter and weathered particles of the earth's crust a film of water and dissolved minerals coats these soil particles, and air fills many of the larger spaces between them. Hundreds of thousands of root hairs as well as the root-fungal extensions project from the cells of lateral roots into the spaces in soil. These projections have a huge combined surface area and can take up water from the minute reservoirs all around them.




Despite the tremendous importance of water to a plant's survival, water enters roots by passive diffusion. Water diffuses across root hairs and then passes through the root cortex. Some moves through the cytoplasm of root cells, but most passes between the walls of adjacent cells. When it reaches the

endodermis (the cell layer that separates the root cortex from the central vascular cylinder), water can no longer pass between cell walls because of the waxy belts (Casparian strips) that surround each endodermal cell; the belts act like gaskets that prevent water from flowing from cell to cell, forcing it to pass through the cytoplasm of endodermal cells in order to enter the xylem.

Water diffuses into the root's xylem tissue by osmosis because the fluid inside xylem has a higher concentration of dissolved particles than the surrounding cells. The reason the xylem fluid contains a high concentration of dissolved particles is that surrounding cells use energy to actively pump ions into the fluid. The original source of the pumped ions was the soil. Root hair cells absorb the ions and the ions pass through the cortex and endodermis into the vascular cylinder primarily via the cytoplasmic route.

What happens to the water drawn into the xylem by the osmotic mechanism just discussed? The process tends to increase the volume of fluid into the xylem, which must be somewhere. It cannot flow back between the endodermal cells because the waxy Casparian strip prevents both the irons and the water from leaking back out of the vascular cylinder. The only place the fluid can move, therefore is up the xylem where it creates a force called ***root pressure***. The force can push water out of the leaves of grass tomatoes, strawberries, and numerous other small plants – a process called guttation – where the water forms droplets of it does not evaporate quickly enough. Interestingly, measurements of root pressure show that it is much too weak to push water up to the tops of tall trees, and many plants, including pines, do not develop root pressure at all.

***X. Find answers to the following questions in the text.***

1. How much water will each tomato plant consume in summer?
2. Where does the explanation for this "thirst" lie?

3. How does a garden plant absorb water?
4. What is soil for a plant?
5. How does water enter roots?
6. What are waxy belts(Caspian strips)?
7. How does water diffuse into the root's xylem tissue?
8. Why cannot water flow back between the endodermal cells?
9. What is the only place the fluid can move?
10. What can root pressure do?
11. What process is called guttation?
12. Do all plants develop root pressure?

***XI. Find information confirming the following statements:***

1. in most animals, fluids tend to recycle;
2. in plants, water travels in a one-way path from roots through stems to leaves;
3. water is very important for plant's survival;
4. the original source of the pumped ions was the soil;
5. measurements of root pressure show that many plants do not develop root pressure.

***XII. Think and find arguments to prove that:***

1. each tomato plant will consume about 32 gal. of water in summer;
2. a steady supply of water enables a plant to carry out photosynthesis;
3. water enters roots by passive diffusion;
4. soil is a combination of organic matter and weathered particles of the earth's crust;
5. the waxy belts act like gaskets that prevent water from flowing from cell to cell.

## Unit XIV

## THE SCIENCE OF ECOLOGY: LEVELS OF INTERACTION

***I. Remember the following words and word combinations from the text:***

1. whereabouts – местонахождение
2. edible fruit – съедобные фрукты
3. to probe the explanations – исследовать объяснение
4. to bristle – изобиловать
5. distribution and abundance of organisms – распространение и изобилие организмов
6. tenets – принципы
7. crucial – критический, решающий
8. to influence plant growth – влиять на рост растений
9. to manipulate – умело обращаться
10. to channel water – пустить воду по каналам
11. biotic environment – биотическая (состоящая из живых организмов) окружающая среда
12. abiotic environment – абиотическая (состоящая из неживых организмов) окружающая среда
13. acorns – желуди
14. blue jays – голубые сойки
15. to endure – выносить, терпеть
16. saber-toothed cats – саблезубые кошки
17. to pollinate – опылять
18. grouping – группирование
19. sparse rainfall – редкие осадки
20. climate patterns – особенности погоды
21. tiered hierarchy – уровневая иерархия

22. genetic engineering – генетическая инженерия (создание новых генетических признаков организма с помощью некомбинированных ДНК)

***II. Match each word in A with its synonym in B:***

A. distribution, edible, to probe, to bristle, tenets, to influence, seek to do, individuals, together, entire, different

B. species, to be abundant, spread, along with, eatable, try to do, various, principles, to investigate, to affect, whole

***III. Give the Russian equivalents for the following words and word combinations:***

deer populations, whereabouts of food sources, natural history, research tools, valley bristling with huckleberries, to influence plant growth, plant breeding, biotic environment, definition of ecology, ancestors, to have roots in natural biology, to produce additional food, to channel water to the desert.

***IV. Find the English equivalents for the following Russian words and word combinations in the right column:***

| | |
|---|---|
| 1. абиотическая окружающая среда | 1. abundance of organisms |
| 2. распространение организмов | 2. research tools |
| 3. выживание человека | 3. physical factors of the environment |
| 4. взаимодействующие особи | 4. biological cycles |
| 5. физические факторы окружающей среды | 5. distribution of organisms |
| 6. четырёхуровневая иерархия | 6. human survival |
| 7. вся планета земля | 7. to influence the ecosystem |

| | |
|---|---|
| 8. биологические циклы | 8. genetic engineering |
| 9. влиять на экосистему | 9. the entire planet earth |
| 10. генетическая инженерия | 10. abiotic environment |
| 11. изобилие организмов | 11. interacting individuals |
| 12. механизмы исследования | 12. four-tiered hierarchy |

***V. Change the sentences into the Present or Past Simple Passive.***

*Model: What factors cause deer populations to increase?*

*What factors are deer populations caused to increase by?*

1. The Hohokam Indians channeled water to the desert.
2. Ecologists use their science to determine the distribution and abundance of organisms.
3. The Hohokam's ecosystem included saguaro cactus and corns.
4. Biologists organize ecology, science of interaction into a hierarchy of four levels: populations, communities, ecosystems and biosphere.
5. The abiotic environment includes the rainfall, sunlight and soil.

***VI. Read the text below carefully to learn how ecology interacts with biology.***

Text 14A

THE SCIENCE OF ECOLOGY LEVELS OF INTERACTION

Rachel Carson (in Silent Spring) was altering the world to what has been called the fundamental principle of ecology, namely: we can never do merely one thing, because the world is a system of fantastic complexity. Nothing stands alone. No intervention in nature can be

focused exclusively on but one element of the system.

*Garrett Hardin. Bulletin of the Atomic Scientists (January 1970)*

Early people amassed a simple form of natural history. Their survival depended on knowing whereabouts of food sources, and they could describe, often through legends or rituals, the seasons where deer were abundant and the valleys where huckleberries grew along with other edible fruit, nuts and plants. The modern science of ecology has its roots in natural history, but it applies research tools and the scientific method to probing the explanations behind observed phenomena. What factors cause deer populations to increase in the summer, for example, and what allows a particular valley to bristle with huckleberries?

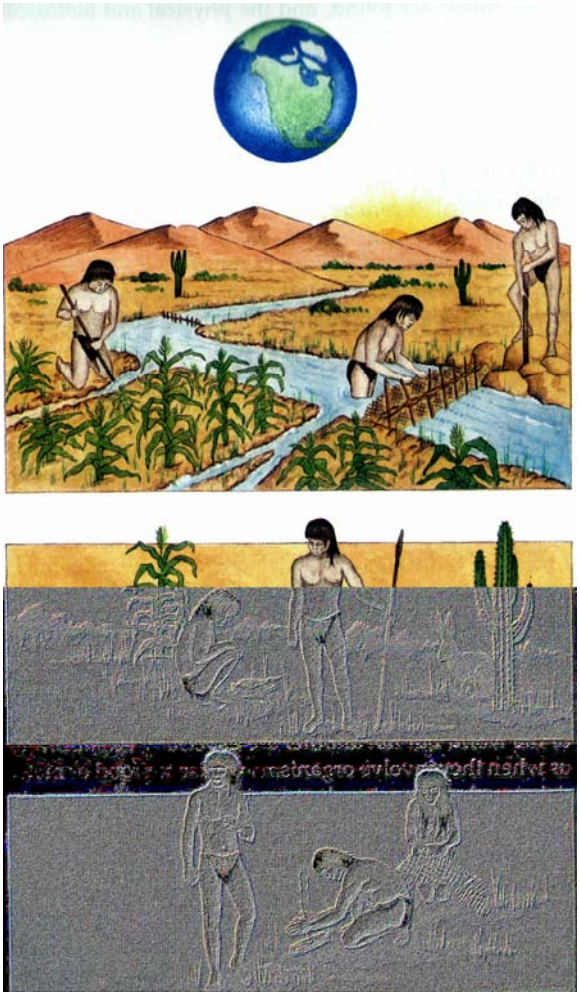
***Ecology*** is the scientific study of how organisms interact with their environment. Ecologists use their science to determine the distribution and abundance of organisms, and the tenets of ecology have become as crucial to human survival as natural history once was to our ancestors. The more people know about the factors that influence plant growth, the better they can manipulate those factors to produce additional food. That is what the Hohokam Indians did when they channeled water to the desert, and it is what modern plant scientists seek to do with plant breeding and genetic engineering.

A key word in the definition of ecology is ***interact***. Organisms interact with the other living things that collectively contribute their ***biotic environment***, as well as with the nonliving physical surroundings that make up their ***abiotic environment.*** For a squirrel, the biotic environment includes acorns it eats, the blue jays that complete for the nuts, the ticks that parasitize and weaken the squirrel, and the seedlings that share the squirrel's terristory. The abiotic environment includes the rainfall, sunlight, and soil that regulate acorn

production and the hot and cold temperatures that the squirrel must endure in summer and winter.

So numerous are each organism's interactions with other living and the physical environment that biologists organize ecology, the science of interactions into a hierarchy of four levels: populations, communities, ecosystems, and the biosphere.

A ***population*** is a group of interacting individuals of the same species that inhabit a defined geological area. The Hokoham Indians of Central Arizona, the Saguaro cactus of the same region, the saber-toothed cats of Rancho La Brea in prehistoric Los Angeles, and the alligators of a Louisiana swamp are all examples of populations.



A ***community*** consists of two or more populations of different species occupying the same geographical area. The Hohokam and the giant saguaro cactus whose fruits they gathered and ate made up a community, and so do alligators and the fish they consume and orchids and the bees that pollinate them.

Populations and communities include only biotic factors. Such groupings always exist within a physical setting, however, and so ecologists have a third hierarchical level: the ***ecosystem***, made up of interacting living things together with the physical factors of the environment. The Hohokam's ecosystem included saguaro cactus, corn and

black-tailed jackrabbits, as well as sparse rainfall and the searing summer temperatures of the Arizona desert.

Ecologists recognize that ecosystems are further influenced by global phenomena, such as climate patterns, wind currents, and nutrient cycles. Thus, in the four-tiered hierarchy, groups of ecosystems make up the highest level, the biosphere – our entire planet with all its living species, its atmosphere, its oceans, the soil in which living things are found, and the physical and biological cycles that affect them.

*Notes:*

1. to describe through legends or rituals – описать с помощью легенд и обрядов
2. to become crucial – стать критическим
3. that is what – это как раз то, что
4. as well as – также как и
5. searing summer temperatures – иссушающие летние температуры

***VII. Answer the following questions about the text:***

1. What did the survival of early peoples depend on?
2. Where does modern science of biology have its roots?
3. What is ecology?
4. What do ecologists use their science for?
5. What is the key word in the definition of ecology?
6. How do biologists organize ecology?
7. What is a population?
8. What does a community consist of?
9. What is the third hierarchical level?
10. What is our entire planet earth with all its living species, its atmosphere, its oceans, the soil called?

***VIII. Read the sentences that follow and decide whether they are true or false. Use the following phrases to express your agreement or disagreement.***

| *Agreement* | *Disagreement* |
|---|---|
| I think so | I don't think so |
| I believe so | I'm afraid not |
| I agree on this point | I don't agree on this point |
| That's right | That's wrong |

1. Populations and communities include only biotic factors.
2. The ecosystem is made up of interacting living things together with the physical factors of the environment.
3. Ecologists recognize that ecosystems are not further influenced by climate patterns, wind currents, and nutrient cycles.
4. The modern science of ecology has its roots in natural history.
5. The non-living physical surroundings make up biotic community.

***IX. Read the text, try to get it as a whole.***

Text 14B

WHERE ORGANISMS RESIDE AND HOW THEY LIVE

To understand the intricate web of relationships between populations of organisms in a community, the observer must discover where the organisms live and how they get needed energy and materials. The general physical place in the environment where a certain kind of organism resides is its habitat. A habitat is analogous to an organism's "address", or "home". In describing general places where aquatic organisms live, for example, an ecologist might speak of an open water habitat, a shore habitat, a muddy bottom, or a surface-film habitat. Likewise, certain birds may be found in grass-land, pinyon-jumpier, or tropical habitats – all places where birds live.

Whereas a species' physical home is its habitat, its functional role in the community is its ***niche***. The niche is analogous to the organism's "job" – how it gets its supply of energy and materials and what it does in and for a living community. The yucca's niche, for example, is that of ***primary producer***, deriving energy directly from the physical environment. The niche of the yucca moth is that of ***herbiore***, obtaining nourishment from plants like the yucca that grows in its habitat.

A field ecologist might investigate a warbler's niche in the forests of New England and observe that the bird eats insects wherever they occur in trees at any height and at any distance from the trunk, and that the bird nests any time in June or July. The potential range of all conditions under which an organism can make a living is called its ***fundamental niche***.

In nature, however, a warbler cannot find insects just anywhere because several species of insect-eating warblers compete for food in eastern forests, each species performing a slightly different but specialized role in the community. The different species eat insects at different heights in the trees and at different distances from the trunk, and their heavy eating comes at slightly different times during the year, depending on when they nest. The myrtle warbler, for instance, eats insects at the base of trees and in lower branches, while the bay-breasted warbler specializes in insects in middle branches, and the Cape May warbler seeks insects at the outer edges of the top branches. The part of the fundamental niche that a species actually occupies in nature is its realized niche, and interactions with other organisms often force a species into realized niche that is more restricted than its fundamental niche.

***X. Find answers to the following questions in the text:***

1. What must the observer discover to understand the web of relationships between populations of organisms?

2. What is a habitat?

3. What is the species' functional role in the community?

4. What is the fundamental niche of an organism?

5. What role does each species play in the community?

6. Where does the myrtle warbler eat insects?

7. What can you say about bay-breasted warbler?

8. What is the realized niche?

9. What niche is more restricted a realized niche or a fundamental one?

***XI. Find information concerning the following statements in the text:***

1. the physical place where the organism live;

2. the general place where aquatic organisms live;

3. the yucca's niche as a primary producer;

4. a warbler's niche in the forests of New England;

5. the potential range of all conditions under which an organism can make a living;

6. different species eat insects at different heights in the trees and at different distances from the trunk.

***XII. Say which of the following statements are true to the text:***

1. a habitat is the organism's job;

2. the part of the fundamental niche that a species occupies in nature is its realized niche;

3. the potential range of all conditions under which an organism can make a living is called its fundamental niche;

4. the bay-breasted warbler specializes in insects at the base of trees;

5. interactions with other organisms often force a species into a realized niche.

CONTENTS

# АННОТАЦИЯ

Настоящее учебно-методическое пособие построено на традиционных принципах методики и предназначено для студентов II курса специальности «Биология».

Основная цель данного пособия – сформировать у обучающихся умение читать и переводить оригинальную литературу по специальности. Тексты подобраны из оригинальных источников.

Учебное издание

**ЯШИНА Нина Кузьминична**

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