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М. В. ВЕГЕРО

READ AND DISCUSS: ENGLISH FOR BIOLOGISTS

ЧИТАЕМ И ОБСУЖДАЕМ: АНГЛИЙСКИЙ ДЛЯ БИОЛОГОВ

Практическое пособие

для студентов 1 курса
специальности 1-31 03 01 02 «Биология»

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Издание состоит из 12 разделов, каждый из которых включает текст или несколько текстов для чтения и упражнения для развития навыков говорения.

Практическое пособие предназначено для обучения студентов 1 курса биологического факультета чтению текстов профессиональной направленности, а также умению общаться на профессиональные темы.

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Оглавление

Предисловие

Предлагаемое практическое пособие предназначено для чтения на английском языке и обсуждения прочитанного для студентов неязыковых специальностей. Помещенные в издание аутентичные тексты отвечают развитию современной науки, а также требованиям программы по английскому языку для студентов высших учебных заведений.

Основной целью практического пособия является развитие у студентов навыков чтения профессионально-ориентированных текстов, что крайне необходимо современным специалистам, а также общения на профессиональные темы, является развитие навыков реферирования специальной литературы.

Издание состоит из 12 разделов, каждый из которых включает текст или несколько текстов для чтения и упражнения для развития лексико-грамматических навыков говорения. Оригинальные тексты по темам разделов, а также комплекс упражнений, входящие в настоящее практическое пособие, отвечают принципам современной коммуникативной методики.

При отборе текстов внимание было уделено тому, чтобы каждый текст носил профессиональный характер и был насыщен лексикой, связанной с профессиональной деятельностью будущих специалистов-биологов.

Активный лексический минимум определяется темами.

Unit 1
What Are Insects?

Ex. 1. Read the text.

Insects are the largest group in the animal kingdom. Scientists estimate there are over 1 million insect species on the planet, living in every conceivable environment from volcanoes to glaciers.

Insects help us by pollinating our food crops, decomposing organic matter, providing researchers with clues to a cancer cure, and even solving crimes. They can also harm us, such as by spreading diseases and damaging plants and structures.

Insects are arthropods. All animals in the phylum Arthropoda have exoskeletons, segmented bodies, and at least three pairs of legs. Generally taxonomists use the physical characteristics of the insects to group similar insect families. Some insect taxonomists organize the insects differently, using evolutionary links instead of physical traits. For the purpose of identifying an insect, it makes more sense to organize insects by their physical characteristics, since you can see the physical similarities and differences between insects you observe.

The genus and species names are always italicized, and used together to give the scientific name of the individual species. An insect species may occur in many regions, and may have different common names in other languages and cultures. The scientific name is a standard name that is used by entomologists around the world. This system of using two names (genus and species) is called binomial nomenclature.

The most basic definition of an insect is an organism with three pairs of legs and three body regions – head, thorax, and abdomen. Entomologists might also add that insects have a pair of antennae and external mouthparts. (As you learn more about insects, you will find there are some exceptions to these rules.) Insects have mouthparts designed to help them feed on different things. Some insects drink nectar, and have mouthparts modified into a tube called a proboscis to suck up liquid. Other insects have chewing mouthparts and eat leaves or other plant matter. Some insects bite or pinch, and others pierce and suck blood or plant fluids.

The pair of antennae may have obvious segments, or look like a feather. They come in different forms and are a clue to identifying

the insect. Antennae are used to perceive sounds, vibrations, and other environmental factors.

Insects can have two types of eyes – compound or simple. Compound eyes are usually large with many lenses, giving the insect a complex image of its surroundings. A simple eye contains just a single lens. Some insects have both kinds of eyes.

The thorax, or middle region of an insect's body, includes the wings and legs. All six legs are attached to the thorax. The thorax also contains the muscles that control movement.

All insect legs have five parts. Legs can be different shapes, and have different adaptations to help the insect move in its unique habitat. Grasshoppers have legs designed for jumping, while honey bees have legs with special baskets to hold pollen as the bee moves from flower to flower.

Wings also come in different shapes and sizes, and are another important clue to help you identify an insect. Butterflies and moths have wings made of overlapping scales, often in brilliant colors. Some insect wings appear transparent, with just a web of veins to identify their shape. When at rest, insects like beetles and praying mantis keep their wings folded flat against their bodies. Other insects hold their wings vertically, like butterflies.

The abdomen is the final region in the insect body, and contains the insect's vital organs. Insects have digestive organs, including a stomach and intestines, to absorb nutrients from their food and separate waste matter. The sexual organs of the insect are also in the abdomen. Glands that secrete pheromones for marking the insect's trail or attracting a mate are in this region as well.

Useful vocabulary:

estimate – насчитывать

species – вид, виды

conceivable – мыслимый, постижимый; вероятный, возможный

arthropods – членистоногие

phylum – тип

exoskeleton – наружный скелет

binominal nomenclature – система классификации по роду и виду

thorax – грудная клетка

abdomen – брюшная полость, брюшко

proboscis – хоботок
praying mantis – богомол
digestive – пищеварительный
intestine – кишечник

Ex. 2. Answer the following questions.

1 How many insect species are there on the planet?
2 How do insects help us?
3 What do all insects have?
4 How do taxonomists organize insects?
5 How do scientists give names to individual species?
6 Where are insect's vital organs contained?

Ex. 3. Complete the statements.

1 Insects can be found...
2 Insects can harm us by...
3 Binominal nomenclature is...
4 The most basic definition of an insect is...

Ex. 4. Speak about:

1) insect mouthparts;
2) antennae;
3) insect eyes;
4) insect thorax;
5) insect legs;
6) insect wings.

Unit 2
Bumblebees

Ex. 1. Read the text.

Bumblebees are familiar insects in our gardens and backyards. Still, you might be surprised by how much you *don't* know about these important pollinators. The genus name, *Bombus*, comes from the Latin for booming.

Most people recognize the large, furry bees that visit backyard flowers as bumblebees. Fewer probably know that they are social

bees, with a caste system of queen, workers, and reproductives cooperating to meet the needs of the colony.

Bumblebees range in size from about half an inch to a full inch in length. Patterns of yellow and black, along with the occasional red or orange, help indicate their species. However, bumblebees of the same species can vary quite a bit.

Cuckoo bumblebees, genus *Psithyrus*, resemble other bumblebees but lack the ability to gather pollen. Instead, these parasites invade *Bombus* nests and kill the queen. The *Psithyrus* bees then lay their eggs in the collected pollen in the conquered nest. This group is sometimes included as a subgenus of Bombus.

Bumblebees feed on pollen and nectar. These efficient pollinators forage on both wildflowers and crops. Adult females use modified hind legs equipped with corbicula to carry pollen to their offspring. Nectar is stored in the honey stomach, or crop, in the digestive system. Larvae receive meals of regurgitated nectar and pollen until they pupate.

Like other bees, bumblebees undergo a complete metamorphosis with four stages to the life cycle:

Egg. The queen lays eggs in a pollen clump. Then she or a worker bee incubates the eggs for four days.

Larva. The larvae feed on pollen stores, or on regurgitated nectar and pollen provided by the worker bees. In 10–14 days, they pupate.

Pupa. For two weeks, the pupae remain inside their silk cocoons. The queen incubates the pupae as she did her eggs.

Adult. Adults assume their roles as workers, male reproductives, or new queens.

Useful vocabulary:

pollen – пыльца, опылять
corbicula – корзиночки (на задней ножке рабочей пчелы)
hind leg – задняя нога
forage – еда, корм; добывать корм
invade – захватывать
larva(e) – личинка(и)
pupa(e) – куколка(и)
regurgitate – срыгивать

Ex. 2. Answer the questions.

1 What does the genus name, *Bombus*, come from?

2 Why are bumblebees called social insects?
3 What is the size of a bumblebee?
4 Do all bumblebees gather pollen?
5 What bumblebees can be called parasites?
6 What do bumblebees feed on?
7 How do adult females carry pollen to their offspring?
8 How do bumblebees support their larvae?
9 How many stages of metamorphosis do bumblebees undergo?
10 How long do bumblebees incubate eggs?
11 How long do pupae remain under their silk cocoons?

Ex. 3. Speak about:
1) bumblebee's diet;
2) Cuckoo bumblebees;
3) 4 stages of metamorphosis.

Ex. 4. Translate the text.

Before flying, a bumblebee's flight muscles must be warmed to around 86 °F. Since most bumblebees live in climates where cool temperatures may occur, they cannot rely on the ambient warmth of the sun to achieve this. Instead, bumblebees shiver, vibrating the flight muscles at a high speed but keeping the wings still. The familiar buzz of the bumblebee comes not from the wings themselves, but from these vibrating muscles.

The bumblebee queen must also generate heat when she incubates her eggs. She shivers muscles in the thorax, then transfers the heat to her abdomen by contracting muscles down her body. The warmed abdomen stays in contact with the developing young as she sits on her nest.

Ex. 5. Read the text below and be ready to answer the following questions.

1 *How can bumblebees defend themselves if threatened?*
2 *How do bumblebee's stings differ from those of a bee?*

Female bumblebees come equipped with stingers, and will defend themselves if threatened. Unlike their cousins, honey bees, bumblebees can sting and live to tell about it. The bumblebee's sting lacks barbs, so she can easily retrieve it from the flesh of her victim and attack again, if she chooses.

Ex. 6. Complete the text with the words in italics.

Throughout, shelter, foraging, species, nest, temperate.

Good bumblebee habitat supplies adequate flowers for … , especially early in the season when the queen emerges and prepares her … . Meadows, fields, parks, and gardens all provide food and ... for bumblebees.

Members of the genus *Bombus* live mostly in … areas of the globe. Range maps show *Bombus spp.*(виды) … North and South America, Europe, Asia, and the Arctic. Some introduced … are also found in Australia and New Zealand.

Ex. 7. Be ready to speak about bumblebees.

Unit 3
How Do Bees Make Honey?

Ex. 1. Read the text.

Honey bees use their stores of energy-rich honey to get them through lean times, including winter. Worker bees gather nectar from flowers and convert it into enough honey to keep the colony alive. How do bees make honey from nectar?

Nectar contains about 80% water, along with complex sugars. Left in its natural state, nectar would ferment. In order to store the sugars in a usable and efficient state, bees convert the nectar into honey. Honey contains only 14–18% water. Pound for pound, honey provides a much greater energy source than pure nectar.

The actual process of transforming the flower nectar into honey requires teamwork. Older workers do the foraging and bring the nectar back to the hive. There, younger hive bees complete the task of turning it into honey.

First, worker bees fly out from the hive in search of nectar-rich flowers. Using its straw-like proboscis, a worker bee drinks the liquid nectar and stores it in a special stomach called the honey stomach. The bee continues to forage, visiting hundreds of flowers, until its honey stomach is full.

Within the honey stomach, enzymes break down the complex sugars of the nectar into simpler sugars, which are less prone to crystallization. This process is called inversion.

With a full belly, the worker bee heads back to the hive and regurgitates the already modified nectar for a hive bee. The hive bee ingests the sugary offering and further breaks down the sugars. It then regurgitates the inverted nectar into a cell of the honeycomb.

Now, the hive bees beat their wings furiously, fanning the nectar to evaporate its remaining water content. As the water evaporates, the sugars thicken into honey. Once the honey is finished, the hive bee caps the beeswax cell, sealing the honey into the honeycomb for later consumption.

A single worker bee produces only 1/12th of a teaspoon of honey in its lifetime. Working cooperatively, thousands of worker bees can produce over 200 pounds of honey for the colony within a year.

Useful vocabulary:

hive – улей
proboscis – хоботок
stomach – желудок
belly – брюшко
prone to – подвержен
ingest – глотать
honeycomb – медовые соты
evaporate – испарять(ся)
seal – запечатывать
consumption – потребление

Ex. 2. Answer the questions.

1 What do bees use their stores of honey for?
2 What does nectar contain?
3 Why do bees convert nectar to honey?
4 Can a single bee make honey from nectar?
5 What bees do the foraging?
6 How do worker bees gather nectar?
7 What happens within a honey stomach of a bee?
8 How do hive bees help make honey?
9 How much honey does a single worker bee produce in it lifetime?

Ex. 3. Complete the sentences.

1 Worker bees gather ... and convert it …
2 Nectar contains ….

3 Using its straw-like proboscis ….
4 Older worker bees …
5 Within the honey stomach …
6 Now, the hive bees beat their wings furiously …

Ex. 3. Speak about the process of making honey.

Unit 4
Communication Within the Honey Bee Colony

Ex. 1. Read the text and answer the question.

What information do bees communicate when they "dance"?

As social insects living in a colony, honey bees must communicate with one another. Honey bees use movement, odor cues, and even food exchanges to share information.

Honey bee workers perform a series of movements, often referred to as the "waggle dance," to teach other workers the location of food sources more than 150 meters from the hive. Scout bees fly from the colony in search of pollen and nectar. If successful in finding good supplies of food, the scouts return to the hive and "dances" on the honeycomb.

The honey bee first walks straight ahead, vigorously shaking its abdomen and producing a buzzing sound with the beat of its wings. The distance and speed of this movement communicates the distance of the foraging site to the others. Communicating direction becomes more complex, as the dancing bee aligns her body in the direction of the food, relative to the sun. The entire dance pattern is a figure-eight (повторяет очертания «восьмерки»), with the bee repeating the straight portion of the movement each time it circles to the center again.

Honey bees also use two variations of the waggle dance to direct others to food sources closer to home. The round dance, a series of narrow circular movements, alerts colony members to the presence of food within 50 meters of the hive. This dance only communicates the direction of the supply, not the distance. The sickle dance alerts workers to food supplies within 50–150 meters from the hive.

After performing the waggle dance, the scout bees may share some of the foraged food with the following workers, to communicate the quality of the food supply available at the location.

The honey bee dance was observed and noted by Aristotle as early as 330 BC. Karl von Frisch, a professor of zoology in Munich, Germany, earned the Nobel Prize in 1973 for his groundbreaking research on this dance language. His book *The Dance Language and Orientation of Bees*, published in 1967, presents fifty years of research on honey bee communication.

Useful vocabulary:

cue – знак, сигнал

waggle – покачиваться

sickle – серповидный

vigorously – сильно, энергично

Ex. 2. Read the text again and answer the questions.

1 What do honey bees use to share information?

2 When do scout bees “dance” on the honeycomb?

3 What dance alerts honey bees to food supplies within 50 metres of the hive?

4 What does the sickle dance mean?

5 Why do honey bees share food after the dance?

6 When was the honey bee dance first observed?

7 What did Karl von Frisch get the Nobel Prize for?

Ex. 3. Read the texts and answer the questions.

How does the queen control reproduction in the hive?

Odor cues also transmit important information to members of the honey bee colony. Pheromones produced by the queen control reproduction in the hive. She emits pheromones that keep female workers disinterested in mating, and also uses pheromones to encourage male drones to mate with her. The queen bee produces a unique odor that tells the community she is alive and well. When a beekeeper introduces a new queen to a colony, she must keep the queen in a separate cage within the hive for several days, to familiarize the bees with her smell.

What role do pheromones play in the defense of the hive?

Pheromones play a role in the defense of the hive as well. When a worker honey bee stings, it produces a pheromone that alerts her

fellow workers to the threat. That's why a careless intruder may suffer numerous stings if a honey bee colony is disturbed.

What made scientists believe that honey bees use odor cues in addition to the waggle dance?

In addition to the waggle dance, honey bees use odor cues from food sources to transmit information to other bees. Some researchers believe the scout bees carry the unique smells of flowers they visit on their bodies, and that these odors must be present for the waggle dance to work. Using a robotic honey bee programmed to perform the waggle dance, scientists noticed the followers could fly the proper distance and direction, but were unable to identify the specific food source present there. When the floral odor was added to the robotic honey bee, other workers could locate the flowers.

Ex. 4. Be ready to speak about the ways of communication within the honey bee colony.

Unit 5
Do Insects Sleep?

Ex. 1. Read the text.

Sleep restores and rejuvenates. Without it, our minds aren't as sharp, and our reflexes become dull. Scientists know for sure that birds, reptiles, and other mammals experience brain wave patterns similar to our own during periods of rest. But what about insects? Do bugs sleep?

It's not quite as easy for us to tell whether insects sleep the way we do. They don't have eyelids, for one thing, so you'll never see a bug close its eyes for a quick nap. Scientists haven't found a way to study insect brain activity, as they have in other animals, to see if typical rest patterns occur.

Still, by most accounts, the answer is yes, insects do sleep. Insects clearly rest at times, and are aroused only by strong stimuli – the heat of day, the darkness of night, or perhaps a sudden attack by a predator. This state of deep rest is called torpor, and is the closest behavior to true sleep that bugs exhibit.

Migrating monarchs fly by day, and gather for large butterfly slumber parties as night falls. These sleep aggregations keep individual butterflies safe from predators while resting from the long day's travels.

Some bees have peculiar sleep habits. Certain members of the family Apiadae will spend the night suspended by only the grip of their jaws on a favorite plant.

Torpor also helps some insects adapt to life threatening environmental conditions. The New Zealand weta (a large brown wingless insect related to the grasshoppers, with long spiny legs and wood-boring larvae) lives at high elevations where nighttime temperatures get quite icy. To combat the cold, the weta simply goes to sleep at night, and literally freezes. In the morning, it thaws out and resumes its activity. Many other insects seem to take a quick nap when threatened – think of the pillbugs that roll themselves into balls the moment you touch them.

Useful vocabulary:

mammal – млекопитающий
pattern – модель, образец, схема
predator – хищник
peculiar – особенный, странный
torpor – неподвижность, оцепенение
to thaw out – оттаять
to take a quick nap – вздремнуть
pillbug – мокрица

Ex. 2. Answer the questions.

1 Why is it difficult to say if insects sleep the way we do?
2 How can we prove that insects also sleep?
3 How do some bees spend the night?
4 How are some species adapt to threatening environmental conditions?

Ex. 3. Speak about sleep habits of some insects.

Ex. 4. Find additional information and give a talk on peculiar sleep habits of insects.

Unit 6
Can Insects Learn?

Ex. 1. Read the text.

Most insect behavior is genetically programmed, or innate. A caterpillar with no prior experience or instruction can still spin a silken cocoon. But can an insect change its behavior as a result of its experiences? In other words, can insects learn?

You won't see one graduating from Harvard anytime soon, but indeed, most insects can learn. “Smart” insects will change their behaviors to reflect their associations with and memories of environmental stimuli.

For the simple insect nervous system, learning to ignore repetitive and meaningless stimuli is a fairly easy task. Blow air on a cockroach’s rear end, and it will flee. If you continue to blow air on the cockroach over and over, it will eventually conclude that the sudden breeze is no cause for concern, and stay put. This learning, called habituation, helps insects save energy by training them to ignore what is harmless. Otherwise, the poor cockroach would spend all its time running away from the wind.

Imprinting occurs during a brief period of sensitivity to certain stimuli. You've probably heard stories of baby ducks falling in line behind a human caretaker, or of nesting sea turtles that return to the beach where they hatched years earlier. Some insects also learn this way. Upon emerging from their pupal cases, ants notice and retain the scent of their colony. Other insects imprint on their first food plant, showing a clear preference for that plant for the remainder of their lives.

Like Pavlov’s’ dogs, insects can also learn through classical conditioning. An insect exposed repeatedly to two unrelated stimuli will soon associate one with the other. Wasps can be given food rewards each time they detect a certain scent. Once a wasp associates food with the smell, it will continue to go to that scent. Some scientists believe trained wasps may replace bomb and drug sniffing dogs in the near future.

A honeybee demonstrates its ability to learn each time it leaves its colony to forage. The bee must memorize patterns of landmarks within its environment to guide it back to the colony. Often, she is following the instructions of a fellow worker, as taught to her through

the waggle dance. This memorization of details and events is a form of latent learning.

Useful vocabulary:

innate – врожденный
caterpillar – гусеница
flee – убегать
habituation – приучение
imprinting – импринтинг, запечатление
to fall in line behind – следовать примеру
to hatch – выводиться
to retain – сохранять
scent – запах
classical conditioning – классический условный рефлекс
to expose – подвергать
latent learning – скрытое обучение

Ex. 2. Answer the questions.

1 What behaviour is innate?
2 What is habituation?
3 How does habituation help insects?
4 When does imprinting occur?
5 How can insects learn through classical conditioning?
6 What insects demonstrate their ability of latent learning?

Ex. 3. Give examples of:

1) innate behaviour of insects;
2) habituation;
3) imprinting;
4) classical conditioning in insects;
5) latent learning.

Unit 7
What inspires insect names?

Ex. 1. Read the text.

Taxonomy is the foundation stone of science and the system we use to categorize our complex natural world. Around one million

insect species have been named and described to date. But there are 8-10 million living insect species on Earth, meaning new species are being discovered on a daily basis.

Scientists who study insects are coming up with ever more imaginative names, referencing everything from musicians to childish jokes, to meet the demand.

It wasn't until the 18th century when the Swedish botanist Carl Linnaeus created the binomial system of nomenclature that we use today. The official start date for modern entomological taxonomy is based on Linnaeus' tenth edition of his work Systema Naturae published in 1758. Linnaeus' hierarchical system means that species can be identified in around six steps, from kingdom right down to species.

The majority of insect names refer to their appearance, behaviour or the place in which they are found. As you'd expect *Titanus giganteus* is a large beetle and a species with the name *hawaiiensis* is predictably found on Hawaii.

It is seen as pretty egotistical for an entomologist to name an insect after themselves, but having a species named after you by someone else is regarded as an honour. The name has the potential to live on after the person it is named after, and perhaps even long after the species itself becomes extinct.

Some names are chosen to educate a younger audience on the joys of taxonomy. For example, in 2012 a rare Australian horsefly with a bright golden behind *Scaptia beyonceae* was named after the singer Beyoncé. Republican scientists from the USA named new species after President Bush, his Vice-President and Defence Secretary. But others consider it unwise to name species after politicians because you don't know what they're going to do and the name is going to last forever, and your name is going to be associated with that name forever. One of the most infamous examples of this is a tiny blind orange beetle called *Anophthalmus hitleri*. Found in only a few caves in Slovenia, it was named in honour of the Nazi leader in 1936 by Oscar Scheibel.

Some of the more inoffensive names are best when read out loud. In 1904 a British entomologist George Willis Kirkaldy gave a series of true bugs the suffix -chisme, meaning “news” but pronounced “kiss me”. Starting with polychisme (Polly kiss me), he went on to name

dolichisme (Dolly kiss me), ochisme (Oh kiss me), and many more, seemingly after his romantic conquests. Kirkaldy was post-humorously criticised for frivolity by the London Zoological Society in 1912. An entomologist at the Bishop Museum in Hawaii carried on Kirkaldy's work in 2002 by naming a fossil fly *Carmenelectra shechisme* after the actress Carmen Electra. He's also behind other funny names including *Pieza rhea* (Pizzeria), *Pieza pi* (Pizza Pie), *Pieza kake* (Piece of cake).

Scientific names are hard to change once decided upon. There are no strict rules on who or what you can name your insect discoveries after, but rather a series of recommendations laid out by the International Commission on Zoological Nomenclature. The ICZN are currently working together with scientists from all around the world to create a comprehensive online record of every living species on earth called ZooBank.

Useful vocabulary:

binomial nomenclature – биномиальная номенклатура
true bug – клоп
fossil – ископаемый
horsefly – слепень
extinct – вымерший

Ex. 2. Answer the questions.

1 How many species have already been named?
2 What system do scientists use today to name species?
3 Who introduced the system of binomial nomenclature?
4 What does this system mean?
5 What do the majority of insect names refer to?
6 Can scientists name species after themselves?
7 Are there any strict rules one should follow when giving names to new species?

Ex. 3. Complete the sentences.

1 Taxonomy is …
2 There are 8–10 million ...
3 Linnaeus' hierarchical system means …
4 The majority of insect names refer to …
5 It is seen as pretty egotistical …
6 There are no strict rules …

7 The ICZN are currently working …

Ex. 4. Explain why it is important to be careful when giving names to new species.

Ex. 5. Give examples from the text of the most inoffensive and funny names.

Unit 8
Evolution

Ex. 1. Read the text.

Evolution is change over time. Under this broad definition, evolution can refer to a variety of changes that occur over time – the uplifting of mountains, the erosion of riverbeds, or the creation of new species. To understand the history of life on Earth though, we need to be more specific about what kinds of changes over time we're talking about. That's where the term *biological evolution* comes in. The term biological evolution is a more specific type of evolution.

Biological evolution refers to the changes over time that occur in living organisms. An understanding of biological evolution, how and why living organisms change over time, enables us to understand the history of life on Earth. The key to understanding biological evolution lies in a concept known as descent with modification**.** Living things pass on their traits from one generation to the next. Offspring inherit a set of genetic blueprints from their parents. But those blueprints are never copied exactly from one generation to the next. Little changes occur with each passing generation and as those changes accumulate, organisms change more and more over time. Descent with modification reshapes living things over time and biological evolution takes place.

Biological evolution occurs at different scales. These include small-scale evolution and broad-scale evolution. Small-scale evolution, also referred to as microevolution, is the change in gene frequencies within a population from one generation to the next. Broad-scale evolution, also referred to as macroevolution, refers to evolution at a grander scale. It focuses on the progression of species from a common ancestor over the course of numerous generations.

Another important concept relating to biological evolution is that all life on Earth shares a common ancestor. This means that all living things on our planet are descended from a single organism. Scientists estimate that this common ancestor lived some 3.5 to 3.8 billion years ago and has since given rise to all living things that have inhabited our planet. The implications of sharing a common ancestor are quite remarkable and mean that we're all cousins – humans, green turtles, chimpanzees, monarch butterflies, sugar maples, parasol mushrooms and blue whales.

Useful vocabulary:

occur – происходить
offspring – потомство
inherit – наследовать
frequency – частотность
genetic blueprint – генетическая программа
ancestor – предок
descend – происходить
sugar maple – клён сахарный

Ex. 2. Answer the questions.

1 What is evolution?
2 What is biological evolution?
3 What is the key to understanding biological evolution?
4 What is descent with modification**?**
5 What are the two scales of biological evolution?
6 What is microevolution?
7 What is macroevolution?
8 How are all living things on our planet “cousins”?

Ex. 3. Complete the sentences with the words and phrases in italics.

Inherit, biological evolution, generation, common ancestor, occurs, species, macroevolution, descent with modification.

1 Another important concept relating to … is that all life on Earth shares a common ancestor.

2 The implications of sharing a … are quite remarkable and mean that we're all cousins.

3 Biological evolution ... at different scales.

4 Evolution can refer to a variety of changes that occur over time – the uplifting of mountains, the erosion of riverbeds, or the creation of new …

5 The key to understanding biological evolution lies in a concept known as …

6 Offspring … a set of genetic blueprints from their parents.

7 Little changes occur with each passing … and as those changes accumulate, organisms change more and more over time.

8 … focuses on the progression of species from a common ancestor over the course of numerous generations.

Ex. 4. Complete the sentences.

1 Biological evolution refers to …
2 An understanding of biological evolution enables us …
3 Living things pass on …
4 Offspring inherit …
5 Little changes occur …
6 Scientists estimate that this common ancestor …

Ex. 5. Be ready to speak about biological evolution.

Unit 9
Invertebrates

Ex. 1. Read the text.

Invertebrates are animals that do not have a backbone or a bony skeleton. Scientists have identified close to one million living species of invertebrates but this represents only a small fraction of the total number of invertebrates alive today. Scientists estimate that there are perhaps as many as 30 million species of living invertebrates and more than 97 percent of all animal species alive today are invertebrates. The vertebrates, the group to which we humans and all other mammals, birds, reptiles, amphibians, and fishes belong, are far outnumbered by our invertebrate cousins.

There are more than thirty groups of invertebrates. Some of the more commonly known groups include arthropods, cnidarians, echinoderms, molluscs, segmented worms and sponges.

Arthropods. There are more than one million known arthropods species and many millions more that have yet to be named. Scientists estimate there may be as many as 30 million species of arthropods (most of which are insects). Members of this group include centipedes, millipedes, spiders, mites, crabs, scorpions, insects and crustaceans. Arthropods are bilaterally symmetrical and have a segmented body, an exoskeleton, numerous pairs of legs and specialized limbs.

Cnidarians. There are about 9,000 species of cnidarians alive today. Members of this group include jellyfish, corals, sea anemones and hydras. Cnidarians are radially symmetrical and have a gastrovascular cavity with a single opening that is surrounded by tentacles.

Echinoderms. There are about 6,000 species of echinoderms. Members of this group include star fish, sea lilies, sea cucumbers and sea urchins. Echinoderms are pentaradially symmetrical and have an endoskeleton composed of calcareous ossicles.

Molluscs. There are about 100,000 species of molluscs. Members of this group include bivalves, gastropods, cephalopods,and several other groups. Molluscs have soft bodies that consist of three basic parts: a foot, a visceral mass and a mantle.

Segmented worms. About 12,000 species of segmented worms are known today. Members of this group include earthworms, ragworms and leeches. Segmented worms are bilaterally symmetrical and their bodies consist of a head region, a tail region and a middle region of numerous repeated segments

Sponges. There are about 10,000 species of sponges. Sponges are primitive multi-cellular animals that have no digestive system, circulatory system or nervous system.

Useful vocabulary:

invertebrates – беспозвоночные
vertebrates – позвоночные
backbone – позвоночник
arthropods – членистоногие
cnidarians – стрекающие кишечнополостные, книдарии
echinoderms – иглокожие
segmented worms – кольчатые черви
sponges – губки
mite – клещ
crustaceans – ракообразные

limb – конечность
tentacle – щупальце
urchins – морской еж
endoskeleton – внутренний скелет
ossicle – косточка
bivalves – двустворчатые моллюски
gastropods – брюхоногие моллюски
cephalopods – головоногие
visceral – висцеральный, внутренностный
ragworms – нереиды
leeches – пиявки

Ex. 2. Answer the questions.

1 What are invertebrates?
2 How many living species of invertebrates have scientists identified?
3 What group do humans belong?
4 How many groups of invertebrates are there?
5 What are the more commonly known groups?
6 What are the basic characteristics of arthropods?
7 What group do jellyfish and corals belong to?
8 What do cnidarians look like?
9 Do all invertebrates have an exoskeleton?
10 What groups of invertebrates have soft bodies?
11 What parts do bodies of segmented worms consist of?
12 Why are sponges primitive animals?

Ex. 3. Translate the following sentences into Russian.

1 Cnidarians are radially symmetrical and have a gastrovascular cavity with a single opening that is surrounded by tentacles.
2 Echinoderms are pentaradially symmetrical and have an endoskeleton composed of calcareous ossicles.
3 Arthropods are bilaterally symmetrical and have a segmented body, an exoskeleton, numerous pairs of legs and specialized limbs.
4 The vertebrates, the group to which we humans and all other mammals, birds, reptiles, amphibians, and fishes belong, are far outnumbered by our invertebrate cousins.
5 Members of this group include centipedes, millipedes, spiders, mites, crabs, scorpions, insects and crustaceans.

Unit 10
Amphibians

Ex. 1. Read the text.

Amphibians are a group of vertebrates that includes salamanders, newts, caecilians, frogs and toads. There are between 5,000 and 6,000 species of amphibians alive today. The first amphibians arose about 370 million years ago. The world of those early amphibians was quite different than it is today. No birds, mammals or reptiles lived on land (or in the water for that matter) at that time. Only invertebrates and an assortment of prehistoric plants had yet colonized land. The ancestors of modern amphibians were the first animals to venture out of the water and adapt to life on land.

Amphibian larvea are often aquatic and go through a complex metamorphosis process as they grow to adulthood. They have moist skin and do not have scales, feathers or hair. The life cycles of amphibians reflects their evolutionary history of bridging land and water. Most amphibians lay their eggs in freshwater. A few species tolerate brackish water and some species lay their eggs on land. Extraordinarily, some species even carry their eggs inside their body. Although life cycles of amphibians vary from species to species, they all share the following three basic stages of development: egg, larva, adult.

Amphibian eggs do not have hardened shells like reptiles, birds, and mammals. Instead, amphibian eggs consist of a gelatinous envelope that must remain moist to survive. Eggs hatch to release tiny larvae which later undergo a metamorphosis into the adult form.

Many amphibians can absorb oxygen directly into their bloodstream through their skin and are also able to expell carbon dioxide waste back into the air. The skin of amphibians lacks scales and hair. It is smooth and sometimes moist, making it quite permeable to gases and water. This permeability is thought to make amphibians particularly vulnerable to toxins in air and water such as herbicides, pesticides, and pollutants. Amphibians have been sharp decline throughout many areas worldwide. This is thought to be an early warning sign of a troubled environment.

Amphibians are divided into the following basic groups:

Frogs and toads. There are about 4,380 species of frogs and toads alive today, making them the most diverse of all amphibian groups.

Members of this group have no tail, a large head, large eyes, and long, powerful hind legs.

Caecilians. Members of this group are sleek, limbless amphibians.

Newts and salamanders are slender-bodied amphibians with a long tail and usually two pairs of limbs.

Useful vocabulary:

newt – тритон
caecilians – червяги
brackish – соленый
permeable – проницаемый

Ex. 2. Answer the questions.

1 When did the first amphibians appear?
2 What does the life circle of amphibians reflect?
3 Where do amphibians lay eggs?
4 Do amphibian eggs have hardened shells?
5 How can amphibians absorb oxygen?
6 What makes amphibians particularly vulnerable?
7 What is thought to be an early warning sign of a troubled environment?
8 What groups are amphibians divided into?

Ex. 3. Complete the sentences.

1 Amphibian larvea are …
2 Amphibians have …
3 Amphibians can expell …
4 The skin of amphibians …
5 Frogs and toads have …
6 Caecilians are …
7 Newts and salamanders are …

Ex. 4. Scan the text and speak about newts and salamanders.

Newts and salamanders are a group of amphibians that include about 10 subgroups and 470 species. Newts and salamanders have a long, slender body, a long tail, and usually two pairs of limbs. They inhabit cool, shady habitats and are most active during the night. Newts and salamanders are silent amphibians, they do not croak or make loud sounds like frogs and toads. Of all amphibians, newts and

salamanders most closely resemble the earliest fossil amphibians, the earliest animals to have adapted to life on land.

All salamanders and newts are carnivorous (плотоядный). They feed on small invertebrates such as insects, worms, snails, and slugs (слизень). Many species of newts and salamanders have poison glands in their skin which help to protect them against predators.

The skin of newts and salamanders is smooth and lacks scales or hair. It acts as a surface through which respiration can take place (oxygen is absorbed, carbon dioxide is released) and for this reason it must stay moist. This means newts and salamanders are restricted to damp or wet habitats to ensure their skin never dries out.

During the larval stage, many species of newts and salamanders have feathery external gills (жабры) that enable them to breath in water. These gills disappear when the animal matures into the adult form. Many adult newts and salamanders breath using lungs. Some species also absorb oxygen through the surfaces of their mouth. Moving air and water through the mouth also enables the newt or salamander to sample the odors in the surrounding environment.

Ex. 5. Read the text and answer the following questions.

1 What is the diet of caecilians?

2 How do caecilians breath?

Caecilians are a group of slender-bodied, limbless amphibians that – at first glance – resemble snakes, worms or eels. Yet caecilians are only distantly related to such animals.

Most species of caecilians have lungs that enable them to take in oxygen from the surrounding air, although they also absorb additional oxygen through their mouth and skin. Two species of caecilians have no lungs and therefore rely entirely on the air they obtain through their skin and mouth.

Some species of caecilians are aquatic and have a fin (плавник) that runs along their back that enables them to move through water efficiently. Other species of caecilians are primarily terrestrial and spend much of their time burrowing underground as they hunt using their sense of smell.

Like all amphibians, caecilians are vertebrates and have jaws and teeth. These armaments enable caecilians to lead a carnivorous lifestyle, feeding on insects, worms and other invertebrates they encounter.

Caecilians are found primarily in wet tropical regions of South America, Southeast Asia, and Central America. They are most widespread throughout South America where they inhabit eastern Brazil, northern Argentina and northern South America.

Unit 11
Fishes

Ex. 1. Read the text.

Fishes are a group of aquatic chordates that have gills and lack limbs. Most fish breath using gills. They take water in through their mouth and push it out through their gills. As the water enters the fishes mouth, it is rich in oxygen. When it passes through the gills, the oxygen is absorbed from the water. At the same time, the waste product of respiration, carbon dioxide, is released into the water before it is then released from the gills through openings on either side of the pharynx.

Most fish are cold-blooded animals that have a streamlined body that is adapted for efficient movement in water. There are exceptions to both of these rules though. Tuna, swordfish and a few shark species are warm-blooded, not cold-blooded. Rays are flat-bodied fish that not streamlined. They move through the water at a slower pace.

The development of jaws in the evolutionary history of fish represents an important step. Jaws enabled fish to catch and eat a wide variety of food including marine plants and animals. Food is broken down in the esophagus and digested in the stomach and digestive tract.

Most fish move using pairs of muscles on either side of their backbone. These muscle pairs contract in sequence such that the fish moves in S-shaped wave through the water. Many species have a swim bladder, an organ that contains air and enables the fish to control its buoyancy in the water.

There are many animals whose name includes the term fish but that are not true fish. Such organisms include crayfish, cuttlefish, starfish, and jellyfish.

A group of fish that is loosely organized, with each individual fish foraging on its own independently, is called a shoal. A tightly organized group of fish that moves and feeds as one coherent unit is called a school.

The largest living fish is the whale shark which grows to 60 feet in length and over 20 tons. The smallest known living fish is *Paedocypris progenetica*, a species that belongs to the carp family and is native to the Indonesian island of Sumatra. It is less than 8 mm in length.

Useful vocabulary:

pharynx – глотка, зев
ray – скат
tuna – тунец
swordfish – рыба меч
esophagus – пищевод
digest – переваривать
swim bladder – плавательный пузырь
buoyancy – плавучесть
shoal – стая, косяк
school – косяк

Ex. 2. Answer the questions.

1 How do fish breath?
2 Are all fishes cold-blooded?
3 What species of fish do not have a streamlined body?
4 What enables fish eat a wide variety of food?
5 How do most fish move? Explain why.
6 What is a swim bladder for?
7 What is the difference between a shoal and a school?
8 What “fishes” are not fish?
9 What is the largest living fish?
10 What is the size of the smallest fish?

Ex. 3. Make a plan of the text and then retell it using your plan.

Unit 12
Sea lice

Ex. 1. Read the text.

Sea lice are marine ectoparasites (external parasites) that feed on the mucus, epidermal tissue, and blood of host marine fish. The

speckled sea louse *Eurydice pulchra* grows up to 5mm in length and burrows deep into the sand at low tide and returns to the surface to swim and feed when the tide comes in. It turns dark during the day as a protection against UV light while it turns white at night and becomes a vigorous swimmer.

The speckled sea louse, a marine cousin of the wood louse, has two body clocks - one for time and the other for tides, say researchers at Aberystwyth University (in Wales). Some lice had their circadian cycle, the one used by land dwellers including humans to tell the time by changes in light and dark, switched off. Despite being out of their habitat, the lice continued to swim every 12.4 hours as they would with changes of the tide.

Dr David Wilcockson, aquatic biologist at the Institute of Biological, Environmental and Rural Sciences at Aberystwyth University, and senior author on the research, said the lice's circadian cycle was switched off by using genetic, pharmacological and in vitro cell biology techniques. Yet the lice carried on swimming in time to anticipated tide changes.

He said: “The discovery of the circadian clock mechanisms in various terrestrial species from fungi to humans was a major breakthrough for biology.... The identification of the tidal clock as a separate mechanism now presents us with an exciting new perspective on how organisms define biological time. It is a completely unexplored field.”

The team believe similar solutions to measuring tidal change may have evolved in unrelated species in the same environment. Dr Wilcockson said: "There is tremendous diversity in the oceans and biology is so inventive that it may have come up with many different solutions exploiting various mechanisms to solve the same challenges of life.

“Our work has revealed that evolution created a greater diversity of clock types than we ever thought previously, so we really are on the threshold of some exciting science.”

Useful vocabulary:

mucus – слизь

tissue – ткань

tide – прилив

circadian cycle – циркадианны цикл, околосуточный цикл

breakthrough – прорыв, достижение, успех, открытие
threshold – преддверие, отправной пункт, начало

Ex. 2. Answer the questions.

1 What do Sea lice feed on?
2 How big are they?
3 How do they change over the circadian period?
4 Why does the speckled sea louse have two body clocks?
5 How was the lice's circadian cycle switched off?
6 How did the lice behave after the their circadian cycle had been switched off ?
7 What has the research revealed?

Ex. 3. Translate the following sentences.

1 The discovery of the circadian clock mechanisms in various terrestrial species from fungi to humans was a major breakthrough for biology.

2 The identification of the tidal clock as a separate mechanism now presents us with an exciting new perspective on how organisms define biological time.

3 Our work has revealed that evolution created a greater diversity of clock types than we ever thought previously, so we really are on the threshold of some exciting science.

Ex. 4. Speak about the sea lice's body clock.

Ex. 5. Read the text and match the paragraphs of the text to the questions.

1 What is circadian rhythm?
2 Is circadian rhythm the same thing as biological clock?
3 What is "biological clock"?
4 What is "master clock"?
5 Do circadian rhythms have a genetic component?
6 Does the body make and keep its own circadian rhythms?
7 How do circadian rhythms affect body function and health?
8 How are circadian rhythms related to sleep?
9 How are circadian rhythms related to jet lag?
10 How do researchers study circadian rhythms?

11 How does circadian rhythm research contribute to human health?

A The biological clocks that control circadian rhythms are groupings of interacting molecules in cells throughout the body. A “master clock” in the brain coordinates all the body clocks so that they are in synchronization.

B The “master clock” that controls circadian rhythms consists of a group of nerve cells in the brain called the suprachiasmatic nucleus (супрахиазматическое ядро), or SCN. The SCN contains about 20,000 nerve cells and is located in the hypothalamus, an area of the brain just above where the optic nerves from the eyes cross.

C No, but they are related. Our biological clocks drive our circadian rhythms.

D Circadian rhythms are physical, mental and behavioral changes that follow a roughly 24-hour cycle, responding primarily to light and darkness in an organism’s environment. They are found in most living things, including animals, plants and many tiny microbes. The study of circadian rhythms is called chronobiology.

E Circadian rhythms are important in determining human sleep patterns. The body’s master clock, or SCN, controls the production of melatonin, a hormone that makes you sleepy. Since it is located just above the optic nerves, which relay information from the eyes to the brain, the SCN receives information about incoming light. When there is less light—like at night—the SCN tells the brain to make more melatonin so you get drowsy.

F Jet lag occurs when travelers suffer from disrupted circadian rhythms. When you pass through different time zones, your body’s clock will be different from your wristwatch. For example, if you fly in an airplane from California to New York, you “lose” 3 hours of time. So when you wake up at 7:00 a.m., your body still thinks it’s 4:00 a.m., making you feel unstable and disoriented. Your body’s clock will eventually reset itself, but this often takes a few days.

G Scientists can learn about circadian rhythms by studying humans or by using model organisms that have similar “clock”

genes. Basic researchers doing these experiments can control the subject's environment by altering light and dark periods and then look for changes in gene activity or other molecular signals.

H Circadian rhythms can influence sleep-wake cycles, hormone release, body temperature and other important bodily functions. They have been linked to various sleep disorders, such as insomnia. Abnormal circadian rhythms have also been associated with obesity, diabetes, depression, bipolar disorder and seasonal affective disorder.

I Circadian rhythms are produced by natural factors within the body, but they are also affected by signals from the environment. Light is the main cue influencing circadian rhythms, turning on or turning off genes that control an organism's internal clock.

J Understanding what makes biological clocks tick may lead researchers to treatments for sleep disorders, jet lag and other health problems. Learning more about the genes responsible for circadian rhythms will also enhance our understanding of biological systems and the human body.

K Yes. Researchers have already identified genes that direct circadian rhythms in people, fruit flies, mice, fungi and several other model organisms used for studying genetics.

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