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АНГЛІЙСЬКА МОВА ДЛЯ БІОЛОГІВ

Навчальний посібник

Львів
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Навчальний посібник **«Англійська мова для біологів»** укладений відповідно до вимог програми рівневого вивчення іноземної мови в університеті і призначений для студентів 1-3 курсів біологічного факультету, які вивчають англійську мову у групах середнього та вищого рівнів.

Мета посібника - поглиблення теоретичних і практичних знань студентів з англійської мови, формування та розвиток умінь і навичок сприймати і відтворювати іншомовний науковий фаховий дискурс, розширення словникового запасу загально-наукової та професійної лексики.

Посібник містить сучасний автентичний текстовий матеріал, який охоплює базову лексику основних галузей біологічної науки. Практичні завдання укладено з урахуванням новітніх методичних стратегій викладання іноземної мови професійного спрямування.

Посібник може бути корисним для магістрантів, аспірантів та науковців-біологів, які самостійно удосконалюють свої знання з англійської мови.

Передмова

Навчальний посібник "Англійська мова для біологів" призначений для студентів 1-3 курсів біологічних спеціальностей стаціонарного відділення, вищих навчальних закладів, які вже володіють базовим та середнім рівнем мовленнєвої компетенції.

Мета посібника - підвищення фахової мовленнєвої компетенції студентів-біологів на матеріалі автентичних наукових джерел та сприяння розвиткові наступних вмінь та навичок:

- ефективне читання англомовної наукової літератури;
- нагромадження словникового запасу та його закріплення й активізація в усному мовленні;
- ведення бесіди в межах фаху;
- реферування та переклад наукових текстів;
- самостійна робота над проектами та їх презентація.

Належне оволодіння цими вміннями і навичками дасть майбутнім фахівцям змогу адекватно функціонувати у професійному середовищі.

Посібник складається з 18 уроків, згрупованих у 5 тематичних блоків, що відповідають основним напрямкам сучасної біологічної науки, а саме "Життя та його походження", "Клітина як основа всього живого", "Мікроорганізми", "Рослинний та тваринний світ", "Основи еволюції та екології".

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- завдання, які зосереджують увагу студентів на граматичних явищах, притаманних науковому біологічному стилю мовлення (особливості вживання часових форм дієслова у активному та пасивному станах, множина іменника, конструкції з інфінітивом, герундієм, дієприкметником, емфатичні конструкції, модальні дієслова, основи словотвору тощо);
- секція із завданнями для аудіювання, спрямованими на формування навичок сприйняття на слух та розуміння оригінального усного мовлення;
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Посібник сприяє комплексному вивченню англійської мови професійного спрямування та інтегрованому розвитку мовленнєвих навичок.

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Автори

Unit 1

Lesson 1

BIOLOGY – THE SCIENCE OF LIFE

PRE-READING TASKS

I. Answer the following questions

- What is the subject matter of biological science?
- What branches of modern biology can you name?
- Why did you choose to study biology?

II. Listen to the following words and practice their pronunciation

Biology, science, discipline, zoology, botany, molecule, molecular, population, biophysics, biochemistry, nucleic acid, protein, heredity, organismal, cellular, multicellular, developmental, physiology, nervous, neurophysiology, behaviour, ethology, evolutionary, gene, genetics, ecology, natural, habitat, sociobiology, human, biomedicine, anthropology.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) encompass, v	a) a mutual or reciprocal action or influence;
2) scope, n	b) to stretch or extend across, over, or around;
3) segregation, n	c) lack of due care or attention; negligence;
4) cogent, adj	d) separation, setting apart;
5) span, v	e) the range of things that a subject, activity, book, etc.
6) breakthrough, n	deals with;
7) interaction, n	f) the natural home of a plant or animal;
8) neglect, n	g) forcefully convincing;

9) boundary, n	h) something that indicates the farthest limit, as of an area;
10) habitat, n	i) to include entirely or comprehensively;
11) fluid, adj	j) a significant development or discovery, esp. in science;
	k) (1) liquid; (2) constantly changing or apt to change.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

Biology is the science of life. The term biology was introduced in Germany in 1800 and popularized by the French naturalist Jean-Baptiste de Lamarck as a means of encompassing the growing number of disciplines involved with the study of living forms. The scope of biological science is so broad that it has been subdivided into separate branches for convenience of study. Despite apparent differences, all the subdivisions are interrelated by basic principles that underlie all biological manifestations.

It was once the custom to separate the study of plants (botany) from that of animals (zoology), and the study of the structure of organisms (morphology) from that of function (physiology). The English zoologist Thomas Henry Huxley was the first to insist that the conventional segregation of ***zoology*** and ***botany*** was intellectually meaningless and that all living things should be studied in an integrated way. Huxley's approach to the study of biology is even more cogent today, because scientists now realize that many lower organisms are neither plants nor animals. The limits of the science, however, have always been difficult to determine, and as the scope of biology has shifted over the years, its subject areas have been changed and reorganized.

The current approach to the study of living things is based on the levels of biological organization involved — whether molecules, cells, individuals, or populations — and on the specific subject matter under investigation — for

example, structure and function, types and classification, and growth and development.

Molecular biology, which spans ***biophysics*** and ***biochemistry***, has made the most fundamental contributions to modern biology. Much is now known about the structure and action of ***nucleic acids*** and ***protein***, the key molecules of all living matter. The discovery of the mechanism of ***heredity*** was a major breakthrough in modern science. Another important advance was in understanding how molecules conduct metabolism, that is, how they process the energy needed to sustain life.

Cellular biology is closely linked with molecular biology. To understand the functions of the cell — the basic structural unit of living matter — cell biologists study its components on the molecular level. ***Organismal biology***, in turn, is related to cellular biology, because the life functions of ***multicellular*** organisms are governed by the activities and interactions of their cellular components. The study of organisms includes their growth and development (***developmental biology***) and how they function (***physiology***). Particularly important are investigations of the brain and nervous system (***neurophysiology***) and animal behaviour (***ethology***).

Population biology became firmly established as a major subdivision of biological studies in the 1970s. Central to this field is ***evolutionary biology***, in which the contributions of Charles Darwin have been fully appreciated after a long period of neglect. ***Population genetics***, the study of ***gene changes*** in populations, and ***ecology***, the study of populations in their ***natural habitats***, have been established subject areas since the 1930s. These two fields were combined in the 1960s to form a rapidly developing new discipline often called, simply, population biology. Closely associated is a new development in animal-behaviour studies called ***sociobiology***, which focuses on the genetic contribution to social interactions among animal populations.

Biology also includes the study of ***humans*** at the molecular, cellular, and organismal levels. If the focus of investigation is the application of biological

knowledge to human health, the study is often termed ***biomedicine***. Human populations are by convention not considered within the province of biology; instead, they are the subject of ***anthropology*** and the various social sciences. The boundaries and subdivisions of biology, however, are as fluid today as they hlave always been, and further shifts may be expected.

III. USEFUL PHRASES. Study the following phrases and use them in the sentences of your own

as a means of – як засіб
under investigation – що вивчається
in turn – у свою чергу; у відповідь

IV. Decide whether the following statements are true or false according to the text

1. Different branches of biology are connected with each other.
2. According to Huxley it is logical to divide biology into zoology and botany.
3. The subject of biological studies has changed for the past years.
4. Biophysics is a part of molecular biology whereas biochemistry can be referred to cellular biology.
5. The principles and mechanisms of heredity were known to scholars in late middle ages.
6. Energy that is necessary for the maintenance of life in a cell is obtained in a process called replication.
7. Developmental biology, physiology, and ethology are the branches of organismal biology.
8. Population biology and sociobiology are concerned with the studies of humans.
9. Biomedicine is a branch of science that deals with animal treatment.

V. Make up 6-7 questions on the text and ask them to your partner

VI. Find the English equivalents of the following words in the text

Взаємопов'язані; звичайний, традиційний; сучасний, теперішній; внесок; поступ; здійснювати; підтримувати; оцінювати, цінувати; зосереджуватися, концентрувати увагу; застосування.

VII. Use the words from exercise VI to fill in the blanks in the following sentences

1. Is it really necessary to _____ experiments on animals?
2. He did not fully _____ the significance of his invention.
3. All parts of the course are _____.
4. He was unable to _____ lasting relationships with women.
5. Their aim is to reduce _____ pollution levels in the Black Sea.
6. Einstein was awarded the Nobel Prize for his _____ to Quantum Theory.
7. _____ in medical science may make it possible for people to live for 150 years.
8. Acupuncture may work, but I still believe in a more _____ approach to medicine.
9. He felt he needed to _____ more on his research.
10. The possible _____ of this invention are limitless.

GRAMMAR IN USE: *Questions*

I. Read the following questions and identify their type

1. What is biology?
2. Did life on Earth appear 3 million or 3 billion years ago?
3. Who was the inventor of the first microscope?
4. Is cell considered the basic unit of life?
5. The phenomenon of diversity of life has had a long history of study, hasn't it?
6. Do all living organisms reproduce?
7. I am going to study hard this semester, aren't I?

II. Ask questions to the underlined words

1. At the present time taxonomy is based on two major assumptions.
2. Metabolism is the most obvious hallmark of life.
3. Science is a uniquely human activity.
4. The history of science shows that generally accepted hypotheses are likely to be overturned by new discoveries.
5. For many centuries Europeans believed that they were superior to people from other regions of the earth.
6. The controlling factors in plant senescence and death are poorly understood.
7. Specialized structures help terrestrial plants reproduce without the assistance of liquid water. (*2 questions*)
8. Fungi and plants reproduce both sexually and asexually.
9. The Greeks believed that plants derived their nourishment from the soil only.
10. Botany as a pure science began in the 4th century BC with the Greek philosopher Theophrastus.

III. Make question-tags

1. Evidence to support the theory of evolution has come primarily from the fossil record, _____?
2. Cuckoos don't build nests, _____?
3. Evolution itself is a biological phenomenon common to all living things, _____?
4. Before the invention of a microscope, people didn't know anything about cells, _____?
5. In agriculture, both asexual and sexual reproduction are important, _____?
6. You weren't listening to the lecture, _____?
7. I'm going to become a scientist, _____?
8. Keep on working on your project, _____?
9. There are a lot of students in the lecture hall, _____?
10. This isn't very interesting, _____?

LISTENING COMPREHENSION

I. You are going to hear two fragments of a lecture about the history of our planet and life on it. Listen to the first fragment and answer the following questions. Before listening discuss the meaning of the words in the box below with your classmates or teacher

big bang	cluster	mountain range
background radiation	compress	plain
permeate	melt	erode
be tuned to	radioactive decay	hydrogen
expand	core	carbon dioxide
collapse	crust	nitrogen
gravitational attraction	mantle	water vapour
solid matter	dense	dissolve
aggregation	silicate materials	lightning
dust particles	sea bed	

1. When did the “big bang” occur?
2. Has the universe stopped expanding?
3. How can we “feel” the effects of the original explosion?
4. What do we call our galaxy?
5. When did our solar system shape up?
6. How were most of the planets built?
7. What is the composition of the earth’s core and mantle?
8. How thick is the earth’s crust?
9. Is the atmosphere we have now the same one that used to surround the earth about 5 billion years ago?

II. Listen to the second fragment and complete the following sentences. Study the following words before listening

to bear traces of	mud	ice age
to teem with life	ozone layer	glacier
ultraviolet radiation	damaging wavelength	high latitude
be confined to	shallow coastal waters	

1. The oldest rocks we can find on earth (over 3.5 billion years old) _____.
2. Life was confined to depths below 5 meters (m) in the ocean, _____by the absorbing shield of water, or _____.
3. _____, the atmosphere gradually changed.
4. The ozone blocked some of the most damaging _____.
5. Life evolved and the land was colonized long before _____ positions.
6. Throughout the history of the planet, there have been _____.
7. During warmer epochs, _____, and mild climates prevailed even at high latitudes.
8. It was during this period that Homo sapiens – _____ – evolved.

WRITING AND SPEAKING

Write a short essay about biology using the vocabulary of Lesson 1. Get ready to present it in class

Lesson 2

LIFE

PRE-READING TASKS

I. Answer the following questions

- How do you understand the meaning of the word “Life”?
- How do you think it can be interpreted by the following disciplines: philosophy, theology, biology?
- Try to develop your own definition of this notion.

II. Listen to the following words and practice their pronunciation

Metabolism, growth, reproduction, responsiveness, adaptation, chemical, heterotroph, autotroph, evolution, unicellular, mutability, offspring, generation, environment, unique, pressure, sophisticated.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) adjust, v	a) an idea, method, or quality that is typical of a particular person or thing;
2) hallmark, n	b) to let a substance or energy flow out;
3) imply, v	c) a group of animals or plants whose members are similar and can breed together to produce young animals or plants;
4) origin, n	d) a quality or power that a substance, plant etc has;
5) property, n	e) to continue to live in spite of difficulties;
6) release, v	f) to become or make something more suitable for a particular purpose;
7) sample, n	g) the importance of an event, action etc, especially because of the effects or influence it will have in the future;
8) significance, n	
9) species, n	
10) survive, v	

h) a small part or amount of something that is examined in order to find out something about the whole;
i) to suggest that something is true, without saying this directly;
j) the place or situation in which something begins to exist.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

Although a great deal is known about life, defining life turns out to be more difficult than one might suppose. There is no simple description that sets living organisms apart from nonliving matter. The most generally accepted definition of life describes it as the state of a material complex or individual characterized by the capacity to perform certain functional activities, including ***metabolism, growth, reproduction***, and some form of ***responsiveness*** and ***adaptation***. Life is further characterized by the presence of complex transformations of organic molecules and by the organization of such molecules into the successively larger units of protoplasm, cells, organs, and organisms.

Metabolism is the most obvious hallmark of life. Every organism carries out chemical reactions that release energy. The metabolism of an organism is the sum of all the chemical reactions it performs. Some organisms obtain their energy by taking up complex chemical substances (foods) from their environment and metabolizing these substances to release energy and to make chemical building blocks from which other substances may be made. Such organisms are called ***heterotrophs*** (other-feeders). The remaining species are ***autotrophs*** (self-feeders) and obtain their energy either from sunlight or, in a few cases, by taking up very simple mineral substances (but not foods) and carrying on energy-releasing metabolism based on changes in those substances. Modern-day heterotrophs obtain their energy directly or indirectly from the autotrophs.

Growth and reproduction are always associated with life. ***Unicellular organisms*** grow to a certain size and then divide. Some more complex organisms bud off small portions of their bodies to form new individuals. Most large organisms reproduce by means of special ***cells*** produced specifically for that purpose. The key is that these reproductive portions, however small, contain the information necessary to form an entire new individual.

Heredity and mutability are also essential features of life. When living things reproduce, they often produce ***offspring*** that are *not* exact copies of themselves. The difference between parents and offspring can, in turn, be transmitted to the next generation, usually with additional changes. It is this property of reproducing with changes that makes possible the evolution of life and gives life one of its most distinctive features: adaptation. When we say that organisms are adapted to their ***environments***, we mean that they have characteristics that enable them to survive and reproduce in those environments. It has long been evident that living organisms are adjusted to their environments in remarkably subtle ways, but people found it difficult to develop scientifically rigorous ways to study how organisms had become adapted. Biology could not and did not become a sophisticated science until scientific methods could be applied to the study of adaptation. This did not occur until a little over a century ago, when Charles Darwin proposed the first scientifically testable theory about adaptation.

Adaptation is a uniquely biological notion. It does not make sense to ask what the function of the law of gravity is or what the adaptive significance of the relationships among temperature, pressure, and volume of a sample of a gas is. These are features of the nonliving world that we simply take as given, and the explanations of them are sought in purely mechanistic terms. However, in biology we do ask questions about function — for example, "What do wings do?" All studies of wings, even purely descriptive ones, are strongly influenced by thoughts about function. It is, in fact, difficult to describe a wing without referring to its

function. Structure in biology is strongly linked to function, and biologists look at differences in structure to find out how they affect functioning.

Another specific feature of life lies in the fact that all the organisms on Earth are extremely closely related, despite superficial differences. The fundamental ground pattern, both in form and in matter, of all life on Earth is essentially identical. This identity probably implies that all organisms on Earth are evolved from a single instance of the origin of life.

III. USEFUL PHRASES. Study the phrases below and match two halves of the sentences that follow

turn out – виявитись, виявлятись
set something apart from something – відокремлювати
carry out – здійснювати
by means of – за допомогою
adapt/adjust to – пристосовуватись до

1. Many of Lamarck's examples, such as the long neck of the giraffe, can be more satisfactorily explained…
2. Many other organisms adapt…
3. Most mutations, however, turn…
4. A three-domain system, however, accounts for the differences that set the archaea…
5. Each membrane structure has its own distinct composition of proteins and lipids enabling it to carry…

a) …out to be deleterious and often lead to some impairment or to death of the organism.
b) …out unique functions.
c) …by means of natural selection.
d) …apart from prokaryotes and eukaryotes.
e) …to seasonal temperature changes by producing dormant forms, such as spores or eggs, to survive the low temperatures.

IV. Answer the following questions about the text "Life"

1. What is the main problem of defining life?

2. What functional characteristics differentiate living things from non-living ones?
3. Why is metabolism important for living beings?
4. What is the difference between heterotrophs and autotrophs?
5. What reproduction patterns are mentioned in the text?
6. What is the role of mutability for living organisms?
7. What is adaptation?
8. How is structure related to function in biology?
9. What arguments can be presented to support the idea of common origin for all living beings on earth?

V. Find the following words in the text "Life" and explain their meanings. Then select the synonyms of these words from the list below. Explain the difference between the synonyms using a dictionary

essential, _____, _____;
entire, _____, _____;
occur, _____, _____;
obtain, _____, _____;
rigorous, _____, _____;
evident, _____, _____;
perform, _____, _____.

Whole; acquire; complete; exact; important; necessary; accomplish; take place; happen; thorough; clear; gain; carry out; obvious.

VI. Use the words from the previous exercise in your own sentences

GRAMMAR IN USE: *Emphatic Structures*

I. Look at the following sentences. What is special about their structure? Discuss this type of structure with your teacher and do the task that follows

1. It is this property of reproducing with changes that makes possible the evolution of life.
2. This did not occur until a little over a century ago, when Charles Darwin proposed the first scientifically testable theory about adaptation.

3. However, in biology we do ask questions about function.
4. Not until the late 1920s and the early '30s was the full significance of Mendel's works realized.

Paraphrase the following sentences as required making them emphatic

Example: *Life on this planet originated in water.* ***(It was)*** *->*
It was in water that life originated on this planet.

1. It became possible to study unicellular organisms after the invention of microscope. **(Only after)**
2. The specific carrier of the genetic information in higher organisms is deoxyribonucleic acid. **(It is)**
3. The genetic code was broken only in the 1960s. **(It was not)**
4. Artists began to paint horses correctly only after the invention of camera. **(Not until)**
5. Scientists didn't know much about the true mechanism of blood circulation before the 17th century. **(Little)**
6. Mendel's work on heredity was recognized only in 1900. **(It was)**
7. The English chemist Joseph Priestley demonstrated that growing plants "restore" air from which the oxygen has been removed. **(It was)**
8. Water is interesting chemically and it is one of the most biologically important substances. **(Not only)**
9. Scientists do not often have an opportunity to observe this phenomenon. **(Rarely)**

LISTENING COMPREHENSION

I. You are going to hear four different definitions of life (A, B, C, D). Choose the best summary for each of the definitions. Before listening discuss the meaning of the words in the box below with your classmates or teacher

excrete	revive	host animal
alter	clement conditions	emphasis
oxidation state	proteinacious catalysts	to confer benefits
sulfur	enzymes	random processes
boundary	counterexample	complexity
to remain dormant	virus-like	

A

1. The physiological definition is inconsistent because automobiles can “breathe”, “eat”, “excrete”, etc. similarly to living things.
2. The physiological definition has certain drawbacks because some non-living objects (e.g. machines) can “perform” functions similar to those of living beings whereas some living organisms such as certain bacteria do not carry out all processes of life (e.g. breathing).
3. The physiological definition is incorrect because some bacteria don’t breathe.

B

1. The metabolic definition emphasizes the ability of living organisms to exchange substances and energy with their external environments while preserving their basic characteristics.
2. According to the metabolic definition seeds and spores are not alive because they remain dormant for hundreds of years without any visible metabolism.
3. There are exceptions to the metabolic definition because some living organisms are inclined to change their inner structure and properties during their life cycles.

C

1. The biochemical definition is inconsistent because viruses cannot reproduce.
2. Modern scientists agree that the biochemical definition is better than other theories and there are virtually no arguments against it.
3. The biochemical definition of life places an emphasis on the fact that all living organisms contain hereditary information in the form of certain biochemical structures such as nucleic acids.

D

1. The genetic definition relies on such characteristics of living organisms as replication and evolution.
2. The genetic definition concludes that since a replicating organism has no obvious benefits from replication some living beings (e.g. hybrids) do not replicate.
3. According to the genetic definition it is improbable that a variety of modern living forms might have evolved from one common ancestor.

II. Listen to fragment B again and fill in the gaps in the text below

The metabolic definition is still popular with many biologists. It describes (1)_____ as an object with a (2)_____, continually exchanging (3)_____ with its surroundings, but without altering its (4)_____, at least (5)_____. But again there are exceptions. There are (6)_____ that remain, so far as is known, perfectly dormant and totally without (7)_____ at low temperatures for hundreds, perhaps thousands, of years but that (8)_____ upon being subjected to more clement conditions.

SPEAKING

Speak about Life covering the following issues:

a) **The variety of approaches to the problem of life: the physiological, metabolic, biochemical, and genetic definitions of life.**
b) **Metabolism, growth, reproduction, responsiveness, and adaptation as the main functional activities performed by living organisms.**

Lesson 3

THE ORIGIN OF LIFE

PRE-READING TASKS

I. Answer the following questions

- In all cultures there are legends explaining the origin of the Earth and life on it. Which legends do you know? Tell them to your group-mates.
- The scientific and religious views on the problem of origin of life are quite contradictory. Which of them do you support? Do you believe that a compromise between religion and science in relation to this problem will ever be possible?

II. Listen to the following words and practice their pronunciation

Hypothesis, spontaneous, polymer, nucleotide phosphate, primer, enzyme, catalyst, template, scarce, proteinoid microsphere, mitotic spindle, chloroplast, DNA, symbiosis, bacteria, algae, oxygen.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) relevant, adj	a) a large quantity of something;
2) site, n	b) happening or coming after something else;
3) subsequent, adj	c) to completely get rid of something that is unnecessary or unwanted;
4) catalyst, n	
5) template, n	d) directly relating to the subject or problem being discussed or considered;
6) diverse, adj	
7) eliminate, v	e) something that is used as a model for another thing;
8) descendant, n	f) a place where something important happens;

9) ancestor, n
10) abundance, n

g) a living form that lived in the past, that modern living forms have developed from;
h) something that has developed from something else;
i) a substance that makes a chemical reaction happen more quickly without being changed itself;
j) very different from each other.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

All the essential building blocks for life and their ***polymers*** may have been produced in some fair concentration on the primitive Earth. This possibility is certainly relevant to the origin of life, but it is not the same thing as the origin of life. By the genetic definition of life a self-replicating, mutable molecular system, capable of interacting with the environment, is required. In contemporary cells the ***nucleic acids*** are the sites of self-replication and mutation. Laboratory experiments have already shown that ***polynucleotides*** can be produced from ***nucleotide phosphates*** in the presence of a specific ***enzyme*** of biological origin and a pre-existing ***"primer" nucleic acid*** molecule. If the primer molecule is absent, polynucleotides are still formed, but they of course contain no genetic information. Once such a polynucleotide spontaneously forms, it then acts as primer for subsequent syntheses.

Imagine a primitive ocean filled with nucleotides and their phosphates and appropriate mineral surfaces serving as ***catalysts***. Even in the absence of the appropriate enzyme it seems likely, although not yet proved, that spontaneous assembly of nucleotide phosphates into polynucleotides occurred. Once the first such polynucleotide was produced, it may have served as a ***template*** for its own reproduction, still of course in the absence of enzymes. As time went on there were bound to be errors in replication. These would be inherited. A self-replicating and

mutable molecular system of polynucleotides, eventually leading to a diverse population of such molecules, may have arisen in this way.

So far as is known, polynucleotides have no catalytic properties, and proteins have no reproductive properties. It is only the partnership of the two molecules that makes contemporary life on Earth possible. Accordingly, a critical and unsolved problem in the origin of life is the first functional relation between these two molecules, or, equivalently, the origin of the genetic code. If polynucleotides were initially capable of crude, nonenzymatic replication, and if a crude primitive genetic code existed, then any one of a very large number of catalytic properties was available to some self-replicating polynucleotides on the primitive Earth. This situation is all that would be necessary for the origin of life; those polynucleotides that could code for a ***primitive protein*** having catalytic properties furthering the replication of the polynucleotide would preferentially replicate. Other polynucleotides coding for less effective proteins would have replicated more slowly. The foregoing is one of several possibilities for the origin of the first living systems. Many separate and rather diverse instances of the origin of life may have occurred on the primitive Earth, but competition eventually eliminated all but one line. Every organism on Earth today would be a descendant of that line.

Even the evolution of enzymatic reaction chains may have occurred in free nucleic acids before the origin of the cell. The cell may have arisen in response to the need for maintaining a high concentration of scarce building blocks or enzymes, or as protection against the gradually increasing abundance of oxygen on the primitive Earth. Oxygen is a well-known poison to many biological processes, and in contemporary higher organisms the ***mitochondria*** that handle molecular oxygen are kept in the ***cytoplasm***, far from contact with the nuclear material. Even today processes are known whereby ***polyamino acids*** form small spherical objects, microns to tens of microns across, with some of the properties of cells. These objects, called proteinoid microspheres by Fox, are certainly not cells, but they may indicate processes by which the ancestors of cells arose. ***Prokaryotic cells***

almost certainly preceded ***eukaryotic cells***, and the evolution of so extremely complex an apparatus as the ***mitotic spindle*** (which ensures equal segregation of replicated chromosomes) must have taken very long periods of time to evolve. The development of mitochondria and ***chloroplasts*** (each of which contains its own ***DNA***) in the eukaryotic cell may have been the result of a ***symbiosis***, a cooperative arrangement entered into at first tentatively by originally free-living cells.

Among the oldest known fossils are those found in the Fig Tree chert from the Transvaal, dated at 3,100,000,000 years old. These organisms have been identified as ***bacteria*** and ***blue-green algae***. It is very reasonable that the oldest fossils should be prokaryotes rather than eukaryotes. Even prokaryotes, however, are exceedingly complicated organisms and very highly evolved. Since the Earth is about 4,500,000,000 years old, this suggests that the origin of life must have occurred within a few hundred million years of that time.

III. USEFUL PHRASES. Study the following phrases and complete the sentences that follow

in the presence/absence of – за наявності, у присутності/відсутності чогось
serve as – слугувати, виступати як/у ролі
be capable of – бути здатним, спроможним
in response to – у відповідь на щось, як реакція на щось

1. At lower temperatures ammonia or hydrogen cyanide could _____ a liquid medium.
2. Humans, along with some other organisms, are omnivores that means they _____ functioning as herbivores or carnivores.
3. Antibodies are chemicals (Y-shaped) produced by an animal _____ a specific antigen.
4. Under alkaline conditions, and _____ inorganic catalysts, formaldehyde spontaneously reacts to form a variety of sugars.

5. _____ ozone, the ultraviolet solar flux is so high that a lethal dose for most organisms would be delivered in less than an hour.

IV. Make up 7-8 questions on the text "The Origin of Life" and ask them to your partner

V. Find the English equivalents of the following words in the text "The Origin of Life"

Відповідний, потрібний; збирання, монтаж; помилка; в кінцевому результаті, врешті решт; на початку; грубий, примітивний; рідкісний, дефіцитний; гарантувати, забезпечувати; відділення, відокремлення; викопні рештки.

VI. Use the words from exercise V to fill in the blanks in the following sentences

1. There must be an _____ in our calculations.
2. Racial _____ in schools still exists in some southern states.
3. Each patient is given a special exercise routine that is _____ for his or her needs.
4. Several dinosaur _____ were found in Montana.
5. Babbage's great calculating machine was a _____ form of computer.
6. Stan _____ wanted to go to medical school, but later he changed his mind and began to work as a manager.
7. Water is always _____ in deserts.
8. All the necessary steps had been taken to _____ their safety.
9. During its _____ on the ribosome, each protein acquires a group of from 4 to 100 amino acids called a signal.
10. _____, the sky cleared up and we went to the beach.

GRAMMAR IN USE: *Word Order*

I. Look at the following sentences and try to identify the position of the words like *probably, often, always, both, ever, never, already,* etc.

a) The first living systems *probably* resided in a molecular garden of Eden, where all the building blocks were available free.

b) Mitochondria, chloroplasts, and the endoplasmic reticulum are *always* absent in prokaryotic cells.

c) Some adaptations of undoubted utility, such as tractor treads in swampy environments, have *never* been evolved by natural selection on Earth.

II. Put the words in brackets in their correct places in the following sentences

1. It was proved that the larger animals came from eggs. *(always)*
2. The study of the molecular organization of the cell has had the greatest impact upon biology during the 20th century. (*probably*)
3. A man in the street, if asked about life on other planets, will picture life of a distinctly human sort. (*often*)
4. Exobiology has deep significance even if extraterrestrial life is found. (*never*)
5. The cross-sectional structure of the cilia and flagella is nine pairs of peripheral and one pair of internal fibres. (*almost always*)
6. It is claimed that the rise of Christianity was the cause of the decline in science. (*sometimes*)
7. Condensing agents can be quite effective in inducing polymerization. (*often*)
8. Albertus Magnus was the greatest naturalist of the Middle Ages. (*probably*)
9. Whether a gene is active is the result of an interaction between cells. (*sometimes*)
10. Science was virtually dead by the end of the 2nd century AD. (*already*)

III. Reconstruct the sentences below by putting their fragments in order

1. S.L. Miller / in 1953 / experimental simulation / The first / was carried out / by / deliberate /a U.S. graduate student / of the early Earth conditions.
2. through a liquid / continuously sparked / methane / and hydrogen / was circulated / a corona discharge / water vapour / water solution / ammonia / A mixture of / and / by / elsewhere / in the apparatus.
3. to sparking /After / of exposure / changed / the solution / several days / colour.
4. amino and hydroxy acids / indicated that / intimately involved / simple procedure / in contemporary life / Subsequent analysis / had been produced / by this / several.
5. particularly / quite remarkable / It is / biologically abundant / simulated /can be made / so readily / under / that amino acids / primitive conditions / amino acids.
6. become oxidizing / are formed / for prebiological / however / no amino acids / laboratory conditions / suggesting / that / When / were necessary / reducing conditions / organic synthesis.

LISTENING COMPREHENSION

I. You will hear a text "Life from Outer Space?" Complete the notes below which summarize it. You will need to write a word or a short phrase in each space. Discuss the words from the box before listening

to gain popularity	to be blasted into space
entirely absurd	to capture a meteor
archaea	crash into a planet
environmental tolerance	precursor of life
tentative evidence	cognizant life

There is a hypothesis that life did not _____ but emerged elsewhere _____ and was then transported to our planet.

It is not senseless because the most primitive _____ have extreme _____ and some possibly could survive _____.

In _____ a team of NASA scientists announced that _____ had been found in a 4.5-billion-year-old meteorite _____.

Mars has much weaker _____.

The Earth is more likely _____ than _____.

We may all be _____.

It is possible that life _____ on the Earth and Mars.

To answer these questions scientists should:

1) carry out experiments on _____;
2) continue exploration for _____;
3) search for a source _____ from outer space.

WRITING

Make a written summary of the text "Origin of Life" in 150 words using the active vocabulary of the lesson

Unit 1 Focus Words and Phrases

abundance, n (3)
adjust, v (2)
advance, n (1)
ancestor, n (3)
application, n (1)
appreciate, v (1)
appropriate, adj (3)
assembly, n (3)
boundary, n (1)
breakthrough, n (1)
catalyst, n (3)
cogent, adj (1)
conduct, v (1)
contribution, n (1)
conventional, adj (1)
crude, adj (3)
current, adj (1)
descendant, n (3)
diverse, adj (3)
eliminate, v (3)
encompass, v (1)
ensure, v (3)
entire, adj (2)
error, n (3)
essential, adj (2)
eventually, adv. (3)
evident (2)
fluid, adj (1)
focus, v (1)
fossils, n (3)
habitat, n (1)
hallmark, n (2)
imply, v (2)
initially, adv. (3)
interaction, n (1)
interrelated, adj (1)
neglect, n (1)
obtain, v (2)
occur, v (2)
origin, n (2)
perform, v (2)
property, n (2)
release, v (2)
relevant, adj (3)
rigorous, adj (2)
sample, n (2)
scarce, adj (3)
scope, n (1)
segregation, n (1, 3)
significance, n (2)
site, n (3)
span, v (1)
species, n (2)
subsequent, adj (3)
survive, v (2)
sustain, v (1)
template, n (3)

adapt/adjust to (2)
as a means of (1)
be capable of (3)
by means of (2)
in response to (3)
in the presence/absence of (3)
in turn (1)
serve as (3)
set something apart from something (2)
turn out (2)
under investigation (1)

REVISION AND ADDITIONAL PRACTICE 1

Revision Exercises

I. Translate the following sentences into English

1. Біологія охоплює велику кількість дисциплін, які вивчають будову та функції живих організмів, їх взаємодію між собою та з навколишнім середовищем.
2. Різноманітність нащадків при статевому розмноженні дозволяє організмам пристосуватись до змінних умов існування.
3. Планети сонячної системи, як вважають вчені, сформувались завдяки нагромадженню холодних часточок пилу близько 5 мільярдів років тому.
4. Сучасна біологічна наука вивчає життя на різних рівнях його організації: молекулярному, клітинному, на рівні організму та популяції.
5. Близько 3,5 мільярдів років тому живі організми не могли поширюватися суходолом внаслідок смертоносного ультрафіолетового випромінювання і тому зосереджувалися у воді, на глибині нижче 5 м від поверхні океану.
6. Ще у книзі Буття спостерігаємо спробу класифікації як спосіб впорядкування знань про різноманітність організмів.
7. Завдяки спадковості та мінливості живі організми не лише відтворюють себе у потомстві, але й здатні еволюціонувати і пристосовуватись до змінних умов середовища.
8. Згідно з метаболічним визначенням життя, жива істота постійно здійснює обмін речовин із зовнішнім середовищем, не змінюючи при цьому своїх основних характеристик.
9. У відповідь на зовнішній сигнал активуються гени, які кодують необхідний клітині білок.
10. Відповідно до способу живлення організми поділяються на автотрофи та гетеротрофи. Перші використовують енергію сонця, воду та інші неорганічні речовини, щоб забезпечити здійснення необхідних процесів

для підтримки життя, а другі у своїй життєдіяльності залежать від органіки, яку продукують автотрофи.

11. Відповідно до генетичного визначення, життя — це система, яка здатна до еволюціонування шляхом природного добору.
12. Гіпотеза про те, що життя могло бути занесеним на Землю із космосу, спирається на той факт, що бактерії здатні витримувати екстремальні умови середовища і тому могли вижити на кометах чи метеоритах, які колись падали на Землю.
13. Життя на Землі можливе лише завдяки взаємодії білків і полінуклеотидів. Перші мають каталітичні властивості, але не здатні до реплікації, а другі реплікуються, але не можуть каталізувати хімічні реакції.
14. На перший погляд може здатися парадоксальним, що кисень, без якого ми не уявляємо собі життя на Землі, шкідливий і навіть небезпечний для багатьох біологічних процесів.
15. Існують дані про те, що нуклеотидні основи можуть сполучатися з цукрами у присутності фосфатів або ціанідів під впливом ультрафіолетового випромінювання.

II. Choose the appropriate word to complete each of the following sentences

1. Our plans for the project are still somewhat _____.
   a) liquid b) obscure c) ambiguous d) fluid
2. It was a fruitful discussion which _____ several different viewpoints.
   a) encompassed b) embraced c) contained d) involved
3. This is only true in deep space when the gravitational force can be _____.
   a) omitted b) neglected c) avoided d) forgotten
4. The _____ of fertilizer increased the size of the plants.
   a) introduction b) usage c) application d) choice
5. The _____ practice is to investigate those biological phenomena that all living things have in common.

a) present b) current c) contemporary d) existing

6. It was during the 12th century that botany was developed from the study of plants with healing _____.

a) properties b) qualities c) characteristics d)features

7. Homology became an important concept in uniting outwardly diverse groups of animals into distinct groups, a factor that is of great _____ in the study of evolution.

a) value b) importance c) significance d) weight

8. Calcium is _____ for the development of healthy teeth and bones.

a) crucial b) vital c) basic d) essential

9. Students _____ increasingly difficult tasks as the course continues.

a) perform b) achieve c) complete d) fulfil

10. The number of elementary particles in the _____ physical universe is only about 1080.

a) complete b) all c) entire d) full

11. The first meeting will be in the City Hall, but all _____ meetings will be held in the school.

a) afterwards b) successive c) follow-up d)subsequent

12. We can't make a decision until we have all the _____ information.

a) relevant b) important c) concerning d) referring

13. The next chapter will _____ on this problem in greater detail.

a) deal b) focus c) conern d) attend

14. Advances in medical science have _____ the need for many patients to spend long periods of time in hospital.

a) scrapped b) eliminated c) abolished d) cancelled

15. Scientists have made a major _____ in the treatment of cancer.

a) breakthrough b) progress c) milestone d) step

16. A(n) _____ of fruits and vegetables grow in Kenya's temperate climate.

a) plenty b) multitude c) amount d) abundance

17. All the children in the class have to _____ their own science experiments.

a) do b) go about c) conduct d) carry on

18. Major earthquakes like this _____ very rarely.

a) occur b) come about c) turn up d) arise

19. Some _____ of the marine invertebrates have left the water.

a) forefathers b) descendants c) ancestors d) followers

20. _____, I thought I would only stay there a year.

a) originally b) at the start c) at the outset d) initially

Additional Practice

I. Reconstruct the following text using the words from the box to fill in the blanks. What do you think about extraterrestrial life?

occurred	unique	stemmed	morphology
incompatible	orbiting	considered	panspermia
evidence	possibly	universe	carbon
motor	terrestrial	temperatures	sustaining
frequently	star	alternative	interior
source	abundance	things	substance
solvent	rejected	utilize	element
capable	hypothetical		

The existence of extraterrestrial life is currently (1)…….; there is as yet no (2)……. of life outside the planet Earth that has been widely accepted by scientists. Most scientists hold that if extraterrestrial life exists, its evolution would have (3)……. independently in different places in the (4)……. . An (5)……. hypothesis, held by a minority, is (6)……., which suggests that life in the universe could have (7)……. from a single initial point of origin, and then spread across the universe, from habitable planet to habitable planet. These two hypotheses are not mutually (8)……. .

All life on Earth is based on the building block element (9)……. with water as the (10)……. in which bio-chemical reactions take place. Given their relative (11)……. and usefulness in (12)……. life it has long been assumed that life forms elsewhere in the universe will also (13)……. these basic components. However, other elements and solvents might be (14)……. of providing a basis for life. Silicon is usually (15)……. the most likely alternative to carbon, though this remains improbable. Silicon life forms are proposed to have a crystalline (16)……., and are theorized to be able to exist in high (17)……., such as planets closer to the sun. Life forms based in ammonia rather than water are also considered, though less (18)……. . Nor can the possibility be (19)……. that a completely new (20)……. may be found that may react in a similar way to carbon or that wholly (21)……., non-chemical life-forms may (22)……. flourish through exotic physics.

Along with a building block (23)……. and a solvent, life also requires an energy (24)……. . Energy from a parent (25)……. is the most obvious source for extraterrestrial life but this is not the only possibility, as the example of (26)……. extremophiles shows. Geothermal energy from a planet's (27)……., for instance, may drive sub-surface or oceanic life, while tidal flexing (e.g., for bodies (28)……. a gas giant) provides another possible (29)……. to sustain living (30)……..

II. Reconstruct the text below putting the extracted fragments (a-i) into their correct places (1-9). Make a written translation of the text into Ukrainian

Perhaps the most fundamental and at the same time (1)……. . It is central to many scientific and philosophical problems and to any consideration of extraterrestrial life. One of the hypotheses connected with the origin of life, popular during the Middle Ages, (2) ……. . It was believed that worms are generated in cheese and timber, beetles and wasps, in cow dung, (3) ……. .

It was only in the Renaissance that such transformations were realized to be impossible. A British physiologist, William Harvey, during the mid-17th century, in the course of his studies on the reproduction and development of the king's deer, (4)……. . An Italian biologist, Francesco Redi, in the latter part of the 17th century, established that the maggots (5)……. . And an Italian priest, Lazzaro Spallanzani, in the 18th century, showed that spermatozoa (6)……. . But the idea of spontaneous generation died hard. Even though it was proved that the larger animals always came from eggs, (7)……. . It seemed obvious that, because of their ubiquity, these microscopic creatures must be generated continually from inorganic matter.

Meat could be kept from going maggoty (8)……. . This was the subject of a great controversy between the famous French bacteriologists Louis Pasteur and F.A. Pouchet in the 1850s, in which Pasteur triumphantly showed (9)……. . Actually, Pouchet was arguing that life must somehow arise from nonliving matter; if not, how had life come about in the first place?

a) … that even the minutest creatures came from germs floating in the air, but that they could be guarded against by suitable filtration.
b) … made the basic discovery that every animal comes from an egg.
c) … were necessary for the reproduction of mammals.
d) … and generally simple living forms can be procreated of putrefied matter.
e) … was based on the assumption that Life—particularly simple forms—spontaneously and readily arises from nonliving matter in short periods of time and this process continues up to the present time.
f) … by covering it with a fly-proof net, but grape juice could not be kept from fermenting by putting over it any netting whatever.
g) … the least understood biological problem is the origin of life.
h) … there was still hope for the smaller ones, the microorganisms.
i) … in meat came from flies' eggs, deposited on the meat.

III. Read the extracts from the Pope John Paul II's message to the Pontifical Academy of Sciences on evolution and the origin of life. Consider and discuss the questions following the text in the Discussion section

In celebrating the 60th anniversary of the Academy's refoundation, I would like to recall the intentions of my predecessor Pius XI, who wished to surround himself with a select group of scholars, relying on them to inform the Holy See in complete freedom about developments in scientific research, and thereby to assist him in his reflections.

He asked those whom he called the Church's *Senatus Scientificus* to serve the truth. I again extend this same invitation to you today, certain that we will be able to profit from the fruitfulness of a truthful dialogue between the Church and science…

I am pleased with the first theme you have chosen, that of the origins of life and evolution, an essential subject that deeply interests the Church, since Revelation, for its part, contains teaching concerning the nature and origins of man. How do the conclusions reached by the various scientific disciplines coincide with those contained in the message of the Revelation? And if, at first sight, there are apparent contradictions, in what direction do we look for their solution? We know, in fact, that truth cannot contradict truth… It is necessary to determine the proper sense of Scripture, while avoiding any unwarranted interpretations that make it say what it doesn't intend to say. In order to delineate the field of their own study, the exegete and the theologian must keep informed about the results achieved by the natural science…

…The Encyclical Humani generis (1950), considered the doctrine of "evolutionism" a serious hypothesis, worthy of investigation and in-depth study equal to that of the opposing hypothesis… Today, new knowledge has led to the recognition that the theory of evolution is more than a hypothesis…

…The Church's Magisterium is directly concerned with the question of evolution, for it involves the conception of man: Revelation teaches us that he was

created in the image and likeness of God…this doctrine…is pivotal to Christian thought… St. Thomas observes that man's likeness to God resides especially in his speculative intellect, for his relationship with the object of his knowledge resembles God's relationship with what he has created. But even more, man is called to enter into a relationship of knowledge and love with God himself, a relationship which will find its complete fulfillment beyond time, in eternity. All the depth and grandeur of his vocation are revealed to us in the mystery of the risen Christ. It is by virtue of his spiritual soul that the whole person possesses such a dignity even in his body. Pius XII stressed this essential point: if the human body takes its origin from pre-existent living matter, the spiritual soul is immediately crated by God…

It is significant that in St. John's Gospel life refers to the divine light which Christ communicated to us. We are called to enter into eternal life, that is to say, into the eternity of the divine beatitude.

To warn us against the serious temptations threatening us, our Lord quotes the great saying of Deuteronomy: "Man shall not live by bread alone, but by every word that proceeds from the mouth of God."

Even more, "life" is one of the most beautiful titles which the Bible attributes to God. He is the living God.

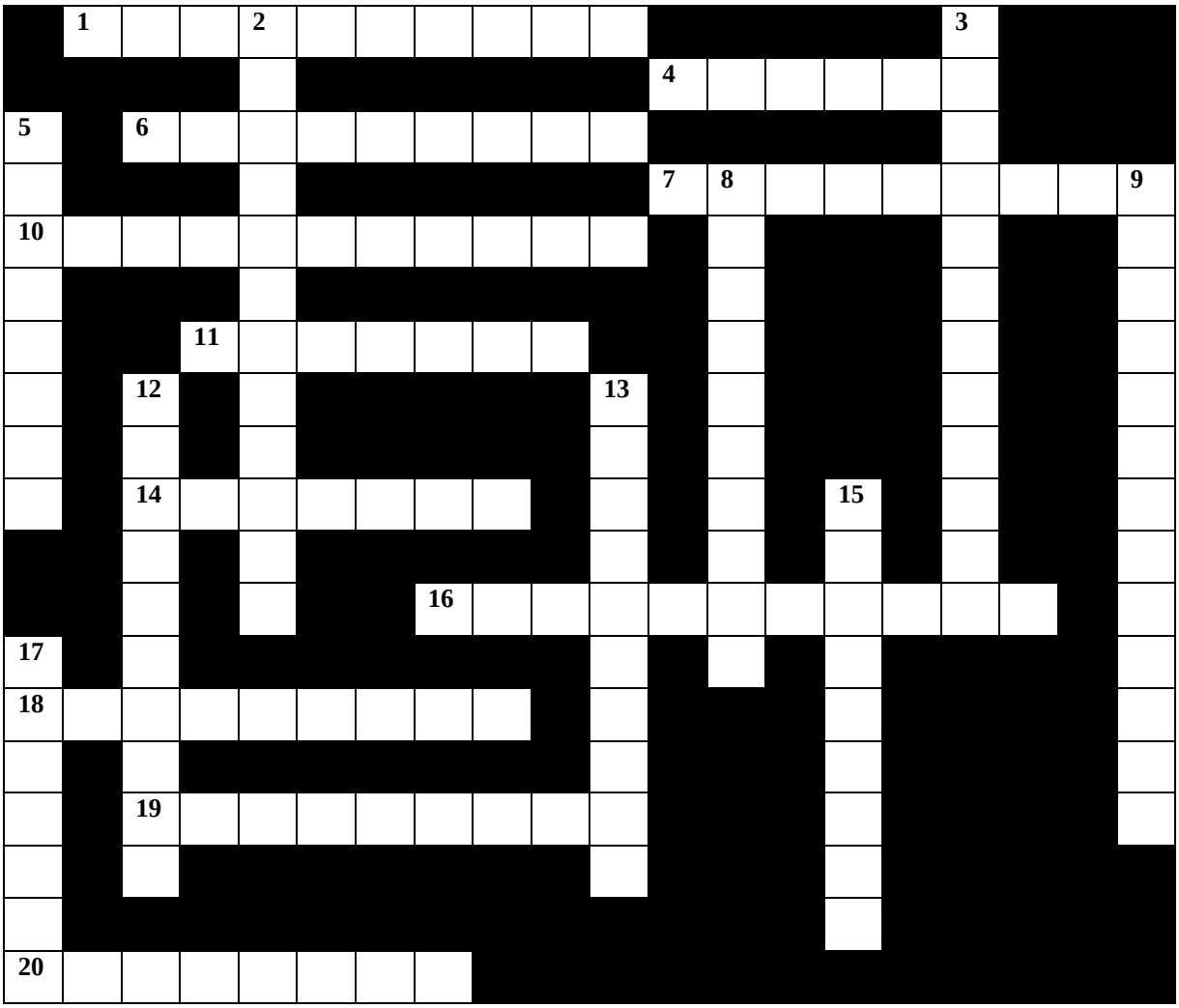
I cordially invoke an abundance of divine blessings upon you and upon all who are close to you.

Discussion

1. How does the Pope interpret the notion of "life" in the message?
2. Prove the authors opinion concerning the importance of cooperation between theology and natural sciences.
3. Why is the problem of the origin of man of extreme importance for the Church?
4. Do any obvious contradictions between the theological and scientific points of view on this problem exist? Is it possible to overcome them?

5. How does St. Thomas regard the nature of man?
6. Explain the meaning of the phrase “truth cannot contradict truth”.
7. Do you agree with the Church’s official position concerning the origin of life and man expressed in the Pope’s message?

IV. Solve the crossword puzzle



Across:

1. The sum of all chemical reactions (energy exchanges) in cells; **4.** Protein molecule that acts as catalysts in biochemical reactions; **6.** The complex of chemical compounds and structures within a plant or animal cell excluding the nucleus; **7.** A microorganism that lacks a nucleus and has a cell wall composed of peptidoglycan, a protein-sugar molecule; **10.** An organism that obtains its nutrition

by breaking down organic molecules in foods; the group includes animals and fungi; **11.** A structure along which chomosomes are distributed and drawn apart during cell division; **14.** A polymer of amino acids linked together by peptide bonds; **16.** The natural world within which people, plants, and animals live; **18.** An organism that synthesizes its nutrients and obtains its energy from inorganic raw materials; **19.** A human child or an animal's baby; **20.** Something used as a model for making another thing.

Down:

2. Scientific study of people; their societies, culture, etc.; **3.** The process whereby all living organisms produce offspring; **5.** The study of the behaviour of animals in their natural habitat; **8.** Tendency of an organism to suit to its environment; **9.** Composed of many cells and exhibiting some division of labor and specialization of cell structure and function; **12.** A group of individuals of the same species living in the same area at the same time and sharing a common gene pool; **13.** The science that studies the way in which the bodies of living things work; **15.** An interactive association between two or more species living together; **17.** The physical environment in which a population lives.

V. Using additional sources of information prepare a report on one of the following topics and present it to the class

- **The interpretation of the notion of life from the point of view of natural sciences, philosophy, theology, astrology, cultural studies, etc.**
- **Life and forms of its presentation on the Earth and other planes. Facts and hypotheses.**
- **Objectives and research methods of modern biological investigations. Science versus ethics.**

Unit 2

Lesson 1

MACROMOLECULES

PRE-READING TASKS

I. Answer the following questions

- What organic macromolecules do you know?
- What are the main properties of lipids, carbohydrates, proteins and nucleic acids?
- What role do these substances play to sustain life?

II. Listen to the following words and practice their pronunciation

Substance; carbohydrate; lipid; protein; starch; dextrin; cellulose; glycogen; monosaccharide; disaccharide; sucrose; lactose; maltose; invertebrate; chitin; arthropod; triglyceride; hormone; haemoglobin; insulin; deoxyribonucleic acid; ribonucleic acid.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) compound, n	a) order of succession;
2) diet, n	b) to initiate, actuate, or set off;
3) yield, v	c) a distinct substance formed by chemical union of two or more ingredients in definite proportion by weight;
4) distinguish, v	
5) recognize, v	d) a thread or a structure or object resembling a thread;
6) coin, v	e) to make, create or invent;
7) trigger, v	f) food and drink regularly provided or consumed; habitual nourishment;
8) accomplish, v	

9) backbone, n	g) the longest chain of atoms or groups of atoms in a usually long molecule;
10) fibre, n	h) an elongated or twisted and plaited body resembling a rope;
11) strand, n	i) to bring to completion;
12) sequence, n	j) to produce a result;
	k) to mark as separate or different;
	l) to admit as being of a particular status.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

Cells are made up of many substances, especially ***carbohydrates, lipids, proteins,*** and ***nucleic acids***. Each of these substances plays a vital role in the processes occurring in living structures. In fact, life on Earth in its present form would be impossible without any of these substances.

Carbohydrates are a large group of compounds in which hydrogen and oxygen, in the proportions in which they exist in water, are combined with carbon. As a class, carbohydrates, are the most abundant organic compounds found in nature. They are produced by green plants and by some bacteria using the process of photosynthesis.

The carbohydrate group consists principally of ***sugar***, ***starch, dextrin, cellulose,*** and ***glycogen***, substances that constitute an important part of the human diet and that of many animals. The simplest of them are the simple sugars, or ***monosaccharides***. The most important of them is ***glucose***. Two monosaccharide molecules joined together by an oxygen atom, with the elimination of a molecule of water, yield a ***disaccharide***, of which the most important are ***sucrose, lactose,*** and ***maltose***. ***Polysaccharides*** have enormous molecules made up of one type or several types of monosaccharide units.

Within living organisms, carbohydrates serve both essential structural and energy-storage functions. In plants, cellulose and ***hemicellulose*** are the main structural elements. In ***invertebrate animals***, the polysaccharide ***chitin*** is the main component of the ***exoskeletons*** of ***arthropods***. In ***vertebrate animals***, the cell coatings of ***connective tissues*** contain carbohydrates. Cell membranes are rich in ***glycoproteins***, and so forth. Plants use ***starch*** and animals use ***glycogen*** to store energy; when the energy is needed, the carbohydrates are broken down by enzymes.

Lipids are a diverse group of fatty substances found in all living organisms. Lipids are distinguished from other classes of organic compounds in that they do not dissolve in water but are soluble in alcohol, ether, or other organic solvents. Among the most important lipids are the ***phospholipids***, which are major components of the cell membrane. Phospholipids limit the passage of water and water-soluble compounds through the membrane, enabling the cell to keep its contents separate from the outside environment.

Fats and oils, which are composed of ***triglycerides***, serve as stored energy reserves in plant and animal cells. Each triglyceride is composed of three ***fatty acid molecules*** bonded to one ***glycerol molecule***. When an organism has excess energy available from food or from photosynthesis, it may use that energy to form stores of triglycerides. These can later be broken down to yield energy when the organism needs it. ***Fats*** and ***oils*** contain twice as much stored energy, per unit of weight, as carbohydrates or proteins. Other important lipids are the ***waxes***, which form protective coatings on the leaves of plants and the skins of animals, and the ***steroids***, which include vitamin D and several key hormones.

Proteins constitute a large number of organic compounds that make up living organisms and are essential to their functioning. First discovered in 1838, proteins are now recognized as the predominant ingredients of cells, making up more than 50 percent of the dry weight of animals. The word protein is coined from the Greek proteios, or “primary.”

Protein molecules range from the long, insoluble fibers that make up connective tissue and hair to the compact, soluble globules that can pass through cell membranes and set off metabolic reactions. They are all large molecules, ranging in molecular weight from a few thousand to more than a million, and they are specific for each species and for each organ of each species. Humans have an estimated 30,000 different proteins, of which only about 2 percent have been adequately described. Proteins in the diet serve primarily to build and maintain cells, but their chemical breakdown also provides energy, yielding close to the same 4 calories per gram as do carbohydrates.

Besides their function in growth and cell maintenance, proteins are also responsible for muscle contraction. The ***digestive enzymes*** are proteins, as are ***insulin*** and most other ***hormones***. The ***antibodies*** of the immune system are proteins, and proteins such as ***hemoglobin*** carry vital substances throughout the body.

Nucleic Acids are extremely complex molecules produced by living cells and viruses. Their name comes from their initial isolation from the nuclei of living cells. Certain nucleic acids, however, are found not in the cell ***nucleus*** but in cell ***cytoplasm***. Nucleic acids have at least two functions: to pass on hereditary characteristics from one generation to the next, and to trigger the manufacture of specific proteins. How nucleic acids accomplish these functions is the object of some of the most intense and promising research currently under way. The nucleic acids are the fundamental substances of living things, believed by researchers to have first been formed about 3 billion years ago, when the most elementary forms of life began on Earth.

The two classes of nucleic acids are the ***deoxyribonucleic acids*** (DNA) and the ***ribonucleic acids*** (RNA). The backbones of both DNA and RNA molecules are shaped like helical strands. Their molecular weights are in the millions. To the backbones are connected a great number of smaller molecules (side groups) of four different types. The sequence of these molecules on the strand determines the code

of the particular nucleic acid. This code, in turn, signals the cell how to reproduce either a duplicate of itself or the proteins it requires for survival.

III. USEFUL PHRASES. Study the phrases below and complete the sentences that follow

play a role (in) – відігравати роль

both…and… – як…так і…

rich in – багатий на

range from…to… - (коливатися) в межах від…до…

1. Having a dual attraction, i.e., containing _____ a lipid-soluble _____ a water-soluble region is basic to the role of lipids as building blocks of cellular membranes.
2. Actin filaments _____ _____ structural _____, forming a dense complex web just under the plasma membrane.
3. The outer surface of the membrane will tend to be _____ glycolipids, which have their hydrophobic tails embedded in the hydrophobic region of the membrane and their heads exposed outside the cell.
4. The carbon dioxide released by cells is generated by the Kreb's Cycle, as are the energy carriers (NADH and $FADH_2$) which _____ _____ _____ in the next step.
5. The ultimate limit to the resolution of a light microscope is set by the wavelength of visible light, which _____ _____ about 0.4 μm (for violet) _____ 0.7 μm (for deep red).
6. The internal membranes of eukaryotic cells differ _____ structurally _____ chemically from the plasma membrane.
7. Speculative forms of extraterrestrial life _____ _____ humanoid and monstrous beings seen in works of science fiction _____ life at the much smaller scale of bacteria and viruses.
8. Citrus fruits are _____ _____ vitamin C.

IV. Choose the correct option. In some cases more than one answer is possible

1. Carbohydrates are substances which include:
   a) carbon, nitrogen and water;
   b) oxygen, hydrogen and water;
   c) carbon, oxygen and hydrogen;
   d) carbon, oxygen and water.
2. To the carbohydrate group belong such substances as
   a) sugars, starch and glycogen;
   b) cellulose, enzymes and dextrin;
   c) glycogen, cellulose and dextrin;
   d) oils, sugars and starch.
3. Different organisms can store energy in:
   a) cellulose and lipids;
   b) starch and triglycerides;
   c) glycogen and lipids;
   d) triglycerides and glycogen.
4. Lipids do not dissolve in:
   a) ether;
   b) organic solvents and water;
   c) water;
   d) alcohol and other organic solvents.
5. Lipids do not perform the following functions:
   a) participate in the regulation of transport across the cell membrane;
   b) catalyze important reactions taking place in the cell;
   c) serve as important energy reserves;
   d) form protective coatings for plant leaves.
6. Proteins are important because they:
   a) serve as structural material for organisms;
   b) provide protection from a wide range of infectious agents and toxic substances;
   c) store hereditary information and pass it to next generations;
   d) can be used as energy reserves.
7. Nucleic acids are believed to have been formed
   a) at the time when the most primitive living forms appeared on Earth;
   b) together with the first multicellular organisms;
   c) 4,5 billion years ago;
   d) in the primordial soup.

V. Think of possible questions for the following answers

1. They are produced by green plants and by bacteria in the process of photosynthesis.
2. The most important of them is glucose.
3. These are cellulose and hemicellulose.
4. Animals use glycogen for this purpose.
5. No, they can only dissolve in alcohol, ether and other organic solvents.
6. They were discovered in 1838.
7. 30,000.
8. This problem is still being researched.
9. It resembles a double helix.

VI. In the text "Macromolecules" find the words with the following meanings. Use these words in the sentences of your own

1) to unite into a chemical compound;
2) marked by extraordinarily great size, number, or degree;
3) any of various organic compounds characterized by an oxygen atom attached to two carbon atoms;
4) a usually liquid substance capable of dissolving or dispersing one or more other substances;
5) being most frequent or common; prevailing;
6) a tiny globe or ball especially of a liquid; a droplet;
7) the shortening and thickening of a functioning muscle or muscle fiber;
8) having a spiral form;
9) distinctive among other examples or cases of the same general category.

VII. Find the following words and expressions in the text "Macromolecules". Explain the differences in their meanings and usage. Use these words and expressions to fill in the gaps in the sentences below

a) Constitute; make up.

b) Contain; include; be composed of; consist of.

1. Each cell typically _____ a central, usually spherical, nucleus and an outermore heterogeneous region, termed the cytoplasm.
2. Up to 70% of your total body weight is _____ of water.
3. Cigarettes which _____ less than 0.8 mg nicotine can be classified as "light".
4. Symptoms of the disease _____ tiredness and loss of memory.
5. Water is _____ hydrogen and oxygen.
6. Doctors are struggling to _____ the epidemic.
7. The environment of an organism also _____ the other organisms in its surroundings.
8. It is sometimes difficult to believe that the different groups living within our borders _____ a single society.
9. Hereditary information is carried by large molecules known as genes which are _____ nucleic acids.
10. The rise in crime _____ a threat to society.
11. Human cells are in many fundamental respects similar to those that _____ all the other animals and plants on Earth.

GRAMMAR IN USE: *Word Formation 1*

I. Look at the words below. They are all the derivatives of one word — *solve*. Explain the meaning of each word. What morphological means have been used to produce these words? What other means of word formation do you know?

Solvent; insoluble; dissolve; soluble.

II. Regard the suffixes enlisted below. What parts of speech are formed by means of these suffixes? Find the words containing such suffixes in the text. What do they mean?

-Ance/-ence; -ity; -ness; -ment; -ion/-sion/-tion; -age; -sys; -y; -ty; -ly; -(a)ble; -ive; -en; -ful;-er/-or; -ish; -less.

III. Fill in the following table as in the model

verb	noun	adjective	adverb
dissolve	*solute; solution*	*soluble; insoluble*	---
contract			
function			
reproduce			
store			
maintain			
diversify			
connect			
recognize			
compose			
generate			

IV. Fill in the spaces in the following text using a suitable form of the word given at the end of the lines. The first is given as an example

Any of the organic compounds required by the body in small amounts for (0) **<u>metabolism</u>**, to protect health, and for proper (1)_____ are referred to as vitamins. Vitamins also assist in the (2)_____ of hormones, blood cells, nervous-system chemicals, and (3)_____ material. The various vitamins are not (4)_____ related, and most differ in their (5)_____ actions. They generally act as (6)_____, combining with proteins to create metabolically (7)_____ enzymes that in turn produce hundreds of (8)_____ chemical reactions throughout the body. Without vitamins, many of these (9)_____ would slow down or cease. The intricate ways in which vitamins act on the body, however, are still far from clear.	**metabolic (0)** **grow (1)** **form (2)** **gene (3)** **chemical (4)** **physiology (5)** **catalize (6)** **act (7)** **importance (8)** **react (9)**

LISTENING COMPREHENSION

I. Listen to a fragment of a lecture about DNA structure. Say whether the following statements are true or false according to the text on the tape. Before listening discuss the meaning of the words in the box below with your classmates or teacher

nucleotides	nitrogen base	complementary base pairing	thriving
deoxyribose	double helix	junk	

1. Nucleotides are the constituent parts of DNA molecules.
2. Each nucleotide is made up of two main components.
3. There are four types of bases in the DNA structure: cytosine, guanine, thymosine, and adenine.
4. The DNA molecule resembles a double helix or a "ladder" in which the "sides" are made up of bases and the "rumps" consist of phosphate and sugar molecules.
5. The bases in the DNA combine randomly with each other.
6. The mode of base pairing is very important for DNA replication and storage of genetic information.
7. An average human gene includes 100 bases.
8. 98% of a DNA molecule is considered "junk" and useless.

II. Listen to the following piece of information about cellulose. Fill in the missing words or phrases

Cellulose is the (1)_____ of the cell wall of all plant cells. In plants, cellulose is normally combined (2)_____ or gummy substances. With some exceptions among insects, true cellulose is not found (3)_____. Microorganisms in the digestive tracts of (4)_____ break down the cellulose into products that can then be absorbed. Cellulose is insoluble in (5)_____ and may be readily separated from the other (6)_____. Depending on its concentration, sulphuric acid acts on cellulose (7)_____,

soluble starch, or amyloid; the last is a form of starch (8)_____ of parchment paper. When cellulose is (9)_____ and then exposed to the fumes of carbon disulfide, the solution (10)_____. Rayon and cellophane are cellulose regenerated from such solutions. (11)_____ are spun into fine filaments for the manufacture of some fabrics and are also used for (12)_____, as a substitute for glass, for the manufacture of safety glass, and as (13)_____. Cellulose ethers are used in paper sizings, adhesives, (14)_____, and (15)_____.

WRITING AND SPEAKING

Write a summary of the text "Macromolecules" in 200 words using the vocabulary of Lesson 1. Get ready to present it in class

Lesson 2

CELL AS A BASIC UNIT OF LIFE

PRE-READING TASKS

I. Answer the following questions

- What meanings of the word "cell" do you know?
- Why do you think the basic unit of life was called the cell?
- What do you know about cells as units of life?

II. Listen to the following words and practice their pronunciation

Virus; totipotent; subcellular; micrometer; algae; neuron; prokaryotic; eukaryotic; Monera; nucleus; nuclei; nucleoid; fungus; fungi; plasma membrane; cytoplasm; minute.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) preexisting, adj
2) fusion, n
3) induce, v
4) intact, adj
5) volume, n
6) projection, n
7) interfere, v
8) remainder, n
9) enclose, v

a) to get involved in a situation where one is not wanted or needed;
b) to call forth or bring about by influence or stimulation;
c) the part of something that is left; the rest of;
d) to surround or fence off;
e) a merging of diverse, distinct, or separate elements into a unified whole;
f) having no relevant component removed or destroyed; entire; uninjured;
g) the amount of space occupied by a three-dimensional object as measured in cubic units;
h) something that existed earlier or before;
i) something that sticks out from a surface.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

The basic unit of life. The cell is the basic unit of organization in living things. All organisms are composed of cells, and all cells come from preexisting cells — these two statements constitute the cell theory. Even viruses, which are not cells themselves, are entirely dependent on the presence and chemical machinery of cells for their reproduction. A cell may arise either by the division of another cell or by the fusion of two other cells. In nature, a cell cannot simply be formed by a combination of its component parts, nor has such a feat of synthesis been achieved in the laboratory. This situation raises an important question: Where did the first cells come from?

Some cells are free-living organisms in their own right. Others are parts of a multicellular organism. In general, each cell in an organism is ***totipotent***, that is, it contains all the genetic information required to generate that entire organism.

Many plants reproduce by means of ***seeds***, but this form of reproduction can sometimes be bypassed. With some species it is possible to take a cutting consisting of a bit of ***stem*** and a ***leaf*** or two, put it in soil and care for it, and end up with an entire plant. Going further, one may isolate single cells; and in special laboratory conditions even these may be induced to develop into intact plants. However, if we try to go to a level of structure below that of an entire cell, we come to the end of the line. ***Subcellular structures*** such as nuclei and ***chloroplasts*** may be isolated from cells in quantity and caused to carry out their normal functions; but they can never be induced to regenerate whole cells, let alone an entire plant. The inability of even the nucleus to produce a life form is one sense in which the cell is a basic unit of function and reproduction.

Main characteristics of cells. Cells are tiny: Most have a volume of 1-1000 cubic micrometers (μm^3). Eggs of some birds are enormous exceptions and

individual cells of several types of ***algae*** are large enough to be viewed with the unaided eye. ***Neurons*** (nerve cells) have volumes that fit within the "normal" range, but they often have fine projections that may extend for meters, carrying signals from one part of a large organism to another. In spite of these special cases, we may generalize and say that cells are very small objects.

The cell's activities depend upon specific component structures and their organization into a coordinated whole. A cell must do many things in order to survive. It must obtain energy from its environment. It must be selective as to what materials enter and leave it. All cells must interpret and use the information contained in their DNA. The chemical reactions essential for life must be kept from interfering with one another, etc.

A comparison of numerous kinds of cells shows that there are two distinct general arrangements, with only a few intermediate forms in evidence. One general arrangement, usually the simpler, is the ***prokaryotic*** (prenuclear) type, characteristic of the ***Monera (the bacteria)***. Organisms in the kingdom Monera are often referred to as prokaryotes; they lack nuclei. The rest of the living world is eukaryotic: Its cells contain true nuclei. These cells usually include additional internal compartments that are surrounded by membranes, and organisms with this type of cell are known as ***eukaryotes***. Both prokaryotes and eukaryotes are to be regarded as great successes, for they have prospered through billions of years of evolution.

Prokaryotic cells. Prokaryotic cells exhibit great variety of internal structure. What they all have, without exception, is three things. The first is a ***plasma membrane***, separating the cell from its environment and regulating the inward and outward traffic of material. The second is a relatively clear area, as seen under the electron microscope, containing the hereditary material (DNA) of the cell. This region is called the ***nucleoid***. Each cell has at least one of these, and some may contain more than one. The remainder of the material within the cell is called the ***cytoplasm***. At high magnification it is seen to be full of minute,

roughly spherical structures called ***ribosomes***, the third of the components found in all prokaryotic cells. The ribosomes are approximately 15-20 nm in diameter and consist of three molecules of RNA and about 50 different protein molecules. Their function is to coordinate the synthesis of proteins: The ribosome controls the interaction of various forms of RNA and the other parts of the protein-synthesizing machinery. The remainder of the cytoplasm is a complicated solution containing many kinds of ***enzymes*** and the other chemical constituents of the cell. Structurally, a prokaryotic cell is relatively simple, but functionally it is exceedingly complex. There are literally thousands of kinds of chemical reactions occurring under the precise direction of enzymes, with the cell's DNA serving as the molecular memory that allows successive generations of a given cell to be very much like one another.

Eukaryotic cells. The vast majority of living species, including all ***animals***, ***plants***, ***fungi***, and ***protists***, have cells that are considerably more complex in structure than those of the prokaryotes. The eukaryotic cell is full of membranous structures of wondrous diversity. Many of the structures are completely enclosed by one or two membranes, have distinct and characteristic external and internal forms, and carry on particular biochemical functions. They are, in effect, neatly packaged subsystems, with membranes to control their functions and to regulate what gets in and out. Some of the subsystems are like little factories that make specific products. Others like power plants that take energy in one form and convert it to a more useful one. These membranous structures as well as other structures lacking membranes but possessing distinctive shapes and functions (the ribosomes, for example) are referred to as ***organelles***.

III. USEFUL PHRASES. Study the following phrases and use them in your own sentences

in spite of something (= despite something) – незважаючи на

depend (up)on – залежати від

in order to (do something) – для того, щоб

interfere with – перешкоджати, втручатися

IV. Answer the following questions about the text "Cell as a Basic Unit of Life"

1. What experiments can prove that the cell is the smallest unit capable of sustaining life?
2. What is the size of a typical cell?
3. What functions do cells need to perform in order to survive?
4. How many basic types of cell organization do we distinguish?
5. What are the main distinctive characteristics of prokaryotic cells?
6. In what ways are eukaryotic cells different from prokaryotic ones?

V. Fill in the following table with synonyms (from list A) and opposites (from list B) of the given words. Explain the difference between the synonyms and illustrate it using your own examples

word	*synonym*	*opposites*
achieve, v		
entire, adj		
regenerate, v		---------
extend, v		
obtain, v		
exhibit, v		
regard, v		
minute, adj		
convert, v		---------
precise, adj		
successive, adj		---------

A: accomplish; accurate; acquire; change; complete; consider; display; exact; following; get; microscopic; protrude; reach; renew; reproduce; show; stick out; subsequent; tiny; transform; view; whole.

B: conceal; contract; disregard; enormous; fail; forgo; hide; huge; incomplete; inexact; lose (x2); neglect; partial; shorten; vague.

VI. Explain the difference between the words in each group below

1. Rise, raise, arise. 2. Distinct, distinctive.

VII. Fill in the blanks in the sentences below with the words from the previous exercise putting them in the appropriate forms

1. In the Galápagos Islands, Charles Darwin noted how species on the various islands were similar but _____ from one another.
2. A full moon _____ over the valley.
3. Creating animals with genetic defects _____ challenging ethical questions.
4. The chairman _____ from his chair and came forward to greet her.
5. As night fell, the outline of the mountain became less _____.
6. The concert has been organized to _____ money for charity.
7. When a conflict _____ in the workplace, you should aim to repair the relationship as quickly as possible.
8. The most _____ feature of the building is its enormous dome-shaped roof.
9. Ambitious people often _____ to the top in their chosen professions.
10. Most of the world's people, including Americans, get the bulk of their food from crops and livestock _____ in areas where they did not originate.
11. Different species _____ when, for one reason or another, members of a population cease to interbreed.
12. His sister _____ horses in Colorado.
13. Male birds of this species have _____ blue and yellow markings.

14. Low achievements at school often _____ from poverty and bad social conditions.
15. In evolution successful creatures possess a perfecting principle, that enables them to _____ to meet the demands of their world.
16. I have a _____ memory of my grandma sitting in the rocking chair, knitting.
17. _____ your hand if you know the right answer.

GRAMMAR IN USE: *Word Formation 2*

I. Many new words in the English language are formed by means of prefixes. Look at the prefixes below. What meanings do they add to words?

Co-, dis-, in-, im-, ir-, mis-, over-; pre-, re-, sub-, un-, super-, extra-, de-, macro-, micro-, semi-, anti-, mono-, multi-, uni-, poly-.

II. Match the following words with the prefixes from the previous exercise. Some of the words can take several different prefixes. What is the meaning of the resulting words?

Soluble; saccharide; existing; production; populated; natural; biology; organism; body; regular; approve; aware; cellular; understand; operation; matter; possible; vertebrate; system; ability; meter; molecule; conception; terrestrial; circle; infect; weight; conductor; rational; operate; believable.

III. Some of the English words consist of two or more components that function as one word. Match the words from the left and right columns to form such nouns or adjectives making necessary changes. Use these words in your own sentences

1 *phosphorus*	a) ache	
2 carbon	b) base	
3 pain	c) brigade	
4 head	d) *lipid*	*-> 1. d) phospholipid*

5 photo	e) condition	
6 sun	f) glasses	
7 *baby*	g) hydrate	
8 water	h) kill	
9 air	i) marrow	
10 fire	j) membrane	
11 data	k) proof	
12 soft	l) *sit*	*7. l) -> babysitter*
13 plasma	m) suit	
14 bone	n) synthesis	
15 swim	o) ware	

LISTENING COMPREHENSION

I. Listen to the following piece of information about origin of the eukaryotes. Choose the correct options to complete the statements below. In some cases more than one answer is possible. Before listening discuss the meaning of the words in the box below with your classmates or teacher

sediments	to be treated like	to be incomplete
to be ingested	to nurture thoughts	compelling objections
to get digested	successive generations	to resolve a matter
to sit trapped	to account for	to reside in

1. Among the cell organelles that contain their own ribosome and DNA are:
   a) chloroplasts; b) lyzosomes; c) vacuoles.
2. The attempts to grow mitochondria in culture out of cells…
   a) have been successful;
   b) have never produced the expected result;
   c) have never been made.
3. Eukaryotic cells appeared on earth…

a) 2 billion years after prokaryotes;

b) 3 million years after prokaryotes;

c) 2 billion years ago.

4. According to Lynn Margulis, Boston University, about a billion years ago earth was inhabited…

a) by photosynthetic prokaryotes;

b) by several types of prokaryotes;

c) by prokaryotes and first eukaryotes.

5. According to Lynn Margulis, Boston University, …

a) some prokaryotes "infected" others;

b) some prokaryotes were parasites that lived within others;

c) Some prokaryotes got engulfed by others and survived within them

6. The endosymbiotic theory is incomplete because…

a) it does not account for a number of features that distinguish eukaryotes from prokaryotes;

b) chloroplasts and mitochondria lack nuclei;

c) mitochondria and chloroplasts are not the only organelles within the eukaryotic cell.

7. The endosymbiotic theory…

a) will soon be rejected as inconsistent;

b) has already been accepted as true;

c) can be further improved and developed.

II. Listen to the text again and fill in the missing parts into the following sentences

1. Chloroplasts and mitochondria are about the size of bacteria; they _____ and DNA; they _____ the cell.
2. Prokaryotic cells are generally_____, since they _____.

3. Prokaryotic _____ in sediments well over _____, whereas the earliest known eukaryotic fossils _____ years ago.
4. Suppose that an occasional small prokaryote _____ but did not _____, so that it sat _____ cell.
5. Modern scientists have _____ that those little prokaryotes _____ could have become the first chloroplasts and _____.
6. The endosymbiotic theory_____, although suggestions have been made _____ to deal with the origin of _____.
7. A number of _____ to the theory have been raised, among them the fact _____ of most of the enzymes in chloroplasts and mitochondria _____.
8. The endosymbiotic theory is a good example of _____; and it gives us a useful perspective on the _____ of the mitochondria and chloroplasts.

WRITING

Make a written translation of the following passage into English

Для здійснення життєвих функцій евкаріотам необхідні органічні молекули: вуглеводи, такі, як цукор та крохмаль; білки, жири та нуклеїнові кислоти, такі, як ДНК. Цукор у вигляді глюкози особливо важливий, тому що евкаріоти використовують його як джерело енергії для побудови білків, жирів та інших органічних молекул. Фотосинтезуючі евкаріоти є автотрофами. До них належать, наприклад, вищі рослини, морські багатоклітинні водорості, мікроскопічні одноклітинні водорості – всі вони можуть самі синтезувати цукри. Ті організми, що мусять отримувати цукор із зовнішніх джерел, називають гетеротрофами. Серед гетеротрофів багато одноклітинних евкаріотів, всі гриби та тварини.

Евкаріоти-гетеротрофи зазвичай поглинають поживні речовини їжі через плазматичну мембрану. Для цього вони їжу розщеплюють або перетравлюють. Гриби виділяють травні ферменти на поверхню поживного сережовища, часто розкладають (decaying) листя або гілки, а згодом вбирають звільнені ферментами поживні сполуки через клітинну стінку та плазматичну мембрану. На відміну від грибів, тварини спершу поглинають їжу в середину якоїсь травної структури, наприклад, шлунка. Там травні ферменти розщеплюють їжу і поживні речовини вбираються в клітини.

Lesson 3

CELL STRUCTURE

PRE-READING TASKS

I. Answer the following questions

- Can you name the main components of a typical cell?
- Do cells of different types (e.g. plant and animal cells, etc.) have the same structure?
- Can you describe the functions of some cellular components?

II. Listen to the following words and practice their pronunciation

Chloroplast, nutrients, cytosol, cytoskeleton, vesicle, vacuole, ion, permease, osmosis, turgor, lysosome, hydrolase, glycolipid, glycoprotein, to digest, endoplasmic reticulum, ribosome, cholesterol, phospholipid, mitochondrion, peroxisome, adenosine triphophate, plastid, chlorophyll, chromoplast, leucoplast.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) compartment, n	a) a membranous and usually fluid-filled pouch (as a cyst or vacuole) in a plant or animal;
2) digest, v	b) a separate division or section;
3) framework, n	c) a substance that catalyzes the transport of another substance across a cell membrane;
4) fuse, v	d) the quality or state of being inflexible;
5) impart, v	e) to become blended or joined by or as if by melting together;
6) maturation, n	f) to convert (food) into absorbable form;
7) nutrient, n	
8) permease, n	
9) reinforce, v	

10) rigidity, n
11) sequester, n
12) vesicle, n

g) to set apart, segregate;
h) the process or the final stage of becoming fully developed;
i) to give, convey, grant or communicate something;
j) to strengthen or increase by fresh additions;
k) a chemical or food that provides what is needed for plants or animals to live and grow;
l) the main supporting parts of an object.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

A cell is enclosed by the ***plasma membrane***, which forms a selective barrier allowing nutrients to enter and waste products to leave. The interior is organized into many specialized compartments, or ***organelles***, each surrounded by a separate membrane. Between all organelles is the space in the cytoplasm called the ***cytosol***, which is organized around a framework of fibrous molecules constituting the ***cytoskeleton***. The cytosol contains more than 10,000 different kinds of molecules involved in cellular biosynthesis.

A thin **membrane**, some 0.005 micrometre across, surrounds every living cell, delimiting the cell from the environment around it. The plasma membrane has two functions: first, to be a barrier keeping the constituents of the cell in and unwanted substances out; and second, to be a gate allowing transport into the cell of essential nutrients and movement from the cell of waste products.

Most plant cells contain one or more membrane-bound vesicles called **vacuoles**. Within the vacuole is the ***cell sap***, a water solution of salts and sugars kept at high concentration by the active transport of ions through ***permeases*** in the vacuole membrane. This high concentration causes the entry, via ***osmosis***, of water into the vacuole, which in turn expands the vacuole and generates a hydrostatic pressure, called ***turgor***, that presses the cell membrane against the ***cell wall***. Turgor is the cause of rigidity in living plant tissue.

Potentially dangerous hydrolytic enzymes functioning in acidic conditions (pH 5) are segregated in the **lysosomes,** bound by a single ***phospholipid bilayer membrane***, to protect the other components of the cell from random destruction. They probably originate by ***budding*** from the Golgi membranes. Enzymes known to be present in the lysosomes include ***hydrolases***, which degrade proteins, nucleic acids, lipids, glycolipids, and glycoproteins; they are most active in the acidity maintained in the lysosomes. Lysosomes fuse with vacuoles containing material from inside or outside the cell to be digested. After the material is broken down, lipids and amino acids are transported across the lysosomal membrane by permeases for use in biosynthesis.

The **endoplasmic reticulum (ER**) is a system of membranous vesicles extending throughout the cytoplasm. Often, it constitutes more than half of the total membrane in the cell. The endoplasmic reticulum can be classified in two functionally distinct forms, the ***smooth endoplasmic reticulum (SER)*** and the ***rough endoplasmic reticulum (RER***). The morphological distinction between the two is the presence of protein-synthesizing particles, called ***ribosomes***, attached to the outer surface of the RER. The functions of the SER vary considerably from cell to cell. One important role is the synthesis of phospholipids and ***cholesterol***. In ***liver cells***, the SER is specialized for the detoxification of a wide variety of compounds produced by metabolic processes. In cells of the ***adrenal glands*** and ***gonads***, cholesterol is modified in the SER at one stage of its conversion to ***steroid hormones***. Finally, the SER in ***muscle cells***, known as the ***sarcoplasmic reticulum***, sequesters calcium ions from the cytoplasm. The RER plays a central role in the synthesis and export of proteins and glycoproteins and is best studied in the ***secretory cells*** specialized in these functions.

Ribosomes are particles that synthesize proteins from amino acids. They are composed of four RNAmolecules and about 50 proteins assembled into a large and a small subunit. Ribosomes are either free (i.e., not bound to membranes) in the cytoplasm of the cell or bound to the RER. Lysosomal enzymes, ***proteins destined***

for the ER, Golgi, and plasma membranes, and proteins to be secreted from the cell are among those synthesized on ***membrane-bound ribosomes***. Fabricated on ***free ribosomes*** are proteins remaining in the cytosol, those bound to the internal surface of the plasma membrane, as well as those to be incorporated into the ***nucleus***, ***mitochondria***, ***chloroplasts***, ***peroxisomes***, and other organelles.

The **Golgi complex** is the site of the modification, completion, and export of secretory proteins and glycoproteins. This organelle has a characteristic structure composed of five to eight flattened, disk-shaped, membrane-defined cisternae arranged in a stack. The Golgi is thought to be the principal director of protein traffic in the cell. Secretory proteins and glycoproteins, plasma membrane proteins and glycoproteins, lysosomal proteins, and some glycolipids all pass through the Golgi structure at some point in their maturation. In plant cells, much of the cell-wall material passes through the Golgi as well.

The **nucleus** is the information centre of the cell in all higher organisms. It is separated from the cytoplasm by the ***nuclear envelope***, and it houses the double-stranded, spiral-shaped deoxyribonucleic acid (DNA) molecules. The primary function of the nucleus is the expression of selected subsets of the genetic information encoded in the DNA double helix. The messenger RNA molecules are transported through the nuclear envelope into the cytoplasm, where they are translated, serving as templates for the synthesis of specific proteins.

One type of eukaryotic organelle, called **mitochondrion**, functions primarily to capture energy from food substances in a form useful for the cells. The process begins in the cytosol, resulting in molecules that are taken up by mitochondria, where they are oxidized, that is, electrons are removed from them. The energy available from the electrons is used to drive the synthesis of ***adenosine triphosphate*** (ATP), which stores energy in two special chemical bonds. The oxidative metabolism in the mitochondria, with the associated formation of ATP, is called cellular respiration. The number of mitochondria in a cell is variable, ranging from one contorted giant in some protists to a few hundred in large ***egg***

cells. Cells that require the most chemical energy tend to have more mitochondria per unit volume.

The **plastids** are produced only in plants and certain protists. The most familiar of the plastids are the ***chloroplasts***, which are the site of ***photosynthesis*** and contain all the chlorophyll in the cell. The major function of the chloroplast is to carry on the process of photosynthesis, by which light energy is converted into the energy of chemical bonds; the molecules thus formed provide food for the plant itself and for other organisms. Chloroplasts are not the only kinds of plastids found in plants. The presence of legions of plastids called ***chromoplasts*** imparts the characteristic red, orange, or yellow colouring to different parts of the plant body. Other types of plastids, ***leucoplasts***, serve a storage depot for ***starch*** and fats.

The **cytoskeleton** is the name given to a fibrous network formed by different types of long protein filaments present throughout the cytoplasm of eukaryotic cells. These filaments create a scaffold or framework that organizes other cell constituents and maintains the shape of the cell. In addition, some filaments cause coherent movements, both of the cell itself and of its internal organelles. Three major types of cytoskeletal filaments are commonly recognized: actin filaments, microtubules, and intermediate filaments. Actin filaments and microtubules are dynamic structures that continuously assemble and disassemble in most cells. Intermediate filaments are stabler and seem to be involved mainly in reinforcing cell structures.

III. USEFUL PHRASES. Study the following phrases and paraphrase the underlined parts of the sentences that follow

be responsible for – відповідати за щось
be involved in something – брати участь у чомусь
as well as – так само як і; а також...
result in – мати результатом, спричиняти

1. The progressive destruction of the environment can be attributed, in part, to an increase in population pressure and also to certain technological advances.
2. Alzheimer's disease is a disorder of the brain causing a progressive decline in intellectual and physical abilities.
3. Actin intimately takes part in linking the plasma membrane to the underlying cytoplasm.
4. Actin is also present in non-muscle cells, where it forms less highly ordered arrays of filaments that have control over certain types of cellular movement.

IV. Are the following statements about the text "Cell Structure" true or false?

1. The plasma membrane does not allow all substances to enter and leave a cell.
2. Chromoplasts can be found in all eukaryotic cells.
3. Turgor is the normal state of tension in a living cell.
4. The contents of lysosomes could be harmful for the rest of the cell.
5. Scientists distinguish three basic types of endoplasmic reticulum.
6. The main function of the SER is synthesis of proteins to be used outside the cell.
7. The DNA molecule resembles a spiral by its shape.
8. Mitochondria provide cells with energy.
9. Leucoplasts are responsible for giving plants their peculiar colouring.
10. Free ribosomes can be found outside cells in multicellular organisms.

V. Continue the sentences below

1. Organelles can be described as special compartments …
2. The cell membrane performs such functions …
3. Lysosomes are responsible …
4. The difference between SER and RER …
5. Most of the proteins …
6. The messenger RNA molecules …

7. Cells that need much energy …
8. Actin filaments, microtubules and …

VI. Look for the equivalents of the following words in the text "Cell Structure"

Визначати межі, обмежувати; відбруньковування; розділяти, відокремлювати; розкладати, руйнувати; ділянка, місце; спіраль; зберігати; скручений, деформований; послідовний, гармонійний, злагоджений.

VII. Translate the sentences below using the English equivalents of the words from the previous exercise

1. Ґрунт у цій місцевості значно зруйнований ерозією.
2. Ці ліки необхідно зберігати в прохолодному місці.
3. Його обличчя було викривлене гримасою люті.
4. Кожна спіраль у молекулі ДНК має кістяк, який складається з довгої послідовності змінних цукрів і фосфатів.
5. Темношкірі діти колись були відокремлені від білих у школах.
6. Визначивши межі тематики вашого дослідження, ви тепер повинні обрати власну дослідницьку стратегію.
7. Аристотель розрізняв такі види розмноження живих організмів як відбруньковування (нестатеве розмноження), статеве розмноження, яке не включає спарювання (copulation) і статеве розмноження, яке включає спарювання.
8. Журналістів не пускали на місце авіакатастрофи.
9. Він був такий збентежений, що не міг дати зв'язної відповіді.

GRAMMAR IN USE: *Tense Forms*

I. What tense forms are the verbs in italics in the following sentences? Comment on the tense form usage in these sentences

1. Membrane-bound organelles *occur* only in eukaryotic cells.
2. Russian scientist and academecian A.I. Oparin, in 1922, *hypothesized* that cellular life was preceeded by a period of chemical evolution.
3. In this class we *will use* light microscopes for our laboratory observations.
4. Many Americans *are turning* now to herbal remedies to ease arthritis pain, improve memory, as well as improve our moods.
5. The students *were working* in the laboratory the whole morning yesterday.
6. The nurse *will be giving* medicine to the patients at 11 am tomorrow.
7. A lot is known about living things today. For example, anatomists and taxonomists *have studied* the forms and relations of more than a million separate species of plants and animals.
8. The nurse *had taken* the patients' temperature before the doctor made the morning round.
9. Next month they *will have already been working* for a year on the problem of side effects of the new vaccine.

II. Put the verbs in brackets into the correct tense form

1. In the past few decades, many developments in physiology and embryology (result) from studies in cell biology, biophysics, and biochemistry.
2. A good science experiment simultaneously (not test) several variables.
3. In 1838 Mattias Schleiden (conclude) all plant tissues consisted of cells.
4. Probably the greatest biological problem of the future, (be) to find ways to curb environmental pollution without interfering with man's constant effort to improve the quality of his life.

5. The compound light microscope, shown in Figure 8, (use) two ground glass lenses to form the image.
6. The nurse (prepared) the instruments for the operation by the time the doctor came.
7. I hope next year she (enter) the Medical University.
8. The changes that (take) place since the origin of the cell are also thought to have occurred as a result of natural selection.

LISTENING COMPREHENSION

I. You will hear a text about cells' movement. Before listening discuss the words and expressions in the box with your fellow students and teacher

glide	flagellum (flagella)	to search for food
thrash	cilium (cilia)	dense, hairy appearance
whip	to propel oneself	a current of mucus
fertilization	to swallow	temporary pseudopodium
oar	respiratory tract	to pursue and devour prey
to extrude	inhaled dust	to roam the bloodstream
to anchor	basal body	to stalk and engulf a bacterium or virus

II. Listen to the text and answer the questions below

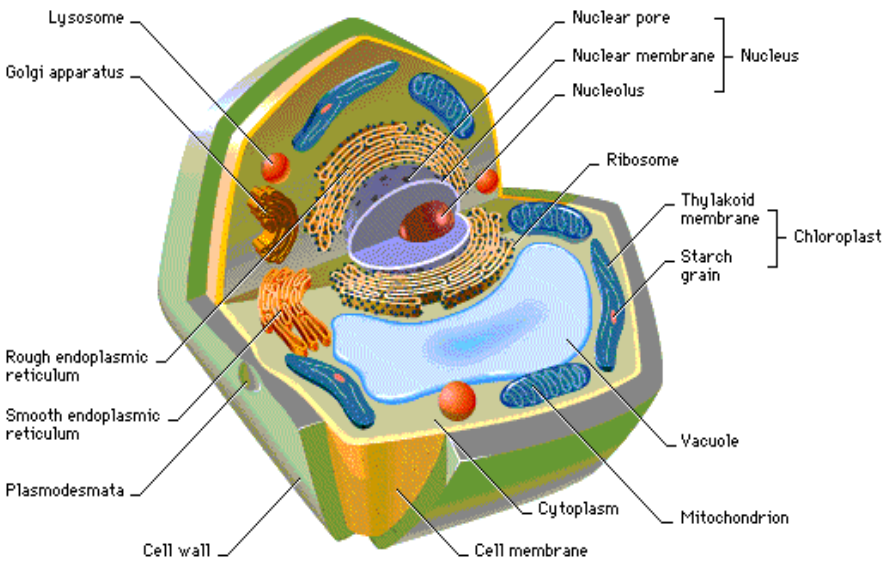
1. Why do cells have to move?
2. What adaptation do they use for this purpose?
3. What is the difference between prokaryotic and eukaryotic flagella?
4. What eukaryotic cells use flagella as a means of motion?
5. Give an example of an organism that cilia for motion?
6. What functions do cilia perform in cells which do not move?
7. What are basal bodies?
8. Describe the principle of amoeboid motion?
9. Which types of motion in cells are faster and which are slower?
10. In what conditions is amoeboid motion most effective?

III. Read the following passage and try to complete it with the appropriate words. Then listen to the recording and check yourself

An animal cell typically contains several types of _____-bound organs, or _____. The _____ directs activities of the cell and carries _____ information from generation to _____. The _____ generate energy for the cell. Proteins are manufactured by _____, which are bound to the _____ or float free in the _____. The _____ modifies, packages, and distributes proteins while _____ store enzymes for digesting food. The entire _____ is wrapped in a lipid membrane that selectively permits _____ to pass in and out of the cytoplasm.

SPEAKING

Look at the typical photosynthetic plant cell below. Speak about the structure and functions of the depicted organelles and other cellular components



Lesson 4

CELL DIVISION

PRE-READING TASKS

I. Answer the following questions

- What is reproduction?
- Do cells reproduce? How?
- Can you explain the meaning of the terms ‘mitosis’ and ‘meiosis’? What is the difference between them?

II. Listen to the following words and practice their pronunciation

Diversity, mitosis, meiosis, interphase, prophase, telophase, anaphase, metaphase, karyokinesis, cytokinesis, inheritance, tetrard, centriole, centromere, chromatin, chromatide, fertilization, zygote.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) attribute, n	a) to fasten or connect one object to another;
2) intricate, adj	b) a quality or feature, especially one that is considered to be good or useful;
3) vital, adj	
4) coil, v	c) a wide deep line made in the surface of something;
5) attach, v	d) to not do something that is usually done, to miss;
6) wrap, v	e) to wind or twist into a series of rings;
7) furrow, n	f) to cover especially by winding or folding;
8) consecutive, adj	g) following one after the other without any interruptions;
9) skip, v	h) containing many small parts or details that all work or fit together;
	i) extremely important and necessary for something to succeed or exist.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

Reproduction is one of the main attributes of living organisms and their constituent cells. There is an intricate mechanism by which the genetic material in the ***nucleus*** is first copied and then partitioned so that each of the two ***daughter nuclei*** gets one complete copy of the genetic information. This mechanism is called ***mitosis*** in eukaryotes. The diversity of organisms is possible partly due to another mechanism for nuclear division, referred to as ***meiosis***. Meiosis produces four daughter nuclei, each with only half the genetic information contained in the original cell, and each differing from the others with respect to the exact information contained.

Mitosis is vital for growth; for repair and replacement of damaged or worn out cells; and for ***asexual reproduction.*** The life cycle of eukaryotic cells is a continuous process typically divided into the following phases: ***interphase*** and ***mitosis,*** which includes ***karyokinesis*** and ***cytokinesis.*** Interphase includes three stages, referred to as G1, S and G2. In G1, a newly formed cell synthesizes materials needed for cell growth. In the S stage, deoxyribonucleic acid (DNA) is replicated. At this stage, DNA consists of long, thin strands called ***chromatin***. When the S stage is complete, the cell enters a brief stage known as G2, when specialized enzymes correct any errors in the newly synthesized DNA, and proteins involved with the next phase, mitosis, are synthesized.

Karyokinesis occurs in four steps. In ***prophase*** the replicated, linked DNA strands slowly wrap around proteins that in turn coil and condense into two short, thick, rodlike structures called ***chromatids***, attached by the ***centromere***. Two structures called ***centrioles***, both located on one side of the nucleus, separate and move toward opposite poles of the cell. As the centrioles move apart, they begin to radiate thin, hollow, proteins called ***microtubules***. The microtubules arrange themselves in the shape of a spindle. As the spindle forms, the nuclear membrane

breaks down into tiny sacs or vesicles that are dispersed in the cytoplasm. Final disintegration of the membrane marks the beginning of metaphase.

In ***metaphase***, the spindle fibers attach to the chromatids near the centromeres, and tug and push the chromatids so that they line up in the equatorial plane of the cell halfway between the poles. One chromatid faces one pole of the cell, and its linked partner faces the opposite pole. ***Anaphase*** begins when the centromeres split, separating the identical chromatids into single ***chromosomes***, which then move along the spindle fibers to opposite poles of the cell. As these two identical groups of single chromosomes gather at opposite poles of the cell, ***telophase*** begins. A new nuclear membrane forms around each new group of chromosomes. The spindle fibers break down and the newly formed chromosomes begin to unwind. If viewed under a light microscope, the chromosomes appear to fade away. They exist, however, in the form of chromatin, the extended, thin strands of DNA too fine to be seen except with electron microscopes. Mitosis accomplishes replication and division of the nucleus, but the cell has yet to divide.

The final phase of the cell cycle is known as cytokinesis. It can begin in anaphase and finish in telophase; or it can follow telophase. In cytokinesis, the cell's cytoplasm separates in half, with each half containing one nucleus. Animals and plants accomplish cytokinesis in slightly different ways. In animals, the cell membrane pinches in, creating a cleavage furrow, until the mother cell is pinched in half. In plants, cellulose and other materials that make up the cell wall are transported to the midline of the cell and a new cell wall is constructed. The new cells enter interphase, and the cell cycle begins again.

Meiosis is a process of cell division in which the cell's genetic information, contained in chromosomes, is recombined and divided into ***sex cells*** with half the normal number of chromosomes, known as the ***haploid number***. The random sorting of chromosomes during meiosis assures that each new sex cell, and therefore each new offspring, has a unique genetic inheritance. Meiosis involves

two consecutive cell divisions instead of one and the genetic material contained in chromosomes is not copied during the second meiotic division.

To illustrate the steps of meiosis, consider a corn plant cell with 10 pairs of chromosomes, so the ***diploid number*** of chromosomes is 20. In order for the diploid corn cell to reproduce, it must undergo meiosis to produce cells with half the normal number of chromosomes. Each haploid corn cell contains only 10 chromosomes.

Each of the two consecutive cell divisions consists of four stages: prophase, metaphase, anaphase, and telophase. In prophase I each long DNA strand forms a chromosome. Since the DNA was copied during interphase, each chromosome condenses to form two identical chromatids, joined at a centromere. A corn cell has 20 chromosomes at this stage, each with two identical chromatids, making a total of 40 chromatids.

Chromosomes exist in two pairs. These pairs of chromatids gather together in groups of four called ***tetrads***. Each corn cell contains 10 tetrads. While grouped together in tetrads, sections of the chromatids from different chromosomes exchange, or ***cross over***. Called genetic recombination, this process is the first of two ways that meiosis mixes genetic information during ***sexual reproduction***. Also in prophase I, two structures called centrioles separate and move toward opposite sides of the cell and the membrane around the nucleus of the cell breaks down. During metaphase I, the spindle fibers move the tetrads so that they line up in a plane halfway between two centrioles. Anaphase I begins when the spindle fibers pull the tetrads apart, pulling the chromosomes from each pair toward opposite sides of the cell. The first meiotic division concludes with telophase I, when the two new groups of chromosomes reach opposite sides of the cell. A nuclear membrane may form around the two new groups of chromosomes and a division of cell cytoplasm forms two new daughter cells.

Each daughter corn cell receives 10 chromosomes made up of a random mixture of maternal and paternal chromosomes. This second mixing of genetic

information is called ***independent assortment***. Genetic recombination and independent assortment make it possible for parents to have many offspring who are all different from each other.

In the second meiotic division the cell moves directly into prophase II, skipping the interphase replication of DNA. Each corn cell begins the second division with 10 chromosomes. Once again the centrioles radiate spindle fibers as they move to opposite sides of the cell. During metaphase II, the chromosomes line up along the plane in the center of the cell, and in anaphase II the pairs of chromatids are pulled apart, each moving toward opposite ends of the cell. Telophase II completes meiosis.

The original diploid corn cell with 20 chromosomes has undergone meiosis to form four haploid daughter cells, each containing 10 chromatids. It is now possible for two haploid sex cells to join during ***fertilization*** to form one egg cell with the normal diploid number of chromatids. After fusion and DNA replication, two haploid corn cells will yield one diploid ***zygote*** with 10 pairs of chromosomes.

III. USEFUL PHRASES. Study the following phrases and use them in the sentences of your own

due to – завдяки, через
referred to as – що називається як
instead of - замість
make it possible (for someone/something) to do something – уможливлювати щось

IV. Answer the following questions about the text "Cell Division"

1. What reproductive mechanism in cells provides for the diversity of the offspring?
2. How many stages does mitosis include?
3. What is interphase characterized by?

4. How many steps of karyokinesis are distinguished?
5. At what stage of mitosis does the nuclear membrane disintegrate?
6. What happens in a cell during telophase?
7. What is cytokinesis?
8. What cells use meiotic pattern of reproduction and why?
9. How do you understand the phrase "the chromatides from different chromosomes cross over"?
10. What are haploid and diploid cells?

V. Look for the words with the following meanings in the text "Cell Division"

1. To divide a country, building, or room into two or more parts;
2. To make denser or more compact;
3. Either extremity of an axis of a sphere and especially of the earth's axis;
4. To pull hard;
5. To sink away; vanish;
6. Lacking a definite plan, purpose, or pattern;
7. A flat or level surface;
8. To bring to an end especially in a particular way or with a particular action;
9. To send out in or as if in rays; to spread around from a centre.

VI. Make up your own sentences using the words from exercise V

VII. Find the following words in the text "Cell Division" and explain their meanings. Then select the synonyms of these words from the list below. Explain the difference between the synonyms using a dictionary

1) condense, _____, _____, _____;
2) disperse, _____, _____, _____;
3) fine, _____, _____, _____;
4) hollow, _____, _____, _____;
5) split, _____, _____, _____.

Break, abridge, empty, slender, compress, spread, vacant, crack, diffuse, little, void, separate, minute, contract, scatter.

VIII. Fill in the spaces in the sentences below with the words from exercise VII

1. During cold nights, air _____ on the grass to form dew.
2. I hate coming home to an _____ house late at night.
3. The _____ edition of the encyclopaedia is widely used in smaller general libraries, specifically school libraries and small public libraries.
4. Her eyes were _____ of all expression.
5. Mandy was tall, _____ and very fair with long golden hair.
6. At this point the satellite _____ from its launcher.
7. The walls are made of _____ concrete blocks.
8. Rutherford first _____ the atom on 3rd January 1919.
9. When the muscle is triggered by nerve stimuli, the calcium ions are released, making the muscle _____.
10. Serum is placed into a circular-well area and allowed to _____ into the agar forming antigen antibody complexes.
11. Scuba divers used cylinders of _____ air.
12. Cholera is _____ through the refugee camps at an alarming rate.
13. Scientists are now able to measure _____ distinctions between levels of sleep depth.
14. She fell downstairs and _____ her leg.
15. Only _____ amounts of the chemical were found in the water supply.
16. Do not put boiling water in the glass or it will _____.
17. If you're looking for somewhere to rent, I think there's a _____ apartment in my building.

GRAMMAR IN USE: *Passive Voice*

I. Turn the following sentences into Passive Voice

1. William Harvey established the true mechanism of blood circulation.
2. Botanist Carolus Linnaeus established taxonomy as a discipline.
3. Charles Darvin developed the theory of evolution by natural selection.
4. The Austrian monk Gregor Mendel first formulated the concept of particulate heredity factors.
5. Scientists employ the metric system to measure the size and volume of specimens.
6. In this first unit we will examine the nature of science.
7. In 1953, American scientist James Watson and British scientist Francis Crick developed the model for deoxyribonucleic acid (DNA).
8. Since that time scientists have successfully applied the evolutionary explanation to newly discovered creatures.
9. A team of American scientists is carrying out a research into the effects of exhaust gases.
10. The doctor postponed the operation yesterday due to the patient's bad condition.

II. Turn the following sentences into Active Voice making any necessary changes

1. The theory of evolution is well accepted by scientists and most of the general public.
2. This heat is removed from our bodies by sweating.
3. The word "cell" was introduced by the English scientist Robert Hooke.
4. Embriology was founded by Karl Ernst von Baer.
5. Living things are found virtually everywhere.

6. The Allende Meteorite (and others of its sort) have been analyzed and found to contain amino acids, the building blocks of proteins.
7. A lecture on the structure of the muscles was delivered by the professor on Monday.
8. The operation will be performed tomorrow morning.
9. The doctor will be examining the patients from 9 till 12.
10. The new methods had been included into investigation by that time.

LISTENING COMPREHENSION

I. You will hear a text about an uncontrolled cells proliferation resulting in tumours. Before listening discuss the words and expressions in the box with your fellow students and teacher

apoptosis	cell cycle clock	to evaluate the health of the cell
telomere	tumour suppressor gene	to proceed with cell division
telomerase	runaway cell division	to render the cells immortal
unsightly	benign/ malignant tumour	"silent" genes
metastasis	odds for a full recovery	oncogenic virus
bloodstream	lymphatic system	to reduce the risk dramatically
carcinogen		

II. Listen to the text and answer the questions below

1. What is the cell cycle clock?
2. What happens if a cell's condition is not right?
3. What is gene p53 responsible for?
4. Is apoptosis "good" or "bad" for living beings?
5. How many times does a single cell normally divide?
6. What is the difference between telomeres and telomerase?
7. What types of tumours can you name?
8. Do surgeons always remove benign tumours?

9. How do cancer cells metastasize?
10. Do all people have equal chances to develop a tumour?
11. What lifestyle should one adopt to reduce the risk of cancer?

III. Listen to the following passage and fill in the missing information into the text below

For reasons not well understood, cancer rates vary by gender, _____, and geographic region. For instance, more _____ have cancer than _____, and African Americans are more likely to develop cancer than persons of any other racial and _____ group in North America. Cancer rates also vary globally — residents of the United States, for example, are nearly _____ more likely to develop cancer than are residents of _____. The highest death rate from all cancers in males is _____ per 100,000 men in Hungary while the lowest death rate of _____ men per 100,000 is found in Mauritius, an island off the coast of eastern Africa. For women the highest cancer rate is _____ per 100,000 women in _____ compared to only 63 per 100,000 women in _____. The figures for the United States are _____ per 100,000 _____ and _____ per 100,000 _____. For particular cancers, the difference between countries may be as high as _____. Differences also occur within populations.

Scientists called epidemiologists study particular populations to identify why cancer rates vary. One method they use is to compare _____ and characteristics such as the _____, age, _____, or race of cancer patients to those of healthy people. Population studies provide useful information about _____ that increase the _____ of developing cancer.

WRITING AND SPEAKING

Write a summary of the text "Cell Division" in 200 words using the vocabulary of Lesson 4. Get ready to present it in class

Unit 2 Focus Words and Phrases

accomplish, v (1)
achieve, v (2)
arise, v (2)
attach, v (4)
attribute, n (4)
backbone, n (1)
budding, n (3)
coherent, adj (3)
coil, v (4)
coin, v (1)
combine, v (1)
compartment, n (3)
compound, n (1)
conclude, v (4)
condense, v (4)
consecutive, adj (4)
consist of (1)
constitute, v (1)
contain, v (1)
contorted, adj (3)
contraction, n (1)
convert, v (2)
degrade, v (3)
delimit, v (3)
diet, n (1)
digest, v (3)
disperse, v (4)
distinct, adj (2)
distinctive, adj (2)
distinguish, v (1)
enclose, v (2)
enormous, adj (1)
entire, adj (2)
ether, n (1)
exhibit, v (2)
extend, v (2)
fibre, n (1)
fine, adj (4)
framework, n (3)
furrow, n (4)
fuse, v (3)
fusion, n (2)
globule, n (1)
helical, adj (1)
helix, n (3)
hollow, adj (4)
minute, adj (2)
nutrient, n (3)
obtain, v (2)
impart, v (3)
include, v (1)
induce, v (2)
intact, adj (2)
interfere, v (2)
intricate, adj (4)
maturation, n (3)
particular, adj (1)
partition, n (4)
permease, n (3)
plane, n (4)
pole, n (4)
precise, adj (2)
predominant, adj (1)
preexisting, adj (2)
projection, n (2)
radiate, v (4)
raise, v (2)
random, adj (4)
recognize, v (1)
regard, v (2)
regenerate, v (2)
reinforce, v (3)
remainder, n (2)
rigidity, n (3)
rise, v (2)
segregate, v (3)
sequence, n (1)
sequester, n (3)
site, n (3)
skip, v (4)
solvent, n (1)
split, v (4)
store, v (3)
strand, n (1)
successive, adj (2)
trigger, v (1)
tug, n (4)
vesicle, n (3)
vital, adj (4)
volume, n (2)
wrap, v (4)
yield, v (1)

as well as (3)
be composed of (1)
be involved in something (3)
be responsible for (3)
both…and… (1)
depend (up)on (2)
due to (4)
fade away (4)
in order to (do something) (2)
in spite of something (= despite sth) (2)
instead of (4)
interfere with (2)
make it possible (for someone/something) to do something (4)
make up (1)
play a role (in) (1)
range from…to… (1)
referred to as… (4)
result in (3)
rich in (1)

REVISION AND ADDITIONAL PRACTICE 2

Revision Exercises

I. Translate the following sentences into English

1. Після відкриття у 1953 році структури ДНК, здійсненого американським біохіміком Джеймсом Д. Ватсоном та британським біофізиком Френсісом Кріком, дослідження генів та білків на молекулярному рівні стало однією з найважливіших та швидко прогресуючих галузей сучасної науки.
2. Вченим вдалося синтезувати деякі органічні молекули у лабораторних умовах, але штучно поєднати їх у живу клітину досі не зумів ніхто.
3. Усі клітини — як прокаріотичні так і евкаріотичні — оточені плазматичною мембраною, яка визначає межі клітини і відокремлює її вміст від зовнішнього середовища.
4. Хоча прокаріотичні клітини зазвичай простіші за будовою та менші за розмірами за евкаріотичні, клітини обидвох типів мають багато спільного, особливо це стосується біохімічних процесів, які відбуваються у них.
5. Завдяки своїй молекулярній структурі, плазматична мембрана клітини є вражаюче гнучкою та еластичною, але водночас залишається потужним бар’ єром, який пропускає одні речовини, але блокує проникнення інших.
6. Білки переважають серед компонентів клітини; білкові молекули відзначаються великою різноманітністю форм, і здійснюють багато різних функцій.
7. Ретельні дослідження різних типів клітин показали, що усі плазматичні мембрани складаються із білків та ліпідів.
8. На відміну від крихітних прокаріотичних клітин, відносно великі евкаріотичні клітини потребують окремих структур. Цитоскелет є такою динамічною структурою, утвореною із білкових трубочок та волокон, яка пронизує цитоплазму, фіксує положення органели і надає форми клітині.

9. Клітинна стінка виконує важливі структурні та фізіологічні функції у рослинній клітині, зокрема бере участь у процесах транспорту, абсорбції та секреції.
10. Багато поширених одноклітинних організмів, таких як інфузорії та амеби, так само як і клітини усіх вищих організмів, і людини в тому числі, є евкаріотичними.
11. Поділ клітин вкрай важливий для існування багатоклітинних організмів. Завдяки йому останні розмножуються, ростуть, відновлюються та заміщують пошкоджені або відпрацьовані клітини.
12. Ендосимбіотична теорія ще не дає відповідей на усі запитання, пов'язаних з виникненням евкаріотичних клітин, і тому на даний час ще незавершена.
13. Щоб жити, клітини здійснюють цілу низку різноманітних функцій: зокрема вони рухаються, діляться, споживають їжу, перетворюють енергію, будують білки, виділяють відходи, а також реагують на зміни у зовнішньому середовищі.
14. Молекулярним біологам вдалося відкрили саме ті молекули, які відповідають за репродукцію та передачу спадкової інформації від одного покоління до іншого.
15. Білки дуже важливі компоненти клітини. Вони можуть бути структурними елементами окремих частин клітини, наприклад плазматичної мембрани та рибосом. У формі ферментів білки необхідні для здійснення контролю над більшістю біохімічних реакцій, які відбуваються всередині клітини. У багатоклітинних тваринних організмах білки також відіграють роль гормонів та антитіл.

II. Choose the appropriate word to complete each of the following sentences

1. The gaseous metal is put in a closed container and cooled so that it _____ into liquid.

   a) compresses b) condenses c) contracts d) concentrates

2. He _____ the company in half, and then sold both new companies to different buyers.
   a) cracked b) broke c) separated d) split
3. A black widow spider has a _____ red marking on its stomach.
   a) distinct b) typical c) exotic d) distinctive
4. Fire quickly _____ through the building.
   a) dispersed b) diffused c) spread d) expanded
5. Microtubules are long filaments formed from 13 strands of a globular subunit called tubulin, with the strands arranged in the form of a _____ cylinder.
   a) empty b) hollow c) void d) vacant
6. As solvent _____ through the membrane, the increase in volume causes the diaphragm to move.
   a) permeases b) diffuses c) scatters d) dilutes
7. Behind the factory is a machine that _____ old cars into blocks of scrap metal.
   a) wraps b) abridges c) coils d) compresses
8. Seventeenth-century advances in biology _____ the establishment of scientific societies for the dissemination of ideas and progress in the development of the microscope.
   a) made up b) included c) contained d) composed
9. The clouds _____ as quickly as they had gathered.
   a) diffused b) dissolved c) dispersed d) spread
10. Stan's dad died, leaving his mother to _____ three sons alone.
    a) breed b) raise c) rise d) bring out
11. He explained the plan in _____ detail.
    a) small b) fine c) minute d) microscopic
12. The bell _____ after many years of use.
    a) cracked b) split c) broke d) divided

13. The problems were caused by changing climate and _____ sea levels.
    a) rising b) raising c) raised d) risen
14. In Lake Erie, water snakes form _____ populations — snakes that live on the rock islands in the lake, and others that live in the vegetation close to the shore.
    a) distinguished b) distinctive c) distinct d) diverse
15. In winter, parts of Northern Canada can only be _____ by plane.
    a) reached b) obtained c) achieved d) received
16. Because life comes only from preexisting life, it is only through reproduction that _____ generations can carry on the properties of a species.
    a) successful b) successive c) subsequent d) following
17. Aristotle believed that the _____ living world could be described as a unified organization rather than as a collection of diverse groups.
    a) complete b) every c) full d) entire
18. The book is an _____ account of his experiences in India before Independence.
    a) abridged b) contorted c) compressed d) compact
19. In spite of the classical basis, a significant amount of Albertus Magnus's works _____ new observations and facts; for example, he described with great accuracy the leaf anatomy and venation of the plants he studied.
    a) included b) consisted of c) constituted d) contained
20. Carbon from atmospheric carbon dioxide is incorporated by plants and _____ into carbohydrates through the process of photosynthesis.
    a) converted b) modified c) changed d) altered

Additional Practice

I. Read the passage below and fill in the blanks with the words from the box

invention (2)	observations	microscope	tissue

scientist	boxes	pond water	comprehend
pioneered	grasped	including	to observe
bacteria	occupied		

The first (1)……. of cells were made in 1665 by English (2)……. Robert Hooke, who used a crude (3)……. of his own (4)……. to examine a variety of objects, (5)……. a thin piece of cork. Noting the rows of tiny (6)……. that made up the dead wood's (7)……., Hooke coined the term *cell* because the boxes reminded him of the small cells (8)……. by monks in a monastery. While Hooke was the first to observe and describe cells, he did not (9)……. their significance. At about the same time, the Dutch maker of microscopes Antoni van Leeuwenhoek (10)……. the invention of one of the best microscopes of the time. Using his, (11)……. Leeuwenhoek was the first (12)……., draw, and describe a variety of living organisms, including gliding (13)……. in saliva, one-celled organisms cavorting in (14)……., and sperm swimming in semen. Two centuries passed, however, before scientists (15)……. the true importance of cells.

II. Reconstruct the text below putting the extracted fragments (a-h) into their correct places (1-8). Make a written translation of the text into Ukrainian

A typical cell must have on hand about 30,000 proteins at any one time. Many of these proteins are enzymes (1)……. Other proteins are part of the cell's structure — the plasma membrane and ribosomes, for example. In animals, proteins also function (2)……. . Hemoglobin, for example, is a protein that transports oxygen in red blood cells. The cell's demand for proteins never ceases.

Before a protein can be made, however, the molecular directions (3)……. In humans, for example, one gene holds the information for the protein insulin, the hormone that (4)……. . The process of building proteins begins when enzymes, in response to a signal from the cell, bind to the gene that carries the code for the

required protein, or part of the protein. The enzymes transfer the code to a new molecule (5)……. . This enables the original genetic code to remain safe in the nucleus, with messenger RNA delivering small bits and pieces of information from the DNA to the cytoplasm as needed. Depending on the cell type, hundreds (6)……. .

Once in the cytoplasm, the messenger RNA molecule links up with a ribosome. The ribosome moves along the messenger RNA like (7)……. . The protein is modified as necessary by the endoplasmic reticulum and Golgi apparatus before embarking on its mission. Cells teem with activity as they (8)……. .

a) … or even thousands of molecules of messenger RNA are produced each minute.
b) … to build it must be extracted from one or more genes.
c) … forge the numerous, diverse proteins that are indispensable for life.
d) … as hormones and antibodies, and they function like delivery trucks to transport other molecules around the body.
e) … called messenger RNA, which carries the code from the nucleus to the cytoplasm.
f) … cells need to import glucose from the bloodstream, while at least two genes hold the information for collagen, the protein that imparts strength to skin, tendons, and ligaments.
g) … needed to construct the major molecules used by cells — carbohydrates, lipids, proteins, and nucleic acids — or to aid in the breakdown of such molecules after they have worn out.
h) … a monorail car along a track, stimulating another form of RNA — transfer RNA — to gather and link the necessary amino acids, pooled in the cytoplasm, to form the specific protein, or section of protein.

III. Read the following extracts about stem cells. Answer the questions in the Discussion section

Stem cells are truly remarkable. They bridge the gulf between the fertilized egg that is our origin and the architecture that we become. They supply the cells that construct our adult bodies and, as we age, replenish worn out, damaged and diseased tissues. They renew themselves, resisting the powerful pull towards differentiation that overcomes more prosaic cells. And depending on the source, they have the potential to form one, many or all cell types of an organism.

Stem cell research has a history of more than 20 years, and has made some outstanding contributions to our understanding of haematopoiesis and mouse embryology. But the field has been transformed in the past few years by successes achieved in culturing human embryonic stem cells, the building blocks for every tissue we comprise, and in manipulating their differentiation *in vitro*. Below you can see three articles describing the achievements in the researches connected with the use of stem cells in treating a variety of human diseases and warning us against potential risks the method may involve.

MINIATURE HUMAN LIVER DEVELOPED FROM STEM CELLS

A team of scientists in a British University have been able to create a small size version of the human liver in a major breakthrough. Though it's a far cry from being useful for a transplant it's a giant leap for the treatment of liver ailments.

The mini liver is the size of a penny coin and was created from the blood in umbilical cords of newborn babies. This was then placed in a NASA bio-reactor. This bio-reactor recreates the atmosphere of weightlessness. In the absence of gravity the cells replicated faster. Then chemicals and hormones were added to the stem cells to cause it to become liver tissue.

The mini liver, thus formed, can be used for testing of drugs used in liver diseases. The current method of testing involves first testing on human cells, then on animals and then used on humans. The scientists, who created the stem cell

liver, claim that the pharmaceutical companies can now test on this artificial liver. Both animal and human testing would be unnecessary. They also point out to the recent incident where 6 people on whom tests were being done developed near fatal reactions. Similar incidents could be avoided in the future. The artificial liver can also be used as a dialysis machine to keep the patient's liver going till it heals itself or till a donor liver is available.

This development is significant as the options for the treatment of liver ailments are limited. Adding to that is the fact that nearly 10 percent of the population of Britain suffers from liver ailments, the cause of which is considered to be alcohol consumption and unhealthy lifestyles.

Some sections of the medical profession felt that this achievement was significant from the point of view that it does not use embryos for stem cell growth. On the other hand critics of this method say that since this has not been published it might not be dependable.

(From The Earth Times, 31 October, 2006)

ONE-OFF TREATMENT TO STOP BACK PAIN — USING PATIENTS' OWN STEM CELLS

A University of Manchester researcher has developed a treatment for lower back pain using the patient’s own stem cells. Dr Stephen Richardson, of the University’s Division of Regenerative Medicine in the School of Medicine (FMHS), has developed the treatment; and in collaboration with German biotechnology company Arthrokinetics and internationally-renowned spinal surgeons Spinal Foundation are hoping to enter pre-clinical trials next year. It is expected to rapidly yield a marketable product which will revolutionise treatment of long-term low back pain.

Low back pain (LBP) affects a large proportion of the adult population at some point in their lives and in many of these cases it is persistent, eventually leading to debilitating pain. The majority of the cases of LBP are due to

degeneration of the intervertebral disc (IVD), the soft tissue which separates the vertebrae in the spine and protects them from damage; it is the flexibility of this tissue that allows movement of the spine (bending, twisting etc). The IVD is comprised of a central gel-like tissue (nucleus pulposus or NP), surrounded by a fibrous ring of tissue (annulus fibrosus or AF). Over time the NP becomes dry and fibrous and cannot support the weight of the body, which means the disc becomes damaged and painful and this is the source of the LBP in many people.

Currently, treatments address the symptoms — mainly pain — using a combination of painkillers, physiotherapy or surgery, removing tissue to relieve the pain or fusing the vertebrae above and below the painful disc level together to remove the pain, although this also stops movement at that disc level. None of these options is ideal as they only treat the symptoms, not the cause, and are of limited long-term success.

The treatment Dr Richardson is developing uses a cell-based tissue engineering approach to regenerate the IVD at the affected level. This is achieved through the combination of the patients' own mesenchymal stem cells (MSCs) and a naturally occurring collagen gel that can be implanted through a minimally-invasive surgical technique. MSCs are a population of progenitor cells found in the bone marrow of adults which can differentiate into many different cell types in the body, including bone, cartilage, fat and muscle cells. Dr Richardson found that for several reasons he could not use cells from the IVD itself and thus spent a number of years developing a method of producing NP cells from MSCs. He, together with colleagues, now has an international patent on this method.

Dr Richardson explained: "Once we have extracted the bone marrow from the patient and have purified the MSCs, they will be grown in culture and our patented method of differentiation will be applied. They will then be embedded within a gel which can be implanted back into the patient through an arthroscope.

The treatment has massive implications for the future of LBP treatment — with substantial cost savings as patients could be treated quickly and effectively

without any need for extended hospitalisation. In addition, as both the cause and the symptoms are treated, only one treatment should be needed in a lifetime and there would be no need for continuous treatments with painkillers and physiotherapy.

(From Innovations Report, 30 November, 2006)

CANCER WARNING OVER STEM CELLS

Stem cells could prove a double-edged sword in the treatment of diseases like leukaemia. Donna Forrest of the British Columbia Cancer Agency in Canada and her colleagues found that patients who had received bone-marrow transplants containing haemopoietic stem cells faced a 2.3 per cent risk of developing a secondary cancer, such as skin, lung, or breast cancer, over the course of 10 years — nearly twice the risk of the general population.

Given that bone-marrow transplants are known to increase leukaemia patients' chance of survival, it is possible that the drugs given following the procedure — rather than the transplanted stem cells themselves — were responsible for putting patients at greater risk of developing secondary tumours.

However, Forrest warns, more studies are necessary to find out whether such treatments might influence cancer risk, especially as stem-cell transplants may eventually be developed to treat patients with conditions such as spinal-cord injury and heart failure.

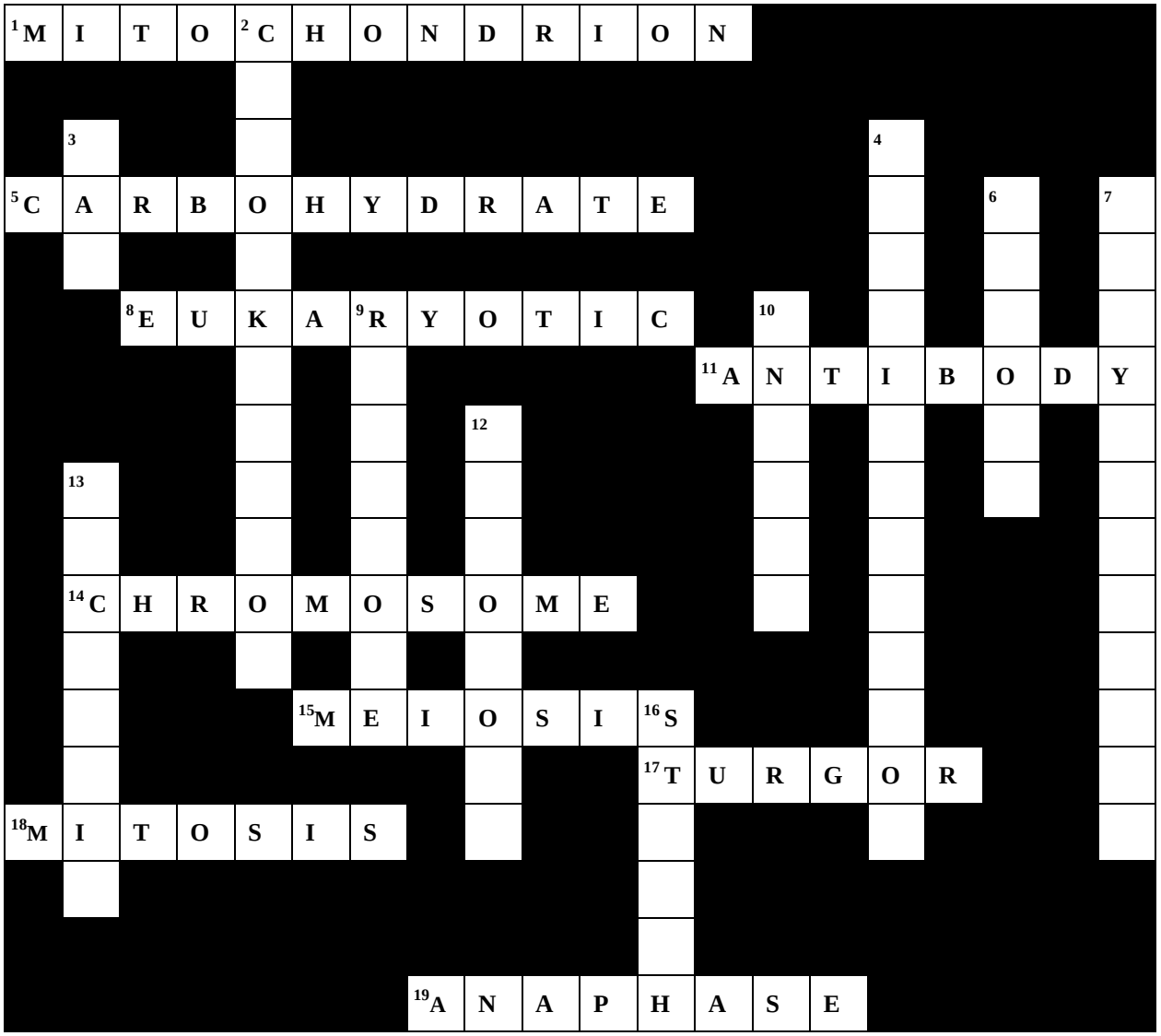
(From issue 2580 of the New Scientist magazine, 02 December 2006)

Discussion

1. What are stem cells?
2. What clinical uses of stem cells do you know about?
3. What are the advantages of stem cell therapy over the traditional methods of treating human diseases?
4. What potential dangers, risks and side effects can the use of stem cell therapy involve?

IV. Solve the crossword puzzle. Work in pairs. Student A make the clues to the given answers for your partner to guess. Student B go to page 279

Student A



V. Using additional sources of information prepare a report on one of the following topics and present it to the class

- **Recent investigations into the structure and functions of separate cellular components.**
- **The potential of the stem cell therapy.**
- **Cooperation and differentiation of cells in a multicellular organism.**

Unit 3

Lesson 1

THE PROTISTA

PRE-READING TASKS

I. Answer the following questions

- How many kingdoms of life do you know? Name them.
- What criteria are considered for classifying and grouping living organisms?
- Have any changes been introduced into taxonomy and systematics with the invention of new methods of observation and investigation?

II. Listen to the following words and practice their pronunciation

Primordial, dichotomy, flagellum, coenocytic plasmodium, phagotroph, osmotroph, parasite, mixotroph, symbiont, saprophyte, phylum, genus, genera, class, species.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) constrain, v	a) to take in (food) by or as if by flowing over and enclosing;
2) aquatic, adj	
3) intermediate, adj	b) without taking into account;
4) ingestion, n	c) the act of taking in food or other substances into one's body;
5) reject, v	
6) regardless, adv	d) destroying something or proving that an idea or opinion is completely wrong;
7) engulf, v	
8) prey, n	e) a living organism taken by another organism (predator) as food;
9) demolition, n	

f) to secure by or as if by bonds; to confine or limit;
g) to refuse to accept, believe in, or agree with something;
h) being or occurring at the middle place, stage, or degree or between extremes;
i) growing or living in water.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

The earliest concepts of organismal classification were constrained within narrow boundaries that defined all life as either plant or animal. The ***Kingdom Plantae*** and ***Kingdom Animalia*** were the most basic dichotomy of Linneaus's (1753) classification of living organisms. Nevertheless, there were complex organisms, mainly microscopic and aquatic, with the greater characteristics of greenness of plants and the movement of animals that stretched those plant and animal boundaries.

In 1866, the German naturalist Ernst Haeckel (1834 – 1919) made the first of many proposals for a third kingdom of life. He named this third kingdom and the organisms contained within it the ***Protista***, "the first of all, primordial". Haeckel considered the Protista to be a "boundary kingdom intermediate between the animal and vegetable kingdoms" containing organisms "neither animals nor plants".

In 1838, American biologist Herbert F. Copeland (1902 – 1968) proposed a four-kingdom classification of life. Its foundation was in the exclusion of the ***bacteria*** and the "blue-green algae" (***cyanobacteria***) from Haeckel's Kingdom Protista into a separate kingdom he named ***Monera***.

In 1957 Robert H. Whittaker (1924 – 1980) began a reassessment of Copeland's four-kingdom system from an ecologist's point of view. Whittaker based his kingdom groupings upon the three main modes of nutrition in natural communities: ***absorption***, ***ingestion***, and ***autotrophy***. He also credited the

evolutionary sequence of unicellular to multicellular with central importance to his classification scheme. Utilizing these criteria as the basis for classification, Whittaker returned the bacteria to Kingdom Protista (also based upon their unicellular nature) and placed all algae (green, brown and red) into Kingdom Plantae. Whittaker observed the absorptive role of the ***fungi*** in the natural environment. He rejected the common belief that the superficial resemblance of fungi to plants, with their non-motile habit and cell-walls, made them true plants and he erected the kingdom Fungi.

In 1969 Whittaker published a revision of his four-kingdom system to expand it to five kingdoms, now including a separate bacterial kingdom named Monera in recognition of the fundamental division of life as "prokaryotic" versus "eukaryotic". After the removal of the bacteria and fungi, the Kingdom Protista typically contained the ***eukaryotic algae***, the protozoa, the ***slime moulds*** and certain 'fungi' whose zoospores have ***heterokont flagella***.

Protists are most often single-celled microscopic organisms but some, such as seaweeds, are multicellular, and others, such as slime molds, are 'single cells' (***coenocytic plasmodia***) but may become quite large in size. There is substantial diversity amongst the protists, regardless of size or number of cells. ***Photosynthetic (autotrophic) protists*** use a wide range of light–harvesting pigments that greatly exceed those pigments used by plants. Others are ***heterotrophic***, engulfing prey (***phagotrophs)***, absorbing organic molecules from the environment (***osmotrophs***), and digesting organic matter of living (***parasites, symbionts***) or dead (***saprophytes***) organisms. And, perhaps remarkably, some protists are ***mixotrophic***, i.e. carrying out both photosynthesis and some form of active heterotrophic feeding activity simultaneously.

The modern history of protists began with the use of the electron microscope. For all protists, Corliss (1994) listed six kingdoms, 34 ***phyla*** (divisions) and 83 ***classes***, a substantial increase over Haekel's (1866) Kindom Protista. Thus, the

surge of ultrastructural data had profound effects on protistan classification, and probably the most important contribution involved the concept of endosymbiosis.

Molecular biology studies, especially those which compare the ***nucleotide sequences*** of ***genes***, have offered little to our recognition of new classes, but they have contributed substantially to our understanding of evolutionary relationships among classes.

The knowledge gained from electronic microscopy and molecular biology caused the demolition of the traditional classification schemes of algae, fungi and protozoa. However, a modern classification of all protists based upon evolutionary relationships is only partially reconstructed in the place of the traditional classification.

III. USEFUL PHRASES. Study the following phrases and use them in your own sentences

within something – в межах/ всередині чогось

either…or… - або... або...

neither…nor… - (а)ні... (а)ні...

from one's point of view – з (чиєїсь) точки зору

IV. Make up 6-7 questions on the text "The Protista" and ask them to your fellow students

V. Finish the sentences below using the information from the text

1. Several centuries back scientists used to classify all living organisms…
2. It was Ernst Haeckel who…
3. A four-kingdom classification of life was…
4. According to Whittaker, the superficial resemblance of fungi to plants...
5. Some protists, such as seaweeds,…
6. Depending on the mode of nutrition the protists…
7. The invention of the electronic microscope…

8. Scientists began to understand evolutionary relationships among classes of living forms better…

VI. Look for the synonyms of the following words in the text "The Protista"

1) proposition, suggestion; 2) first, prime; 3) reappraisal, reevaluation; 4) taking in, inhausting; 5) use, apply; 6) construct, establish, set up; 7) enlarge, extend; 8) considerable, significant, serious; 9) strong, deep, intense.

VII. Use the words from the previous exercise to fill in the gaps in the sentences below

1. William Harvey demonstrated that the heart _____ passively and contracts actively.
2. The first lighthouse was _____ on the island in 1912.
3. Human activity has recently had a _____ effect on the environment
4. While many exobiologists do stress that the enormously heterogeneous nature of Earth life foregrounds even greater variety in space, others point out that convergent evolution dictates _____ similarities between Earth and off-Earth life.
5. You need to make a _____ of your approach to the problem and start everything anew.
6. There are a lot of contradictory hypotheses concerning the origin of _____ life.
7. Microvilli on the surface of epithelial cells function to increase the cell's surface area, facilitating the _____ of vital molecules through the membrane.
8. They forwarded a list of _____ for the safe disposal of nuclear waste.
9. A French naturalist Georges Cuvier _____ large collections of biological specimens sent to him from all over the world to work out a systematic organization of the animal kingdom.

VIII. Read the sentences below and explain how the meanings of the underlined words change in different contexts. Make up your own sentences using these words in different meanings

COMMON

1. Robert H. Whittaker rejected the common belief that the superficial resemblance of fungi to plants, with their non-motile habit and cell-walls, made them true plants.
2. Heart disease is one of the commonest causes of death.
3. He insisted that he was a revolutionary not a common criminal.
4. Students and faculty are working toward a common goal.
5. Many of the more common forms of cancer can be treated successfully if detected early.
6. It's becoming more and more common for women to keep their family name when they marry.
7. Monkeys and apes are so similar that it is reasonable to say they have a common ancestor.

OBSERVE

1. Whittaker observed the absorptive role of the fungi in the natural environment.
2. One student performs the experiment, while his partner observes.
3. Hakeem is currently observing the Muslim holy month of Ramadan, and fasts between sunrise and sunset.
4. You can avoid danger by observing these simple rules.
5. Zella and George observed their 55th wedding anniversary last August.

GAIN

1. The knowledge gained from electronic microscopy and molecular biology caused the demolition of the traditional classification schemes of algae, fungi and protozoa.
2. The sport has gained in popularity in recent years.

3. She has gained a reputation as a good communicator.
4. He gained a doctorate in Genetic Engineering.
5. A new-born baby will gain weight at around one ounce per day.
6. Evangelical Christianity has been gaining ground since the Second World War.
7. The dollar has gained 8% against the yen.
8. Fortunately, the investment banks have managed to gain control of the dividends of only big and new companies.
9. A gene in a splurge-weed cell stands to gain by promoting the reproduction of its cell.

GRAMMAR IN USE: *Plural of Nouns*

I. Complete the table

singular	plural
1) alga	1) …….
2) …….	2) analyses
3) …….	3) bacteria
4) cilium	4) …….
5) …….	5) crania
6) crista	6) …….
7) …….	7) criteria
8) …….	8) data
9) emphasis	9) …….
10) fish	10) …….
11) …….	11) flagella
12) fungus	12) …….
13) …….	13) genera
14) helix	14) …….
15) …….	15) hypotheses
16) larva	16) …….

singular	plural
17) leaf	17) …….
18) …….	18) lives
19) medium	19) …….
20) …….	20) metamorphoses
21) …….	21) mitochondria
22) nucleus	22) …….
23) …….	23) offspring
24) paramecium	24) …….
25) …….	25) phenomena
26) phylum	26) …….
27) …….	27) pili
28) plasmodium	28) …….
29) …….	29) series
30) species	30) …….
31) sternum	31) …….
32) …….	32) stimuli
33) …….	33) syntheses
34) taxon	34) …….
35) …….	35) theses
36) …….	36) wolves

II. Choose the appropriate word from among those given in Ex. I above and use it in the correct number to complete the following sentences. The first letter of each word is given to help you make the right choice

1. **_P_____** are unicellular organisms usually less than 0.25 mm in length and covered with minute hairlike projections called **_c_____**.
2. **_B_____** are described as prokaryotes, organisms whose cells lack **_n_____**.

3. Many bacteria feature small protrusions from their outside cell surface known as **_p_____**. These hairlike outgrowths assist the bacteria in attaching to various surfaces.
4. Other hairlike extensions called **_f_____** are much longer than pili and can be found at either or both ends of a **_b_____** or all over its surface.
5. Since the earliest days of plant and animal domestication, around 10,000 years ago, humans have understood that characteristic traits of parents could be transmitted to their **_o_____**.
6. Pedigree **_a_____** can be useful when combined with certain genetic tests.
7. The base level in the taxonomic hierarchy is the **_s_____**.
8. The many species of organisms in the plant kingdom are divided into several **_p_____**, or divisions, totaling about 260,000 species.
9. On the next tier of the hierarchy, similar species are grouped into a broader **_t_____** called a **_g_____**.
10. The goals of medicine are to help people live longer, happier, more active **_l_____** with less suffering and disability.
11. A **_l_____** is an extension of a plant's stem. Although most **_l_____** are flat, broad, or bladelike, they also may be many other shapes, including round, oval, or feathery.
12. During replication, the DNA double **_h_____** unwinds and bonds joining the base pairs break, separating the DNA molecule into two separate strands.
13. Unlike plants and animals, **_f_____** obtain food by absorbing nutrients from an external source.
14. The interior of each **_m_____** consists of an inner membrane that is folded into a mazelike arrangement of separate compartments called **_c_____**.
15. One of the phyla of **_a_____**, the green **_a_____**, is believed to have given rise to the plant kingdom, because its chlorophylls, cell walls, and other details of cellular structure are similar to those of plants.

16. Students are reminded that their **_t_____** must be handed in by the end of term.
17. Our **_h_____** is that the dolphins ate contaminated fish, and this affected the dolphins' immune system.
18. Life on Earth is structurally based on carbon and utilizes water as an interaction **_m_____**.
19. This definition places great **_e_____** on the importance of replication.
20. The DNA molecule consists of a long **_s_____** of coded messages capable of directing the **_s_____** of specific proteins at any time in the cell or life cycle.
21. The first of the wonder drugs, penicillin, was isolated from a **_f_____** *Penicillium*.
22. Biological **_c_____** are based on the premise that the structure and function of an aquatic biological community within a specific habitat provide critical information about the quality of surface waters.
23. The **_c_____** or skull is made up of over 20 different bones.
24. A **_l_____** is a juvenile form of animal with indirect development, undergoing **_m_____** (for example, insects or amphibians).

LISTENING COMPREHENSION

I. Human pathogens appear in many groups of protists, especially among protozoa. Protozoans of the genus Plasmodium invade red blood cells in humans causing one of the most dangerous infectious diseases – malaria. You are going to hear a text describing some aspects of the disease and ways of its prevention. Before listening discuss the meaning of the words in the box below with your classmates or teacher

chills	bark	cinchona tree
trembling	bloodstream	quinine

fever	to render unusable	eradication campaign
delirium	saliva	to stem the illness
to sweat profusely	anticlotting agent	drug resistance
spleen	sporozoite	survelliance
relentless	merozoite	bednet
repeated infection	Jesuit missionary	repellent
severe anemia	remedy	circulatory system collapse

II. Listen to the first part of the text and fill in the table below

pathogen	infection carrier	geographical spread	symptoms	course of infection

III. Listen to the second part of the text dealing with eradication of malaria and complete the sentences below

1. Peruvians revealed their secret malaria remedy in …
2. This remedy was …
3. The person who extracted quinine out of cinchona tree bark …
4. Eradication campaign against malaria was announced by …
5. But in 1976 …
6. One of the reasons for malaria spread through the developing countries …
7. It is very difficult to fight malaria for two main reasons: …
8. Mefloquine is a drug that …
9. Mosquitoes can be kept away …
10. One can avoid mosquito bites …

WRITING

I. Kingdoms are the largest groups of organization of life. After kingdoms, plants are classified into *divisions* **and other types of organisms are classified into** *phyla***. Then follow** *classes***,** *orders***,** *families***,** *genera* **and** *species***. The more closely related two species are the more** *taxa* **they share. Some taxonomic groups are further subdivided such as into** *subclass* **and** *superfamily***.**

Tables 1.1 and 1.2 below list the full taxonomic names of two very different organisms, humans and corn. Study these tables and make similar ones for two other organisms of your own choice

Table 1.1 Human (*Homo sapiens*). Taxonomy

Category	**Name**	**Description**
Kingdom	Animalia	Complex cells; multicellular; nervous tissue
Phylum	Chordata	Body consisting of head, trunk, and tail; highly developed organ systems; three tissue layers in embryo; internal cavity; notochord
Class	Mammalia	Hair; mammary glands; internal fertilization; large skull; homeotherm or endotherm (warm-blooded); extra-embryonic membranes
Order	Primates	Complex brain; flexible toes and fingers; excellent vision
Family	Hominidae	Upright posture; small face; large brain; V-shaped jaw
Genus	Homo	Large brain; relatively short arms; lightweight jaws; small teeth; large thumbs
Species	Homo sapiens	Only living species of genus *Homo*

Table 1.2 Corn (*Zea mays*). Taxonomy

Category	**Name**	**Description**
Kingdom	Plantae	Land dwelling; multicellular, eukaryotic organisms with cellulose cell walls; photosynthesize using chlorophyll a and b
Division	Anthophyta	Vascular plants with seeds and flowers; ovules enclosed in an ovary and mature seeds in fruits
Class	Monocotyledoneae	One seed-leaf
Order	Commelinales	Fibrous leaves
Family	Poaceae	Grasses
Genus	Zea	Separate male and female flowers
Species	Zea mays	Corn

Lesson 2

THE BACTERIA

PRE-READING TASKS

I. Answer the following questions

- What distinctive features of bacteria can you name?
- Should we consider bacteria our “friends” or “enemies”?

II. Listen to the following words and practice their pronunciation

Bacterium, tissue, symbiont, lithotroph, saprobe, organotroph, obligate aerobe, facultative anaerobe, pilus, glycocalyx, capsule, binary traverse fission, eubacteria, archaebacteria, archaea.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) encounter, v	a) to stick firmly to something;
2) tissue, n	b) the process in which one gets or gains something;
3) available, adj	c) to come upon face-to-face;
4) acquisition, n	d) something that sticks out from a surface ;
5) projection, n	e) a single thread or a thin flexible threadlike object;
6) rotate, v	f) present or ready for immediate use;
7) filament, n	g) something that happened or existed before something else and influenced its development ;
8) adhere, v	
9) precursor, n	h) able to produce good crops (about land);
10) decay, v	i) to turn about an axis or a center, revolve;
11) fertile, adj	j) to undergo decomposition;
	k) an aggregate of cells usually of a particular kind together with their intercellular substance that form one of the structural materials of a plant or an animal.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

Anyone who has eaten yogurt, cheese, or bread, smelled spoiled milk or suffered from strep throat has encountered ***Monera***, more commonly called bacteria. Bacteria can be found in all natural environments, often in extremely large numbers. As a group, they display exceedingly diverse metabolic capabilities and use almost any organic compound, and even some inorganic salts, as a food source. In a sense, bacteria are the dominant living creatures on Earth, having been present for perhaps three-quarters of Earth history and having adapted to almost all available ecological habitats. Studies of the relationships among different groups of bacteria continue to yield new insights into the origin of life on Earth and the directions of evolution.

Bacteria are classified as the prokaryotic kingdom Monera; all bacterial cells, and only bacterial cells, are prokaryotic in nature. Bacteria are unicellular microorganisms and thus are not organized into tissues. Each bacterium grows and divides independently of any other, although aggregates of bacteria, sometimes containing members of different species, are found. Individual bacteria can assume three basic shapes: spherical (***Coccus***), rodlike (***Bacillus***), or curved (***Vibrio, Spirillum, or Spirochete***). Considerable variation is seen in the actual shapes, and cells are usually stretched or compressed in one dimension.

Monera are grouped by how they acquire energy. The most fundamental distinction reflects carbon source. ***Autotrophs*** extract energy from carbon dioxide and ***heterotrophs*** use more reduced and complex organic molecules, typically from other organisms. A rare type of bacterium, called ***mixotroph***, combines characteristics of autotrophs and heterotrophs and uses inorganic molecules for energy and organic molecules for carbon. Hetorothrophs are further distinguished by their source of organic compounds. ***Saprobes*** obtain nutrients from dead plants and animals. ***Symbionts*** live within living organisms and acquire nutrients from them. Finally, monera are classified by the source of hydrogen or electrons, which

are important in energy acquisition. ***Lithotrophs*** obtain electrons from reduced inorganic compounds. ***Organotrophs*** obtain hydrogen or electrons from organic compounds.

Monera are also classified by their oxygen requirements. ***Obligate aerobes*** require oxygen and harness it in carrier molecules forming an electron transport chain on the inner face of the cell membrane. ***Facultative anaerobes*** use oxygen or not, and they obtain energy from fermentation. For ***obligate anaerobes***, oxygen is toxic, and they live in habitats that lack it. Due to the differences in the structure of the bacterial wall surface scientists distinguish between gram-positive and gram-negative bacteria (named after the Danish physician Hans Christian Gram who developed one of the most useful staining reactions for bacteria).

Bacteria have several distinguishing characteristics**.** ***Pili*** are short projections on bacterial cells, resembling hairs, that enable the cells to attach to objects. Another bacterial structure is a ***flagellum***, which is an extension that rotates, moving the cell. A bacterium's cell wall may have a sticky layer called a ***glycocalyx***, which is composed of proteins and/or polysaccarides. A loose glycocalyx is called a ***slime layer***, and a firm glycocalyx is a ***capsule***. The glycocalyx enables the cell to adhere to various surfaces. Bacteria can form structures called ***endospores*** that enable them to survive harsh conditions. An endospore is a walled structure that forms around the nucleus and a small amount of cytoplasm. The normal cellular form returns when environmental conditions improve.

Most bacteria reproduce by a process of ***binary transverse fission***, in which the cell grows in volume until it divides in half to yield two identical daughter cells. Each daughter cell can continue to grow at the same rate as its parent. One group of environmental bacteria reproduces in a different manner, called ***budding***. A small bud forms at one end of the mother cells or on filaments called prosthecae. As growth proceeds, the size of the mother cell remains about constant, but the bud enlarges. When it is about the same size as the mother cell, it separates. This type

of reproduction is analogous to that in the budding fungi, such as brewer's yeast (Saccharomyces cerevisiae). One difference between transverse fission and budding is that, in the latter, the mother cell often has different properties than the offspring.

Bacteria and Archaea. It has become clear from studies of bacterial genes that bacteria are not simply primitive cells or precursors to higher organisms. In fact, bacteria have been divided into two major phylogenetic kingdoms, ***Eubacteria*** and ***Archaebacteria (Archaea***), based on such differences as chemistry and physiology. All remaining living organisms are eukaryotes. It can be said that members of these two prokaryotic kingdoms are as different from one another as they are from eukaryotic cells; these differences are manifested in almost all observable characteristics, including metabolic pathways, identity of lipids, cell surface structures, and gene sequences.

The archaebacteria have markedly different surface structures from the eubacteria. Their membrane lipids are not fatty acids linked to glycerol by ether bonds, as in eubacteria and eukaryotes, but are branched isoprenoids linked to glycerol by ether bonds. Another difference between bacteria and archaea is in the structure of RNA polymerase, the enzyme that all cells use to transcribe DNA into mRNA. Bacteria use a single type of RNA polymerase consisting of four polypeptide subunits. The archaeal equivalent of this enzyme occurs in several forms that are far more complex than the bacterial RNA polymerase.

Microbial ecology. Monera and other unicellular organisms are essential components of the global ecosystem. Without microscopic life, macroscopic life would not exist, because microorganisms capture energy from the nonliving environment and form the bases of food webs. Photosynthesis harnesses much of this energy and bacteria that can photosynthesize support vast living communities in many habitats. Even in areas far from sunlight, monera support life by harnessing chemical energy from the non-living environment and using it to synthesize compounds that are nutrients for other organisms. Some bacteria cause

disease in humans, animals, or plants, but most are harmless or beneficial ecological agents whose metabolic activities sustain higher life-forms. Without bacteria, soil would not be fertile, and dead organic material would decay much more slowly. Some bacteria are widely used in the preparation of foods, chemicals, and antibiotics.

III. USEFUL PHRASES. Study the following phrases and paraphrase the underlined parts of the sentences that follow

as a source of – як джерело
survive something – витримати, перенести, пережити щось
the latter – останній (з двох названих)

1. Like green plants, Purple Sulfur Bacteria are photosynthetic, using the energy of sunlight to reduce carbon dioxide to carbohydrate. Unlike plants, however, they do not get electrons from water.
2. A population with diverse traits is more likely to continue to live normally in spite of changes in the environment such as emerging diseases, new predatory insects, or climate changes.
3. *The Phylogeny of Life* and *Journey into Phylogenetic Systematics* (UCMP, Berkeley) both explain the relationships and theory behind such evolutionary hypotheses. The second just mentioned gives a brief introduction into cladistics.

IV. Answer the following questions about the text "The Bacteria"

1. What areas of our planet are inhabited by the representatives of the Kingdom Monera?
2. What features make bacteria "the dominant living things on Earth"?
3. Do bacteria vary in shape?
4. How many groups of bacteria do we distinguish depending on the method of obtaining energy? Describe them.
5. Do all bacteria breathe?
6. What are endospores?

7. How many forms of reproduction are used by bacteria? What is the difference between them?
8. Archaebacteria represent one of the classes in the Kingdom Monera, don't they?
9. In what way are archaea and eubacteria different?
10. How important are bacteria for the global ecosystem?

V. Read the text "The Bacteria" again and find the English equivalents of the following expressions there. Use these expressions in the sentences of your own

Гострий фарингіт (запалення горла); скупчення бактерій; набувати форми; видобувати енергію; потреба у кисні; липкий шар; у такому ж темпі; залишатися відносно стабільним; ланцюг живлення; викликати хворобу в людини; підтримувати існування вищих форм життя.

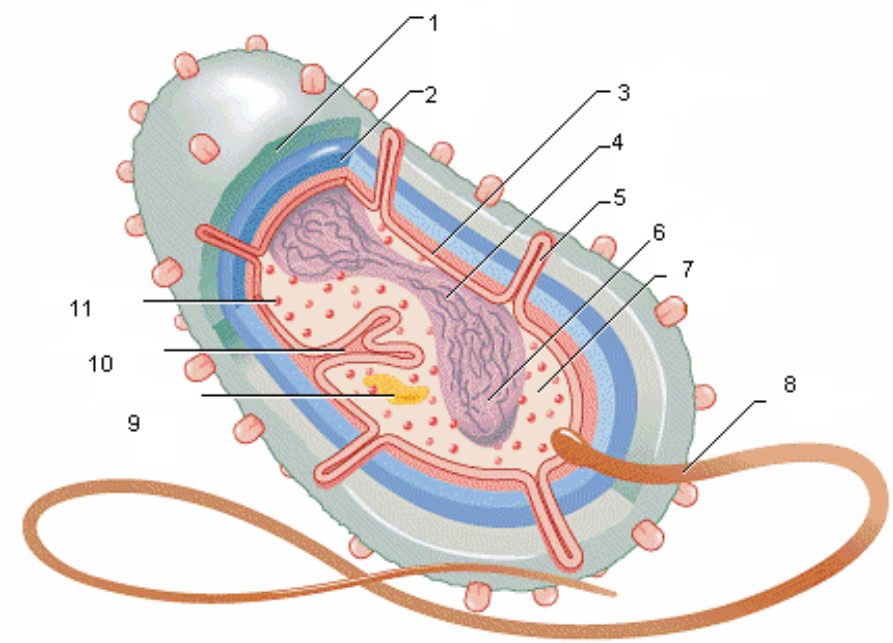
VI. Fill in the following table with synonyms (from list A) and opposites (from list B) of the given words. Explain the difference between the synonyms and illustrate it using your own examples

word	*synonyms (3 for each word)*	*opposites*
natural, adj		(3)
diverse, adj		(2)
dominant, adj		(2)
acquire, v		(2)
important, adj		(3)
lack, n		(2)
firm, adj		(2)
improve, v		(2)

A: absence; chief; common; contrasting; correct; deficiency; develop; different; essential; gain; hard; innate; obtain; perfect; prevailing; principal; progress; remarkable; shortage; significant; stable; steady; various; wild.

B: abandon; abnormal; abundance; artificial; changeable; decline; deteriorate; identical; inconsiderable; minor; same; slight; soft; subordinate; sufficiency; surrender; unimportant; unnatural.

VII. Look at the picture of a bacterium and match the numbers with the correct names of organelles from the list below. Describe the functions of each structural unit of the bacterial cell



Flagellum;
plasmid;
mesosome;
DNA;
cell wall;
cell membrane;
capsule;
pilus;
nucleoid;
cytoplasm;
ribosome.

GRAMMAR IN USE: *Prepositions*

I. Choose the appropriate preposition

When most people think of bacteria, they think of disease-causing organisms, **like/as/of** the *Streptococcus* bacteria, which were isolated **from/out/off** a man with strep throat. While pathogenic bacteria are notorious **of/about/for** such diseases as cholera, tuberculosis, and gonorrhea, such disease-causing species are a comparatively tiny fraction of the bacteria **like/as/in** a whole.

Bacteria are so widespread that it is possible only to make the most general statements **about/of/for** their life history and ecology. They may be found **on/at/in**

the tops of mountains, the bottom of the deepest oceans, **on/at/in** the guts of animals, and even in the frozen rocks and ice of Antarctica. One feature that has enabled them to spread so far, and last so long is their ability to go dormant **on/for/at** an extended period.

II. Complete the following passage by choosing the correct prepositions from the list below to fill in the gaps

as (x3)	**by (x2)**	**from (x2)**	**in (x2)**		**into (x2)**
like	**of**	**on (x2)**	**since**	**to**	**without**

Most bacteria may be placed (1)_____ one of three groups based (2)_____ their response (3)_____ gaseous oxygen. Aerobic bacteria thrive (4)_____ the presence of oxygen and require it (5)_____ their continued growth and existence. Other bacteria are anaerobic, and cannot tolerate gaseous oxygen, such (6)_____ those bacteria which live in deep underwater sediments, or those which cause bacterial food poisoning. The third group are the facultative anaerobes, which prefer growing in the presence of oxygen, but can continue to grow (7)_____ it.

Bacteria may also be classified both by the mode by which they obtain their energy. Classified by the source of their energy, bacteria fall (8)_____ two categories: heterotrophs and autotrophs. Heterotrophs derive energy (9)_____ breaking down complex organic compounds that they must take (10)_____ (11)_____ the environment — this includes saprobic bacteria found in decaying material, (12)_____ well (13)_____ those that rely (14)_____ fermentation or respiration.

The other group, the autotrophs, fix carbon dioxide to make their own food source; this may be fueled (15)_____ light energy (photoautotrophic), or (16)_____ oxidation of nitrogen, sulfur, or other elements (chemoautotrophic). While chemoautotrophs are uncommon, photoautotrophs are common and quite diverse. They include the cyanobacteria, green sulfur bacteria, purple sulfur bacteria, and purple nonsulfur bacteria. The sulfur bacteria are particularly interesting, (17)_____ they use hydrogen sulfide as hydrogen donor, instead

(18)_____ water (19)_____ most other photosynthetic organisms, including cyanobacteria.

LISTENING COMPREHENSION

I. You are going to hear a fragment of a lecture about the best-known prokaryote Escherichia coli (E. coli). Before listening study the following measurements and discuss the meaning of the words in the box below with your classmates or teacher

μm – micrometer = 1/1000 mm = 10^{-6} m (one millionth of a meter)

nm – nanometer = 1/1000 μm = 10^{-9} m (one billionth of a meter)

$μm^3$ – cubic micrometer

10^{-12}g (one-millionth of one-millionth of a gram) = 0,0000000000001g

humble	magnified	immense
intestinal tract	human dimensions	nutritional requirements
length	nonetheless	health hazard
approximately	favorable	extensive precautions
weight	under the conditions	differing genet ic strains
tiny	whereas	potassium (K)
bundle	rapid division	

II. Listen to the tape and fill in the gaps with the correct figures concerning the structure of E. coli

1. length — _____
2. diameter — _____
3. volume — _____
4. weight (approximately) — _____
4. number of identical molecules of DNA within the body of E. coli — _____
5. number of ribosomes within the body of E. coli — _____
5. thickness of a cell wall — _____
6. speed at which flagella push E. coli — _____
7. percentage of the E. coli cell ingredients (approximately):

water _____	carbohydrate _____
protein _____	lipid _____
DNA _____	simple ions such as K+_____

III. Listen to the tape again and decide whether the following statements are true or false

1. Compared to the mycoplasmas, E.coli is about 100 times larger.
2. Every second or so the cell causes the bundle of flagella to separate and reform.
3. Thousands of kinds of specific proteins are made by each prokaryotic cell of E. coli in spite of its genetic material consisting of approximately 1/500 as much DNA as is contained in a single cell of a human being.
4. Under the best conditions the E. coli cell requires about 1 day to go through a division cycle.
5. Among the features that make E. coli a very favorable subject for biological experimentation are its small size, rapid division, simple nutritional requirements, absence of a great health hazard, and readily available many differing genetic strains with known characteristics.

SPEAKING

Speak about the Bacteria covering the following issues:

- **distinctive features of the bacteria;**
- **the diversity of the Kingdom Monera;**
- **bacteria classification;**
- **modes of reproduction;**
- **the eubacteria and the archaea;**
- **representatives of the Kingdom Monera;**
- **the bacteria and ecology.**

Lesson 3

VIRUSES

PRE-READING TASKS

I. Answer the following questions

- In what way are viruses different from all other living "things"?
- Would life on earth change for better if all viruses suddenly disappeared?

II. Listen to the following words and practice their pronunciation

Virion, prion, capsid, viroid, parasite, nuclease, lipoprotein, vaccine, bacteriophage, lysogenic, ultraviolet, incubation period.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) shell, n	a) having a sudden onset, sharp rise, and short course;
2) derive, v	b) to cause to pass from one place or person to another;
3) invade, v	c) to take, receive, or obtain especially from a specified source;
4) furnish, v	d) to provide or equip with what is needed;
5) inject, v	e) to introduce into something forcefully;
6) progeny, n	f) to get into something in an unwanted way; to affect injuriously;
7) convey, n	g) evil in nature, influence, or effect;
8) acute, adj	h) to continue to exist; to remain unchanged;
9) malignant, adj	i) descendants, children; offspring;
10) persist, v	j) a hard rigid covering or support of an organism.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

Viruses occupy a special taxonomic position: they are not plants, animals, or prokaryotic bacteria, and they are generally placed in their own kingdom or imperia. In fact, viruses should not even be considered organisms, in the strictest sense, because they are not free-living (i.e., they cannot reproduce and carry on metabolic processes without a ***host cell***).

All true viruses contain nucleic acid, either DNA or RNA, and protein. The nucleic acid encodes the genetic information unique for each virus. The infective, extracellular (outside the cell) form of a virus is called the ***virion***. It contains at least one unique protein synthesized by specific genes in the nucleic acid of that virus. In virtually all viruses, at least one of these proteins forms a shell (called a ***capsid***) around the nucleic acid. Certain viruses also have other proteins internal to the capsid; some of these proteins act as enzymes, often during the synthesis of viral nucleic acids. ***Viroids*** (meaning "viruslike") are disease-causing organisms that contain only nucleic acid and have no structural proteins. Other viruslike particles called ***prions*** are composed primarily of a protein tightly complexed with a small nucleic acid molecule. Prions are very resistant to inactivation and appear to cause degenerated brain disease in mammals, including humans.

Viruses are quintessential parasites; they depend on the host cell for almost all of their life-sustaining functions. Unlike true organisms, viruses cannot synthesize proteins, because they lack ribosomes for the translation of viral messenger RNA into proteins. Viruses must use the ribosomes of their host cells to translate viral mRNA into viral proteins.

Viruses are also energy parasites; unlike cells, they cannot generate or store energy in the form of adenosine triphosphate (ATP). The virus derives energy, and all other metabolic functions, from the host cell. The invading virus uses the nucleotides and amino acids of the host cell to synthesize its nucleic acids and

proteins, respectively. Some viruses use the lipids and sugar chains of the host cell to form their membranes and glycoproteins.

The true infectious part of any virus is its nucleic acid, either DNA or RNA but never both. In many viruses, but not all, the nucleic acid alone, stripped of its protein coat (capsid), can infect (transfect) cells, although considerably less efficiently than can the intact virions.

The virion capsid has three functions: (1) to protect the viral nucleic acid from digestion by certain enzymes (***nucleases***), (2) to furnish sites on its surface that recognize and attach (adsorb) the virion to receptors on the surface of the host cell, and (3), in some viruses, to provide proteins that form part of a specialized component which enables the virion to penetrate through the cell surface membrane or, in special cases, to inject the infectious nucleic acid into the interior of the host cell.

Biologists use several criteria to classify viruses, including their nucleic acid content, their size, the shape of their protein capsid, the presence of a surrounding ***lipoprotein envelope***, as well as the types and range of organisms the viruses infect, and the disease they cause.

The primary taxonomic division is into two classes based on nucleic acid content: DNA viruses or RNA viruses. Both the DNA and the RNA viruses are subdivided into those that contain either double-stranded or single-stranded DNA or RNA. Further subdivision of the RNA viruses is based on whether the ***RNA genome*** is segmented or not. Viruses can "evolve" in the sense that their DNA and RNA sequence changes rapidly. This is because viruses replicate very often and cannot "repair" errors in the sequences, as cells can. The changeable nature of viruses is the reason why ***vaccines*** for many diseases like the common cold cannot be developed.

Viruses can exist outside cells but they must enter cells to reproduce. Here, they commandeer the DNA replication and protein synthesis machinery of the host (the nucleus, ribosomes, and ER) and use it to produce the progeny viruses, which

may busrt from the cell causing its death. Certain viruses, particularly ***bacteriophages***, are called temperate because the infection does not immediately result in cell death. The viral genetic material remains dormant or is actually integrated into the genome of the host cell. Cells infected with temperate viruses are called ***lysogenic*** because the cells tend to be broken down when they encounter some chemical or physical factor, such as ultraviolet light. In addition, many animal and plant viruses, the genetic information of which is not integrated into the host DNA, may lie dormant in tissues for long periods of time without causing much, if any, tissue damage. Viral infection does not always result in cell death or tissue injury; in fact, most viruses lie dormant in tissue without ever causing pathological effects, or they do so only under other, often environmental, provocations.

Although viruses were originally discovered and characterized on the basis of the diseases they cause, most viruses that infect bacteria, plants, and animals (including humans) do not cause disease. In fact, bacteriophages may be helpful in that they rapidly transfer genetic information from one bacterium to another, and viruses of plants and animals may convey genetic information among similar species, helping their hosts survive in hostile environments. In the future this could also be true for humans. ***Recombinant DNA biotechnology*** shows great promise for the repair of genetic defects. Afflicted persons are injected with cells transformed by viruses that carry a functional copy of the defective human gene. The virus integrates the normal gene into the DNA of the human cell.

Of those viruses that cause disease, some cause short-term (***acute***) diseases and others recurring or long-term (***chronic***) diseases. Some viruses cause acute disease from which there is fairly rapid recovery but may persist in the tissues, remaining dormant for long periods of time, and then become active again, bringing about serious disease decades later. Slowly progressive viruses have long ***incubation periods*** before the onset of disease. The DNA of certain viruses

becomes integrated into the genome of the host cell, often resulting in malignant transformation of cells, which become ***cancers***.

III. USEFUL PHRASES. Study the following phrases and match two halves of the sentences that follow

in fact - фактично
at least – принаймні, щонайменше
act as – виступати, діяти як
unlike something – на відміну від
infect with – заражати (чимось)
in addition (to) – до того ж, на додачу (до)

1. Two types of vaccine to protect horses from West Nile virus are available this year. West Nile kills about one-third of unvaccinated horses that mosquitoes…
2. Viruses, like bacterial infective agents,…
3. Smallpox was effectively elimated as a scourge on humanity by worldwide vaccination programs. In…
4. Virions contain at least…
5. Not infrequently, the virus-specific T lymphocyte kills vital cells such as nerve cells (neurons), muscle cells, and liver cells, all of which carry out important functions. In…
6. Unlike bacteria,…

a) …fact the chances of getting smallpox from a bad vaccine were greater than that of ever encountering the virus in nature.
b) …addition, the death of cells results in an inflammatory response, which also can damage vital tissues.
c) …infect with the virus, a Kansas State University scientist said.
d) …viruses mimic the metabolic functions of their host cells.
e) …40 proteins and lipids, as well as internal structures called lateral bodies.
f) …act as antigens in the body and elicit formation of antibodies in an infected individual.

IV. Split the text "Viruses" into several logical parts and give titles to them

V. Think of possible questions for the following answers

1. Because viruses are not free-living organisms.
2. It's the extracellular form of a virus;
3. These organisms are called viroids.
4. Because they do not have ribosomes.
5. The virus derives it from the host cell.
6. It performs three basic functions.
7. The reason is in the frequent changes of the viral DNA or RNA sequences.
8. Viruses can reproduce only in host cells.
9. Such viruses do not destroy the cell at once.
10. Short term diseases are referred to as acute and long-term diseases are called chronic.

VI. Say whether the following statements are true or false according to the text "Viruses"

1. Viruses lack some functions characteristics of other living organisms.
2. All viruses have RNA molecules.
3. At different stages of their development virions can transform into viroids or prions.
4. The parasitic nature of viruses is manifested in their dependence on host cells for energy and protein synthesis mechanism.
5. A virus deprived of its capsule can never penetrate into the host cell.
6. The virion capsid performs a protective function.
7. The main criteria used for viruses classification are their size and shape.
8. Viruses lack the mechanism of correcting the errors in the nucleic acid sequences.

9. The viruses are harmless for their host cell as long as the latter are not subjected to specific physical or chemical influences.
10. Medicine of the future may rely on viruses for the repair of certain genetic defects in humans.

VII. Skim the text "Viruses" one more time to find the words with the following meanings

1) to a large extent or degree;
2) to pass into or through;
3) the inner part of a thing : inside;
4) the amount of specified material contained; proportion;
5) a natural enclosing covering;
6) to take something that belongs to someone else forcibly;
7) marked by moderation; not extreme or excessive; mild;
8) hurt or damage;
9) affected in a negative way and suffering as a result of it;
10) occurring again after an interval.

VIII. Use the words from the previous exercise to fill in the blanks in the sentences below

1. Most viruses enclosed in _____ appear to be spherical, although the rhabdoviruses are elongated cylinders
2. The weather here continues to be _____!
3. Even after all these years, the patient still suffers from constantly _____ respiratory problems and skin rashes.
4. Elderly people are frequently _____ by this type of pneumonia.
5. The sea turtle's natural habitat has been _____ reduced.
6. Beckham has missed several games through _____.

7. Aiming your light down into it, you can see right through the membrane to the cell _____.
8. Science has _____the mysteries of nature.
9. Two hijackers used fake explosives to _____ the airliner.
10. The fat _____ of this cheese is 60%.
11. With trembling hands Mr Utterson opened the _____.
12. People pay as much attention to your voice as to the _____ of your speech.
13. If this bacterium gets into the body by means of an _____ or wound, the bacterial capsule stimulates the body to wall off the bacteria into an abscess, which reduces the spread of the bacteria but also makes them much more difficult to eradicate.
14. Bromocriptine increases the level of dopamine in the brain, which controls rhythmic biological cycles _____ every 24 hours.
15. The sun's rays can _____ the sea to a depth of twenty metres.
16. Heat is trapped in the Earth's _____.

FOCUS ON GRAMMAR: *Phrasal Verbs*

I. Read the following sentences paying special attention to the highlighted phrasal verbs. What do they mean? What do you know about phrasal verbs?

a) Viruses cannot reproduce and **carry on** metabolic processes without a host cell.
b) Some viruses cause acute disease from which there is fairly rapid recovery but may persist in the tissues, remaining dormant for long periods of time, and then become active again, **bringing about** serious disease decades later.
c) Powerful digestive enzymes concentrated in the lysosome **break down** worn-out organelles and ship their building blocks to the cytoplasm where they are used to construct new organelles.

II. Match each of the following phrasal verbs to the correct meaning

1) break down a) to make use of something;

2)	bring up	b) to make something start happening;
3)	bring back	c) to separate (as a chemical compound) into simpler substances: decompose;
4)	draw on	
5)	give off	d) to develop;
6)	go on	e) to happen;
7)	make up	f) to mention; to introduce a subject;
8)	set off	g) to happen in a particular way; to have a particular result;
9)	turn out	h) to compose;
10)	work out	i) to produce a smell, light, heat, a sound, etc.;
		j) to reintroduce.

III. Use a proper phrasal verb from the previous exercise to complete each of the following sentences

1. Molecular biology, which studies the chemical structures and processes of biological phenomena at the molecular level, _____ several disciplines and has become one of the most important biological sciences.
2. Biochemists have probed the biological interactions of the organic molecules that _____ life on our planet.
3. Organisms such as fungi and bacteria _____ dead or dying matter into nutrients that can be used again.
4. A French naturalist Georges Cuvier utilized large collections of biological specimens sent to him from all over the world to _____ a systematic organization of the animal kingdom.
5. A valuable method useful in tracing the movement of substances in living matter is radioautography: when radioactive nutrients, which can be incorporated into cells, are injected into animals, they _____ detectable rays by which their presence and location can be determined.

6. The formation of the cell theory — all plants and animals are made up of cells — marked a great conceptual advance in biology, and it resulted in renewed attention to the living processes that _____ in cells.
7. Avicenna was an outstanding Persian scientist around the beginning of the 11th century. He was the true successor to Aristotle. His writings on medicine and drugs did much to _____ the works of Aristotle _____ to Europe, where they were translated into Latin from Arabic.
8. Most mutations, however, _____ to be deleterious and often lead to some impairment or to death of the organism.
9. The life cycle of slime molds, or humans, or any other multicellular organism, _____ a fundamental and still largely unsolved problem.
10. Protein molecules range from the long, insoluble fibers that make up connective tissue and hair to the compact, soluble globules that can pass through cell membranes and _____ metabolic reactions.

LISTENING COMPREHENSION

I. You are going to hear a text about the well-known disease cholera and the agent causing it. Before listening discuss the meaning of the words in the box below with your classmates or teacher

cramps	circulatory shock	small intestine
vomiting	to devastate	chloride ions
watery diarrhea	to contaminate	sodium ions
to deplete	water supply	to leak out
mild symptoms	to harbor a viral infection	life-threatening
lethal infection	bacteriophage	to bear a gene
genetic stowaway	to acquire virulence	route
immune response	to set on the right track	to reveal

II. Listen to the first fragment of the text and tick the items below that are mentioned in it

1. Symptoms of the disease;
2. Statistics on the number of people suffering from cholera worldwide;
3. Regions covered by epidemics of the disease;
4. The pathogene;
5. The course of infection;
6. Development of cholera vaccines;
7. Prevention of the disease.

III. Listen again and note down as much information on the items you've ticked as possible

IV. Listen to the second part of the text and choose all possible continuations for the sentences below

1. Cholera vaccines have never worked well …
   a) because there are many strains of the bacterium;
   b) because Vibrio Cholerae is not the pathogene itself;
   c) because of frequent genetic mutations in the pathogene.
2. A vaccine is …
   a) a mutated pathogene; b) a disabled virus; c) a weak pathogene.
3. Using electron microscope researchers have found …
   a) a gene responsible for the production of cholera toxin;
   b) a phage inserted into the bacterial cell;
   c) that some bacteria Vibrio Cholerae lack pili.
4. The phage penetrates into Vibrio Cholerae …
   a) trough pili;
   b) across the plasma membrane;
   c) by pricking the cell wall.

5. Bacterial cell without pili …

a) can never cause cholera in humans;

b) usually cause the disease;

c) do not produce cholera toxin.

WRITING

Translate the following passage using the vocabulary of this lesson

Віруси — інфекційні агенти, відомі для більшості живих форм, у тому числі для людини, тварин, рослин, грибків та бактерій. Віруси містять генетичний матеріал (ДНК або РНК), оточений захисною білковою капсулою, яка може бути вкритою зовнішньою ліпідною оболонкою. Віруси у 20 — 100 разів менші за бактерії, надто малі, щоб їх можна було побачити у світловий мікроскоп. Найбільші віруси — поксвіруси — сягають 450 нанометрів, розмір найменших — поліовірусів — близько 30 нанометрів. Оскільки віруси не можуть розмножуватися поза межами живої клітини, вони задля розмноження розвинули механізм передачі своєї генетичної інформації від однієї клітини до іншої.

Віруси часто приносять шкоду, або навіть вбивають клітини, які вони інфікують, викликають хвороби у інфікованих організмах. Деякі віруси здатні стимулювати неконтрольований ріст клітин, спричиняють рак. Від багатьох інфекційних хвороб, викликаних вірусами, таких як, наприклад, грип, не існує ліків. Головною проблемою у розробці антивірусних препаратів є велика кількість варіацій вірусів, що спричиняють ту саму хворобу. З другого боку, практично неможливо створити ліки, які б знешкоджували вірус, не руйнуючи при цьому саму клітину. Однак, сучасні дослідження вірусів принесли багато нових відкриттів, які можуть бути корисними для покращення здоров’я людини.

Unit 3 Focus Words and Phrases

absorption, n (1)
acquire, v (2)
acquisition, n (2)
acute, adj (3)
adhere, v (2)
afflicted, adj (3)
aquatic, adj (1)
available, adj (2)
class, n (1)
commandeer, v (3)
common, adj (1)
considerably, adv (3)
constrain, v (1)
content, n (3)
convey, n (3)
decay, v (2)
demolition, n (1)
derive, v (3)
diverse, adj (2)
division, n (1)
dominant, adj (2)
encounter, v (2)
engulf, v (1)
envelope, n (3)
erect, v (1)
expand, v (1)
family, n (1)
fertile, adj (2)
filament, n (2)
firm, adj (2)
furnish, v (3)
gain, v (1)
genus, n (1)
important, adj (2)
improve, v (2)
ingestion, n (1)
inject, v (3)
injury, n (3)
interior, n (3)
intermediate, adj (1)
invade, v (3)
lack, n (2)
malignant, adj (3)
natural, adj (2)
observe, v (1)
order, n (1)
penetrate, v (3)
persist, v (3)
phylum, n (1)
precursor, n (2)prey, n (1)
primordial, adj (1)
profound, adj (1)
progeny, n (3)
projection, n (2)
proposal, n (1)
reassessment, n (1)
recurring, adj (3)
regardless, adv (1)
reject, v (1)
rotate, n (2)
shell, n (3)
species, n (1)
substantial, adj (1)
taxon, n (1)
temperate, adj (3)
tissue, n (2)
utilize, v (1)

act as (3)
as a source of (2)
at least (3)
either…or… (1)
from one's point of view (1)
in addition (to) (3)
in fact (3)
infect with (3)
neither…nor… (1)
survive something (2)
the latter (2)
unlike something (3)
within something (1)

REVISION AND ADDITIONAL PRACTICE 3

Revision Exercises

I. Translate the following sentences into English

1. З часів Аристотеля до середини 19ст. біологи виділяли дві головні групи організмів: рослини і тварини. Організми, які не є ні рослинами, ні тваринами, наприклад гриби, відносили до того царства, представників якого вони найбільше нагадували.
2. У 1959 році еколог Роберт Віттакер запропонував систему із чотирьох царств, у якій виокремлював групи рослин, тварин, грибів і найпростіших, але все ще об'єднував прокаріоти із одноклітинними евкаріотами.
3. Бактерії є найпоширенішими організмами на Землі, і вони тісно взаємопов'язані із іншими живими істотами.
4. Розробка вакцин проти застуди, спричиненої риновірусами, є вкрай складним або й неможливим завданням, оскільки існує щонайменше 100 антигенних типів риновіруса.
5. Нещодавні молекулярні дослідження виявили, що група організмів, відомих під назвою архебактерії, яких раніше відносили до бактерій, суттєво відрізняється від останніх за будовою клітинної стінки, плазматичної мембрани та іншими ключовими молекулярними характеристиками.
6. Серед тисяч видів бактерій, що населяють Землю, лише мала частка спричиняє хвороби, однак бактеріальні інфекції у значній мірі впливали на хід історії людства.
7. Молекули антитіл здатні хімічно «впізнавати» ділянки поверхні (так звані епітопи) великих молекул, що виступають у якості антигенів.
8. Найпростіші відзначаються великою різноманітністю і населяють різні середовища — їх можна зустріти у прісній та морській воді, у ґрунті і

навіть у кишковому тракті тварин, де вони беруть участь у важливих травних процесах.

9. Клітини крові, що транспортують оксиген всередині тіла, називаються еритроцитами.
10. Подібно до рослин, багато видів найпростіших можуть здійснювати процес фотосинтезу. Подібно до тварин, вони можуть самостійно рухатися. Однак, на відміну від рослин і тварин, клітини найпростіших не організовані у тканини.
11. Термін «дріжджі» застосовується переважно до одноклітинних аскоміцетів, таких як *Candida albicans* та *Saccharomyces cerevisiae*. Останні використовує людина як закваска при випіканні хліба, а також для виготовленні пива та деяких інших алкогольних напоїв.
12. Віруси складаються із генетичного матеріалу у формі ДНК або РНК, оточеного захисною білковою оболонкою, яку називають капсидою, і можуть бути вкритими зовнішнім ліпідним шаром.
13. Віруси класифікують відповідно до їх структури, типу генетичного матеріалу, який вони містять, та стратегій, які вони застосовують для реплікації.
14. Практично усе живе на Землі прямо чи опосередковано залежить від фотосинтезу як джерела поживи, енергії та кисню, завдяки чому фотосинтез є одним із найважливіших з усіх відомих біохімічних процесів.
15. Деякі віруси, наприклад альфавіруси (alphaviruses) та флавівіруси (flaviviruses), повинні інфікувати більш ніж один вид організмів, щоб завершити свій життєвий цикл.

II. Choose the right word to complete each of the sentences below

1. Snakes track their _____ by its scent.

a) victim b) prey c) predator d) casualty

2. Organic compounds are _____ by chemoheterotrophs as the source of carbon and energy.

   a) applied b) exercised c) utilized d) taken

3. The ,ajority of psychrophilic bacteria are in the gram-negative _____ Pseudomonas, Flavobacterium, Achromobacter, and Alcaligenes.

   a) genera b) species c) phyla d) families

4. Bacteria are so small that the details of their internal structure can be _____ only with the aid of the electron microscope.

   a) watched b) viewed c) observed d) regarded

5. Unfortunately, fertilizers from surrounding farmland have reduced the _____ life.

   a) river b) watery c) liquid d) aquatic

6. Certain _____ products of cells, called interferons, may have potential antiviral and anticancer properties.

   a) prevalent b) natural c) common d) normal

7. The problem how viruses may cause disease or _____ the death of their host cells is discussed in the article.

   a) bring about b) break through c) bring round d) bring up

8. Only in the 17th century biologists began to realize that important insights could be _____ by comparative studies of all animals, including man.

   a) obtained b) received c) acquired d) gained

9. Energy supplied by electrical storms and ultraviolet light may have _____ the atmospheric gases into their constituent elements, and organic molecules may have been formed when the elements recombined.

   a) broken out b) brought down c) broken down d) brought up

10. Lysogenic conversion is _____ in bacteria and is an important aspect of the epidemiology of infectious diseases.

    a) general b) common c) usual d) natural

11. The concept of causality, that was developed around 600 BC by Greek philosophers, had a _____ effect on subsequent scientific investigation.
    a) significant b) substantial c) prominent d) profound
12. The primary taxonomic division of viruses into two classes: DNA viruses and RNA viruses is based on their nucleic acid _____.
    a) content b) complex c) proportion d) combination
13. The Greek philosophers, for example, believed that the traits of individuals were _____ from contact with the environment and that such characteristics could be inherited by offspring.
    a) obtained b) acquired c) imparted d) taken
14. Kidney stone disease _____ mostly men between 20 and 55.
    a) contracts b) injures c) afflicts d) attacks
15. In his work Harvey demonstrated that the heart _____ passively and contracts actively.
    a) stretches b) expands c) protracts d) enlarges
16. Much of the earliest recorded history of biology is _____ from bas-reliefs the Assyrians and Babylonians made of their cultivated plants and from carvings depicting their veterinary medicine.
    a) received b) extracted c) found d) derived
17. There is a hypothesis that the eubacterial and archaebacterial lines diverged from a common _____ about the time that eukaryotic cells developed.
    a) precursor b) forerunner c) prototype d) parent
18. Many spores can withstand boiling in water for 10 minutes, and spores in soil can _____ for tens, perhaps hundreds, of years.
    a) survive b) sustain c) persist d) endure
19. _____ soil can contain millions of bacteria per gram.
    a) fruitful b) productive c) resourceful d) fertile
20. Unlike true organisms, viruses cannot synthesize proteins, because of the _____ of ribosomes.

a) deficit b) lack c) need d) deficiency

Additional Practice

I. Reconstruct the text below putting the extracted fragments (a-j) into their correct places (1-10). Make a written translation of the text into Ukrainian

In the late 1970s, biologists began to describe a type of microorganism not seen before. The archaea, at first called archaebacteria, are similar (1)……. . The structures and sequences of certain molecules in these microbes are as different from those in bacteria (2)……. . In other words, the archaea do not fit (3)……. . They are not prokaryotes or eukaryotes, but a third form of life.

Where should taxonomists place the archaea? Some biologists include them with Monera, (4)……. . Placing them in a sixth kingdom is not a satisfying solution either, because their differences are greater (5)……. . In 1990, researchers Carl Woese, Otto Kandler, and Mark Wheelis took a bold step — (6)…….! So they grouped the kingdoms into three broader taxa, the domains of Bacteria, Archaea, and Eukarya. Biologists distinguish organisms within the domains (7)……. . Researchers often add new molecular criteria.

Many biologists today recognize the three domains but also adhere to the long-accepted five-kingdom scheme. This presents a contradiction, however — the archaea, considered distinct enough to warrant a separate domain, have no place in the five-kingdom system, that places them with the bacteria, (8)……. . The domain system is still evolving — don't be surprised if terms change. For example, the term archaea implies that these organisms appeared before all others, and (9)……. . We do not yet know enough about the origins of these three basic types of organisms to determine which came first. It will be interesting to see how taxonomy shifts to accommodate new information on the archaea.

The three-domain system considers mostly subcellular and molecular differences between species — (10)……. . Much work needs to be done, however, to reclassify already known organisms in the three-domain system.

a) …which they may only superficially resemble;

b) …into any kingdom in the five-kingdom scheme;

c) …by cell complexity, sequences of ribosomal RNA molecules, and the types of lipids that make up cell membranes;

d) …differences we cannot easily see;

e) …to prokaryotes in cellular structure because they lack nuclei;

f) …than those that distinguish members of other kingdoms from each other;

g) …as they are from those in eukaryotes, however, and in some cases they actually more closely resemble molecules in eukaryotes;

h) …the term prokaryote implies that these organisms preceded eukaryotes;

i) …if the life-forms couldn't fit the prevailing taxonomy, then alter the taxonomy;

j) …although they are quite different from bacteria.

II. Read the passage below and fill in the blanks with the words from the box

severe	mild	transfusion	percentage
blindness	pathogens	contracted	causes
defects	attention	mouth	liver
inflammation	revealed	organ	pregnancy
disorder	sporozoa	infected	

Human (1)……. appear in all groups of protozoa, but zooflagellates and (2)……. cause the most (3)……. diseases. *Toxoplasma gondii* is a protozoan that (4)……. toxoplasmosis, with symptoms so (5)……. (fatigue) that many otherwise healthy people are (6)……. and never know it. The infection came to public (7)……. when physicians traced fetal (8)……. to pregnant women who (9)……. toxoplasmosis from cat feces in litter boxes. Symptoms in the fetus include an enlarged (10)……. and spleen, a rash, eye inflammation causing (11)……., and brain damage. The women had no symptoms when pregnant — only an immune system test (12)……. the infection. The maternal

infection must occur early in (13)……. to affect the fetus, and only a small (14)……. of exposed fetuses actually develop symptoms.

People also may contract toxoplasmosis from eating raw or undercooked meat, undergoing an (15)……. transplant, or receiving a blood (16)……. . An infected person takes in cysts through the nose or (17)…….. .

In people with AIDS, toxoplasmosis is not a vague, mild (18)……., but a deadly disease. The protozoa quickly spread to the brain, causing (19)……. (encephalitis), and also travel to the lungs, heart, liver, and eyes.

III. Read the following text and answer the questions in the Discusion section

SHOULD WE DESTROY THE LAST SMALLPOX VIRUS?

In two freezers, one at the Center for Disease Control and Prevention in Atlanta and another at the Research Institute for Viral Preparations in Moscow, lie the last smallpox viruses on the planet. Infectious disease experts and virologists are debating whether or not to destroy the remaining smallpox virus, called Variola.

Smallpox is the deadliest infectious disease known to strike humans, in terms of numbers of people killed. Smallpox ravaged the Roman Empire and enabled the Spaniards to defeat the Aztecs in Mexico, whose immune systems could not handle the foreign virus. Survivors of smallpox often are left with severe scars. Luckiest were those few individuals who had mild cases and were left with relatively smooth skin plus immunity against reinfection.

English physician Edward Jenner's invention of the first vaccine in 1796, against Variola, was the beginning of the end of the scourge. It took many decades before the vaccine was improved and distributed widely enough to impact upon the disease's prevalence. By 1967, when the World Health Organization (WHO) began its eradication campaign, some 10 million people in 40 nations still contracted smallpox each year.

The WHO campaign was remarkably successful, and in October 1977, the last victim in the general population, a Somali man, died of smallpox. A year later, though, a shocking case prompted public health officials and scientists to question the wisdom of maintaining samples of the virus. A photographer, Janet Parker, acquired smallpox while visiting a laboratory in England that kept the virus, obviously not sufficiently contained. Parker developed smallpox and died. The head of the laboratory, overcome with guilt, killed himself.

In 1979, the world was declared free of smallpox. The Global Commission for the Certification of Smallpox Eradication formed and requested that all Variola samples be destroyed or sent to appropriate facilities. In 1986, WHO raised the idea of destroying all samples, if the scientific and public health communities approved. In 1990, scientists request that the decision be postponed until they could learn the virus's DNA sequence, so that they could continue to study it. Researches in the United States and the former Soviet Union collaborated and sequenced all 200,000 DNA bases that constitute Variola virus by 1993.

The remaining Variola samples are tentatively scheduled to be destroyed in the following years, though the debate over their fate continues. The "destroy" arguments tend to be political and practical; the "do not destroy" arguments are scientific in tone. The reasoning is as follows:

Destroy!

1. A terrorist could use the stored virus for biological warfare.
2. Damage to the freezers storing the virus — such as from a bomb, earthquake, or other disaster — could unleash a deadly smallpox epidemic.
3. Knowledge of the DNA sequence of Variola will enable researchers to continue studying the virus, without needing the actual virus.

Do Not Destroy!

1. Learning how the smallpox virus evades the human immune system will provide clues on how to combat HIV. Both Variola and HIV seem to infect only humans, and in many cases they defeat the human immune system.

2. Knowing the DNA sequence of a virus is not sufficient to understand how it causes symptoms and evades the immune system.
3. Viral infections reemerge. Should a new virus evolve to fit the niche that Variola occupied, or an existing virus (such as monkeypox) expand and change to affect humans, the lack of supplies of smallpox virus could hamper research.
4. Smallpox could reappear even if we destroy the frozen samples. Variola may have been stored in other laboratories, and smallpox victims buried in Soviet permafrost could some day thaw and release active virus.

A final note is more philosophical. Even though a virus is not technically alive, do we have the right to destroy it? In the words of one researcher, "It's taken millions of years for nature to make the Variola virus, and why should 10 guys sitting around a table say: 'Let's destroy it'?"

Discussion

1. What is smallpox?
2. When did mankind free itself from the scourge?
3. Is it safe to store a virus like that in laboratories?
4. What is your answer to the question: “Should we destroy the last smallpox virus?”?

IV. Solve the following crossword puzzle

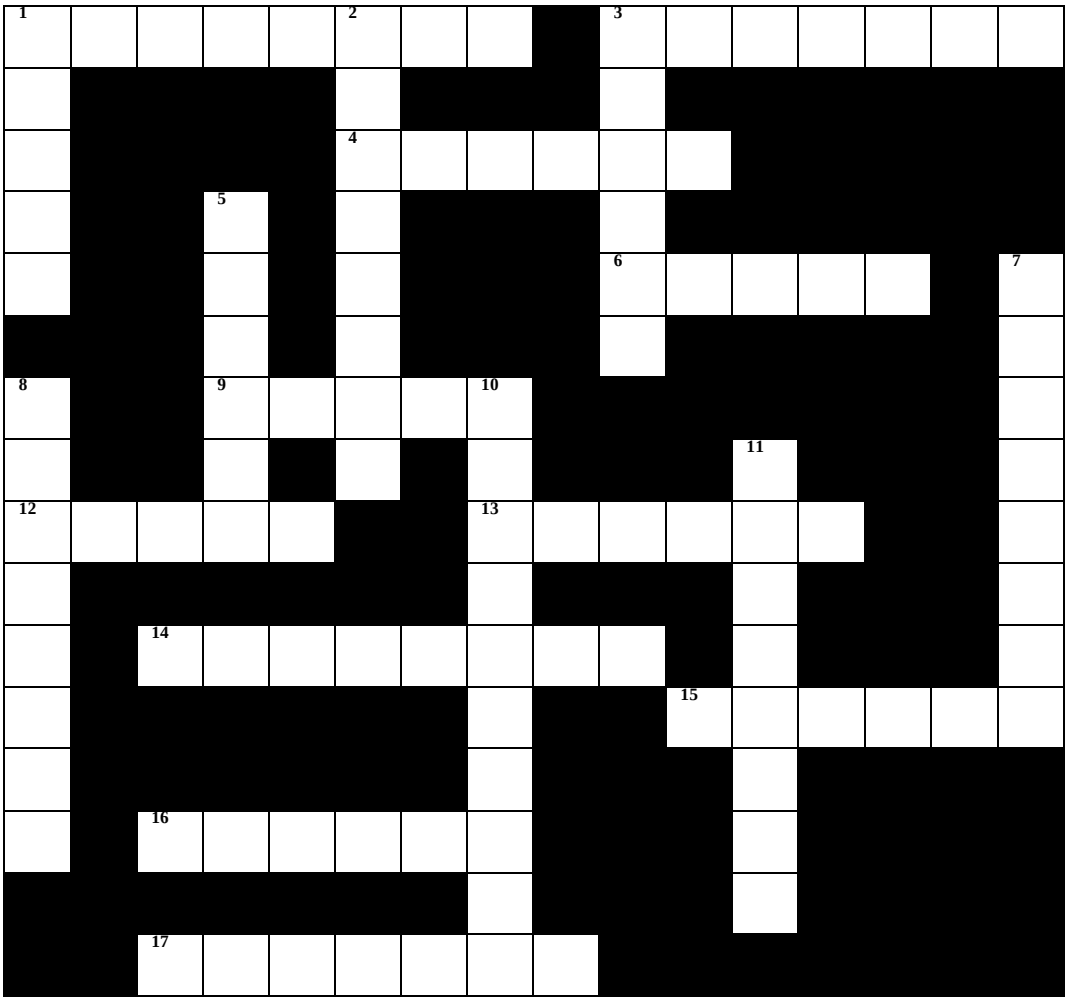
Across:

1 a kingdom of unicellular, colonial, or multicellular organisms usually including the protozoans and most algae; **3** a preparation of killed microorganisms, living attenuated organisms, or living fully virulent organisms that is administered to produce or artificially increase immunity to a particular disease; **4** a kingdom of prokaryotic unicellular round, spiral, or rod-shaped single-celled microorganisms that are often aggregated into colonies or motile by means of flagella, that live in soil, water, organic matter, or the bodies of plants and animals; **6** a category of

taxonomic classification ranking above the family and below the class; **9** a category of biological classification ranking between the family and the species, comprising structurally or phylogenetically related species; **12** a major category in biological taxonomy ranking above the order and below the phylum or division; **13** a group that constitutes one of the usually primary divisions of the animal kingdom; **14** an organism that lives in the absence of free oxygen; **15** an organism capable of performing life functions only in the presence of oxygen; **16** a group of related plants or animals forming a category ranking above a genus and below an order and usually comprising several to many genera; **17** a category of biological classification ranking immediately below the genus or subgenus, comprising related organisms or populations potentially capable of interbreeding.

Down:

1 a protein particle that lacks nucleic acid and is believed to be the cause of various infectious diseases of the nervous system; **2** an organism living together with another dissimilar organism in a mutually beneficial relationship; **3** a complete virus particle that consists of an RNA or DNA core with a protein coat sometimes with external envelopes and that is the extracellular infective form of a virus; **5** any of a major group of saprophytic and parasitic spore-producing organisms usually classified as plants that lack chlorophyll and include molds, rusts, mildews, smuts, mushrooms, and yeasts; **7** an organism living in, with, or on another organism and obtaining benefits from the host which it usually injures; **8** the DNA-containing area of a prokaryotic cell; **10** an organism living on dead or decaying organic matter; **11** any of various enzymes that promote hydrolysis of nucleic acids.



VII. Using additional sources of information prepare a report on one of the following topics and present it to the class

- **Modern views on the problems of taxonomy and systematics in biology.**
- **The role of bacteria in ecology and in human lives.**
- **Modern virology. Recent investigations and discoveries.**

Unit 4

Lesson 1

VASCULAR PLANTS

PRE-READING TASKS

I. Answer the following questions

- What do you associate a plant with?
- What features distinguishing plants from other living organisms can you name?
- What part do plants play in ecology?

II. Listen to the following words and practice their pronunciation

Vascular plant, xylem, phloem, fern, gymnosperm, angiosperm, conifer, monocot, dicot, taproot, fibrous root, meristem, lateral bud, internode, petiole, axil, axillary bud, leaf primordia, protoderm, epidermis, procambium, cuticle, pith, cortex.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) anchor, v	a) the upper layer of earth that may be dug or plowed and in which plants grow;
2) comprise, v	b) the process by which rock or soil is gradually destroyed by wind, rain, or the sea;
3) device, n	c) to hold firmly or fix;
4) dormant, adj	d) the usually pointed end of something;
5) erosion, n	e) not active or not growing at the present time but able to be active later;
6) germinate, v	f) a small shoot or branch usually without its leaves;
7) principal, adj	
8) soil, n	

9) steep, adj — g) to begin to grow or to sprout;

10) tip, n — h) most important or influential, chief;

11) twig, n — i) a mechanism designed to serve a special purpose or perform a special function;

j) to consist of particular parts, groups, etc;

k) making a large angle with the plane of the horizon.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

The ***vascular plants***, or Tracheophyta, differ from the evolutionary more ancient algae and mosses by the possession of conducting systems called ***vascular tissues***. There are two types of vascular tissue: ***xylem*** and ***phloem***. Xylem is concerned primarily with transport of water and dissolved minerals from the roots to the other parts of the plant, whereas the phloem transports food and certain other solutes from sites of production (such as leaves) to sites of utilization (such as roots).

The body of most vascular plants is divided into three principal organs: the ***leaves***, the ***stem*** and the ***root system***. A stem and its leaves, taken together, are called a ***shoot***. The ***shoot system*** of a plant consists of all stems and all leaves. The leaves are the chief organs of food production (photosynthesis), whereas roots serve to anchor the plant in space and to absorb water and mineral nutrients from the soil. The stem may be regarded as a device for holding and displaying all leaves to the sun, so as to maximize the photosynthetic yield, as well as for providing transport connections between the roots and leaves.

The three principal groups of vascular plants are the ***ferns***, ***gymnosperms*** (pines and other ***conifers***), and ***angiosperms*** (***flowering plants***). The angiosperms, in turn, comprise two subclasses, the ***monocots*** and the ***dicots***. Monocots are generally narrow-leaved flowering plants such as grasses, lilies, and orchids. Dicots are broad-leaved flowering plants such as beans, roses and oaks.

Roots. There is more than one type of root system. In many gymnosperms and dicots, there is typically a ***taproot system*** in which a single, large, deep-growing root is accompanied by less prominent secondary roots. The ***taproot*** itself may function as a food-storing organ, as in carrots and radishes. In contrast, monocots and some dicots have ***fibrous root system*** composed of numerous thin roots roughly equal in diameter. Such a root system holds soil very well, making grasses an ally on steep hillsides where runoff from rain could cause erosion. Fibrous root systems often have a tremendous surface area for absorption of water and minerals. The outer layer of cells in roots forms the ***epidermis***. The flattened epidermal cells, called ***root hairs***, produce amazingly long, delicate extensions that vastly increase the surface area of the root. At the tip of each root there is a ***root cap*** that protects the delicate growing region of the root as it pushes through the soil. Cells of the root cap are constantly damaged and scraped away and must therefore be replaced by the growing region, or ***meristem***, of the root. The root cap is also the structure that detects the pull of gravity and thus causes the root to grow downward.

Stems. The vascular tissues run continuosly from root to stem, affording uninterrupted flow of water and food. Unlike the root, the stem may be green and capable of photosynthesis. The stem bears leaves, and, where each leaf meets the stem, there is a ***lateral bud***, which develops into a branch if released from its dormant state. The branching patterns of plants are highly variable, depending upon the species, environment conditions and other factors.

The area, or region (not structure), of a stem where a leaf or leaves are attached is called a ***node***, and a stem region between nodes is called an ***internode.*** A leaf usually has a flattened ***blade***, and in most cases is attached to the twig by a stalk called the ***petiole***. Each angle between a petiole and the stem contains a ***bud***. The angle is called an ***axil***, and the bud located in the axil is ***axillary bud***. Axillary buds may become branches, or they may contain tissues that will develop into the

next season's flowers. Most buds are protected by one to several ***bud scales***, which fall off when the bud tissue starts to grow.

At the tip of each stem there is an ***apical meristem*** which contributes to an increase in the length of the stem. The apical meristem is dormant before the growing season begins. It is protected by bud scales of the bud in which it is located and also to a certain extent by ***leaf primordia***, the tiny embryonic leaves that will develop into mature leaves after the bud scales drop off and growth begins. The apical meristem in the embryonic stem of a seed is also dormant until the seeds begin to germinate.

When a bud begins to expand or a seed germinates, the cells of the apical meristem undergo mitosis, and soon three primary meristems develop from it. The outermost of these primary meristems, the ***protoderm***, gives rise to the ***epidermis***. Although there are exceptions, the epidermis is typically one cell thick and usually becomes coated with a thin, waxy, protective layer, the ***cuticle***. A cylinder of strands constituting the ***procambium*** appears to the interior of the protoderm. The procambium produces water-conducting primary xylem cells and food-conducting primary phloem cells.

The remainder of the meristematic tissue, called ***ground meristem***, produces two tissues composed of parenchyma cells. The parenchyma tissue in the centre of the stem is the ***pith***. Pith cells tend to be very large and may break down shortly after they are formed, leaving a cylindrical hollow area. Even if they do not break down early, they may eventually be crushed as new tissues produced by other meristems add to the girth of the stem, particularly in woody plants. The other tissue produced by the ground meristem is the ***cortex***. The cortex may become more extensive than the pith, but in woody plants, it, too, eventually will be crushed and replaced by new tissues produced from within. The parenchyma of both the pith and the cortex function in storing food or sometimes, if chloroplasts are present, in manufacturing it.

III. USEFUL PHRASES. Study the following phrases and match two halves of the sentences that follow

accompanied by – у супроводі/що супроводжується
develop into – розвинутися у
drop/fall off - відпадати
give rise to – давати поштовх до/призводити до зростання

1. *Field Guide to Plants of Costa Rica* is a must-have reference guide for beginner and expert naturalists alike. It provides a thorough survey of more than 850 plant species, each entry…
2. Plant cells are formed in meristems, and then…
3. Leaves can turn yellow and…
4. A portion of a root will similarly develop one or more shoots, and thus…

a) …drop off the plant.
b) … give rise to a new plant.
c) …accompanied by colour photos and a concise yet detailed narrative description.
d) …develop into cell types which are grouped into tissues.

IV. Decide whether the following statements are true or false according to the text

1. The major characteristic feature of vascular plants is the presence of xylem and phloem.
2. Phloem is a complex tissue in vascular plants which functions chiefly in conduction of water and dissolved minerals.
3. Each vascular plant comprises a root, a stem, leaves and flowers.
4. Gymnosperms can be further divided into two subgroups: dicots and monocots.
5. Botanists distinguish between several types of root systems in vascular plants.
6. Both fibrous and taproot systems often serve as food-storing organs.
7. Root hairs are tiny extensions which contribute to a more efficient absorption of water and minerals from the soil.
8. Leaves are the only organs in plants capable of photosynthesis.

9. Bud scales are special structures that form the protective sheath of a plant bud.
10. Cuticle is a thin continuous fatty or waxy film on the external surface of many higher plants.

V. Make up 6-7 questions about the text "Vascular Plants" and ask them to your partner

VI. Look for the words with the following meanings in the text "Vascular Plants"

1) having something as your own;
2) trees or shrubs of the beech family that produce acorns and are known for their hard, tough and durable wood;
3) standing out or projecting beyond a surface or line, readily noticeable, conspicuous, or widely known;
4) notable by reason of extreme size, power, greatness, or excellence;
5) to keep someone or something safe from harm, damage, or illness;
6) to rub against a rough surface in a way that causes slight damage or injury;
7) to go through, to experience or endure;
8) furthest from the middle;
9) something or someone that is not included in a general statement or does not follow a rule or pattern.

VII. Use the words from exercise VI to fill in the blanks in the following sentences

1. Garlic was once thought to _____ people against evil spirits.
2. The house has been in the family's _____ since the 1500s.
3. On the _____ point of the peninsula we could see straight over to Midland Isle and just beyond that to Skomer Island.
4. The sharp rocks, or moraine, which were stuck in the glaciers caused them to _____ out the valleys much deeper.

5. Her nose was quite _____, and she had small, even teeth.
6. Above them, the branches of the _____ tree were beginning to creak and sway.
7. Each plant, without _____, contains some kind of salt.
8. He _____ major heart surgery last year.
9. The progress that has been made in genetic engineering is _____.

VIII. Fill in the table converting the given words into other parts of speech where possible. Follow the example

noun	verb	adjective	adverb
connection	*connect*	*connective*	*connectively*
possession			
production			
	divide		
		equal	
	protect		
		variable	
			continuously
	provide		

GRAMMAR IN USE: *Articles*

I. Read the following passage and explain the use of each article in it

In the 1880s, Alphonce de Candolle, a Swiss botanist, published a book entitled 'Origin of Cultivated Plants', based on data he had gathered from many sources. He deduced that cultivated plants probably originated in areas where their wild relatives grow. In 1916, N.I. Vavilov, a Russian botanist and geneticist, began a follow-up of de Candolle's work and modified his conclusions. Vavilov became persuaded, as a result of his research, that most cultivated plants differ appreciably from their wild relatives. He also concluded that dispersal centres of cultivated

plants are characterized by the presence of dominant genes in plant populations, with recessive genes becoming apparent towards the margins of a plant's distribution…

II. Use *a/an*, or *the* articles where necessary in the following text

Nothing is more important to ___ relationship of ___ humans to ___ environment than ___ cultivated plants that provide ___ sources of ___ food, ___ fiber, ___ animal forage, and ___ medicines. ___ cultivated plants have been developed in nearly all ___ climatic regions of ___ earth and reflect ___ wide diversity of ___ environments occupied by ___ humans. ___ cultivated plants appear to have originated in ___ six major regions: Near Eastern (wheat, carrots, apple), Chinese (soybean, cucumber, peach), African (yam, cotton, coffee), South Asian and Pacific (rice, sugar, cane, citrus fruits), North American (sunflower, tobacco), and South and Central American (white Irish potato, squash, pineapple). ___ plants originating in these ___ regions are now grown throughout ___ world. Today's ___ most important cultivated plants are ___ tiny fraction of ___ thousands of species used by ___ peoples around ___ world; preserving ___ knowledge of ___ useful plants held by ___ traditional societies is ___ major challenge for this ___ generation of ___ botanists.

LISTENING COMPREHENSION

I. You are going to hear three pieces of information about the ferns. Before listening, look through the words in the box below. Use a dictionary or discuss their meanings in class if necessary.

to scrape off	megaphyl	opinion poll	Carboniferous period
patch	frond	to accumulate	horse tail
inadvertently	pleated	deposit	club moss
to frustrate	clover	to inhibit	swampy area

to float	humus	coal	bacteria-mediated decay

II. Listen to the first fragment and say whether the following statements are true or false

1. The speaker's family often used to sit near the fireplace when he was a child.
2. The speaker liked the potted ferns in his family house and took care of them.
3. But for him the plants would have died from a dangerous disease.
4. He found out that he had been frustrating the plants sex life before he got to college.
5. According to the recent statistical data the ferns occupy the world top position in the list of decorative house plants.
6. Thoreau once said, "God made ferns to bring pleasure into our lives."

III. Listen to the second fragment and answer the following questions

1. How many species of ferns are known to modern science?
2. What size do the largest representatives of this phylum reach?
3. What are fronds?
4. What shapes can fern leaves have?
5. Who benefits from "nest" ferns that grow in the tropics?
6. Why do ferns prefer wet habitats?

IV. Listen to the third fragment and complete the summary below with the missing information

The ferns were among the first land plants that possessed _____ for _____ and roots for _____. Due to these features they increased the _____ where these plants could _____. In the _____ geological period, giant horsetails and _____ grew in _____ in _____. Huge deposits of _____ produced by these plants were eventually transformed into

_____, due to the lack of _____ that inhibited _____ of the plant biomass. The coal deposits contain large _____ that may be reintroduced into the atmosphere in modern times as we _____. This may cause _____.

WRITING AND SPEAKING

Summarize the text "Vascular Plants" in 200 words. Retell your summary

Lesson 2

DEVELOPMENT OF GAMETOPHYTES IN ANGIOSPERMS

PRE-READING TASKS

I. Answer the following questions

- What forms of plant reproduction do you know?
- What do you know about the alteration of generations in higher plants?
- What plant structures are responsible for their distribution?

II. Listen to the following words and practice their pronunciation

Gymnosperm, angiosperm, gametophyte, megaspore, megasporocyte cell, microspore, microsporocyte cell, heterosporous, sporophyte, pollen grain, ovule, micropyle, gamete, synergid, antipodal, megagametophyte, microgametophyte, anther, embryo sac, exine, pollination, fertilization, stigma, pollen tube, style, vegetative nucleus, generative nucleus, gnetophyte, zygote, endosperm.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) aperture, n	a) the disposition or manner of union of the particles of a body or substance;
2) degenerate, v	b) length of life;
3) dense, adj	c) a small, hard object produced by plants, from which a new plant of the same kind grows;
4) discharge, v	d) a structure in a seed plant whose development begins after fertilization and which eventually develops into a seed;
5) fertilization, n	e) to pass from a higher to a lower type or condition;
6) longevity, n	f) a part or area distinct from that about it;
7) ovule, n	
8) patch, n	
9) seed, n	
10) simultaneous, adj	

11) texture, n

g) happening at exactly the same time;
h) the process of union of two gametes whereby the somatic chromosome number is restored and the development of a new individual is initiated
i) having a high mass per unit volume;
j) an opening or open space, a hole;
k) to throw off or deliver a load or burden.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

The plants of Phylum Magnoliophyta (the flowering plants) vary greatly in size, shape, texture, form, and longevity. The phylum includes, for example, the tiny duckweeds that may be less than 1 millimeter long, all the grasses and palms, many aquatic and epiphytic plants, and most shrubs and trees, including the huge Eucaliptus regnans trees of Tasmania that rival the redwoods in total volume.

Like the ***gymnosperms***, the ***angiosperms*** are ***heterosporous*** (produce two kinds of ***spores***), and the ***sporophytes*** are even more dominant than in the gymnosperms. The ***female gametophytes*** are wholly enclosed within sporophyte tissue and reduced to only a few cells. At maturity, the ***male gametophytes*** consist of a germinated ***pollen grain*** with three nuclei.

While the flower is developing in the ***bud***, a ***diploid megasporocyte cell*** differentiates from all the other cells in the ***ovule*** and undergoes meiosis, producing four haploid ***megaspores***. Soon after they are produced, three of these megaspores generate and disappear, but the nucleus of the fourth undergoes mitosis, and the cell enlarges. While the cell is growing larger, its two haploid nuclei divide once more. The resulting four nuclei then divide yet another time. Consequently, eight haploid nuclei in all are produced (without walls being formed between them). By the time these three successive mitotic divisions have been completed, the cell has grown to many times its original volume.

At this stage there are eight haploid nuclei in two groups, four nuclei toward each end of the large cell. One nucleus from each group then migrates toward the middle of the cell. These two central cell nuclei may become a binucleate cell, or they may fuse together, forming a single diploid nucleus. Cell walls also form around the remaining nuclei. In the group closest to the ***micropyle***, one of the cells functions as the ***female gamete***, or egg. The other two cells, called ***synergids***, either are destroyed or degenerate during or after events that occur later. At the other end, the remaining three cells, called ***antipodals*** degenerate too. The large sac, usually containing eight nuclei in seven cells, constitutes the female gametophyte (***megagametophyte***), formerly known as the ***embryo sac***.

Usually while the megagametophyte is developing, a parallel process that leads to the formation of male gametophytes takes place in the ***anthers***. As an anther develops, four patches of tissue differentiate from the main mass of cells. These patches of tissue contain many diploid ***microsporocyte cells***, each of which undergoes meiosis, producing a quartet (also referred to as tetrad) of ***microspores***.

After meiosis, the haploid microspores in the pollen sacs undergo several changes more or less simultaneously, the processes usually taking from a day to a couple of weeks. The following three changes are the most important: (1) the nucleus in each microspore divides only by mitosis; (2) the members of each quartet of microspores separate from one another (in some species, the separation does not occur, but this is unusual); (3) a two layered wall, whose outer layer ***exine*** is often finely sculptured, develops around each microspore. When these events are complete, the microspores have become ***pollen grains***.

Pollination. Those who consider pollination to be the equivalent of fertilization are mistaken. Pollination is simply the transfer of pollen grains from an anther to a stigma. ***Fertilization*** involves the union of ***egg*** and ***sperm***, and it may not occur until days or weeks or months after pollination has taken place, or it may not follow pollination at all.

Most pollination is brought about by insects or wind, but in many species, water, birds, bats, other mammals, and gravity act as agents or pollinators. In some instances, self pollination may occur, with the pollen grains germinating on the ***stigma*** of the same flower in which they were produced.

After pollination, the dense cytoplasm of the pollen grain absorbs fluids from the stigma and bulges out through one of the apertures in the form of a tube. This ***pollen tube*** then grows down between the cells of the stigma and ***style*** until it reaches the micropyle of the ovule. As the tube grows, most of the contents of the pollen grain are discharged into it. The ***vegetative nucleus*** stays at the tip, while the ***generative nucleus*** (cell) lags behind and divides by mitosis, usually in the tube, producing two nuclei that become sperm cells; no flagella develop. Sometimes, the generative nucleus (cell) divides before the pollen tube has formed. The germinated pollen grain with its vegetative nucleus and two sperms constitutes the mature male gametophyte (***microgametophyte***).

When the pollen tube reaches the micropyle, it continues on to the female gametophyte (megagametophyte), which it enters, destroying now degenerating synergid in the process; it then either bursts or forms a pore, discharging its contents. Next, an event unique to angiosperms (and a few ***gnetophytes***), called ***double fertilization*** (or ***double fusion***) takes place. One sperm migrates from the synergid to the egg, losing most of its protoplasm along the way. The sperm cell nucleus then unites with the egg nucleus, forming a ***zygote***.

The other sperm cell also migrates from the synergid, and, upon reaching the central nuclei, unites with them, producing a 3n (triploid) endosperm nucleus. The endosperm nucleus becomes exceptionally active and divides repeatedly by mitosis. This nutritive 3n tissue, called ***endosperm***, may eventually have hundreds of thousands of nuclei; it surrounds the ***embryo*** that develops from the zygote. At the conclusion of theses various events, the ovule has become a ***seed***, and at the same time, the ovary matures into a ***fruit***.

III. USEFUL PHRASES. Study the following phrases and use them in the sentences of your own

at this stage – на цій ступені/стадії

take place - відбуватися

more or less – більш менш

at the same time – у той же ж час

IV. Answer the following questions about the text "Development of Gametophytes in Angiosperms"

1. Can you name any representatives of the phylum Magnoliophyta?
2. What do female and male gametophytes in angiosperms look like?
3. What happens to the four haploid megaspores which are produced as a result of division of the diploid megasporocyte cell in the ovule?
4. What processes take place during the formation of a female gametophyte?
5. What changes do the haploid microspores in the pollen sacs undergo after meiosis?
6. What is the difference between pollination and fertilization?
7. In what ways can pollination be accomplished?
8. What does a mature microgametophyte include?
9. What role does each of the sperm cells in the male gametophyte play during fertilization?

V. Read the text "Development of Gametophytes in Angiosperms" again and find there the English equivalents of the following words and expressions. Use them in the sentences of your own

Ряска; кущі, чагарі; змагатися, бути суперником; переміщуватися, переселятися; двохядерна клітина; яйцеклітина; раніше, колись; комаха; кажан; відставати, рухатись позаду; розриватися.

VI. The words below can be easily confused because of their similar pronunciation and spelling. Using a dictionary learn the meanings of these words and explain the difference between them

Success; succeed; successive; succession; successful; successfully; successor; succeeding.

VII. Use the words from the previous exercise in the following sentences

1. Chimeraplasty has been _____ tested in animals, and investigators have recently begun to test it in humans.
2. I didn't think my chances of _____ were very good.
3. The development of a seed requires that the megasporangium (the structure inside which the female egg will be formed) and the _____ development of an embryonic plant be surrounded by a covering referred to as an integument.
4. If the prince dies, the _____ passes to his son.
5. Eddie Murphy is one of Hollywood's most _____ stars.
6. George VI died in 1952, leaving his elder daughter Elizabeth to _____ him.
7. _____ rows of cilia always beat slightly out of phase, causing a wavelike motion to pass over the cell surface.
8. Such an analysis is an important prerequisite to much of the discussion that follows in _____chapters.
9. She won the championship four times in _____.
10. The experiment was a big _____.
11. Scientists claim they have _____ in finding a cure for cancer.
12. His _____ died after only 15 months in office.
13. In April 2000, French researchers reported the _____ use of gene therapy to treat two female infants with human severe combined immunodeficiency disease (SCID)
14. The radiation caused by the military tests will add to the risks of genetic effects in _____ generations.

15. Several _____ governments have tried to deal with this issue.
16. Ecosystems are dynamic, in that the populations constituting them do not remain the same. This is reflected in the gradual changes of the vegetational community over time, known as _____**.**
17. Most clinical trials of gene therapy have not resulted in enough improvement in the patient's underlying condition to consider it an unqualified _____ and to justify treating large numbers of people.
18. The research team _____ in finding a self-replicating RNA molecule that was only 218 nucleotides long.
19. In some methods the peptide is synthesized in solution by the _____ addition of amino acids to the amino acid chain.
20. He _____ completed a master's degree.

FOCUS ON GRAMMAR: *Modal Verbs*

I. Read the following sentences and explain the use of modal verbs in them

1. These two central cell nuclei ***may*** become a binucleate cell, or the ***may*** fuse together, forming a single diploid nucleus.
2. Plants range in size and complexity from small, nonvascular mosses, which depend on direct contact with surface water, to giant sequoia trees, the largest living organisms, which ***can*** draw water and minerals through their vascular systems to elevations of more than 100 m.
3. The nucleus ***must*** not only synthesize the mRNA for many thousands of proteins, but it ***must*** also regulate the amounts synthesized and supplied to the cytoplasm.
4. On the one hand, water vapour is a greenhouse gas, and its increased presence ***should*** add to the insulating effect. On the other hand, more vapour in the atmosphere will produce more clouds, which reflect sunlight back into space, which ***should*** slow the warming process.

5. Gene therapy ***might*** help older people to regain strength in withered muscles and density in thinned bones, and to increase pumping power in their aging hearts.
6. One female silkworm moth ***need*** release only 10^{-8} grams of sex attractant per second in order to attract every male silkworm moth in a volume hundreds of meters to kilometers on a side.
7. Some researchers predict that in the distant future gene therapy ***could*** be used to eliminate genetic defects from families or even to produce "designer babies" with more muscle strength, higher intelligence, sweeter dispositions, or whatever traits parents desire.

II. Fill in *can, may, must, need, should, might,* and *could* in the sentences below

1. Researchers approached the use of retroviruses with caution because of concerns that they _____ attack inappropriate cells.
2. Neither ATP nor ADP, being large, charged molecules, ___ cross the membrane unaided, but ADP ____ enter and ATP ____ leave the mitochondrial matrix in order for ATP synthesis to continue.
3. Conservatives have argued that too much public money is being spent on the environment and that the federal government ____ play a much-reduced role in environmental regulation.
4. Heterotrophs — organisms that ____not manufacture their own food — usually lead less sedentary lives than plants, but they ultimately depend on autotrophs as sources of food.
5. Auxin, one of the most important plant hormones, is produced by growing stem tips and transported to other areas where it ____ either promote growth or inhibit it.
6. Once gene therapy methods have been developed in a laboratory and tested on animals, scientists ____ to prove that they work in humans.

7. Many people feel that because gene therapies use altered genes and potentially dangerous viruses, these treatments ____ be more extensively tested than drugs before being approved.
8. The extraordinary potential of gene therapy has also raised alarms among critics who warn that the technology ____ go too far.
9. Germ-line therapy is highly controversial because genetic alternations made to germ cells would change the genetic endowment of the unborn and ____ be passed on to future generations.
10. Today many domesticated plants ____ scarcely be traced back to their wild ancestors or to the original plant communities in which they originated.

III. Translate the following sentences using modal verbs

1. Мутації можна штучно стимулювати за допомогою рентгенівських та ультрафіолетових променів.
2. Зоологи вважають, що розведення диких тварин у неволі не можна вважати західом, який замінить охорону видів у дикій природі.
3. Ще з часів перших спроб освоєння та одомашнення тварин і рослин люди зрозуміли, що характерні риси батьків можуть передаватися їхньому потомству.
4. Сучасному суспільству потрібно розвивати енергозберігаючі технології та відновлювати енергетичні ресурси.
5. Залежно від тканини-цілі, певний гормон може виявляти різну дію.
6. Для того щоб передати спадкові ознаки від батьків до нащадків, генетична інформація, закодована у ДНК, повинна бути скопійована з великою точністю під час поділу клітини.
7. Коли вчені виділяють цікавий фрагмент ДНК, їм необхідно визначити чи відповідає послідовність нуклеотидів у цьому фрагменті їх послідовності у відомих генах, та з’ясувати, який білок він міг би кодувати.

8. Культиватори рослин можуть поширювати старі культури у нові регіони та знаходити для них нові застосування.
9. У багатьох видів рослин існують чоловічі та жіночі особини, і пилок чоловічих квіток повинен бути перенесений на жіночу квітку для запилення і розвитку насіння.
10. Епідерміс може містити трихоми, крихітні, переважно волоскоподібні утвори.

LISTENING COMPREHENSION

I. Listen to the text about fruit and answer the questions (a-c). Before listening discuss the meanings of the words and phrases in the box

dispersal of the seeds	helicopter blade	prickled
ash	dandelion	barbed
elm	hitching ride	sticky
maple	to exemplify	fleshy
tree of heaven	burdock	to be regurgitated
to spin		

a) What is a fruit?

b) What plants can have fruit?

c) Why are fruits so important for plant reproduction?

II. Listen again and fill in the spaces in the chart below

plant	*way of seed dispersing*	*major adaptations*
• coconut • ash, elm, maple • burdock • berries		

III. Listen to the poem by Henry Abbey and fill in the gaps with the appropriate words to complete the text of the poem below. Before listening, make sure you understand the words in the box

mast	keel	rafter	siding spire
sail	keelson	shingle	crag
plank	beam	studding	staff
to withstand	knee	lath	to out-tower
gale			

What do we plant _____?

_____, which will cross the sea.

We plant the mast _____;

_____ the planks _____ the gales –

The keel, the keelson, the beam, _____;

_____.

_____?

We plant _____.

We plant the rafters, the shingles, _____,

We plant the studding, the lath, _____,

The beams, the siding, _____;

_____.

What do we plant when we plant the tree?

_____ we daily see;

We plant the spire _____,

We plant the staff _____,

We plant _____ sun free;

_____.

IV. Discuss the poem from the previous exercise. What do you feel when you plant a tree? How important are plants in our lives? Try to add one more verse to the poem

SPEAKING

Speak about plants covering the following issues:

- **Vascular plants and their major characteristics.**
- **The main organs in vascular plants.**
- **The male and female gametophytes in angiosperms.**
- **Pollination and fertilization in the flowering plants.**
- **Fruits in angiosperms and their role.**

Lesson 3

ANIMALS

PRE-READING TASKS

I. Answer the following questions

- What are the main characteristics of animals?
- How many taxonomic groups of animals (phyla and classes) can you name?
- Which classes of animals are evolutionary most highly developed? Why?

II. Listen to the following words and practice their pronunciation

Annelid, arthropod, bilateral symmetry, cavity, chordate, coelenterate, coelom, deuterostome, digestive tract, echinoderm, excretion, flatworm, gill, hydrostatic skeleton, mollusk, nervous system, osmotic pressure, protostome, pseudocoel, radial symmetry, respiration, sense organ, somatic cell, sponge, vascular system, vertebrate.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) cavity, n	a) marked by complexity and fullness of detail;
2) elaborate, adj	b) to hang freely;
3) excrete, v	c) an act or the power of moving from place to place;
4) expenditure, n	d) permanently attached or established : not free to move about;
5) gill, n	
6) locomotion, n	e) an unfilled space within a mass, a hollowed-out space;
7) medium, n	f) to separate and eliminate or discharge (waste) from the blood or tissues or from the active protoplasm;
8) obscure, adj	
9) sessile, adj	g) the act or process of utilizing or using something up;

10) suspend, v

h) relatively unknown, not prominent or famous;

i) a condition or environment in which something may function or flourish;

j) an organ (as of a fish) for obtaining oxygen from water.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

The plant way of life can be characterized as the utilization of simple inorganic molecules from the environment by a usually sessile organism relying on the direct energy of sunlight. An animal can be viewed as an organism that requires a variety of complex organic molecules as sources of energy and obtains these molecules by the active expenditure of energy either to move through the environment, or to move the environment to it. The cells of animals are differentiated primarily in terms of their internal structure. Lacking rigid cell walls, animals, unlike plants, are unable to utilize high ***osmotic pressures*** to regulate the intake of materials from the environment. Instead, they have evolved elaborate mechanisms for regulating their internal environments. Active seeking for food has also given strong selective advantage to structures that provide more detailed information about the environment and to structures able to receive and coordinate this information. Consequently most animals are behaviorally more complex than plants.

Animals are believed to have arisen evolutionary from ancestral Protista by a process of division of labour among cells. Within the ancestral colonies of cells some cells began to differentiate into ***somatic types*** and others into ***gametes*** and ***gamete precursors***. Once this step was taken, it was possible for the units to become increasingly differentiated as specialized types of cells, all the while improving their coordination with other cells as working groups. These groups of cells made up even larger and more complex organisms: animals.

The multicellular animal form of organization has arisen from the protists at least three times. The ***sponges*** (phylum Porifera), ***coelenterates*** (phyla Cnidaria and Ctenophora), and ***flatworms*** (phylum Platyhelmintes) each probably represent separate ***phylogenetic lines***. Some zoologists believe that two other small and obscure phyla (Placozoa and Mesozoa) also evolved independently from the protists. The other 28 animal phyla are generally thought to have been derived from a flatworm or a flatworm-like ancestor.

Over 1 million living species of animals are now known to science, and estimates of the true number range up to 15 million or more. These species have arisen over more than 1 billion years of evolution.

Traits that figure prominently in current classifications of animals are ***body symmetry*** (***radial*** or ***bilateral***), ***body cavities*** (***none, pseudocoel, coelom***), ***embryological development*** (***protostomes*** or ***deuterostomes***), ***segmentation*** and ***type of skeleton***. The radially symmetrical phyla (Cnidaria and Ctenophora) have no well developed ***tissues*** or ***organs***, ***dead-end digestive tracts***, and no body cavities. The Platyhelminthes, believed to be the ancestors of most animal phyla, also lack body cavities and have dead-end digestive tracts, but they are bilaterally symmetric and have heads where ***sense organs*** are concentrated. All other phyla except the Nemerteans have some type of body cavity. A fluid-filled body cavity functions as a ***hydrostatic skeleton*** and provides an incompressible medium in which internal organs are suspended. More precise control over ***locomotion*** and other physiological functions is found among animals whose bodies are segmented (***annelids*** and ***arthropods)***.

Very different types of body plans are found among the ***mollusks***, which are built around a large ***muscular foot***, a ***mantle***, which secretes the ***shell*** in those species that have one, and a large ***gill***; and among the ***echinoderms***, which have secondarily adopted radial symmetry and an unusual ***water vascular system*** which is in direct contact with the surrounding sea water. The water vascular system functions in locomotion, ***respiration*** and ***excretion***. The ***chordate*** body plan is

based upon an ***internal skeleton***, gills and a dorsal, hollow ***nervous system***. Different phyla have radiated at different times during the evolution of life on Earth, but the representatives of most groups that have ever lived still survive today.

Currently, the most diverse phylum is arthropoda, with nearly 1 million described species and many more undescribed ones. The ***vertebrates*** – the subphylum to which humans belong – are the ecologically dominant and conspicuous animals in both aquatic and terrestrial environments.

III. USEFUL PHRASES. Study the phrases below and complete the sentences that follow

way of life – спосіб життя
rely (up)on – покладатися на/залежати від
control over something – контроль над чимось

1. Tropical forests also owe their existence to animals, because most of their trees _____ animals to distribute their pollen and seeds.
2. The growth of vegetarianism in the Western world is testament to the increasing desire among many people to live a more humane, healthy and environmentally friendly _____.
3. When off your property the dog must be on a leash where you have effective and immediate _____ the dog.

IV. Make up 6-7 questions about the text "Animals" and ask them to your fellow students

V. Finish the sentences below using the information from the text

1. Unlike sessile plants…
2. Animals can regulate their internal environments…
3. Active seeking for food has influenced…
4. Due to the division of labour in ancestral colonies of protists…

5. The number of animal species currently living on earth…
6. Body symmetry, body cavities, embryological development, …
7. The Platyhelmintes, or flatworms, have…
8. The animals whose bodies are segmented, …
9. An internal skeleton, gills and a dorsal, hollow nervous system…
10. While the arthropoda …, the vertebrates …

VI. Look for the synonyms of the following words in the text "Animals"

1) be regarded;
2) need, demand;
3) be distinguished;
4) complicated, elaborate;
5) germ cell;
6) arise, originate;
7) two-sided;
8) blind, deadlock;
9) noticeable;
10) earthy, earth-bound.

VII. Use the words and expressions from the previous exercise to fill in the gaps in the sentences below

1. Photosynthesis is a highly _____ process.
2. Rain forests are home to numerous species, _____ and epiphytes.
3. He thinks they have reached an evolutionary _____.
4. Campbell's broken leg will probably _____ surgery.
5. It's an issue that can be _____ from several perspectives.
6. The award is given for notable or _____ achievement in science.
7. Its unusual nesting habits _____ this bird from others.
8. Size is not the only difference between male and female _____.
9. This enzyme is _____ from human blood.
10. In _____ symmetrical animals, sensory nerves are concentrated in the head.

FOCUS ON GRAMMAR: *The Infinitive*

I. Look at the following sentences and identify the form and function of the infinitives used in them

1. Lacking rigid cell walls, animals, unlike plants, are unable to utilize high ***osmotic pressures*** to regulate the intake of materials from the environment.
2. Animals are believed to have arisen evolutionary from ancestral Protista by a process of division of labour among cells.
3. The other 28 animal phyla are generally thought to have been derived from a flatworm or a flatworm-like ancestor.
4. The leaves are the chief organs of food production (photosynthesis), whereas roots serve to anchor the plant in space and to absorb water and mineral nutrients from the soil.
5. The root cap is also the structure that detects the pull of gravity and thus causes the root to grow downward.
6. When a bud begins to expand or a seed germinates, the cells of the apical meristem undergo mitosis, and soon three primary meristems develop from it.

II. Change the highlighted parts of the following sentences using the infinitive or infinitive constructions

1. *It appears that certain sensory organs, such as eyes, have evolved* quite independently in different animal groups.
2. Some fishes have electroreceptors *with which they measure* electric fields.
3. In very many animals chemical cues are responsible for elaborate communications about paths *which they should follow*, dangers *which they should avoid*, and other important events.
4. Most scientists consider *that earth and the moon formed* at the same time and in the same part of the solar system approximately 4.5 billion years ago.
5. The surface of Venus is *so hot that it cannot maintain* liquid water.

6. Any theory for the evolution of life from non-living systems requires an energy source *that drives* the chemical reactions.
7. *It is believed that* the lack of atmospheric shielding of earth's surface from ultraviolet light *prevented* living organisms from having evolved in exposed locations.
8. It was very kind *that you helped* me with my laboratory work.
9. The Monera of today are astoundingly diverse, and *it is likely that they represent* the current products of many independent evolutionary lines that have been separate for millions of years.
10. Scientists were surprised *when they learnt* that the actual number of human genes is far lower than expected — only about 31,000 genes compared to the predicted 100,000 genes.

III. Translate the sentences below into English using the infinitive or infinitive constructions

1. Таксономічні системи використовуються не лише для визначення відношень між організмами. Вони також можуть допомогти в ідентифікації невідомих організмів.
2. Спроби класифікувати бактерії на основі еволюційної спорідненості (evolutionary affinity) ще не завершились створенням загальновизнаної класифікації.
3. Багато вчених вважають, що проект дослідження геному людини потенційно здатен зробити переворот як у лікуванні, так і в профілактиці багатьох хвороб.
4. Дослідники у галузі біоінформатики створили бази даних загального користування з виходом в Інтернет, щоб інформація про геном людини стала доступною для вчених по всьому світу.
5. Як відомо, клітинна стінка відіграє важливу структурну та фізіологічну роль у житті рослини.

6. Група вчених, що працює над цим проектом, сподівається завершити його до наступного року.
7. Вам може виявитися нелегко зрозуміти лекції цього професора без попередньої підготовки у галузі клітинної біології.
8. Группа науковців стверджує, що їм вдалося розробити ефективні ліки від раку легенів.
9. Вчені, задіяні у проекті, зазначили, що загальний напрямок дослідження імовірно може змінитися з надходженням нових даних.
10. Відома вівця Доллі була першою твариною, успішно клонованою із дорослого ссавця.

LISTENING COMPREHENSION

I. You will hear a text describing an unusual living creature discovered in late 1990s. Before listening discuss the words in the box with your fellow students and your teacher

adhesive disk	free-swimming individual	merit
asexual budding	jug-shaped	molt
crustacean	larva	shed
fledgling	latch	trigger

II. Listen to the tape and fill in the table below

species name	**habitat**	**morphology**	**reproduction modes**	**life cycles**

III. Answer the following questions about Symbion pandora

1. Who discovered the new life form?
2. How do the scientists explain the choice of the name for the species?
3. When does the asexual stage or S. pandora's reproduction take place?
4. What happens when the parent organism molts?
5. What is special about S. pandora's regeneration of lost organs?
6. When does the sexual stage of reproduction start?
7. What is the dwarf male?
8. Where does fertilization take place?
9. What happens to the new individual produced as a result to the sexual stage of reproduction?
10. Why do you think the animal needs such a complicated life cycle?

WRITING

Make a literary translation of the following passage into Ukrainian

Arthropods make up a phylum of invertebrates that includes insects, such as ants, beetles, and butterflies; crustaceans, such as lobsters, shrimps, and crabs; and arachnids, including scorpions, spiders, and ticks. In terms of sheer numbers and the variety of niches they fill, arthropods are the most successful animals on Earth. More than one million arthropod species have been identified — more than 20 times the number of known fish, amphibian, reptile, bird, and mammal species combined. This figure is considered a low estimate of the phylum's actual size because many arthropod species have yet to be discovered and documented. Some scientists suggest the number of arthropod species in tropical forests alone may approach six million to nine million.

Arthropods have adapted to life on land, at sea, and in the air. They occupy an array of habitats, from scorching deserts and scalding hot springs to snow-capped mountains and frigid fjords. As plant pollinators, nutrient recyclers, and prey for

other animals, they are essential members of the web of life. If all arthropods suddenly were to perish, thousands of animals and plants that depend on their services soon would vanish as well.

Many arthropods, including shrimp, lobsters, and crabs, are harvested as food for people throughout the world. Other arthropods provide the ingredients for fabric dyes, wood preservatives, and medicines. Members of one arthropod class in particular — insects — can be formidable pests, devouring crops, destroying wood structures, and spreading malaria and other life-threatening disease.

Lesson 4

PHYLUM CHORDATA

PRE-READING TASKS

I. Answer the following questions

- What makes representatives of the phylum chordata different from other animals?
- Do you know the origin and the meaning of the word “chordata”?
- How many classes of vertebrates do you know?

II. Listen to the following words and practice their pronunciation

Abdominal organ, amphibian, caecilian, capillary, cartilaginous fish, cerebellum, cerebral cortex, cerebral hemisphere, chambered heart, chimera, diaphragm, eel, horn, jawless fish, keratin scales, lamprey, larva, mammal, nerve cord, notochord, reptile, salamander, salmon, sensory apparatus, squamate, sternum, sturgeon, swim bladder, tadpole, tuatara, turtle, ventricle.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) abdomen, adj	a) either of two complex cartilaginous or bony structures in most vertebrates that border the mouth, support the soft parts enclosing it, and usually bear teeth on their oral margin;
2) burrow n, v	b) to emerge from an egg;
3) carnivore, n	c) a flesh-eating animal;
4) cartilage, n	d) awareness of the elements of environment through physical sensation;
5) evaporation, n	
6) feather, n	
7) hatch, v	
8) herbivore,	

9) jaw, n
10) perception, n
11) scavenger, n
12) yolk, n

e) a hole or excavation in the ground made by an animal for shelter and habitation;
f) the process by which a liquid changes into a gas;
g) a plant-eating animal;
h) the yellow spheroidal mass of stored food that forms the inner portion of the egg of a bird or reptile and is surrounded by the white;
i) the part of the body between the thorax and the pelvis;
j) an organism that feeds habitually on refuse or carrion (dead flesh);
k) a somewhat elastic tissue that composes most of the skeleton of vertebrate embryos and except for a small number of structures (as some joints, respiratory passages, and the external ear) is replaced by bone during ossification in the higher vertebrates;
l) any of the light horny epidermal outgrowths that form the external covering of the body of birds.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

Most of ***the chordates*** in the sea, and all those on the land, are vertebrates. The remaining species — the ***invertebrate chordate*** — belong to two subphyla that are extremely dissimilar in outward appearance. The three diagnostic characteristics of the phylum Chordata are: (1) a dorsal, hollow ***nerve cord***; (2) clefts in the wall of the throat region, usually referred to as ***gill slits***, which circulate water during feeding and respiration; and (3) a ***notochord***, a unique, stiffening rod located along the back. All chordates are ***deuterostomes***.

A ***vertebrate*** is an animal with a series of bones — ***vertebrae*** — that surround the notochord and the nerve cord. In the groups that appeared later in time, the

notochord is present only during embryonic stages. Among vertebrates ***the fishes*** are the principal large-bodied herbivores, carnivores, and scavengers of the sea and fresh water. ***Amphibians***, ***reptiles***, ***birds***, and ***mammals*** play the same role on land. Although low in numbers of individual organisms, vertebrates rival the major invertebrate phyla in diversity and ecological significance.

Vertebrates have a complicated ***closed circulatory system*** in which the blood, containing ***hemoglobin-filled red blood cells***, is pumped by ***the chambered heart*** through dense system of ***capillaries***. Another trait associated with increased size and activity is the highly developed nervous system. The ***brain*** reaches its highest degree of complexity and organization in mammals. A third development in vertebrate evolution is a complex ***sensory apparatus***, including large eyes capable of sharp image perception, ears that serve in some forms as organs of equilibrium and in other forms for both equilibrium and hearing, and, in certain aquatic forms, a lateral-line system that provides a sense capable of detecting slight changes in water pressure and currents.

Fishes. Scientists divide fish into three groups based on their anatomy: ***jawless fish***, ***cartilaginous fish***, and ***bony fish***. Jawless fish are the only living vertebrates that have never evolved jaws. There are about 50 species — a tiny fraction of the world's total fish — and they are instantly recognizable by their sucker-like mouths. ***Eels***, ***lampreys***, and ***hagfish*** are examples of jawless fish. Cartilaginous fish do have jaws and use them to deadly effect. Numbering about 1,000 species, they include ***sharks***, ***skates***, and ***rays***, as well as ***chimaeras***, also known as ***ratfish***. Bony fish are some of the most successful vertebrates alive today. These animals can be found in a vast variety of habitats, from coral reefs and the deep-sea bed to lakes hidden away in caves. As their name indicates, bony fish have a skeleton made of bone, and most also have an air-filled sac called a ***swim bladder*** that keeps them buoyant. At least 24,000 species of bony fish have been identified, and many more probably await discovery. Common bony fish include ***salmon***, ***sturgeon***, and ***cod***.

The amphibians arose from the crossopterygian-like ancestors in Devonian times. This epochal event did not require a new design of the respiratory system, for the ability to breathe air was already present in the ancestral bony fishes. Instead, the crucial step was the evolution of the stubby fins of the crossopterygians into the walking legs of the amphibians — legs whose basic design has remained unchanged throughout the evolution of terrestrial vertebrates.

Three major orders of amphibians are alive today — the worm-like, tropical, burrowing ***caecilians***; ***frogs*** and ***toads*** (***anurans***); and ***salamanders***. Most modern amphibians spend part or all of their adult lives on land, typically in a moist habitat, but return to freshwater to lay their eggs. Amphibian eggs are surrounded by delicate membranes. They contain only limited supplies of yolk, so the ***larvae*** must feed soon after hatching. Usually the egg gives rise to an ***aquatic larva***, such as the ***tadpole*** of the anurans, that pursues a life in water for some period of time before metamorphosing into a terrestrial adult form. Some salamanders, however, lay their eggs in moist sites on land and never enter the water. Others are aquatic throughout their lives.

Reptiles have a number of prominent adaptations that allow them to exploit terrestrial environment more effectively than do amphibians. Reptiles that live mostly in water (like most turtles) entered this habitat later, as a secondary adaptation. The first reptiles arose from early amphibians some 300 million years ago. The major order of modern reptiles are ***the turtles***, ***the crocodiles, the squamates*** (***snakes*** and ***lizards***), and ***the tuatara*** (represented by a single species on a few islands of New Zealand).

The liberation of the reptile life cycle from the water depended upon the structure of the reptilian egg, which is essentially identical to the bird egg. It has a leathery or brittle calcium-impregnated shell that resists evaporation of the fluids inside and a number of other features due to which such an egg need not be laid in the water. Some other adaptation of reptiles include the ***horny keratin scales*** that cover their skin reducing water loss from the body surface, and the generally larger

surface area of their lungs in comparison with the amphibians. The ***ventricle*** of the reptilian heart is divided into ***chambers*** that separate the freshly oxygenated blood from unoxygenated blood and permit oxygenated blood to be pumped to needy tissue more efficiently. Respiration involves a bellows-like movement of the ribs. The reptilian brain, with small ***cerebral hemispheres***, is more complex than that of amphibians.

The birds. Zoologists sometimes lightly refer to birds as "feathered reptiles" or "hot lizards", and there is an important truth embodied in these phrases. Virtually all the important differences between the birds and their reptilian ancestors have arisen as adaptations to flight. The single most characteristic feature is their feathers, which are highly modified versions of reptilian scales. The major modifications in the body skeleton of the birds include light and strong hollow bones with internal struts and a conspicuous change in the shape of the ***sternum*** (breast bone), which was transformed into a large vertical keel for the attachment of the breast muscles. A flying bird has a very high metabolic rate that requires a highly efficient circulation, which has been achieved by the complete division of the ventricle into two chambers. One chamber pumps "used" blood to the lungs; the other receives freshly oxygenated blood from the lungs and pumps it to the rest of the body. The lungs have a flow-through pattern that allows a more complete exchange of respiratory gases than does the pattern of mammalian lungs. The avian brain is much larger in proportion to body size than that of reptiles. The difference is not in the ***cerebral cortex***, the principal seat of intelligence in mammals, but rather in the ***cerebellum***, the centre of sight and muscular coordination.

The features considered to be diagnostic of ***mammals*** include well-developed sensory capabilities and intelligence. Only mammals suckle their young with nutritive fluid. Other characteristics contributing to the success of mammals in many ecological situations include: (1) teeth variously specialized for cutting, chewing, and grinding: (2) the ***diaphragm***, a muscle wall that completely separates the chest cavity from the ***abdominal organs*** and increases the depth and efficiency

of breathing; (3) hair, providing mechanical protection and an aid in heat conservation; and (4) a greatly enlarged brain, chiefly in the cerebral hemispheres, allowing mammals both more complex instincts and more elaborate learning.

III. USEFUL PHRASES. Study the phrases below and paraphrase the underlined parts of the sentences that follow

rival something – конкурувати з/рівнятися з
in comparison with – у порівняні з
in proportion to – що є пропорційним до/відносно до

1. When compared with the other animals of its size big cat jaguar has particularly powerful jaws and often kills its prey by piercing the skull with one swift bite.
2. About the same size as a chicken, a kiwi's eggs are almost as big as those of the emu and are one of the largest relative to body size of any bird in the world.
3. Few animals can be equal to the flamingo in terms of beauty and grace.

IV. Answer the following questions about the text "Phylum Chordata"

1 Are the terms 'chordates' and 'vertebrates' synonymic?
2 What are the main features of the Phylum Chordata?
3 What animals have a notochord?
4 Why do vertebrates need a complicated circulatory system and a highly developed nervous system?
5 What purposes do ears serve in vertebrate animals?
6 Do jawless fish constitute a numerous group?
7 What are the main representatives of cartilaginous fish?
8 Why do amphibians depend on watery environment in their life cycle?
9 What adaptations have reptiles evolved that differentiate them from amphibians?
10 Why do zoologists sometimes call birds 'feathered reptiles' or 'hot lizards'?
11 What features provide for the ability to fly in birds?

12 Enumerate the main characteristics of mammals that make them the most ecologically successful class of animals.

V. Find the following words in the text "Phylum Chordata" and explain their meanings. Then select the synonyms of these words from the list below. Explain the difference between the synonyms using a dictionary

identify, _____, _____, _____; provide, _____, _____, _____;

feature, _____, _____, _____; reduce, _____, _____, _____.

moist, _____, _____, _____;

Attribute, cut, damp, decrease, determine, diminish, distinguish, furnish, give, humid, property, recognise, supply, trait, wet.

VI. Fill in the spaces in the sentences below with the appropriate words from exercise V

1. The _____ of the soil influence the growth of the plants.
2. Just wipe off the surface with a _____ paper towel.
3. Epithelial tissue covers the body's inner and outer surfaces, while connective tissue binds it together and _____ support.
4. Mobility, coupled with rapid responses to opportunities and hazards, is one _____ that _____ animals from other forms of life.
5. Don't let him _____ your achievements.
6. Quizzes are used to _____ how much material students have learned.
7. Hurry up with the umbrella - I'm getting _____!
8. Attacks of asthma _____ in frequency through early adult life.
9. He had all the _____ of a great leader: charisma, energy, discipline, and resourcefulness.
10. It was malaria, but Dr Lee hadn't _____ the symptoms.
11. The entire island is covered by thick _____ jungle.

12. In the open ocean, many planktonic animals carry out larger daily migrations, rising to the surface at dusk and then sinking at sunrise. By doing this, they _____ the chances of being eaten.
13. Natural selection is tied to _____ that organisms pass from one generation to the next.
14. An informer _____ the police with the names of those involved in the crime.
15. Water the plants regularly to keep the soil _____.
16. The community has certain _____, among them dominance and species diversity.
17. Scientists are warning that unless carbon emissions are _____, we could be heading for an environmental catastrophe.
18. Being able to move _____ animals many advantages, but it also generates its own demands.
19. Will these finds _____ more information on prehistoric man?
20. After years of research, scientists have _____ the virus that is responsible for the disease.

FOCUS ON GRAMMAR: *The –ing Forms*

I. Read the following sentences and identify the form and function of the gerunds and participles used in them

1. The remaining species — the invertebrate chordate — belong to two subphyla that are extremely dissimilar in outward appearance.
2. The three diagnostic characteristics of the phylum Chordata: (1) a dorsal, hollow nerve cord; (2) clefts in the wall of the throat region, usually referred to as gill slits, which circulate water during feeding and respiration; and (3) a notochord, a unique, stiffening rod located along the back.
3. Numbering about 1,000 species, they include sharks, skates, and rays, as well as chimaeras, also known as ratfish.

4. Other characteristics contributing to the success of mammals in many ecological situations include: (1) teeth variously specialized for cutting, chewing, and grinding: (2) the diaphragm, a muscle wall that completely separates the chest cavity from the abdominal organs and increases the depth and efficiency of breathing; (3) hair, providing mechanical protection and an aid in heat conservation; and (4) a greatly enlarged brain, chiefly in the cerebral hemispheres, allowing mammals both more complex instincts and more elaborate learning.

II. Open the brackets in the following sentences using the correct forms of the gerund, participle or infinitive

1. _____ (lack) internal skeletons, arthropods wear their "bones" on the outside in the form of an _____ (armour) exoskeleton.
2. Arthropod limbs are adapted for many forms of locomotion — _____ (leap), _____ (swim), _____ (walk), _____ (scurry), and _____ (burrow).
3. Aquatic arthropods have gills with which they obtain _____ (dissolve) oxygen from their watery surroundings.
4. Like mammals, birds have four-chambered hearts and are warm-blooded — _____ (have) a relatively constant body temperature that enables them _____ (live) in a wide variety of environments.
5. Highly _____ (develop) animals, birds are sensitive and responsive, colourful and graceful, with habits that excite interest and inquiry.
6. Some birds have plumage that blends in with their surroundings _____ (provide) camouflage, _____ (help) these birds escape notice by their predators.
7. _____ (take) flight is less demanding for small birds than it is for large ones, but small birds need more energy _____ (stay) warm.

8. In _____ (keep) with their enormous energy needs, birds have an extremely fast metabolism, which includes the chemical reactions _____ (involve) in _____ (release) _____ (store) energy from food.
9. A _____ (fly) pigeon breathes 450 times each minute, whereas a human, when _____ (run), might _____ (breathe) only about 30 times each minute.
10. Birds spend much of their time _____ (feed) and _____ (search) for food.

LISTENING COMPREHENSION

I. You will hear a text about animal rights. Before listening discuss the words in the box with your fellow students and your teacher

advocate	endangered species	pest
badger baiting	garden slug	rhinoceros horn
be concerned with	group captivity	sewer rat
be subject to legislation	ivory trade	solitary species
crucial tool	legal issue	toxicity testing
deer and stag hunting	pacing	whaling

II. Say whether the following statements are true or false

1. Peter Singer is a philosopher who opposes the movements for animal rights.
2. Three American public organizations whose activities are directed at protecting animal rights have been mentioned.
3. Experiments on animals contributed to a number of important discoveries in modern medicine.
4. Now most countries have stopped using animals for medical and toxicity tests because of their cruelty.
5. The author of the text draws examples of injury caused to animals in such activities as badger baiting, horse racing, stag hunting and cockfighting.
6. Zoos claim that they play an important role in animal conservation.
7. There is no legislation concerning the cruel treatment of animals in the fur industry.

8. People in Scandinavia don't wear fur coats to demonstrate their friendliness to animals.
9. Such cases of animal maltreatment as whaling or killing dolphins have been the subject of international discussion.
10. It is equally immoral to kill a pet or a pest.

III. Listen to the first part of the text again. What do the following abbreviations stand for: ASPCA, HSUS, PETA? Do you know any organizations protecting animal rights in Europe or in your country?

IV. Listen to the abstract about using animals in entertainment and sports one more time. Complete the passage below

The use of animals in sports has resulted in many cases of animal (1)_____. Laws on badger baiting, (2) _____, and deer and stag hunting vary from country to country. (3)_____ has been banned in certain countries, but in Spain it remains a (4)_____. Animal rights advocates have expressed concern over the conditions in many (5)_____where animals are kept, claiming that animals in these facilities are forced to live in unnatural (6)_____, with unsuitable housing and (7)_____. Other critics argue that such conditions promote (8)_____ such as pacing. Zoos maintain, however, that their institutions provide (9)_____, and conservational benefits. Many cases of cruelty and neglect of animals (10)_____ have also been reported.

SPEAKING

Speak about animals covering the following issues:

- **animals versus plants;**
- **the variety of the animal world;**
- **features that provide the basis for modern classification of animals;**
- **chordates and vertebrates: distinctive characteristics;**
- **the main classes of modern vertebrates;**
- **animals and humans.**

Unit 4 Focus Words and Phrases

abdomen, adj (4)
anchor, v (1)
aperture, n (2)
bat, n (2)
bilateral, adj (3)
binucleate cell (2)
burrow n, v (4)
burst, v (2)
carnivore, n (4)
cartilage, n (4)
cavity, n (3)
complex, adj (3)
comprise, v (1)
conspicuous, adj (3)
dead-end, n (3)
degenerate, v (2)
dense, adj (2)
derive, v (3)
device, n (1)
differentiate, v (3)
discharge, v (2)
dormant, adj (1)
duckweeds, n (2)
egg, n (2)
elaborate, adj (3)
erosion, n (1)
evaporation, n (4)
exception, n (1)
excrete, v (3)
expenditure, n (3)
feather, n (4)
feature, n (4)
fertilization, n (2)
formerly, adv (2)
gamete, n (3)
germinate, v (1)
gill, n (3)
hatch, v (4)
herbivore, n (4)
identify, v (4)
oak, n (1)
obscure, adj (3)
outermost, adj (1)
ovule, n (2)
patch, n (2)
perception, n (4)
possession, n (1)
principal, adj (1)
prominent, adj (1)
protect, v (1)
provide, v (4)
reduce, v (4)
require, v (3)
rival, v (2)
scavenger, n (4)
scrape, v (1)
seed, n (2)
sessile, adj (3)
shrubs, n (2)
simultaneous, adj (2)
soil, n (1)
steep, adj (1)
suspend, v (3)
terrestrial, adj (3)
texture, n (2)
tip, n (1)
tremendous, adj (1)
twig, n (1)
undergo, v (1)
view, v (3)
yolk, n (4)

accompanied by (1)
at the same time (2)
at this stage (2)
control over something (3)
develop into (1)
drop/fall off (1)
give rise to (1)

insect, n (2)
jaw, n (4)
lag behind, v (2)
locomotion, n (3)
longevity, n (2)
medium, n (3)
migrate,v (2)
moist, n (4)
in comparison with (4)
in proportion to (4)
more or less (2)
rely (up)on (3)
rival something (4)
take place (2)
way of life (3)

REVISION AND ADDITIONAL PRACTICE 4

Revision Exercises

I. Translate the following sentences into English

1. Порівняно з іншими хребетними, ссавці мають високо розвинену нервову систему і виявляють розум та винахідливість, якими небагато інших тварин можуть позмагатися з ними.
2. Пагони рослин зазвичай знаходяться над землею, ростуть угору та мають листки, прикріплені у правильній послідовності на вузлах вздовж стебла.
3. Ссавці є теплокровними або ендотермічними тваринами, а це означає, що вони можуть підтримувати постійну температуру свого тіла, незважаючи на зміни у довколишньому середовищі.
4. Зона поділу кореня рослини (меристема) — це група клітин, які мають здатність до активного поділу. Розташована вона не на самому кінці кореня, а під кореневим чохликом, який захищає її від пошкоджень і полегшує просування кореня у ґрунті.
5. Ссавці пристосувалися до життя у екстремальних умовах. Ці тварини витримують наднизькі та надвисокі температури, вони здатні виживати у розрідженому повітрі на гірських вершинах та у морських глибинах під неймовірним тиском води.
6. Більшість риб дихають під водою за допомогою спеціального органу дихання, який називається зябра. Зябра утворені низкою тонких пластинок або волокон, якими циркулює кров.
7. Рептиліям властиве унікальне поєднання характеристик, яке вирізняє їх з-поміж інших хребетних тварин. Подібно до амфібій сучасні рептилії — холоднокровні, подібно до птахів рептилії вилуплюються із яєць, вкритих захисною оболонкою, які вони відкладають на землі. Рептилії дихають легенями, як це робить більшість дорослих амфібій, а також усі птахи і

ссавці. І, нарешті, подібно до амфібій та ссавців, більшість рептилій, за винятком черепах, мають зуби.

8. Окрім восьмиядерного семиклітинного зародкового мішка існують жіночі гаметофіти покритонасінних із іншою кількістю клітин і ядер.
9. Запилення у голонасінних, на відміну від покритонасінних, часто вимагає крапельно рідкої води.
10. Надлишок вуглекислого газу призводить до затримки росту рослин, і цей процес супроводжується хлорозом або некрозом листя.
11. Цвіт томату облетить, якщо температура відхилиться вище або нижче визначених температурних меж впродовж тривалого часу.
12. Тривалість життя дерева обмежена цілою низкою факторів, однак, живець від старого дерева може дати початок молодому здоровому дереву, і цей процес може повторюватись необмежено, адже точка росту дерева, апікальна меристема, постійно залишається молодою.
13. Мураха — це тварина, у якої співвідношення розміру мозку до тіла є найбільшим.
14. У США налічується понад 52 мільйони домашніх собак та понад 63 мільйони котів. За своєю чисельністю ці тварини можуть позмагатися із людським населенням Сполучених Штатів.
15. Застосовуючи різноманітні біотехнології, культиватори рослин можуть покращувати опірність сільськогосподарських культур до хвороб, збільшувати їх поживні якості, а також розвивати у них властивості, які полегшуватимуть їх зберігання, транспортування та харчову обробку.

II. Choose the appropriate word to complete each of the following sentences

1. One phylum of animals, the chordates, has been more intensively studied than has any other, because it _____ nearly all the world's largest and most familiar animals as well as humans.

   a) composes b) comprises c) contains d) consists

2. All birds are covered with _____, collectively called plumage, which are specialized structures of the epidermis, or outer layer of skin.

   a) wool b) hair c) feathers d) fur

3. The eyes of birds are large and _____ excellent vision.

   a) provide b) produce c) supply d) deliver

4. There are three eyelids that _____ the eyes of birds.

   a) defend b) pretend c) prevent d) protect

5. Birds have well-developed brains, which provide acute sensory _____, keen balance and coordination, and instinctive behaviour, along with a surprising degree of intelligence.

   a) conception b) reception c) perception d) perfection

6. Plant-eaters, or _____, often do not have to search far to find things to eat, and in some cases – for example wood-boring insects — they are entirely surrounded by their food.

   a) herbivores b) omnivores c) carnivores d) scavengers

7. A group of animals — composed chiefly of birds, but also including some bats and insects — _____ to warmer regions before the winter begins and returns again in spring.

   a) travels b) emigrates c) roams d) migrates

8. In animals such as jellyfish and non-parasitic flatworms wastes are _____ through the mouth.

   a) extracted b) excreted c) secreted d) protracted

9. Growing points, called meristems, are located either at the stem and root _____, where they are responsible for the primary growth of plants, or laterally in stems and roots, where they are responsible for secondary plant growth.

   a) tips b) surface c) edges d) tops

10. She has _____ three hip replacement surgeries in the last three years.

    a) gone under b) gone over c) undergone d) overcome

11. Most herbs grow well in dry _____.

a) land b) earth c) ground d) soil

12. The jungle is so _____ you cannot walk through it.

a) solid b) dense c) concentrated d) crowded

13. Despite the benefits _____ from genetic advancements, some observers have voiced concerns that genetically engineered organisms could harm people or the environment.

a) arrived b) arisen c) acquired d) derived

14. Parsley should have a deep, _____, fertile soil for ideal growth.

a) wet b) humid c) moist d) damp

15. Most house plants _____ regular watering.

a) require b) inquire c) desire d) demand

16. Sewage is _____ directly into the sea.

a) delivered b) unloaded c) dispatched d) discharged

17. The college's facilities _____ those of Harvard and Yale.

a) compete b) match c) rival d) contend

18. The function of roots is to _____ the plant to its substrate and to absorb water and minerals.

a) anchor b) connect b) attach d) join

19. Waxes, such as cutin and suberin, _____ water loss from cells.

a) cut b) reduce c) shorten d) increase

20. Tropical forests have existed longer than any other forests on earth and their plants and animals have evolved a/an _____ web of interrelationships.

a) detailed b) refined c) laboured d) elaborate

Additional Practice

I. Reconstruct the following text using the words from the box to fill in the blanks

microscopic	cell walls	divide
external	rigid	tissues
boundary	plates	small
structures	plant cells	organelles
mitosis	skeleton-like	cell membrane
cellulose	absence	plasmodesmata

HIGHER PLANT CELLS VERSUS ANIMAL CELLS

All animals have either internal or (1)……. skeletons or (2)……. systems to support their (3)……. . Animal cells do not have (4)…….; instead, the plasma membrane, called the (5)……. by most zoologists, forms the outer (6)……. of animal cells. Higher plant cells have walls that are thickened and (7)……. to varying degrees, with a framework of (8)……. fibrils. Higher plant cells also have (9)……. connecting the protoplasts with each other through (10)……. holes in the walls. When higher plant cells (11)……., a cell plate is formed during the telophase of (12)……., but cell (13)……. do not form in animal cells, which divide by pinching in two.

Other differences pertain to the presence or (14)……. of certain (15)……. . Centrioles, for example, tiny paired keg-shaped (16)……. found just outside the nucleus, occur in all animal cells but are generally absent from higher (17)……. . Plastids, common in plant cells, are not found in animal cells. Vacuoles, which are often large in plant cells, are either or (18)……. absent in animal cells.

II. Reconstruct the text below putting the extracted fragments (a-i) into their correct places (1-9). Make a written translation of the text into Ukrainian

From the prehistoric beginnings of agriculture until recent times, only a few of the total plant species have (1)……. . This process of plant cultivation and breeding began largely by accident, possibly as the seeds of wild fruits and vegetables, gathered near human habitations, sprouted and were crudely cultivated. Plants such as wheat, which possibly originated in the eastern Mediterranean region more than 9,000 years ago, were (2)……. . This selective process took place with no prior knowledge of plant breeding but, rather, through the constant and close familiarity (3)……. .

Today, however, the human relationship with plants is nearly reversed: an increasing majority of people have little or no contact with plant cultivation, and the farmers that (4)……. . The breeding process, on the other hand, has been greatly accelerated, largely through advances in genetics. Plant geneticists are now able to develop, in only a few years, such plant strains (5)……. .

At the same time, humans have accelerated the demand for food and energy to the extent that entire species and ecosystems of plants are (6)……. . Most species remain little known; those that seem to offer the greatest hope for providing new sources of food, drugs, and other useful products exist in tropical rain forests and other areas (7)……. . According to the World Conservation Union, about 34,000 species of plants are (8)……. . This amounts to about one of every eight known species of ferns, flowering plants, and conifers and related plants. Increased knowledge of plants and attention to their survival are needed to (9)……. .

a) …where rapidly growing human populations can quickly reduce the land to arid, sandy wastes.

b) …selected and replanted year after year for their superior food value; today many domesticated plants can scarcely be traced back to their wild ancestors or to the original plant communities in which they originated.

c) …solve many of the problems confronting the human world today.

d) …do have such contact are becoming more and more specialized in single crops.

e) …at risk of becoming extinct.

f) …been taken from the wild and refined to become primary sources of food, fibre, shelter, and drugs.

g) …solve many of the problems confronting the human world today.

h) … being destroyed before scientists can develop an understanding of which plant species have the potential to benefit humanity.

i) … as wind-resistant corn, thus greatly increasing crop yields.

III. Read the following texts on animal rights. One of the texts is an article from the official website of an American animal protection organization called PETA (People for the Ethical Treatment of Animals). The other is an extract from a summary on cruelty to animals from the free encyclopaedia Wikipedia. Answer the questions in the Discussion section

WHY ANIMAL RIGHTS?

Almost all of us grew up eating meat, wearing leather, and going to circuses and zoos. Many of us bought our beloved "pets" at pet shops, had guinea pigs, and kept beautiful birds in cages. We wore wool and silk, ate McDonald's burgers, and fished. We never considered the impact of these actions on the animals involved. For whatever reason, you are now asking the question: Why should animals have rights?

Australian philosopher, Princeton professor, and author of numerous ground-breaking books — including 1975's *Animal Liberation*, Peter Singer states that the basic principle of equality does not require equal or identical *treatment*; it requires equal *consideration*. This is an important distinction when talking about animal rights. People often ask if animals should have rights, and quite simply, the answer

is “Yes!” Animals surely deserve to live their lives free from suffering and exploitation. Jeremy Bentham, the founder of the reforming utilitarian school of moral philosophy, stated that when deciding on a being’s rights, “The question is not ‘Can they reason?’ nor ‘Can they talk?’ but ‘Can they suffer?’” In that passage, Bentham points to the capacity for suffering as the vital characteristic that gives a being the right to equal consideration. The capacity for suffering is not just another characteristic like the capacity for language or higher mathematics. All animals have the ability to suffer in the same way and to the same degree that humans do. They feel pain, pleasure, fear, frustration, loneliness, and motherly love. Whenever we consider doing something that would interfere with their needs, we are morally obligated to take them into account.

Supporters of animal rights believe that animals have an inherent worth — a value completely separate from their usefulness to humans. We believe that every creature with a will to live has a right to live free from pain and suffering. Animal rights is not just a philosophy — it is a social movement that challenges society’s traditional view that all nonhuman animals exist solely for human use. As PETA founder Ingrid Newkirk has said, “When it comes to pain, love, joy, loneliness, and fear, a rat is a pig is a dog is a boy. Each one values his or her life and fights the knife.”

Only prejudice allows us to deny others the rights that we expect to have for ourselves. Whether it’s based on race, gender, sexual orientation, or species, prejudice is morally unacceptable. If you wouldn’t eat a dog, why eat a pig? Dogs and pigs have the same capacity to feel pain, but it is prejudice based on species that allows us to think of one animal as a companion and the other as dinner.

CRUELTY TO ANIMALS

Cruelty to animals refers to treatment or standards of care that cause unwarranted or unnecessary suffering or harm to animals. There are many different reasons why individuals abuse animals. Animal cruelty covers a wide range of actions (or lack of action), so one blanket answer simply isn’t possible. Each type of abuse has displayed certain patterns of behaviour that we can use to help

understand more about why people commit the crimes we encounter today. Animal cruelty is often broken down into two main categories: active and passive, also referred to as commission and omission, respectively. Passive cruelty is typified by cases of neglect, where the crime is a lack of action rather than the action itself. Examples of neglect are starvation, dehydration, parasite infestations, allowing a collar to grow into an animal's skin, inadequate shelter in extreme weather conditions, and failure to seek veterinary care when an animal needs medical attention.

Active cruelty implies malicious intent, where a person has deliberately and intentionally caused harm to an animal, and is sometimes referred to as NAI (Non-Accidental Injury). Acts of intentional cruelty are often some of the most disturbing and should be considered signs of serious psychological problems. This type of behaviour is often associated with sociopathic behaviour and should be taken very seriously.

Discussion

1. How do you understand Peter Singer's statement: "The basic principle of equality does not require equal or identical *treatment*; it requires equal *consideration"* (see the text "Why Animal Rights?"). Do you agree with it?
2. Do you believe that lack of care towards animals can be regarded as animal abuse?
3. Do you think that individuals who are cruel to animals are socially dangerous?
4. Which of the following human activities can be classified as animal abuse:
   - using animals in experimentation (in medicine, pharmacology, testing cosmetics, etc.);
   - vivisection;
   - using animals for entertainment (circuses, film making);
   - using animals for food;
   - killing animals for their skins, fur, etc.;
   - using animals in sports (horse racing, corrida, etc.);
   - hunting, whaling;

- pets' sterilization;
- keeping wild animals in captivity (zoos);
- killing pests (sewer rats, house mice, garden slugs, etc.)

5. Why should people be concerned about animal rights and neglect the rights of other living beings, such as plants, fungi, etc.?

IV. Solve the following puzzle and read the saying of Jean Henri Fabre, a French naturalist. The clues below will help you – each number corresponds to a letter in the English words defined in the table below

3-19-15-8-1-7-23 21-2-6-2-5-7-11-8-2-15 8-3-2 5-11-8-8-6-2-13-19-2-6-18-15
10-3-2-7-2-1-17 10-2 14-2-2-8 1-20-7 18-2-11-8-3, 5-20-8 19-8
15-21-1-7-17-15 8-1 15-24-2-11-4 1-13 8-3-2 24-6-1-10-2-18 13-9-2-6-18-15
10-3-2-7-2-5-23 10-2 8-3-7-19-9-2.
19-8 4-17-1-10-15 8-3-2 17-11-14-2-15 1-13 8-3-2 4-19-17-22-15'
5-11-15-8-11-7-18-15 5-20-8 21-11-17-17-1-8 8-2-6-6 20-15 8-3-2
1-7-19-22-19-17 1-13 10-3-2-11-8.
8-3-19-15 19-15 8-3-2 10-11-23 1-13 3-20-14-11-17 13-1-6-6-23.

A complex tissue in the vascular system of higher plants that consists of vessels, tracheids, or both usually together with wood fibres and parenchyma cells, functions chiefly in conduction of water and dissolved minerals but also in support and food storage, and typically constitutes the woody element (as of a plant stem).	**16-23-6-2-14**
A complex tissue in the vascular system of higher plants that consists mainly of sieve tubes and elongated parenchyma cells usually with fibres and that functions in translocation and in support and storage.	**24-3-6-1-2-14**
A stem or branch with its leaves and appendages especially when not yet mature.	**15-3-1-1-8**
The part of a stamen that produces and contains pollen and is usually borne on a stalk.	**11-17-8-3-2-7**

A small lateral or terminal protuberance on the stem of a plant that may develop into a flower, leaf, or shoot.	**5-20-18**
A longitudinal flexible rod of cells that in the lowest chordates (as a lancelet or a lamprey) and in the embryos of the higher vertebrates forms the supporting axis of the body.	**17-1-8-1-21-3-1-7-18**
Any of numerous cold-blooded strictly aquatic craniate vertebrates that have typically an elongated somewhat spindle-shaped body terminating in a broad caudal fin, limbs in the form of fins when present at all, and a 2-chambered heart.	**13-19-15-3**
A chamber of the heart which receives blood from a corresponding atrium and from which blood is forced into the arteries.	**9-2-17-8-7-19-21-6-2**
Any of a class or division of vascular plants that have the ovules and seeds enclosed in an ovary and form the embryo and endosperm by double fertilization — called also *flowering plant.*	**11-17-22-19-1-15-24-2-7-14**
A relatively small elongated usually naked and soft-bodied animal; platyhelminth.	**13-6-11-8-10-1-7-14**
The bony or more or less cartilaginous framework supporting the soft tissues and protecting the internal organs of a vertebrate.	**15-3-2-6-2-8-1-17**

V. Using additional sources of information prepare a report on one of the following topics and present it to the class

- **Interactions between living organismsm of different spesies in the natural environment.**
- **Record-breakers among plants and animals.**
- **Adaptations to various forms of pollination in flowers.**
- **Social animals.**

Unit 5

Lesson 1

ANTHROPOGENESIS

PRE-READING TASKS

I. Answer the following questions

- Which of the existing living beings are humans most closely related with?
- How many human species existed throughout the course of evolution?
- What specific features differentiate Homo sapiens from their closest relatives?

II. Listen to the following words and practice their pronunciation

Australopithecine, bipedalism, chimpanzee, extant, extinct, gibbon, gorilla, knee, limb, masticatory complex, maxillary region, Neandertal, orangutan, orthognathic, pelvic flange, Pleistocene, pongid, posture, primate, prognathic, thighbone, upright stance.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1)convolution, n	a) marked by greatness especially in size or degree, enormous;
2)curve, n	b) one of the irregular ridges on the surface of the brain and especially of the cerebrum of higher mammals;
3)discern, v	
4)emerge, v	c) the position or bearing of the body whether characteristic or assumed for a special purpose;
5)extant, adj	
6)extinct, adj	d) a line that gradually bends like part of a circle;
7)grip, n	e) currently or actually existing;
8)immense, adj	f) the human or animal body apart from the head and appendages: torso;
9)posture, n	

10) relax, v
11) trend, n
12) trunk, n

g) to detect with the eyes; to recognize or identify as separate and distinct;
h) a firm tenacious hold typically giving control or mastery;
i) no longer existing;
j) to come into being through evolution;
k) a prevailing tendency or a line of development;
l) to make less tense or rigid.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

Human beings, ***extant*** and ***extinct***, comprise the zoological family ***Hominidae***; and the single living human species, ***Homo sapiens***, is one of some 200 species of the order ***Primates***, in turn one of 20 orders constituting the vertebrate class Mammalia. Within the Primates are included such divergent creatures as the Southeast Asian ***tarsiers***, the Madagascan ***lemurs***, the South American ***monkeys***, the African monkeys, the ***great apes*** or ***pongids*** (***gibbons, orangutans, chimpanzees, gorillas***), and finally, humans themselves. The brains of larger tailless anthropoid apes, although much smaller than a modern human brain, are relatively well developed as compared with lower primates and have the same patterns of ***convolutions*** as the human brain has. Thus, the ***sensory*** and ***motor mechanisms*** fulfill functions closely reproducing those of the human brain. Many features of the ***skull*** and ***skeleton*** of the large apes approximate very closely those of the Hominidae, particularly if account is taken of certain extinct primitive hominids. Some of the structural similarities in the skeleton of the ***trunk*** and ***limbs*** are in part related to ***posture***, for the chimpanzee and gorilla are capable, at times, of balancing themselves on their ***hind limbs*** in a manner that suggests, albeit distantly, the erect posture characteristic of the Hominidae. Many of the muscles of the human body have the same disposition and attachments as those of the anthropoid apes. The disposition of the ***abdominal organs*** in apes corresponds

quite closely with that of man, and even in their microscopic details some of the organs of the body show a remarkable resemblance. These examples of anatomic and physiological similarities between the large anthropoid apes and the Hominidae could well be multiplied. Their implications for a real phylogenetic relationship are further supported by reference to similarities in ***serum protein patterns***, ***immunologic responses***, some of the ***blood groups***, ***parasitic infestation***, and susceptibility to certain diseases.

The main stages of hominid evolution are represented by the ***australopithecines***, ***Homo habilis, Homo erectus***, and ***Homo sapiens***. We shall concentrate on the evolution and adaptations of the only existing species of the genus Homo – Homo sapiens.

Homo sapiens emerged during the ***Pleistocene epoch***, which was marked by the gradual onset of a cooler climate in many parts of the world about 2.5 million years ago and by a general lowering of temperature that finally led to the great ***Ice Ages***. Fossil remains of early Homo sapiens are known from sites in Africa, the Middle East, and Europe, but later examples come from a wide range of sites in the Old World as a whole. The human skull is composed of both cranial and facial portions. The ***cranium*** consists of the ***skull vault*** and ***base***, while the ***facial skeleton*** consists of the region of the ***eye sockets***, nose, ***cheekbones***, ***upper jaw*** (***orbital*** and ***maxillary region***), and the region of the ***lower jaw*** (***mandibular region***). During the evolution of the hominid skull from its apelike precursors, there are a number of general trends that can readily be discerned. The principal trends are the gradual increase in brain size (as measured by ***cranial capacity***), the rounding of the ***cranial vault***, and the gradual reduction of the size of the whole ***masticatory complex***, including both the upper and lower jaws and the teeth. These trends lead to an overall change in skull shape and proportions, so that, while the vault expands, the "muzzle" tends to retract from a protruding (***prognathic***) form to a straighter-faced (***orthognathic***) appearance. At the same time, the whole skull tends to become lighter and more delicate in its structures. The dental

characteristics of H. sapiens revolve around the basic fact of reduction of the masticatory apparatus. Thus, the dentition as a whole shows tooth crowding (dento-alveolar disproportion), accompanied by smallness of the individual teeth and marked reduction in size of the third ***molar***.

The form of the skeleton of the trunk and limbs of Homo sapiens (***postcranial skeleton***) is characterized by its adaptation for a fully ***upright posture*** and a striding ***bipedal gait***. This remarkable locomotor capability is the final expression of an evolutionary process that has taken at least four million years to achieve, and so some aspects of the process are well known from earlier members of the genus Homo and also from the genus Australopithecus.

In terms of posture, the bipedal ***vertebral column*** is held upright and shows two secondarily developed curves when viewed from the side, one in the ***lumbar region*** of the back (***small of the back***) and the other in the ***neck region***. From the front the column should appear straight. These curves allow the weight to be evenly disposed about the line of gravity, which passes vertically through the second ***sacral vertebra*** (at the base of the spine) and behind the rotation centres of the two hip joints. This permits the ***pelvis*** to tip backward just beyond the vertical and rest upon a strap-like ***ligament*** across the front of the ***hip joint***, a sophisticated effort-saving mechanism that allows most of the muscles around the hip to relax so that the ***upright stance*** is an economical posture. Associated with this is the ability to lock the ***knees*** back, which also relaxes some surrounding muscles. To rise from the squatting or seated position requires considerable power of extension of the hip joints, and this is provided by the large ***buttock muscle*** (gluteus maximus) and a backward extension (***posterior superior iliac spine***) of the bony ***pelvic flange*** (***blade of the ilium***) for its attachment.

An alternating bipedal gait, to be fully efficient, must allow each leg to swing clear of the ground during walking; this is provided for by a ***pelvic-tilt mechanism*** that raises the side of the swinging leg. In addition, such a gait must avoid wild side-to-side movements of the centre of gravity, and this is achieved by inclining

the ***thighbones*** toward the midline and thus bringing the feet closer together. Finally the bipedal adaptations of the modern human ***foot*** are such that both weight and force are transmitted to the ground through a propulsive system of short levers that permits a ***heel–toe stride***.

The upper-limb adaptations to bipedalism are fewer and are concerned with the dynamic balance of the body while moving. Arm swinging is a normal part of bipedalism and compensates for the twist of the body toward the side opposite to the advancing foot. The selective advantages of ***bipedalism***, in terms of the ***upper limb***, are immense in that they free the hands for the carriage of infants, food, tools, or weapons, as well as permitting the development of the hands for a manipulative role such as tool making. Although hominids below the human level of evolutionary advance could make tools, the refinement and exploitation of tools demanded hands capable of both power and precision grips. The power grip involves primarily the inner, or ***ulnar, side*** of the hand and permits a firm grip on a branch, a rock, or hammer handle. The precision grip involves the outer, or ***radial***, ***fingers*** and ***thumb***, as in using a small stone for engraving, a small brush for painting, or a pen for writing. This requires the bringing together of the tips of the opposed thumb and the next two fingers in order to grip a small object, a grip that demands that the lengths of the ***index finger*** and thumb be proportionate and that the joint at the base of the thumb be of a special saddle-shaped variety. It seems likely that the precision grip evolved later than the power grip and that its perfection may even have been a specialization in Homo sapiens. Only when human hands had evolved to this level, concomitantly with brain expansion, could manipulative skills give expression to the artistic impulse in terms of cave painting, bas-relief, and sculpture in the round, all of which are sophisticated behavioral correlates of a highly evolved individual, in terms of both locomotor and intellectual skills.

III. USEFUL PHRASES. Study the phrases below and match two parts of the sentences that follow

as compared with – порівняно із
take account of – враховувати
correspond closely with – бути наближеним, схожим; відповідати
susceptibility to a disease – сприйнятливість до хвороби
be concerned with – бути пов'язаним із

1. We can't just measure birth and death rates and make a simple projection. We have to…
2. Eugenics is…
3. Differences in drought tolerance, root distribution, vegetative phenology, and stomatal behavior between taxa…
4. Hepatitis C virus (HCV) is a member of the Flaviviridae family and it is unusual with respect to its biology and pathogenesis as…
5. Most traits and diseases in humans are not so simple, and are referred to as *"multifactorial."* This term indicates that a disease has some genetic components that influence the…

a) …compared with the other members of the family.
b) … susceptibility to a disease, but there are also environmental and other unknown causes that must also be present for expression of the disease.
c) …concerned with improving the human race through heredity.
d) …correspond closely with water uptake limits.
e) …take account of the variability in birth and death rates.

IV. Answer the following questions about the text "Anthropogenesis"

1. What class, order and family does Homo sapiens belong to?
2. What similarities in brain morphology and physiology between large apes and humans can be observed?

3. What other features reveal phylogenetic relationship between Homo sapiens and large apes?
4. Name the main stages of hominid evolution.
5. What environmental changes coincide with the emergence of Homo sapiens?
6. Where did scientists find the sites of the earliest human settlements?
7. What developments in the skull anatomy can be observed in Homo sapiens that differentiate them from their precursors?
8. What morphological adaptations in humans are related with upright posture?
9. In what way did humans benefit from bipedalism?
10. What skills did humans develop due to their hands' capability of power and precision grip?

V. Complete the sentences below

1. The order Primates includes…
2. Some structural similarities between large apes and modern humans suggest…
3. The Pleistocene epoch is characterized by…
4. The main trends in the evolution of the human skull…
5. The curves of the human vertebral column have developed…
6. Human knees lock back because…
7. Due to the thighbones' inclining towards the midline…
8. Human arms swing during walking in order to…
9. Human hands are capable of the precision grip due to…
10. As a result of the parallel development of the human brain and hands…

VI. Look for the English equivalents of the following words in the text "Anthropogenesis"

Наближатись, відповідати; вражаючий, помітний; значення; початок, настання; обертання; ефективний, результативний; нахил; такий, що приводить у рух; точність; попутно.

VII. Use the words and expressions from the previous exercise to fill in the gaps in the sentences below

1. The patients studied were seen and treated up to 3 hours from the _____ of symptoms.
2. The angle of the telescope's _____ is 43 degrees.
3. The Miocene epoch was a _____ phase in primate evolution in which there appears to have been an increase in the numbers of larger primates that were widely spread throughout the Old World.
4. The males and females of this taxon may have been markedly different in body size, which has _____ for any attempts to reconstruct the social organization of these creatures.
5. The rise of criminal rate occurred _____ with the rise of urbanism.
6. It takes 243 Earth days for Venus to complete one _____ around the sun.
7. The bones of this specimen are still apelike in some features, but it is almost certain that the individual from which they came could manipulate objects with _____.
8. My new computer is much faster and more _____ than the old one was.
9. Sunlight is absorbed by dark surface materials and heats the surface to temperatures that sometimes _____ normal room temperature on Earth.
10. The feet are the base, in both standing and walking, through which weight and _____ efforts are transmitted to the ground.

FOCUS ON GRAMMAR: *Comparisons of Adjectives and Adverbs*

I. Look at the following sentences paying attention to the use of the degrees of comparison of adjectives and adverbs

1. The brains of <u>larger</u> tailless anthropoid apes, although <u>much smaller</u> than a modern human brain, are relatively well developed as compared with <u>lower</u> primates and have the same patterns of convolutions as the human brain has.

2. Homo sapiens emerged during the Pleistocene epoch, which was marked by the gradual onset of a cooler climate in many parts of the world about 2.5 million years ago and by a general lowering of temperature that finally led to the great Ice Ages.
3. At the same time, the whole skull tends to become lighter and more delicate in its structures.
4. It seems likely that the precision grip evolved later than the power grip and that its perfection may even have been a specialization in Homo sapiens.
5. At the beginning of the geologic phase now called the Tertiary period — about 66.4 million years ago — there were in existence the most primitive of the primates.

II. Use the adjectives from the brackets in the correct degree

1. One of the _____ (early) defining human traits, bipedalism — the ability to walk on two legs — evolved over 4 million years ago.
2. Australopiths had _____ (short) and _____ (little) flexible toes than do apes.
3. Oldowan toolmakers sought out the _____ (good) stones for making tools and carried them to food-processing sites.
4. With the evolution of late Homo, humans began to hunt even the _____ (large) animals on Earth, including mastodons and mammoths, members of the elephant family.
5. The australopith ilium, or pelvic bone, which rises above the hip joint, was much _____ (short) and _____ (broad) than it is in apes.
6. About 98 percent of the genes in people and chimpanzees are identical, making chimps the _____ (close) living biological relatives of humans.
7. The biochemical systems of modern Asian and European human populations appear to be _____ (similar) to each other than those of either group are to African populations.

8. The _____ (early) monkeys and apes evolved from ancestral haplorhine (meaning "simple-nosed") primates, of which the _____ (primitive) living representative is the tarsier.
9. The foramen magnum (the area of the skull through which the spinal cord passes) lies _____ (near) the centre of the skull in Australopithecus africanus than it does in the apes.
10. Human brains are much _____ (large) and _____ (complex) than those of apes, and people have a unique intellectual capacity and elaborate forms of culture and communication.

III. Translate the sentences below into English

1. Орангутанги, великі людиноподібні мавпи з південно-східної Азії, відрізняються від людини значно більше, ніж шимпанзе, що свідчить про більш віддалену еволюційну спорідненість.
2. Як люди, так і людиноподібні мавпи мають більший мозок та значно кращу здатність до сприйняття, ніж більшість інших ссавців.
3. Викопні рештки найдавніших людей, які жили від 5 до 2 мільйонів років тому, було знайдено лише у Африці.
4. Для деяких видів австралопітеків був характерним значний ступінь статевого диморфізму — самці були набагато більшими від самок.
5. Пальці людиноподібних мавп є довшими, сильнішими і більш зігнутими, ніж у людини, що робить їх краще пристосованими до висіння та розгойдування на гілках дерев.
6. Найбільш важливим серед досі знайдених викопних решток виду Homo ergaster є майже цілий скелет молодого самця із західної Туркани, Кенія, вік якого складає приблизно 1,55 мільйонів років.
7. Кістки представників виду Homo erectus, череп включно, були товстішими, ніж у більш ранніх видів.

8. Найвідоміша колекція викопних решток Homo erectus була розкопана у 1920-30-х роках німецьким анатомом та антропологом Францом Вайденрайхом у печері неподалік від Пекіна у Китаї.
9. Ретельне вивчення викопних решток давніх людей на території Африки, Азії та Європи, а також їхніх кам'яних знарядь допоможе вченим краще зрозуміти причини, які зумовили та зробили можливою першу міграцію людини з Африки.
10. Об'єм черепа неандертальців був дещо більшим за середній об'єм черепа сучасної людини.

LISTENING COMPREHENSION

I. You will hear a report on a Neanderthal DNA testing. Before listening discuss the words and expressions in the box with your fellow students and your teacher

Milestone achievement	interbreeding	to overlap
to report results	to retrieve	polymerase chain reaction
to diverge from the lineage	to pulverize	remote relation
	to caution	on average
to coexist	mating	to extrapolate
to intermingle	undetectable	line of descent
genetic evidence		

II. Listen to the text and fill in the table below

Event	**Time**
1. Neanderthals lived in Europe and West Africa.	1. From _____ to _____ years ago.
2._____	2. 90000 years ago.
3. The first Neanderthal specimen found in Neander Valley, Germany.	3. _____

4._____	4. Between 30000 to 100000 years.
5. Neanderthals split from early modern humans.	5. _____ to _____ years ago.

III. Choose the right option to complete the sentences below

1. The research team that worked on the project included scientists from …
   a) the USA and Great Britain
   b) Germany and the USA
   c) Great Britain and South Africa
2. The results were reported in the …
   a) journal *The Nature* b) Internet c) journal *Cell*
3. The Neanderthals that coexisted with modern humans in Europe were …
   a) larger and stronger b) smaller and weaker c) more primitive
4. The material or the research was retrieved from a Neanderthal …
   a) scull b) arm bone c) pelvic bone
5. The DNA used by the scientists was …
   a) mitochondrial DNA b) nuclear DNA c) DNA of both types
6. Mitochondrial DNA is inherited from …
   a) both parents b) father c) mother
7. The area of the Neanderthal DNA where the scientists identified the sequence of 378 base pairs is called …
   a) a hyperactive region 1
   b) a hypervariable region 1
   c) a supervariable region 2
8. The sequences of the Neanderthal DNA were compared to the corresponding sequences of DNA for …
   a) 994 modern human lineages
   b) 94 modern human lineages

c) 900 modern human lineages and 94 modern great apes lineages

9. On average the Neanderthal DNA differs from the modern human DNA in the region studied by …

a) 72 – 82 base pairs b) 27 – 28 base pairs c) 17 – 18 base pairs

10. The results of the research suggest that …

a) humans might have been the descendants of Neanderthals

b) humans and Neanderthals might have interbred

c) human and Neanderthals are in a distant relation

IV. Reconstruct the following extract from the text about Neanderthals. Listen to the fragment again and check yourselves

The researchers compared the Neanderthal _____ _____to sequences in the same region of DNA for 994 modern _____ _____, which included Australians, Pacific Islanders, _____, Asians, Native _____, and Europeans. The Neanderthal DNA sequence differed from all the modern _____ DNA by either 27 or 28 _____ _____. In comparison, modern human sequences in this _____ of DNA differ from each other on average by _____ base pairs. As a result, the researchers concluded that _____ and modern humans are _____ relations. Extrapolating from their findings, the study authors estimated that Neanderthals _____ from early modern humans 550,000 to 690,000 _____ ago. The work indicates that although human beings and Neanderthals _____ for many thousands of years, they probably did not _____ and Neanderthals are not in our direct line of _____.

WRITING AND SPEAKING

Write a summary of the text "Anthropogenesis" in 200 words using the vocabulary of Lesson 1. Get ready to present it in class

Lesson 2

EVOLUTION

PRE-READING TASKS

I. Answer the following questions

- Is there any relation between the multitude of species inhabiting our planet?
- What is the reason for the great diversity of living beings on the earth?
- What do you know about the theory of evolution?

II. Listen to the following words and practice their pronunciation

Descent, gene migration, gene recombination, genetic drift, genotype, heterogeneity, interbreed, larkspur, lineage, saline.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) accumulate, v	a) a rough or approximate calculation;
2) affect, v	b) the quality of something that consists of dissimilar or diverse ingredients or constituents;
3) affinity, n	
4) bias, n	c) derivation from an ancestor;
5) descent, n	d) a group of individuals tracing descent from a common ancestor;
6) disintegrate, v	
7) estimate, n	e) to produce a material influence upon or alteration in;
8) heterogeneity, n	f) arising from a momentary impulse;
9) lineage, n	g) to convey by inheritance or heredity;
10) preservation, n	h) tendency, inclination or predisposition;
11) propinquity, n	i) to increase gradually in quantity or number;
12) spontaneous, adj	j) to lose unity by or as if by breaking into parts;

13) transmit, v

k) the act of keeping safe from injury, harm, or destruction; protection;
l) nearness of blood; kinship;
m) a relation between biological groups involving resemblance in structural plan and indicating a common origin.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

The ***theory of evolution*** is one of the fundamental keystones of modern biological theory. It postulates that the various types of animals and plants have their origin in other pre-existing types and that the distinguishable differences are due to ***modifications*** in ***successive generations***.

The diversity of the living world is staggering. More than 2,000,000 existing species of plants and animals have been named and described; many more remain to be discovered — from 10,000,000 to30,000,000 according to some estimates. What is impressive is not just the numbers but also the incredible ***heterogeneity*** in size, shape, and way of life: from lowly bacteria, measuring less than one-thousandth of a millimetre in diameter, to the stately sequoias of California, rising 100 metres above the ground and weighing several thousand tons; from bacteria living in the hot springs of Yellowstone National Park at temperatures near the boiling point of water to fungi and algae thriving on the ice masses of Antarctica and in ***saline*** pools at −23° C; and from the strange wormlike creatures discovered in dark ocean depths at thousands of feet below the surface to spiders and ***larkspur*** plants existing on Mt. Everest more than 19,868 feet above sea level.

The virtually infinite variations on life are the fruit of the evolutionary process. All living creatures are related by ***descent*** from common ancestors. Humans and other mammals are descended from shrew like creatures that lived more than 150,000,000 years ago; mammals, birds, reptiles, amphibians, and fishes

share as ancestors aquatic worms that lived 600,000,000 years ago; all plants and animals are derived from bacteria-like microorganisms that originated more than 3,000,000,000 years ago. Biological evolution is a process of descent with modification. ***Lineages*** of organisms change through generations; ***diversity*** arises because the lineages that descend from common ancestors diverge through time.

The 19th-century English naturalist Charles Darwin argued that organisms come about by evolution, and he provided a scientific explanation, essentially correct but incomplete, of how evolution occurs and why it is that organisms have ***features*** — such as wings, eyes, and ***kidneys*** — clearly structured to serve specific functions. ***Natural selection*** was the fundamental concept in his explanation. Genetics, a science born in the 20th century, reveals in detail how natural selection works and led to the development of the modern theory of evolution. Since the 1960s a related scientific discipline, molecular biology, has advanced enormously knowledge of biological evolution and has made it possible to investigate detailed problems that seemed completely out of reach a few years earlier — for example, how similar the genes of humans and chimpanzees might be (they differ in about 1 or 2 percent of the units that make up the genes).

Biological evolution is the process of change and diversification of living things over time, and it affects all aspects of their lives — morphology, physiology, behaviour, and ecology. Underlying these changes are changes in the ***hereditary materials***. Hence, in genetic terms, evolution consists of changes in the organism''s hereditary make-up.

Evolution takes place in populations and can be seen as a two-step process. First, hereditary variation takes place; second, selection is made of those genetic variants that will be passed on most effectively to the following generations. Hereditary variation also entails two mechanisms: the spontaneous ***mutation*** of one variant to another, and the sexual process that recombines those variants to form a multitude of variations. The variants that arise by mutation or ***recombination*** are not transmitted equally from one generation to another. Some

may appear more frequently because they are favourable to the organism; the frequency of others may be determined by accidents of chance, called ***genetic drift***, or else by ***gene migration*** which takes place when individuals migrate from one population to another and ***interbreed*** with its members.

Natural selection refers to any reproductive bias favouring some ***genes*** or ***genotypes*** over others. Natural selection promotes the adaptation of organisms to the environments in which they live; any hereditary variant that improves the ability to survive and reproduce in an environment will increase in frequency over the generations, precisely because the organisms carrying such a variant will leave more descendants than those lacking it. Hereditary variants, favourable or not to the organisms, arise by mutation. Unfavourable ones are eventually eliminated by natural selection; their carriers leave no descendants or leave fewer than those carrying alternative variants. Favourable mutations accumulate over the generations. The process continues indefinitely because the environments that organisms live in are forever changing. Environments change physically — in their climate, physical configuration, and so on — but also biologically, because the predators, parasites, and competitors with which an organism interacts are themselves evolving.

Mutation, migration, and drift are random processes with respect to adaptation; they change gene frequencies without regard for the consequences that such changes may have in the ability of the organisms to survive and reproduce. If these were the only processes of evolutionary change, the organization of living things would gradually disintegrate. The effects of such processes alone would be analogous to those of a mechanic who changed parts in a motorcar engine at random, with no regard for the role of the parts in the engine. Natural selection keeps the disorganizing effects of mutation and other processes in check because it multiplies beneficial mutations and eliminates harmful ones.

Natural selection accounts not only for the preservation and improvement of the organization of living beings but also for their diversity. In different localities

or in different circumstances, natural selection favours different ***traits***, precisely those that make the organisms well adapted to their particular circumstances and ways of life.

The modern theory of evolution provides a causal explanation of the similarities among living things. Organisms evolve by a process of descent with modification. Changes, and therefore differences, gradually accumulate over the generations. The more recent the last common ancestor of a group of organisms, the less their differentiation; similarities of form and function reflect ***phylogenetic propinquity***. Accordingly, ***phylogenetic affinities*** can be inferred on the basis of relative similarity.

III. USEFUL PHRASES. Study the following phrases and use them in the sentences of your own

account for – відповідати за
with no regard for / without regard for – не зважаючи на
keep something in check – тримати під контролем

IV. Decide whether the following statements are true or false according to the text

1. Most of the species inhabiting the earth have already been described by botanists and zoologists.
2. There is no life at elevations over 5000 meters above sea level.
3. All terrestrial organisms derive from creatures that once lived in water.
4. Charles Darwin managed to explain the relation between the morphological structure of living organisms' body parts and their physiological function.
5. In the 20th century genetics largely disproved Darwin's theory of evolution by natural selection.
6. Sexual reproduction is one of the mechanisms that promote evolutionary process.

7. All new features that arise by mutation are acquired by the following generations.
8. Gene migration occurs when individuals from different populations mate producing offspring.
9. When living forms reach perfection in their development the evolutionary process will stop.
10. Mutation, gene migration and drift are processes that facilitate organisms' adaptation to the environment.

V. Make up 6-7 questions on the text "Evolution" and ask them to your partner

VI. Look for the words with the following meanings in the text "Evolution"

1) to claim or assume as true, existent, or necessary;
2) a source of water issuing from the ground;
3) to grow vigorously; flourish;
4) endless; inexhaustible;
5) to become different in character or form;
6) to prove or try to prove by giving reasons;
7) to open up to view; to disclose;
8) to involve something as a necessary part or result;
9) suitable and likely to make something happen or succeed;
10) an animal that kills and eats other animals;
11) having a good effect; advantageous;
12) to derive as a conclusion from facts; to guess or surmise.

VII. Use the words from exercise VI to fill in the blanks in the following sentences

1. So, reasoned Darwin, variations must occur in nature that are _____ or useful in some way to the organism itself in the struggle for existence.

2. A remarkable uniformity exists in the molecular components of organisms which _____ the genetic continuity and common ancestry of all organisms.
3. Some paleontologists _____ that morphological evolution is in most cases gradual and only rarely jerky, whereas others think the opposite is true.
4. The job _____ being on call twenty-four hours a day.
5. The species that arrived on the Hawaiian Islands found there many unoccupied ecological niches, or local environments suited to sustain them and lacking _____ that would prevent them from multiplying.
6. It is of considerable significance to ascertain whether new species arise by altering only a few genes, or whether the process requires drastic changes—a genetic "revolution," as _____ some evolutionists in the past.
7. Increased melanin pigmentation may be advantageous to inhabitants of tropical Africa, where dark skin protects them from the Sun's ultraviolet radiation; but it is not _____ in Scandinavia, where the intensity of sunlight is low and light skin facilitates the synthesis of vitamin D.
8. There are several _____ with hot water in the area.
9. Two geographically separate populations that at one time were members of the same species later may have _____ into two different species.
10. If the fitnesses of the two homozygotes are known, it is possible to _____ the allele equilibrium frequencies.
11. There are a lot of plants that _____ in tropical rainforests
12. The variations of colour that a human eye can see are _____.

VIII. Some of the science-related words can be misused by students of English due to similarities in their meanings. Study the examples below and discuss the difference between the highlighted words. Use a dictionary to find more about their meanings

1. Natural selection can be **studied** by analyzing its effects on changing gene frequencies; but it can also **be explored** by **examining** its effects on the observable characteristics — or phenotypes — of individuals in a population.
2. Paleontologists have recovered and **studied** the fossil remains of many thousands of organisms that lived in the past.
3. The problem of the origin of Homo sapiens from his Middle Pleistocene forebears is complex; hence, it is valuable to **examine** in detail those specimens that come from the earliest well-dated sites.
4. Since the 1960s a related scientific discipline, molecular biology, has advanced enormously knowledge of biological evolution and has made it possible to **investigate** detailed problems that seemed completely out of reach a few years earlier.
5. **Investigations** of hominid origins are variously concerned with diverse comparative studies of extant higher primates and humans, as well as the search for ancestors in the fossil record.
6. Five major areas of **research** can be identified in human evolutionary **studies**: the origins of Hominidae, adaptation and diversification of the genus Australopithecus, the origins of the genus Homo, the emergence of Homo erectus and subsequent hominid occupation of Eurasia, and the origins and dispersals of premodern and modern Homo sapiens.
7. Scientific Officer required to assist with a project **researching** intracellular events in scrapie-infected cells.

IX. Translate the following sentences into English using the focus words from the previous exercise

1. Те, як виникла клітина залишається відкритим та активно досліджуваним питанням науки.
2. Нещодавні дослідження показали, що навіть клітини мозку, які раніше вважалися нездатними здійснювати мітоз, зазнають поділу у тій частині мозку, яка пов’язана із пам’яттю.
3. Починаючи з 50-х років 20 століття важливим напрямком досліджень стало застосування молекулярної біології у вивченні еволюційного процесу.
4. За допомогою сучасних комп’ютерних технологій лікарі, сидячи у своїх кабінетах, можуть легко оглядати пацієнтів, які знаходяться за тисячі миль від них.
5. Дізнатися про доісторичну медицину нам допомагає вивчення стародавніх піктограм, які зображають медичні процедури, та хірургічних інструментів, які знаходять під час археологічних розкопок.
6. Подальші дослідження планет Сонячної системи допоможуть пролити світло на таємницю походження життя та Землі.
7. Засновник френології, німецький лікар Франц Йозеф Гал, вважав, що ретельне вивчення черепа індивіда може надати інформацію про його розумові здібності.
8. Коли це тільки було можливо, Кора і Філ виходили досліджувати довколишню територію.
9. Лікарі, які досліджують причини цієї хвороби, вважають, що скоро їм вдасться знайти ліки від неї.
10. Група вчених вивчає вплив стресу на хімічні процеси в організмі.

FOCUS ON GRAMMAR: *Conditionals*

I. Look at the following sentences and identify the types of conditionals in them

1. If these were the only processes of evolutionary change, the organization of living things would gradually disintegrate.
2. If we now know and understand most of the mechanisms of organic evolution, why are there still any disagreements about the broad subject itself?
3. Even if these gracile and robust australopithecines had been making stone artifacts, it is most unlikely that their tools would have found their way into a carnivore's lair.
4. If it is accepted that all of these skeletons inherited their structures from a common ancestor and became modified only as they adapted to different ways of life, the similarity of their structures makes sense
5. If humans did not overuse natural resources, many species wouldn't have become extinct.

II. Match the halves of the sentences from columns A and B

A	**B**
1. If natural selection rewards those who have the highest reproductive success,…	a) …they may ultimately lose the genetic variation necessary to survive sudden changes.
2. Darwin stated that all living creatures multiply so rapidly that, if left unchecked,…	b) …they would soon overpopulate the world.
3. If acquired characteristics could be inherited,…	c) …there would not necessarily be much trace of them today.
4. Unless extraordinary defense mechanisms existed in Precambrian times,…	d) …they would have had a reliable source of food wherever they went.
	e) …unless it also contains an accessory carotenoid pigment.

5. If species become too narrowly adapted to a given environment,…
6. If new genes are produced in a freely interbreeding population,…
7. If African human populations had developed tools that allowed them to hunt large game effectively,…
8. If large numbers of organic molecules were somehow synthesized on the primitive Earth,…
9. When a chlorophyll-containing cell is exposed both to light and to oxygen, it is killed,…
10. If a baby inherited a defective recessive allele from just one parent,…

f) …no disease would results.
g) …how could sterile worker bees come about by natural selection when worker bees devote themselves to others and do not reproduce?
h) …life near the Earth's surface would have been impossible.…
i) …they will gradually be spread throughout the population
j) …we should be able to demonstrate it experimentally.

III. Choose the appropriate word or word combination to complete the following sentences: *if, even if, unless, provided, providing, otherwise, but for, in case*

1. Phenylketonuria, which results from lack of the enzyme, causes permanent brain damage _____ treated soon after birth.
2. Better medicine enables more people to survive to reproductive age, _____ they carry mutations that in past generations would have caused their early death.
3. Organisms could not grow or function properly _____ the genetic information encoded in DNA was not passed from cell to cell.
4. But heredity is not a perfectly conservative process; _____, evolution could not have taken place.
5. _____ a child inherits the allele for tongue rolling from at least one parent, he or she will be able to roll the tongue.

6. Mutations that change one or even several amino acids may have a small or undetectable effect on the organism's ability to survive and reproduce _____ that the essential biological function of the coded protein is not hindered.
7. _____ an individual's genetic information becomes widely available, it could give health insurers cause to deny coverage to people with certain risk factors or encourage employers to reject certain high-risk job applicants.
8. Because some of the bones are crushed and distorted, the face and braincase are warped and provide less anatomical information than they _____ would.
9. Recent research, however, suggests that bacteria may retain their resistance to antibiotics over many generations, _____ they have not been exposed to the agent.
10. _____ the evolutionary process, the number and diversity of species inhabiting our planet wouldn't be so impressive.

LISTENING COMPREHENSION

I. You will hear a text about one the most outstanding naturalists of all times Charles Darwin. Before listening discuss the words and expressions in the box with your fellow students and teacher

clergyman	tortoise
the Church of England	mockingbird
stellar figure	finch
meticulous and painstaking observer	edition
collector of specimens	embody favourable natural variations
be taken aboard	improve adaptively over the preceding generations
adhere to a theory	orthodox theological opinion
cast doubt on something	the Royal Society

II. Listen to the text and say whether the following statements are true or false

1. Charles Darwin was born into a family with low income and education.

2. Charles Darwin went to school in his hometown.
3. Charles Darwin graduated from a university with a degree in medicine.
4. Charles Darwin decided to participate in a round-the-world expedition on the Beagle because he wanted to earn some money.
5. At that time scientists believed that all living things on the earth had been created and destroyed several times.
6. It was on the Galapagos Islands that Darwin first started thinking of possible links between different species.
7. Darwin developed and published his theory of evolution by natural selection two years after he had returned from his voyage on the Beagle.
8. Alfred Russel Wallace was one of the most ardent opponents of Darwin's theory.
9. Because of criticism, Darwin's work '*On the Origin of Species*' was unsuccessful and did not sell well.
10. Recognition came to Charles Darwin only after his death.

III. Fill in the table below with the events from Charles Darwin's biography

1809	*Charles Darwin was born in Shrewsbury, Shorpshire, England*
1825	
1827	
1831	
1836	
1838	
1839	
1858	
1859	
1878	
1882	

SPEAKING

Prepare a report about life of Charles Darwin and his contribution into science

Lesson 3

GENETICS

PRE-READING TASKS

I. Answer the following questions

- Can you define the term ‘genetics’?
- Why do you think genetics is one of the youngest branches of the science of life?
- Why do some people call genetics ‘a science of the future’?

II. Listen to the following words and practice their pronunciation

Alkaptonuria, amniocentesis, animal husbandry, artificial insemination, autosomal, chromosomal variation, colchicine, crossbreeding, cystinuria, cytogenetics, dominant, enzyme deficiency, experimental breeding, galactosemia, gene distribution, gout, molecular genetics, pharmaceutical industry, phenylketonuria, polygenic, recessive, strain, X-chromosome, yeast.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) budding, n	a) the reception of genetic qualities by transmission from parent to offspring;
2) crossbreeding, n	
3) grafting, n	b) a relatively permanent change in hereditary material involving either a physical change in chromosome relations or a biochemical change in the codons that make up genes;
4) inheritance, n	
5) subordinate, adj	
6) mold, n	
7) mutation, n	c) the procedure of hybridizing or crossing two varieties within the same species;
8) overlap, v	

9) trait, n	d) a distinguishing quality or an inherited characteristic;
10) yeast, n	e) a fungus (as of the order Mucorales);
	f) a minute fungus (especially *Saccharomyces cerevisiae*) that usually has little or no mycelium, and reproduces by budding;
	g) to have something in common with;
	h) a technique of inserting a bud from a plant of one kind into an opening in the bark of a plant of another kind with a purpose of propagating a desired variety;
	i) a technique of joining a part of a plant or tree onto another plant or tree;
	j) occupying a lower class, rank, or position; submissive to or controlled by somebody or something.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

Since prehistoric times, man has recognized the influence of ***heredity*** and has applied its principles to the improvement of cultivated crops and domestic animals. Most of the mechanisms of heredity, however, remained a mystery until the 20th century, when scientifically supported information became available.

Genetics may be defined as the study of the way in which ***genes*** operate and the way in which they are transmitted from parents to offspring. Modern genetics involves study of the mechanism of gene action — the way in which the genetic material affects physiological reactions within the cell. Although genes determine the features an individual may develop, the features that actually develop depend upon the complex interaction between genes and their environment. Genetics overlaps many different branches of biology such as biochemistry, cytology, microbiology, etc., and many other sciences; e.g., chemistry, physics, mathematics, sociology, psychology, and medicine.

Classical genetics, which remains a basis for all other topics in genetics, is concerned primarily with the method by which genetic traits classified as ***dominant*** (always expressed), ***recessive*** (subordinate to a dominant trait), ***intermediate*** (partially expressed), or ***polygenic*** (due to multiple genes) are transmitted in plants and animals. These traits may be ***sex-linked*** (result from the action of a gene on the ***sex, or X, chromosome***) or ***autosomal*** (result from the action of a gene on a chromosome other than a sex chromosome). Classical genetics began with Mendel's study of inheritance in garden peas and continues with studies of inheritance in many different plants and animals.

Cytogenetics blends the skills of cytologists, who study the structure and activities of cells, with those of geneticists, who study the relationship between the mechanism of heredity and cellular activities. Cytologists discovered chromosomes and the way in which they duplicate and separate during cell division at about the same time that geneticists began to understand the behaviour of genes at the cellular level. The close correlation between the two disciplines led to their combination. ***Molecular genetics*** includes the study of the molecular nature of the gene and the method by which genes control the activities of the cell.

A study of genes in populations of animals, ***population genetics***, provides information on past migrations, evolutionary relationships and extents of mixing among different varieties and species, and methods of adaptation to the environment. Statistical methods are used to analyze ***gene distributions*** and ***chromosomal variations*** in populations.

Some geneticists specialize in ***human genetics***. When classical geneticists first determined the principles of heredity in plants, fruit flies, mice, and other forms of life, they tried to interpret man's heredity in a similar way but found many traits that did not fit the patterns. As techniques improved, it was found that the method of inheritance of human characteristics is the same as that for other living things.

Geneticists use a wide range of methods and techniques in their research work. When animals that differ with respect to one or more primary traits are bred, and their offspring then are bred among themselves to give a second generation, the method of inheritance of the trait can be determined; the process is known as ***experimental breeding***. ***Cytogenetic techniques*** are closely associated with experimental breeding. ***Biochemical techniques*** are used to determine the activities of genes within cells. Chemical tests are used to distinguish certain inherited characteristics of man; e.g., urinalysis and blood analysis reveal the presence of certain inherited abnormalities — ***phenylketonuria*** (PKU), ***cystinuria***, ***alkaptonuria***, ***gout***, and ***galactosemia***. Mathematical techniques are used extensively in genetics. The laws of probability are applicable to ***crossbreeding*** and are used to predict ratios concerning the appearance of specific traits in offspring.

Nowadays genetic techniques are used nearly in all spheres of human activities. Agriculture and ***animal husbandry*** apply genetic techniques to improve plants and animals. Plant geneticists produce new species by special treatment; e.g., a ***hybrid grain*** has been produced from wheat and rye, and plants resistant to destruction by insect pests have been developed. Plant breeders use the techniques of ***budding*** and ***grafting*** to maintain desirable gene combinations originally obtained from crossbreeding. The use of the chemical compound ***colchicine***, which causes chromosomes to double in number, has resulted in many new varieties of fruits, vegetables, and flowers. Animal breeders use ***artificial insemination*** to propagate the genes of prize bulls. Prize cows can transmit their genes to hundreds of offspring by hormone treatment, which stimulates the release of many eggs that are collected, fertilized, and transplanted to ***foster mothers***.

Various industries employ geneticists; the brewing industry, for example, may use geneticists to obtain ***strains of yeast*** that produce large quantities of alcohol. The pharmaceutical industry has developed strains of ***molds***, bacteria, and other microorganisms high in antibiotic yield.

Genetic techniques are used in medicine to diagnose and treat inherited human disorders. Knowledge of a family history of cancer or tuberculosis may indicate a hereditary tendency to develop these afflictions. Cells from embryonic membranes reveal certain genetic abnormalities, including ***enzyme deficiencies***, that may be present in newborn babies, and thus permit early treatment. Many countries require a blood test of newborn babies to determine the presence of an enzyme necessary to convert an amino acid, phenylalanine, into simpler products. Phenylketonuria, which results from lack of the enzyme, causes permanent brain damage if not treated soon after birth. The presence of approximately 100 different types of human genetic diseases can be detected in embryos as young as 12 weeks; the procedure, called ***amniocentesis***, involves removal and testing of a small amount of fluid from around the embryo.

III. USEFUL PHRASES. Study the phrases below and complete the sentences that follow

apply something (to something/to do something) – застосовувати щось
provide information on something – забезпечувати інформацію
specialize in (something/doing something) – спеціалізуватись у
the appearance of something – поява, виникнення
resistant to – опірний до

1. Geneticists primarily _____ human genetics, inheritance and inherited traits.
2. The goal of molecular geneticists is to get a better understanding of basic biology and to _____ that knowledge _____ practical problems in medicine, plant and animal breeding, and conservation.
3. By using a genetic screen, we have isolated a mammalian cell line that is _____ infection by retroviruses that are derived from the murine leukemia virus, human immunodeficiency virus type 1, and feline immunodeficiency virus.

4. Numerous Internet sites _____ specific genetic conditions for patients, health care professionals, policy makers, and the general public.
5. Haloxyl is an ingredient that helps to diminish the _____ under-eye circles that can be caused by stress, fatigue, even genetics.

IV. Split the text "Genetics" into several logical parts and give titles to them

V. Think of possible questions for the following answers

1. People began to understand them only in the 20th century.
2. They depend on both the hereditary material and the environmental conditions.
3. The ones that are always expressed.
4. It is studied by molecular genetics.
5. It is the same both in humans and other living beings.
6. Certain chemical tests like urinalysis or blood analysis can be useful for this purpose.
7. Such an effect is produced by a chemical called colchicine.
8. Artificial insemination, hormone treatment of cows and the use of foster mothers.
9. Such microorganisms are important in the pharmaceutical industry.
10. It is a medical procedure whereby some fluid from around the embryo is extracted and tested.

VI. Find the following words in the text "Genetics" and explain their meanings. Then select the synonyms of these words from the list below. Explain the difference between the synonyms using a dictionary

cultivate, _____, _____, _____;

determine, _____, _____, _____;

discover, _____, _____, _____;

dominant, _____, _____, _____;

treat, _____, _____,_____;

Cure, breed, identify, unearth, supreme, reveal, influence, propagate, overbearing, nurse, learn, raise, decide, superior, minister to.

VII. Fill in the spaces in the sentences below with the words from exercise VI

1. A medical examination may _____ evidence of dietary deficiencies.
2. After years of research, scientists have _____ the virus that is responsible for the disease.
3. Australian researchers have _____ a substance in coffee that acts like morphine.
4. He _____ about his appointment by telephone yesterday.
5. In nature plants of this genus are _____ mainly from the seeds.
6. It required a _____ effort to cope with the task.
7. It was difficult to _____ patients because of a shortage of medicine.
8. Last year we _____ a good crop of onions.
9. Many cancer victims can be _____ if the disease is detected early enough.
10. Quizzes are used to _____ how much material students have learned.
11. Several factors are likely to _____ this decision.
12. She _____ in a military hospital for several years.
13. She spent much time _____ to the sick.
14. The disease is under the control of a single _____ gene.
15. The incredible story was _____ by reporters at the "Post".
16. The land was too rocky to _____.
17. The manager can be very _____ at times, and it's difficult to argue with him.
18. The tests will help the doctors _____ what treatment to use.
19. These dogs were originally _____ in Scotland to round up sheep.
20. We think that our own race is incomparably _____ to any other.

FOCUS ON GRAMMAR: *Revision*

I. Read the text below and think of the word which best fits each space. Use only one word in each space. There is an example in (0)

Both metabolism (0) *and* reproduction are carried on (1)_____ cells. In eukaryotic cells the DNA lies (2)_____ the nucleus, a central structure bounded (3)_____ a membrane; in prokaryotic cells (such (4)_____ bacteria), which do (5)_____ have distinct nuclei, the DNA (6)_____ not enclosed. The proteins coded for in the DNA are synthesized (7)_____ the cytoplasm, the fluid material lying outside the nucleus (in eukaryotic cells) and (8)_____ by the cell membrane. All (9)_____ the structures required (10)_____ metabolism are contained (11)_____; thus, the cell is the unit of (12)_____ reproduction and metabolism.

II. Most of the lines in the text that follows contain an extra word. If a line is correct, put a tick (√) next to the line in the answer box provided to the right. If a line has an extra word, write it in the answer box. Lines 1 and 2 are done for you as an example

1. Gene which is a unit of hereditary information that occupies a fixed	*which*
2. position on a chromosome. Genes achieve their effects by directing	√
3. of the synthesis of proteins.	
4. Genes are composed of deoxyribonucleic acid (DNA), except for in	
5. some viruses, which do have genes consisting of a closely related compound	
6. called ribonucleic acid (RNA). A DNA molecule is composed of two chains	
7. of nucleotides that wind about each other to resemble like a twisted ladder.	
8. The sides of the ladder are made up of sugars and phosphates; the rungs	
9. are being formed by bonded pairs of nitrogenous bases.	
10. These bases are so adenine (A), guanine (G), cytosine (C), and thymine (T).	
11. An A on one chain bonds to a T on the other (thus by forming an A–T	
12. ladder rung); similarly, a C on one chain bonds to a G on the other.	
13. If the bonds between the bases are broken over, the two chains	

14. unwind, and free nucleotides within the cell attach themselves to the exposed 15. bases of the now-separated chains. The free nucleotides line up along with 16. each of chain according to the base-pairing rule — A bonds to T, C bonds to 17. G. This process results in the creation of two identical DNA molecules from 18. one original and is the same method by which hereditary information is 19. passed from one generation of cells to the next one.	

III. Fill in the spaces in the following text using a suitable form of the word given at the end of the lines. The first is given as an example

Cytogenetic techniques are *widely* used by geneticists. Older	***wide***
cytogenetic techniques involve _____ cells in paraffin wax,	**place**
slicing thin sections, and preparing them for _____ study.	**microscope**
The _____ and faster squash technique involves squashing	**new**
entire cells and studying their chromosomes. Dyes that _____	**select**
stain _____ parts of the cell are used; the genes, for example,	**vary**
may be located by selectively staining the DNA of which they	
are composed. Radioactive compounds also are _____ in	**value**
determining the _____ of various components of the cell.	**locate**
Tissue-culture techniques may be used to _____ cells before	**growth**
squashing; white blood cells can be grown from samples of	
human blood and studied with the squash technique.	

LISTENING COMPREHENSION

I. You will hear a text about human genetic disorders. Before listening discuss the words in the box with your fellow students and your teacher

physical deformity	salt imbalance	clotting proteins
metabolic dysfunction	thick, suffocating mucus	to have a devastating effect
mental retardation	Huntington's disease	fetus
allele	involuntary movements	to die prenatally

to inhibit severe disability cystic fibrosis	dementia hemophilia	miscarriage shortened life expectancy

II. Fill in the table below with the missing information

Name of the disease	Problems caused	Type of genetic disorder
cystic fibrosis		single gene disorder caused by a recessive allele
	…… ……, ……, death	single gene disorder caused by a dominant allele
hemophilia		
	…… ……, short stature, …… ……, shortened life expectancy	

III. Listen to the text again and summarize it using the following words and expressions

inherited diseases;
altered genes;
chromosomal abnormalities;
physical defects;
metabolic dysfunction;
mental retardation;
disturbances in the body's biochemical processes;
single-gene disorder
dominant-recessive pattern of inheritance;
X chromosome;
defective chromosomal structure.

SPEAKING

Speak about genetics covering the following issues:

- **what is genetics;**
- **divisions of genetics;**
- **methods and techniques used in modern genetics;**
- **practical applications of genetics in medicine, agriculture, industry, etc.;**
- **genetic abnormalities in humans and diseases they cause.**

Lesson 4

ECOLOGY

PRE-READING TASKS

I. Answer the following questions

- How do you understand the word ‘ecology’?
- Why do you think the profession of ecologist has gained importance in recent years?
- How can you characterize human influence on natural ecosystems?

II. Listen to the following words and practice their pronunciation

Abiotic, bioecology, bionomics, biotic, consumer, decomposer, ecological niche, ecosystem, energy budget, energy flow, environmental pollution, food chain, functional niche, microcalorimetry, nutrient cycling, population dynamics, primary production, producer, radioisotope, social behaviour, succession, trophic level, trophic-dynamic concept.

READING COMPREHENSION AND VOCABULARY DEVELOPMENT

I. Match each word on the left to its correct definition on the right

1) community, v	a) deficiency in quantity or number compared with the demand;
2) consumer, n	b) the process of making air, water, soil etc dangerously dirty, or the state of being dangerously dirty;
3) decomposer, n	c) the natural geographic range of an organism;
4) distribution, n	d) to make available for use **,** provide;
5) niche, n	e) the ecological role of an organism in a community especially in regard to food consumption
6) pollution, n	
7) population, n	
8) scarcity, n	

9) starvation, n
10) supply, v

f) an organism requiring complex organic compounds for food which it obtains by preying on other organisms or by eating particles of organic matter;
g) any of various organisms (as many bacteria and fungi) that return constituents of organic substances to ecological cycles by feeding on and breaking down dead protoplasm;
h) suffering or death caused by lack of food;
i) a group of interbreeding organisms that represents the level of organization at which speciation begins
j) an interacting population of various kinds of individuals (as species) in a common location.

II. Read the following text paying attention to the highlighted words. Explain or interpret the contextual meaning of the underlined phrases

Ecology, also called ***bioecology***, ***bionomics***, or ***environmental biology***, studies the relationships between organisms and their environment.

Long unfamiliar to the public, and relegated to a second-class status by many in the world of science, ecology emerged in the late 20th century as one of the most popular and most important aspects of biology. It has become painfully evident that some of the most pressing problems in the affairs of men — expanding ***populations***, food scarcities, ***environmental pollution***, and all the attendant sociological and political problems — are to a great degree ecological.

The word ecology was coined by a German zoologist Ernst Haeckel, who applied the term *oekologie* to the "relation of the animal both to its organic as well as its inorganic environment." The word comes from the Greek *oikos*, meaning "household, home, or place to live." Thus ecology deals with the organism and its environment. The word environment includes both other organisms and physical surroundings. It involves relationships between individuals within a population and

between individuals of different populations. These interactions between individuals, between populations, and between organisms and their environment form ***ecological systems***, or ***ecosystems***. Ecology has been defined variously as "the study of the interrelationships of organisms with their environment and each other," as "the economy of nature," and as "the biology of ecosystems."

In the early and mid-1900s two groups of botanists, one in Europe and the other in America, studied plant communities from two different points of view. The European botanists concerned themselves with the study of the composition, structure, and distribution of ***plant communities***. The American botanists studied the development of plant communities, or succession. Both plant and animal ecology developed separately until American biologists emphasized the interrelation of both plant and animal communities as a biotic whole.

During the same period interest in ***population dynamics*** developed. The study of population dynamics received special impetus in the early 19th century, after Thomas Malthus called attention to the conflict between expanding populations and the capability of the earth to supply food. R. Pearl (1920), A.J. Lotka (1925), and V. Volterra (1926) developed mathematical foundations for the study of populations, and these studies led to experiments on the interaction of predators and prey, competitive relationships between species, and the regulation of populations. Investigation of the influence of behaviour on populations was stimulated by the recognition in 1920 of territoriality in nesting birds. ***Concepts of instinctive and aggressive behaviour*** were developed by K. Lorenz and N. Tinbergen, and the role of ***social behaviour*** in the regulation of populations was explored by V.C. Wynne-Edwards.

While some ecologists were studying the dynamics of communities and populations, others were concerned with ***energy budgets***. In 1920, August Thienemann, a German freshwater biologist, introduced the concept of ***trophic***, ***or feeding***, ***levels***, by which the energy of food is transferred through a series of organisms, from green plants (the producers) up to several levels of animals (the

consumers). An English animal ecologist, C.E. Elton (1927), further developed this approach with the concept of ***ecological niches*** and ***pyramids of numbers***. Two American freshwater biologists, E. Birge and C. Juday, in the 1930s, in measuring the energy budgets of lakes, developed ***the idea of primary production***, i.e., the rate at which food energy is generated, or fixed, by photosynthesis. Modern ecology came of age in 1942 with the development, by R.L. Lindeman of the United States, of the ***trophic-dynamic concept of ecology***, which details the flow of energy through the ecosystem. Quantified field studies of energy flow through ecosystems were further developed by Eugene and Howard Odum of the United States; similar early work on the cycling of nutrients was done by J.D. Ovington of England and Australia.

The study of both energy flow and nutrient cycling was stimulated by the development of new techniques — ***radioisotopes***, ***microcalorimetry***, computer science, and applied mathematics — that enabled ecologists to label, trace, and measure the movement of particular nutrients and energy through the ecosystems. These modern methods encouraged a new stage in the development of ecology — ***systems ecology***, which is concerned with the structure and function of ecosystems.

Until the late 20th century ecology lacked a strong conceptual base. Modern ecology, however, is now focussed on the concept of the ecosystem, a functional unit consisting of interacting organisms and all aspects of the environment in any specific area. It contains both the nonliving (***abiotic***) and living (***biotic***) components through which nutrients are cycled and energy flows. To accomplish this cycling and flow, ecosystems must possess a number of structured interrelationships between soil, water, and nutrients, on the one hand, and ***producers***, ***consumers***, and ***decomposers*** on the other. Ecosystems function by maintaining a flow of energy and a cycling of materials through a series of steps of eating and being eaten, of utilization and conversion, called the ***food chain***. Ecosystems tend toward maturity, or stability, and in doing so they pass from a less complex to a more complex state. This directional change is called ***succession***.

Whenever an ecosystem is used, and that exploitation is maintained — as when a pond is kept clear of encroaching plants or a woodland is grazed by domestic cattle — the maturity of the ecosystem is effectively postponed. The major functional unit of the ecosystem is the population. It occupies a certain ***functional niche***, related to its role in ***energy flow*** and ***nutrient cycling***. Both the environment and the amount of energy fixation in any given ecosystem are limited. When a population reaches the limits imposed by the ecosystem, its numbers must stabilize or, failing this, decline from disease, starvation, strife, low reproduction, or other behavioural and physiological reactions. Changes and fluctuations in the environment represent selective pressure upon the population to which it must adjust. The ecosystem has historical aspects: the present is related to the past and the future to the present. Thus the ecosystem is the one concept that unifies plant and animal ecology, population dynamics, behaviour, and evolution.

III. USEFUL PHRASES. Study the following phrases and use them in the sentences of your own

(un)familiar to – (не)відомий, (не)знайомий
call attention to – привертати увагу до
from (someone's) point of view – з (чиєїсь) точки зору
influence of something on something – вплив чогось на щось

IV. Complete the following sentences using the information from the text

1. It was only in the 20th century that …
2. The word "ecology" originates …
3. Cooperation between plant and animal ecologists started after …
4. Mathematical basis for populations studies…
5. V.C. Wynne-Edwards studied…
6. The concept of trophic levels is concerned with…
7. The idea of primary production…

8. The development of new techniques facilitated…
9. Any ecosystem includes…
10. The population that has reached the limit in a certain ecosystem…

V. Answer the questions

1. What kinds of ecological problems can you name?
2. What is environment from the ecological point of view?
3. How do you understand the definition of ecology as "the economy of nature"?
4. In what directions did ecology develop in the first half of the 20th century?
5. What is systems ecology?
6. What are the main characteristics of an ecosystem?
7. How do human activities influence the tendency of ecosystems to maturity?

VI. Look for the synonyms of the following words in the text "Ecology"

1) create, invent;
2) constitution, makeup;
3) accentuate, stress;
4) impulse, stimulus;
5) keep up, sustain;
6) full development;
7) intervening, invading;
8) delay, hold off;
9) devolution, downgrade, weakening;
10) disorder; sickness;
11) competition, rivalry.

VII. Use the words and expressions from the previous exercise to fill in the gaps in the sentences below

1. It is possible that the deletion is _____ upon an important part of the protein and altering the conformation of the complex.
2. The report _____ the importance of improving safety standards.
3. Eight years of ethnic _____ devastated the country.
4. The discovery gave fresh _____ to the research.
5. The word 'aromatherapy' was _____ in the 1920s.
6. It is important to _____ a constant temperature inside the greenhouse.

7. Several of today's football games have been _____ because of heavy snow.
8. More recent studies have shown that hepatic denervation causes significant changes in the biliary lipid _____.
9. Childhood _____ such as measles and chickenpox are highly contagious.
10. The fur industry is already seeing a major _____ in sales.
11. Sharks take 10 years to reach _____.

FOCUS ON GRAMMAR: *Revision*

I. Choose the appropriate word

As/ while/ during energy moves *along/ through/ by* the ecosystem, much of it is lost at *some/ all/ each* trophic level. For example, only *near/ about/ along* 10 percent of the energy stored in grass is incorporated *into/ within/ inside* the body of a mouse that eats the grass. The remaining 90 percent *are/ is/ has* stored in compounds that cannot be *breaked/ broke/ broken* down by the mouse or is lost *like/ in the form/ as* heat during the mouse's metabolic processes. Energy losses of similar magnitude occur *on/ at/ in* every level of the food chain; consequently, *few/ a few/ little* food chains extend *behind/ above/ beyond* five members (from producer *through/ across/ to* decomposer), because the energy available at higher trophic levels is *to/ too/ two* small to support *further/ farther/ father* consumers.

The flow of energy through the ecosystem drives the movement of nutrients *inside/ within/ outside* the ecosystem. Nutrients are chemical elements and compounds necessary to living organisms. *Like/ not like/ unlike* energy, which is continuously lost from the ecosystem, nutrients are cycled through the ecosystem, oscillating *among/ between/ through* the biotic and abiotic components in *what/ which/ that* are called biogeochemical cycles. Major biogeochemical cycles *contain/ include/ involve* the water cycle, carbon cycle, oxygen cycle, nitrogen cycle, phosphorus cycle, sulfur cycle, and calcium cycle. Decomposers play a key role in many of these cycles, returning nutrients to the soil, water, or air, where they can again be *using/ useful/ used* by the biotic constituents of the ecosystem.

II. Paraphrase each sentence using the word in bold type

1. Obviously some system of replication powered by external sources of energy was formed in the early history of the earth.

   Must Some system …… history of the earth.

2. Primitive systems which were able to carry out the metabolic processes eventually evolved into cells.

   Capable Primitive systems …… into cells.

3. It is possible that parallel evolution occurred on other planets in the universe.

   Have Parallel evolution …… in the universe.

4. It is believed that species that are closely related share a recent common ancestor.

   Are Closely related species …… ancestor.

5. Different forms of the same gene are called alleles.

   Used The term allele …… gene.

6. Individual organisms cannot evolve in a single lifetime.

   For It is …… a single lifetime.

7. Sexual reproduction ensures that the genes in a population are rearranged in each generation.

   Due Genes in a population …… reproduction.

8. All living cells rely on the ATP molecule for the short-term storage of energy.

   Essential The ATP molecule …… all living cells.

9. Organisms and their constituent cells reproduce and yield offspring that are profoundly similar to the parent or parents.

   But Not …… to the parent or parents.

10. Shortly after the formulation of the cell theory, it became apparent that cell division was preceded by division of the nucleus.

    Been After …… division of the nucleus.

III. The following text contains 15 mistakes. Spot and correct them

The study of groups of organisms, called Synecology, is largely descriptive and not easily quantified and contain a bewildering array of terminology. Only recently, since the advent of the electronic and atomic ages, did synecology developed the tools to study complex systems and entering an experimental phase. Important concepts developed by synecology are those concerned of nutrient cycling, energy budgets, and ecosystem development. Synecology has strong ties with pedology, geology, meteorology, and cultural anthropology.

Synecology may been subdivided according with environmental types, as terrestrial or aquatic. Terrestrial ecology, which may be farther subdivided into forest, grassland, arctic, and desert ecology, concerns such an aspects of terrestrial ecosystems as microclimate, soil chemistry, soil fauna, hydrologic cycles, ecogenetics, and productivity. Terrestrial ecosystems are more influencing by organisms and subject too much wider environmental fluctuations then are aquatic ecosystems. Aquatic ecosystems are affected more by the condition of the water and resist such environmental variables as temperature. Because the physical environment is such important in controlling aquatic ecosystems, considerable attention is paid on the chemical and physical characteristics of the ecosystem, such as the currents and the chemical composition of the water. By convention, aquatic ecology, called limnology, is limit to freshwater stream ecology and lake ecology. The former concerns life in flowing waters; the later, life in relatively still water. Marine ecology deals with life in the open sea and in estuaries.

LISTENING COMPREHENSION

I. You will hear a text about the development of ecological systems. Before listening discuss the words and phrases in the box with your fellow students and your teacher

sterile area interference in the development of ecosystems

barren rock	deliberate maintenance of an immature ecosystem
lava flow	sound management of ecosystems
disrupted ecosystem	hinder efficient energy use
climax ecosystem	heightened susceptibility to plant diseases
fertilization	optimal long-term production of pasturage
inbreeding of crops	a moderate grazing schedule
arable lands	renewal of the moisture and nutrient content of the soil
fossil fuels	accumulated insecticides
recycling techniques	

II. Listen and choose the right option to complete the following sentences. In some cases more than one option is possible

1. Ecological succession takes place when…
   a) humans start exploiting an existing ecological system;
   b) an unpopulated territory is colonized by living organisms;
   c) a destroyed ecosystem starts to develop anew.
2. The growth phase of an ecosystem's development is characterized by…
   a) high stability and high productivity;
   b) low stability and high productivity;
   c) low productivity and high stability.
3. A great diversity of species and complex food webs are characteristic of …
   a) an ecosystem of an early stage;
   b) a mature ecosystem;
   c) a climax phase of an ecosystem's development.
4. To obtain an optimal result from agricultural use of an ecosystem we should…
   a) maintain the latter in the immature phase;
   b) combine the features of both early and mature ecosystems;
   c) intensify production by applying fertilizers.
5. By adding energy to the ecosystem in the short run we
   a) increase the crops' resistance to plant diseases;

b) can make its exploitation more efficient;
c) risk to destroy it in the long run by accumulating pollutants.

6. The idea of the mutual dependence between the society and the nature…
   a) was first developed in the late 19th century;
   b) was expressed in the works of ancient philosophers;
   c) was rejected by religion.
7. Nowadays systems ecology plays the key role in
   a) monitoring the effects of human agricultural and industrial activities on the environment;
   b) intensifying agricultural production;
   c) providing the sound management of natural resources.
8. The development of recycling techniques …
   a) is systems ecology's main concern;
   b) will play an important role in the economy of the future;
   c) may help decrease the negative impact of human activities on the nature.

III. Listen to the following fragment of the text again and reconstruct it

Although an awareness of the _____ between human society and its environment was already prominent in _____ and _____, the formulation of the basic principles of systems ecology as a _____ began in the late 19th century. During the _____, the study of ecosystems has become increasingly sophisticated and is now _____ in the assessment and control of the effects of _____ and industrialization on the environment. _____, for instance, it has shown that optimal long-term production of pasturage requires a moderate grazing schedule in order to ensure a steady renewal of the _____of the soil and has emphasized the need for _____ in the cultivation of _____. Systems ecology has been concerned with the _____ of accumulated insecticides and has provided a way of monitoring the _____ of _____ and carbon dioxide released by the _____ (e.g., coal, oil, and natural gas).

It has helped to determine regional _____ and has furthered the development of recycling techniques that may become essential in _____ with the environment.

WRITING

Make a written translation of the following sentences into English.

1. Екосистема — це сукупність живих організмів та їх фізичного середовища, які взаємодіють між собою.
2. Окремі складові екосистеми розподіляються на дві різні групи: абіотичні фактори, такі як мінерали, клімат, ґрунти, вода, сонячне світло та інші неживі елементи, та біотичні складові, що включають усі живі елементи екосистеми.
3. Складові елементи екосистеми пов’язані між собою двома головними силами: потоками енергії та кругообігом речовин всередині системи.
4. Автотрофи використовують зовнішню енергію, яку фіксують у простих вуглеводах для продукування більш складних органічних сполук, таких як білки, ліпіди, крохмаль, тощо, які здатні підтримувати процеси життєдіяльності в організмі.
5. Гетеротрофи є консументами у екосистемі; вони використовують, переробляють і, врешті решт, розкладають складні органічні речовини, накопичені автотрофами.
6. Автотрофи разом з гетеротрофами формують різні трофічні рівні в екосистемі: рівень продуцентів, утворений організмами, які самостійно продукують органічні речовини; первинний рівень консументів — організмів, які живляться продуцентами; вторинний рівень консументів, які живляться первинними консументами і так далі.
7. Останню ланку у ланцюгу живлення складають редуценти — гетеротрофи, які розкладають мертві організми та органічні відходи.

Unit 5 Focus Words and Phrases

accumulate, v (2)
affect, v (2)
affinity, n (2)
approximate, v (1)
argue, v (2)
beneficial, adj (2)
bias, n (2)
budding, n (3)
coin, v (4)
community, v (4)
composition, n (4)
concomitantly, adv. (1)
consumer, n (4)
convolution, n (1)
crossbreeding, n (3)
cultivate, v (3)
curve, n (1)
decline, n (4)
decomposer, n (4)
descent, n (2)
determine, v (3)
discern, v (1)
discover, v (3)
disease, n (4)
disintegrate, v (2)
distribution, n (4)
diverge, v (2)
dominant, adj (3)
efficient, adj (1)
emerge, v (1)
emphasize, v (4)
encroaching, adj (4)
entail, v (2)
estimate, n (2)
extant, adj (1)
extinct, adj (1)
favourable, adj (2)
grafting, n (3)
grip, n (1)
heterogeneity, n (2)
immense, adj (1)
impetus, n (4)
niche, n (4)
onset, n (1)
overlap, v (3)
pollution, n (4)
population, n (4)
postpone, v (4)
postulate, v (2)
posture, n (1)
precision, n (1)
predator, n (2)
preservation, n (2)
propinquity, n (2)
propulsive, adj (1)
relax, v (1)
remarkable, adj (1)
reveal, v (2)
rotation, n (1)
scarcity, n (4)
spontaneous, adj (2)
spring, n (2)
starvation, n (4)
strife, n (4)
subordinate, adj (3)
supply, v (4)
thrive, v (2)
trait, n (3)
transmit, v (2)
treat, v (3)
trend, n (1)
trunk, n (1)
yeast, n (3)

(un)familiar to (4)
account for (2)
apply something (to something/to do something) (3)
as compared with (1)
be concerned with (1)
call attention to (4)
correspond closely with (1)
from (someone's) point of view (4)

implication, n (1)
inclination, n (1)
infer, v (2)
infinite, adj (2)
inheritance, n (3)
lineage, n (2)
maintain, v (4)
maturity, n (4)
mold, n (3)
mutation, n (3)

influence of something on something (4)
keep something in check (2)
provide information on something (3)
resistant to (3)
specialize in (something/doing something) (3)
susceptibility to a disease (1)
take account of (1)
the appearance of something (3)
with no regard for / without regard for (2)

REVISION AND ADDITIONAL PRACTICE 5

Revision

I. Choose the appropriate word to complete each of the following sentences

1. The discovery of fossil bones from large _____ mammals in Argentina and the observation of numerous species of finches in the Galápagos Islands were among the events credited with stimulating Darwin's interest in how species originate.
   a) extant b) extinct c) existing d) extraordinary
2. The progressive development of an erect _____ was an important trend in primate evolution.
   a) pose b) position c) disposition d) posture
3. The Neanderthals, despite their archaic anatomy and their less _____ foraging systems, exhibited some uniquely modern features.
   a) affecting b) effective c) efficient d) effecatious
4. The fossil hand from Olduvai meets the anatomic requirements of the power grip and those of the _____ grip in terms of the opposability of the thumb.
   a) precision b) precise c) precious d) exact
5. The course of a disease — that is, the path it follows from _____ to end — can vary tremendously, depending largely on the individual and the treatment he or she receives.
   a) initiation b) start c) onset d) origin
6. Gene, or point, mutations _____ only a few nucleotides within a gene.
   a) affect b) effect c) impact d) affix
7. Fossil evidence must be examined together with the evidence from comparative studies of living forms and with the quantitative _____ provided by comparative studies of proteins and nucleic acids.
   a) appraisement b) calculations c) estimates d) valuation

8. Only reproducing individuals _____ their genes to the following generation.

a) transfer b) transmit c) transmute d) transplant

9. Investigations of human mitochondrial DNA _____ that the variation among modern human populations is small compared, for example, with that between apes and monkeys, which points to the recency of human origin.

a) expose b) illustrate c) uncover d) reveal

10. Newly arisen mutations are more likely to be harmful than _____ to their carriers, because mutations are random events with respect to adaptation.

a) beneficial b) benevolent c) helpful d) favourable

11. Paleoanthropologists search for the roots of human physical traits and behavior seeking to _____ how evolution has shaped the potentials, tendencies, and limitations of all people.

a) invent b) discover c) learn d) reveal

12. Distribution scales of phenotypic _____ such as height, weight, number of progeny, or longevity typically show greater numbers of individuals with intermediate values and fewer and fewer toward the extremes.

a) characteristics b) features c) peculiarities d) traits

13. Primary care physicians can _____ most common disorders, and provide comprehensive, lifelong care for individuals and families.

a) attend to b) cure c) heal d) treat

14. The ability to interbreed is of great evolutionary importance, because it _____ that species are independent evolutionary units.

a) decides b) determines c) establishes d) identifies

15. Further experience with the currently available antibiotics has served to _____ their usefulness in many infectious diseases, and also some of their limitations.

a) accentuate b) highlight c) emphasize d) underline

16. Evaluation of the theory of human descent from apes was complicated by the _____ of relevant fossil material.

a) deficiency b) deficit c) lack d) scarcity

17. Controlled environmental chambers enable experimenters to _____ plants and animals under known conditions of light, temperature, humidity, and daylength so that the effects of each variable (or combination of variables) on the organism can be studied.

a) hold b) maintain c) support d) sustain

18. As the population approaches the limit of resources, birth rates _____, and mortality of young and adults increases.

a) decline b) degenerate c) deteriorate d) lessen

19. Scientists propose that these free-living bacteria were engulfed and maintained by other prokaryotic cells for their ability to produce ATP efficiently and to _____ glucose.

a) deliver b) give c) offer d) supply

20. Gradually, as knowledge _____ from seemingly disparate areas, the beginnings of modern evolutionary theory began to take shape.

a) collected b) stored c) accumulated d) increased

Additional Practice

II. Reconstruct the following text using the words from the box to fill in the blanks. What do you think about extraterrestrial life?

cycles	enzyme	duplicated
strands	blood	amplify
primers	piece	replicated
copies	fragment	multiplied
diseases	segment	research
nucleotides	technique	identify
deoxyribonucleic acid	round	heating

test	tube	sufficient
complementary		

Polymerase Chain Reaction (PCR) is a (1)_____ in molecular biology by which a small fragment of (2)_____ can be rapidly cloned, or (3)_____, to produce multiple DNA (4)_____. PCR can be used to (5)_____ individuals from minute amounts of tissue or (6)_____, to diagnose genetic (7)_____, and to (8)_____ evolution.

PCR proceeds in a series of (9)_____, or rounds. Each successive (10)_____ doubles the amount of DNA and thus more than 1 billion copies of a single DNA (11)_____ can be made in just a few hours. Performed in a test (12)_____, PCR mirrors the way in which DNA is (13)_____ within a cell. To perform PCR, scientists isolate the piece of DNA to be amplified ((14)_____) in a test tube and heat it to separate the two (15)_____ of the molecule. As cooling occurs, short pieces of DNA called (16)_____ are added to the test tube. The primers attach to each strand, marking the (17)_____ that will be cloned. Free-floating nucleotides and an (18)_____ called DNA polymerase are then added to the mixture. DNA polymerase uses the free-floating (19)_____ to build a (20)_____ copy of each amplified DNA segment, resulting in two new double-stranded DNA molecules. Each cycle of (21)_____ and cooling doubles the amount of the desired DNA fragment in the (22)_____ tube. In a matter of hours, scientists can obtain millions of copies of a desired (23)_____ of DNA. PCR enables scientists to (24)_____ traces of DNA found at a crime scene or in a fossil animal to produce (25)_____ quantities to study.

III. Reconstruct the text below putting the extracted fragments (a-j) into their correct places (1-10). Make a written translation of the passage into Ukrainian

PCR and recombinant DNA techniques create large amounts of DNA segments. To study the structure of these segments, (1)____. This technique can be

used to identify genes in humans, (2)____ such as fruit flies. It can also be used to compare the DNA found from blood or hair samples at a crime scene (3)____. In gel electrophoresis, restriction enzymes break up the DNA under study (4)____. Solutions containing these fragments are placed within a thick gel. An electric current is applied to the gel, (5)____. All of the restriction fragments begin to move from the negative end of the gel toward the positive end. The smaller fragments move faster than the larger fragments. When the current shuts off, typically after several hours, (6)____, with the smaller ones closer to the positive end. The dispersed fragments display a pattern resembling a bar code. Each bar in this pattern contains DNA fragments of a certain size. Scientists can identify specific restriction fragments (7)____. A complementary sequence of DNA can be used as a probe to (8)____. Scientists may use DNA found in blood at a crime scene as the probe to see (9)____. If pairing occurs, the DNA from the crime scene is from the same person (10)____.

a) by their location on the gel;
b) causing one end of the gel to have a positive charge and the other to have a negative charge;
c) find a restriction fragment on the gel that has a particular nucleotide sequence;
d) if it pairs up with any of the DNA fragments in the gel electrophoresis;
e) into restriction fragments of varying lengths;
f) researchers use a process known as gel electrophoresis;
g) that have previously been identified in other organisms;
h) the DNA fragments have spread out across the gel;
i) who provided the DNA sample for the gel electrophoresis;
j) with the DNA of a suspect in the crime.

IV. Read the extracts from the article "Biotechnology, Ethics, and the Politics of Cloning" by *Steven Best* and *Douglas Kellner*. Consider and discuss the questions following the text

As we move into a new millennium fraught with terror and danger, a global postmodern cosmopolis is unfolding in the midst of rapid evolutionary and social changes co-constructed by science, technology, and the restructuring of global capital. We are quickly morphing into a new biological and social existence that is ever-more mediated and shaped by computers, mass media, and biotechnology, all driven by the logic of capital and a powerful emergent technoscience. In this global context, science is no longer merely an interpretation of the natural and social worlds, rather it has become an active force in changing them and the very nature of life. In an era where life can be created and redesigned in a petri dish, and genetic codes can be edited like a digital text, the distinction between "natural" and "artificial" has become greatly complexified. The new techniques of manipulation call into question existing definitions of life and death, demand a rethinking of fundamental notions of ethics and moral value, and pose unique challenges for democracy.

As technoscience develops by leaps and bounds, and as genetics rapidly advances, the science-industrial complex has come to a point where it is creating new transgenic species and is rushing toward a posthuman culture that unfolds in the increasingly intimate merging of technology and biology. The posthuman involves both new conceptions of the "human" in an age of information and communication, and new modes of existence as flesh merges with steel, circuitry, and genes from other species. Exploiting more animals than ever before, technoscience intensifies research and experimentation into human cloning. This process is accelerated because genetic engineering and cloning are developed for commercial purposes, anticipating enormous profits on the horizon for the biotech industry. Consequently, all natural reality — from microorganisms and plants to animals and human beings — is subject to genetic reconstruction in a commodified "Second Genesis."

At present, the issues of cloning and biotechnology are being heatedly debated in the halls of science, in political circles, among religious communities,

throughout academia, and more broadly in the media and public spheres. Not surprisingly, the discourses on biotechnology are polarized. Defenders of biotechnology extol its potential to increase food production and quality; to cure diseases and prolong human life; and to better understand human beings and nature in order to advance the goals of science. Its critics claim that genetic engineering of food will produce Frankenfoods that pollute the food supply with potentially harmful products; that biotechnology-out-of-control could devastate the environment, biodiversity, and human life itself; that animal and human cloning will breed monstrosities; that a dangerous new eugenics is on the horizon; and that the manipulation of embryonic stem cells violates the principle of respect for life and destroys a bona fide "human being"…

…As the debates over cloning and stem cell research indicate, issues raised by biotechnology combine research into the genetic sciences, perspectives and contexts articulated by the social sciences, and the ethical and anthropological concerns of philosophy. Consequently, intervening in the debates over biotechnology require supradisciplinary critical philosophy and social theory to illuminate the problems and their stakes. In addition, debates over cloning and stem cell research raise exceptionally important challenges to bioetbics and a democratic politics of communication. Biotechnology is thus a critical flashpoint for ethics and democratic theory and practice. For contemporary biotechnology underscores the need for more widespread knowledge of important scientific issues; participatory debate over science, technology, values, and our very concept of human life; and regulation concerning new developments in the biosciences, which have such high economic, political, and social consequences…

We need to discuss the numerous issues involved in the shift to a posthuman, postbiological mode of existence where the boundaries between our bodies and technologies begin to erode as we morph toward a cyborg state. Our technologies are no longer extensions of our bodies, as Marshall McLuhan stated, but rather are intimately merging with our bodies, as we implode with other species through the

genetic crossings of transgenic species. In an era of rapid flux, our genotypes, phenotypes, and identities are all mutating. Under the pressure of new philosophies and technological change, the humanist mode of understanding the self as a centered, rational Subject has transformed into new paradigms of communication and intersubjectivity, and information and cybernetics…

…Scientists should recognize that their endeavors embody specific biases and value choices, subject them to critical scrutiny, and seek more humane, life-enhancing, and democratic values to guide their work. Respect for nature and life, preserving the natural environment, humane treatment of animals, and serving human needs should be primary values embedded in science. And when these values might conflict, as in the tension between the inherent value of animals and human "needs," the problem must be addressed as sensitively as possible.

This approach is quite unlike how science so far has conducted itself in many areas. Most blatantly, perhaps, scientists, hand in hand with corporations, have prematurely rushed the genetic manipulation of agriculture, animals, and the world's food supply while ignoring important environmental, health, and ethical concerns. Immense power brings enormous responsibility, and it is time for scientists to awaken to this fact and make public accountability integral to their ethos and research. A schizoid modern science that rigidly splits facts from values must give way to a postmodern metascience that grounds the production of knowledge in a social context of dialogue and communication with citizens. The shift from a cold and detached "neutrality" to a participatory understanding of life that deconstructs the modern subject/object dichotomy derails realist claims to unmediated access to the world and opens the door to an empathetic and ecological understanding of nature…

…Science and technology, however, not only require responsibility and accountability on the part of scientists, but also regulation by government and democratic debate and participation by the public. Publics need to agree on rules and regulations for cloning and stem cell research, and there need to be laws,

guidelines, and regulatory agencies open to public input and scrutiny. To be rational and informed, citizens need to be educated about the complexities of genetic engineering and cloning, a process that can unfold through vehicles such as public forums, teach-ins, and creative use of the broadcast media and internet…

…The human species is thus at a terribly difficult and complex crossroads. Whatever steps we take, it is imperative we do not leave the decisions to the scientists, anymore than we would to the theologians (or corporate-hired bioethicists for that matter), for their judgment and objectivity is less than perfect, especially for the majority who are employed by biotechnology corporations and have a vested interest in the hastening and patenting of the brave new world of biotechnology. The issues involving genetics are so important that scientific, political, and moral debate must take place squarely within the public sphere. The fate of human beings, animals, and nature hangs in the balance, thus it is imperative that the public become informed on the latest developments and biotechnology and that lively and substantive democratic debate take place concerning the crucial issues raised by the new technoscience.

(http://www.gseis.ucla.edu/faculty/kellner/papers/biotechdem.htm)

Discussion

1. How, according to the authors of the article, has the role of science changed in the new millennium?
2. Why has the distinction between “natural” and “artificial” become complexified?
3. The authors of the article refer to a “posthuman culture”. What do they mean? Do you agree that we are entering a “posthuman” era?
4. What arguments do proponents and opponents of cloning and biotechnology provide to support their lines?
5. Who, according to Steven Best and Douglas Kellner, should be involved in the debates over biotechnology?

6. What accusations do the authors level against modern scientists employed by biotechnology corporations?
7. Why do you think the recent developments in biotechnology pose a challenge for democracy?
8. What is your personal opinion on the issues raised in the article?

V. If you solve the following puzzle you will be able to read an epigraph to the article *"Biotechnology, Ethics, and the Politics of Cloning"* (see ex.IV). The clues below will help you — each symbol on the right corresponds to a letter in the English words defined on the left.

Discuss with your classmates why *Steven Best* and *Douglas Kellner* chose this quotation as an epigraph for their article?

1. Using only two feet for locomotion	⇆↓▲⇨⇦⇨↙↓▽↘
2. The part of skull that encloses the brain**:** braincase	⇨△⇨↔↓▶↘
3. Any of a family of apes that includes the chimpanzee, gorilla, and orang-utan	▲↕↔→↓⇦
4. A basin-shaped structure in the skeleton of many vertebrates to which legs are joined	▲⇨↙◁↓▽
5. The proximal bone of the hind or lower limb — called also femur;	◀↑↓→↑⇆↕↔⇨
6. The bony or more or less cartilaginous framework supporting the soft tissues and protecting the internal organs of a vertebrate	▽↗⇨↙⇨◀↕↔
7. One of the four long thin parts on a human hand, not including the thumb	←↓↔→⇨△
8. The transmission of genetically derived qualities from ancestor to descendant through the genes	↑⇨△⇨⇦↓◀◢
9. Environment contamination especially with man-made waste	▲↕↙↙▶◀↓↕↔

10. Either of two complex cartilaginous or bony structures in most vertebrates that border the mouth, support the soft parts enclosing it, and usually bear teeth | ↖⇨▷

▷⇨ ⇨△⇨ △⇨⇨⇦◢ ◀↕ →↕ ⇦⇨⇨⇨▶▽⇨ ▷⇨ ◀↑↓↔↗

◀↑⇨◀ ◀↑⇨ →⇨↔↓⇨ ↓▽ ↕▶◀ ↕← ↑⇨△ ⇦↕◀◀↙⇨

(Dr. Panos Zavos)

VI. Using additional sources of information prepare a report on one of the following topics and present it to the class

- **Biotechnology in the modern world.**
- **Hereditary disorders in humans.**
- **Methods of regulating gene expression.**

List of Biology Terms and Biology Related Words

abdomen ['xbdqmqn], [xb'dqu-] *n* черевна порожнина
abdominal [xb'dOmin(q)l] *adj* черевний
abiotic ["eibai'Otik] *adj* абіотичний
absorb [qb'sO:b], [-'zO:b] *v* всмоктувати, поглинати
absorption [qb'sO:pS(q)n], [-'zO:p-] *n* всмоктування, поглинання
acid ['xsid] *n* кислота
amino [q'mi:nqu] ~ амінокислота
fatty ['fxti] ~ жирна кислота
nucleic [n(j)u:'kli:ik] ~ нуклеїнова кислота
adaptation ["xdqp'teiS(q)n] *n* адаптація, пристосування
adenosine triphosphate [x'denq"si:n trai'fOsfeit] *n* аденозинтрифосфат
adrenal gland [q'dri:n(q)l 'glxnd] n наднирник, наднирникова залоза
aerobe ['eqrqub] *n* аероб
alga ['xlgq] *n (pl –ae* ['xlGi:]) водорость, водорості
alkaptonuria [xl"kxptq'n(j)uriq] *n* алькаптонурія
alteration of generations чергування поколінь
amniocentesis ["xmniqusen'ti:sis] *n (pl –ses* [-si:z]) амніоцентез
Amphibia [xm'fibiq] *n* амфібії, земноводні (як клас)
amphibian [xm'fibiqn] 1) *n* амфібія, земноводне; 2) *adj* земноводний
anaerobe [x'neqrqub], ['xnerqub] *n* анаероб
anaphase ['xnq"feiz] *n* анафаза
ancestor ['xnsestq] *n* предок
angiosperm ['xnGiq"spq:m] *n* покритонасінна (рослина)
animal ['xnimql] *n* тварина
animal husbandry тваринництво
annelid ['xnqlid] *n* кільчик, кільчастий черв
anther ['xnTq] *n* пиляк
anthropology ["xnTrq'pOlqGi] *n* антропологія
antibody ['xnti"bOdi] *n* антитіло
antipodal [xn'tipqd(q)l] *adj* антиподальний
ape [eip] *n* мавпа (людиноподібна)
aperture ['xpqCuq] *n* отвір, апертура, пора
apoptosis ["xpqp'tqusis] *n* апоптоз
archaea ['a:kiq] *n* архея
archaebacteria ["a:kibxk'tiqriq] *pl n* архебактеріа
arthropod ['a:Trq"pOd] *pl n* членистоногі
artificial insemination штучне осіменіння

ATP, *n* АТФ, див. adenosine triphosphate
autotroph ["O:tqtrOf] *n* автотроф
axil ['xksil] *n* пазуха
back [bxk] *n* спина, хребет, задній бік
small of the ~ поперек
backbone ['bxk"bqun] *n* спинний хребет
bacteriophage [bxk'tiriq"feiG] *n* бактеріофаг
bacterium [bxk'tiqriqm] *n (pl –ia* [-iq]) бактерія
beak [bi:k] *n* дзьоб, хоботок
behaviour [bi'heivjq] *n* поведінка
benign [bi'nain] *adj* доброякісний, у легкій формі (мед.)
binary ['bainqri] *adj* бінарний
biochemistry ["baiqu'kemistri] *n* біохімія
biology [bai'OlqGi] *n* біологія
cellular ['seljulq] ~ клітинна біологія
developmental [di"velqp'mqnt(q)l] ~ біологія розвитку
environmental [in"vaiqr(q)n'ment(q)l] ~ біологія довкілля, екологія
evolutionary ["i:vq'lu:S(q)n(q)ri] ~ еволюційна біологія
human ['hju:mqn] ~ біологія людини
molecular [mqu'lekjulq] ~ молекулярна біологія
organismal ['O:gq"nizm(q)l] ~ біологія організмів
bioecology ["baiqui'kOlqGi] *n* біоекологія
biomedicine ["baiqui'med(i)sin] *n* біомедицина
bionomics ['baiqu'nOmiks] *n* екологія
biophysics ["baiqu'fiziks] *n* біофізика
biotechnology ["baiqutek'nOlqGi] *n* біотехнологія
recombinant [ri:'kOmbinqnt] DNA ~ біотехнологія рекомбінантної ДНК
biotic [bai'Otik] adj біотичний
bipedal gait двонога хода
bipedalism ['bai"ped(q)lizqm] *n* двоногість
bird [bq:d] *n* птах
blade [bleid] *n* пластинка (листка)
blood [blAd] *n* кров
body ['bOdi] *n* тіло
bone [bqun] *n* кістка
botany ['bOtqni] *n* ботаніка
brain [brein] *n* мозок
bud [bAd] *n* брунька

apical ['xpik(q)l] ~ верхівкова брунька
axillary [xk'silqri] ~ пазушна брунька
lateral ['lxtqrql] ~ бічна брунька

bud scale *n* брункова луска

budding ['bAdiN] *n* брунькування

burrow ['bArqu] *n* нора

cancer ['kxnsq] *n* рак

capillary [kq'pilqri] 1) *n* капіляр 2) *adj* капілярний

capsid ['kxpsid] *n* капсид, білкова капсула вірусу

capsule ['kxpsju:l] *n* капсула, оболонка, плід коробочка

carbohydrate ["ka:bqu'haidreit] *n* вуглевод

carnivore ['ka:ni"vO:] *n* м'ясоїдна тварина, комахоїдна рослина

cartilage ['ka:t(i)liG] *n* хрящ

catalyst ['kxtqlist] *n* каталізатор

cavity ['kxvity] *n* порожнина

cell [sel] *n* клітина
~ sap [sxp] клітинний сік
~ wall [wO:l] клітинна стінка (оболонка)

cellulose ['selju"lquz] *n* целюлоза

centriole ['sentri"qul] *n* центріоля

centromere ['sentrq"miq] *n* центромера

cerebellum ["seri'belqm] *n* мозочок

cerebral ['seribrql] *adj* церебральний, мозковий
~ cortex ['kOteks] кора мозку
~ hemispheres ['hemisfiqz] півкулі мозку

chamber ['Ceimbq] *n* камера, порожнина

cheek-bone ['Ci:kbqun] *n* вилиця

chemical ['kemik(q)l] 1) *n* хімічний препарат, реактив; 2) *adj* хімічний

chimera [kai'miqrq], [ki-] *n* хімера

chimpanzee ["Cimpqn'zi:] *n* шимпанзе

chitin ['kaitin] *n* хітин

chlorophyll ['klO:rqfil] *n* хлорофіл

chloroplast ['klO:rquplxst] *n* хлоропласт

cholesterol [kq'lestq"rOl] *n* холестерол

chordate ['kO:"deit] 1) *n* хордова тварина; 2) *adj* хордовий

chromatid ['krqumqtid] *n* хроматида

chromatin ['krqumqtin] *n* хроматин

chromoplast ['klOrqu"plxst] *n* хромопласт

chromosome ['krqumq"squm] *n* хромосома

circulation ["sq:kju'leiS(q)n] *n* кругообіг, циркуляція

circulatory system *n* кровоносна система
closed ~ закрита кровоносна система
class [kla:s] *n* клас
cod [kOd] *n* тріска (риба)
coelenterate [si'lentq"reit], [-rit] *adj* кишковопорожнинний
coelom ['si:lq(u)m] *n* целом, вторинна порожнина тіла
coenocyte ['si:nqu"sait] *n* ценоцит
coenocytic plasmodium ценоцитний плазмодій
colchicine ['kOlCi"si(:)n], ['kOlki-] *n* колхіцин
compound ['kOmpaund] 1) *adj* складний, складений; 2) *n* хімічна сполука
conifer ['kOnifq], ['kOn-] *n* хвойна (шпилькова) рослина
consumer [kqn'sju:mq] *n* споживач, консумент
convolution ["kOnvq'lu:Sqn] *n* звивина
cord [kO:d] *n* тяж, звязка, хорда, спинна струна
cortex ['kO:teks] *(pl –tices* [-ti"si:z]) *n* кора
cranial ['kreiniql] *adj* черепний
~ capacity [kq'pxsiti] ємність черепа
~ vault [vO:lt] склепіння черепа
cranium ['kreiniqm] *n (pl –nia* [-niq]) череп
crocodile ['krOkq"dail] *n* крокодил
crossover ['krOs"quvq] *n* кросинговер
crossbreeding ['krOs"briLdiN] *n* перехресне схрещування
cultivate ['kAlti"veit] *v* розводити, культивувати, вирощувати
cuticle ['kju:tik(q)l] *n* кутикула
cyanobacterium ["saiqnqubxk'tiqriqm] n *(pl –ria* [-riq]) цианобактерія
cycle [saikl] *n* цикл
cystinuria ['sisti"n(j)uriq] *n* цистинурія
cytogenetics ["saitquGi'netiks] *n* цитогенетика
cytokinesis ["saitquki'ni:sis], [-kai-] *n* цитокінез, поділ клітини
cytoplasm ['saitqu"plxzqm] *n* цитоплазма
cytoskeleton ['saitqu"skelitqn] *n* цитоскелет
cytosol ['saitqu"sOl] n цитозоль
decay [di'kei] *v* розкладатися, гнити
decomposer ["di:kqm'pquzq] *n* редуцент
deoxyribonucleic acid [di:"Oksi"raibqunju:'kli:ik 'xsid] *n* дезоксирибонуклеїнова кислота
descendant [di'sendqnt] *n* нащадок
descent [dis'ent] *n* походження, родовід
deuterostome ['dju:tqrqu"stqum] *n* вторинний рот

dextrin ['dekstrin] *n* декстрин
diaphragm ['daiq"frxm] *n* діафрагма
dichotomy [dai'kOtqmi] *n* дихотомія
dicot [dai'kOt] n двохдольна рослина
digest [di'Gest], [dai-] *v* перетравлювати, засвоювати
digestive [di'Gestiv], [dai-] *adj* травний
~ enzyme ['enzaim] травний фермент
~ tract [trxkt] травний тракт
diploid ['diplOid] 1) *n* диплоїд; 2) *adj* диплоїдний
disaccharide [dai'sxkq"raid], [-rid] *n* дисахарид
discipline ['disiplin] *n* дисципліна, галузь знання
disease [di'zi:z] *n* хвороба, захворювання
acute [q'kju:t] ~ гостре захворювання
chronic ['krOnik] ~ хронічне захворювання
distribution ["distri'bju:Sqn] *n* розподіл, поширення
diversity [dai'vq:siti] *n* різноманіття
division [di'viZqn] *n* поділ, відділ (бот.)
DNA *n* ДНК, див. deoxyribonucleic acid
dynamics [dai'nxmiks] *n* динаміка
echinoderm [i'kainqu"dq:m] *n* голкошкірий
ecological niche ["i:kq'lOGik(q)l "nI:(t)S] екологічна ніша
ecology [i:'kqlOGi] *n* екологія
ecosystem ['i:kqu"sistqm] *n* екосистема
eel [i:l] *n* вугор
egg [eg] *n* яйце, яйцеклітина
embryo ['embri"qu] *n* зародок
~ sac [sxk] зародковий мішок
endoplasmic reticulum ['endqu"plxzmik ri'tikjulqm] *n* ендоплазматичний ретикулюм
endosperm ['endqu"spq:m] *n* ендосперм
endospore ['endqu"spO:] *n* ендоспора
energy budget ['enqGi "bAGit] бюджет енергії
energy flow ['enqGi "flqu] потік енергії
engulf [in'gAlf] *v* поглинати, заковтувати їжу
environment [en'vairqnmqnt] *n* довкілля, оточуюче середовище
environmental pollution [en'vairqnmqnt(q)l pq'lu:Sqn] забруднення довкілля
enzyme ['enzaim] *n* ензим, фермент
epidermis ["epi'dq:mis] *n* епідерма
erosion [i'rquZqn] *n* ерозія, руйнування

ether ['i:Tq] *n* ефір
ethology [i'TOlqGi] *n* етологія
eubacteria ["ju:bxk'tiqriq] *n* евбактерії
eukaryotic ["ju:kxri'Otik] *adj* евкаріотичний
evaporation [i'vxpq"reiSqn] *n* випаровування
evolution ["i:vq'lu:Sqn] *n* еволюція
excrete [ik'skri:t] *v* виділяти
excretion [ik'skri:Sqn] n виділення
exine ['eksin], [-ain] *n* екзина
exoskeleton ["eksqu'skelitqn] *n* екзоскелет
extant [ik'stxnt], ['ekstqnt] *adj* існуючий нині
extinct [ik'stiNkt] *adj* вимерлий
eye [ai] *n* око
eye socket *n* орбіта, очна ямка
family ['fxm(i)li] *n* родина
fat [fxt] *n* жир
feather, n ['feDq] перо
feature ['fi:Cq] *n* риса, ознака, властивість
female ['fi:meil] 1) *n* самка; 2) *adj* жіночий
fern [fq:n] *n* папороть
fertile ['fq:tail] *adj* родючий, плодючий, фертильний
fertilization ["fq:tilai'zeiS(q)n] *n* запліднення
double [dAbl] ~ подвійне запліднення
fibre ['faibq] *n* волокно
filament ['filqmqnt] *n* філамент, волоконце
fin [fin] *n* плавець
finger ['fiNq] *n* палець
fish [fiS] *n* риба
bony ['bquni] ~ костиста риба
cartilaginous ["ka:ti'lxGinqs] ~ хрящова риба
jawless ['GO:lis] ~ безщелепна риба
fission ['fiSqn] *n* поділ
flagellum [flq'Gelqm] *n (pl –la* [-lq]) джгутик
fluid ['flu:id] 1) *adj* рідкий, текучий; 2) *n* рідина
flatworm ['flxtwq:m] *n* плоский черв
food chain *n* ланцюг живлення
foot [fut] *n* ступня, ніжка
fossil ['fOs(q)l] *n* викопна рештка
foster mother *n* сурогатна мати
frog [frOg] *n* жаба

fruit [fru:t] *n* плід
function ['fANkSqn] 1) *n* призначення, функція; 2) *v* функціонувати
fungus ['fANgqs] *n (pl fungi* ['fANgai], ['fAnGai], ['fAnGi]) гриб
galactosemia ['gxlqktq"simiq] *n* галактоземія
gamete ['gxmi:t], [gq'mi:t] *n* гамета, статева клітина
gametophyte [gq'mi:tqu"fait] *n* гаметофіт
gene [dZi:n] *n* ген
generation ["Genq'reiSn] *n* покоління
generative ['Genqrqtiv] *adj* генеративний
genetic drift [Gi'netik "drift] *n* дрейф генів
genetics [Gi'netiks] *n* генетика
classical ['klxsik(q)l] ~ класична генетика
human ['hju:mqn] ~ генетика людини
molecular [mqu'lekjulq] ~ молекулярна генетика
population ["pOpju'leiSqn] ~ популяційна генетика
genome ['Gi:nqum] *n* геном
genotype ['Genqu"taip] *n* генотип
genus ['Gi:nqs] *n (pl genera* ['Genqrq]) рід
germinate ['Gq:mi"neit] *v* проростати, давати бруньки
gibbon ['gib(q)n] *n* гібон
gill ['gil] *n* зябра
~ slit зяброва щілина
gland *n* [glxnd] *n* залоза
glucose ['glu:kquz] *n* глюкоза
glycerol ['glisq"rOl] *n* гліцерил, гліцерин
glycocalyx ["glaikqu'keiliks], [-'kxl-] *n* глікокалікс
glycogen ['glaikquGqn] *n* глікоген
glycolipid ["glaikqu'lipid] *n* гліколіпід
glycoprotein ["glaikqu'prquti:n] *n* глікопротеїн
gnetophyte ['ni:tqu"fait] *n* гнетофіт, оболонконасінна рослина
gonad ['gOnxd] *n* гонада, статева залоза
gorilla [gq'rilq] *n* горила
gout [gqut] *n* подагра
grafting ['gra:ftiN] *n* щеплення, пересадка тканини (мед.)
grain [grein] *n* зерно
growth [grquT] *n* ріст
gymnosperm ['Gimnqu"spq:m] *n* голонасінна рослина
habitat [‘hxbi"txt] *n* місце існування, природне середовище
haemoglobin ["hi:mqu'glqubin], ["hem-] *n* гемоглобін

hagfish ['hxg"fiS] *n* миксина
hair [heq] *n* волосок, волосся, волосяний покрив
haploid ['hxplOid] 1) *n* гаплоїд; 2) *adj* гапдоїдний
hatch [hxC] *v* виси́джувати, виводити(сь), вилуплюватись із яєць (ікри)
heart [ha:t] *n* серце
helical ['helik(q)l] *adj* спіральний
helix ['hi:liks] n *(pl helices* ['heli"si:z]) спіраль
hemicellulose ["hemi'selju"lquz] *n* геміцелюлоза
herbivore ['he:bi"vO:] *n* травоїдна тварина
heredity [hi'rediti] *n* спадковість
heterogeneity ["het(q)rquGq'ni:qti] *n* неоднорідність
heterosporous ["hetq'rOspqrqs] *adj* різноспоровий
heterotroph ["het(q)rqu'trOf] *n* гетеротроф
hip [hip] *n* стегно, плід шипшини
hormone ['hO:mqun] *n* гормон
horn [hO:n] *n* ріг
human ['hju:mqn] 1) *adj* людський 2) *n* людина
hybrid ['haibrid] *n* гібрид
hydrolase ['haidrq"leiz] *n* гідролаза
hypothesis [hai'pOTisis] *n (pl –ses* [-"si:z]) гіпотеза
Ice Age льодовиковий період
immunologic ["imjunq'lOGik] *adj* імунологічний
~ response [ri'spOnce] імунна реакція
incubation period ['inkju"beiS(q)n 'piqriqd] *n* інкубаційний період (мед.)
independent assortment ["indi'pendqnt q'sO:tmqnt] незалежний розподіл
infestation ["infes'teiS(q)n] *n* інвазія (паразитами)
inflorescence ["inflO:'resqns] *n* суцвіття
ingestion [in'GesCqn] *n* прийом їжі, харчування
inheritance [in'heritqns] *n* успадкування
insect ['insekt] *n* комаха
insulin ['insjulin] *n* інсулін
interact ["intqr'xkt] *v* взаємодіяти
interbreed, v ["intq'bri:d] схрещувати(ся)
interior [in'tiqriq] 1) *adj* внутрішній; 2) *n* внутрішня сторона
internode ['intq"nqud] *n* міжвузля
interphase ['intq"feiz] *n* інтерфаза
intestine [in'testine] *n* кишківник, кишковий тракт
invertebrate [in'vq:tibrit], [-"breit] *n* безхребетна тварина

ion ['aiqn], [-On] *n* іон
isosporous ['aisq"spO:rqs] *adj* ізоспоровий
jaw [jO:] *n* щелепа
joint [GOint] *n* суглоб, вузол (бот.)
karyokinesis ["kxriquki'ni:sis], [-kai-] *n* каріокінез, поділ ядра
keratin scale ['kerqtin "skeilz] *n* кератинова луска
kidney ['kidni] *n* нирки
kingdom ['kiNdqm] *n* царство
knee [ni:] *n* коліно
lactose ['lxktquz] *n* лактоза
lamprey ['lxmpri] *n* міног а
larkspur ['la:k"spq:] *n* живокість
larva ['la:vq] *n (pl –vae* [-vi:]) личинка
leaf [li:f] n *(pl leaves* [li:vz]) листок
lemur [li:mq] *n* лемур
leucoplast ['lu:kq"plxst] *n* лейкопласт
ligament ['ligqmqnt] *n* зв'язка, з'єднання
limb [lim] *n* кінцівка, гілка, сук (бот.)
lineage ['liniiG] *n* родовід, еволюційна гілка
lipid ['lipid], ['laipid] *n* ліпід
lipoprotein ["lipqu'prquti:n], ["lai-] *n* ліпопротеїн
lithotroph ['liTq"trOf] *n* літотроф
liver ['livq] *n* печінка
lizard ['lizqd] *n* ящірка
locomotion ["lqukq'meuSqn] *n* пересування
lumbar ['lAmbq] *adj* поперековий
lung [lAN] *n* легеня
lysogenic ["laisO'Gqnik] *adj* лізогенний
lysosome ['laisq"squm] *n* лізосома
male [meil] 1) *n* самець; 2) *adj* чоловічий
maltose ['mO:ltquz] *n* мальтоза
malignant [mq'lignqnt] *n* злоякісний (мед.)
mammal ['mxmql] *n* ссавець
mandible ['mxndib(q)l] *n* нижня щелепа
mandibular [mxn'dibjulq] *adj* нижньощелепний
mantle ['mxnt(q)l] *n* мантія, покрив
masticatory complex ['mxstikqt(q)ri 'kOmpleks] жувальний апарат
mature [mq'tjuq], [-'Cuq] *adj* зрілий, спілий, дорослий
maturation [mq'tjuqreiS(q)n], [-'Cuq] *n* дозрівання
maxilla [mxk'silq] n *(pl –lae* [-li:]) верхня щелепа (хребетних)

maxillary region [mxk'silqri 'ri:Gqn] верхньощелепний
medium ['mi:diqm] *n (pl media* [-dia]) засіб, середовище
megagametophyte, n ['megqgq'mi:tqu"fait] мегагаметофіт
megaspore ['megq"spO:] *n* мегаспора
megasporocyte ['megq"spO(:)rqu"sait] *n* мегаспороцит
meiosis [mai'qusis] *n (pl –ses* [-"si:z]) мейоз
membrane ['membrein] *n* мембрана, оболонка, перетинка
plasma ['plxzmq] ~ плазматична мембрана
meristem, n ['meri"stem] меристема
apical ['xpikql] ~ верхівкова меристема
ground [graund] ~ основна меристема
intercalary ~ вставна меристема
lateral ['lxtqrql] ~ бічна меристема
metabolism [mi'txbq"lizqm] *n* метаболізм, обмін речовин
metaphase ['metq"feiz] *n* метафаза
microcalorimetry ["maikrqukqlq'rimqtri] *n* мікрокалориметрія
microgametophyte ["maikrqu gq'mi:tqu"fait] *n* мікрогаметофіт
micrometer [mai'krOmitq] *n* мікрометр
micropyle ['maikrqu"pail] *n* мікропіле
microspore ['maikrqu"spO:] *n* мікроспора
microsporocyte ['maikrqu"spO(:)rqu"sait] *n* мікроспороцит
microtubule ["maikrqu'tju:bju:l] *n* мікротрубочка
migrate [mai'greit] *v* мігрувати, здійснювати переліт
mitochondrion ["maitqu'kOndriqn] n *(pl –dria* [-driq]) мітохондрія
mitosis [mai'tqusis], [mi-] *n* мітоз
mitotic spindle [mai'tqutik 'spind(q)l] мітотичне веретено
mixotroph ["miksq'trOf] *n* міксотроф
modification ["mOdifi'keiS(q)n] *n* зміна, видозміна, перетворення
molecule ['mOlikju:l] *n* молекула
molecular ['mq(u)'lekju:lq] *n* молекулярний
mollusk ['mOlqsk] *n* молюск
monkey ['mANki] *n* мавпа
monocot ['mOnqu'kOt] *n* однодольна рослина
monosaccharide ["mOnqu'sxkqraid] or [-rid] *n* моносахарид
motor mechanism ['mqutq 'mekq"nizqm] *n* руховий механізм
multicellular ["mAlti'seljulq] *adj* багатоклітинний
muscle ['mAs(q)l] *n* м'яз
muscular ['mAskjulq] *adj* м'язовий
mutability ["mju:tq'bilqti] *n* мінливість, мутабельність
mutation [mju:'teiS(q)n] *n* мутація

natural selection ['nxtS(q)rql si'lekS(q)n] *n* природній добір
nerve ['nq:v] *n* нерв; жилка (бот.)
nervous system ['nq:vqs 'sistqm] *n* нервова система
neuron ['njuqrOn] *n* нейрон
neurophysiology ["njuqrqu"fizi'OlqGi] *n* нейрофізіологія
node [nqud] *n* вузол
notochord ['nqutq"kO:d] *n* нотохорд
nuclear envelope ['nju:kliq 'envq"lqup] ядерна оболонка
nuclease ['nju:kli"eiz] *n* нуклеаза
nucleoid ['nju:kli"quid] *n* нуклеоїд
nucleolus ["nju:kli'qulqs] *n (pl –lai* [-lai]) ядерце
nucleotide ['nju:kliq"taid] *n* нуклеотид
nucleotide sequence послідовність нуклеотидів
nucleus ['nju:kliqs] *n (pl –clei* [-kli"ai]) ядро
nutrient ['nju:triqnt] *n* поживна речовина, поживний
oak [quk] *n* дуб
offspring ['Of"spriN] *n* нащадок
oil [Oil] *n* олія
orangutan [O:'rxNqtxn] *n* орангутанг
orbital region ['O:bit(q)l 'rI:Gqn] *n* область очних ямок
order ['O:dq] *n* порядок, ряд
organ ['O:gqn] *n* орган
organelle ["O:gq'nel] *n* органела
organism ['O:gq"nizqm] *n* організм
organotroph ["O:gxnqu'trOf] *n* органотроф
origin ['OriGin] n джерело, походження
orthognathic [O:'TOgnqTik] *adj* ортогнатичний
osmosis [Oz'mqusis] *n* осмос
osmotroph ["Ozmqu'trOf] *n* осмотроф
ovary ['quvqri] *n* зав'язь
ovule ['Ovju:l] *n* яйцеклітина, насінний зачаток (бот.)
oxygen ['OksiGqn] *n* кисень
parasite ['pxrq"sait] n паразит
pelvic ['pelvik 'flxnG] *adj* тазовий
pelvis ['pelvis] *n* таз
perception [pq'sepSqn] *n* сприйняття, одержання сенсорних відчуттів
perianth ['peri"xnT] *n* оцвітина
permease ['pq:mieiz] *n* пермеаза
peroxisome [pq'rOksi"squm] *n* пероксисома
petiole ['peti"qul] *n* черешок

phagotroph ["fxgqu'trOf] 1) *n* фаготроф; 2) *adj* фаготрофний
pharmaceutical ["fa:mq'sju:tik(q)l] *adj* фармацевтичний
phenylketonuria ["fi:nail"ki:tq'njuqriq] *n* фенілкетонурія
phloem ['flquem] *n* флоема, луб
phospholipids ["fOsfq'lipid] *n* фосфоліпід
photosynthesis ["fqutqu'sinTisis] *n* фотосинтез
phylogeny [fai'lOGini] *n* філогенія
phylogenetic ["failquGi'netik] *adj* філогенетичний
~ affinity [q'finiti] філогенетична спорідненість
~ line [lain] філогенетична гілка
~ propinquity [prq'piNkwiti] філогенетична близькість
phylum ['failqm] *n (pl –la* [-lq]) тип
physiology ["fizi'OlqGi] *n* фізіологія
pilus ['pailqs] *n (pl pili* ['paili]) піла, фімбрія
pith [piT] *n* серцевина
plant [pla:nt] *n* рослина
flowering ['flauqriN] ~квіткова рослина
vascular ['vxskjulq] ~ судинна рослина
plasmodium [plxz'mqudiqm] n *(pl –dia* [-diq]) плазмодій
plastid ['plxstid] *n* пластида
pollen ['pOlqn] *n* пилок
~ grain [grein] пилкове зерно
~ tube [t(j)u:b] пилкова трубочка
pollination ["pOli'neiSqn] *n* запилення
polymer ['pOlimq] *n* полімер
polynucleotide ["pOli'nju:kliq"taid] *n* полінуклеотид
polysaccharide ["pOli'sxkq"raid], [-rid] *n* полісахарид
pongid ['pONgid], ['pOnGid] *n* людиноподібна мавпа
population ["pOpju'leiSqn] *n* популяція, населення
~ dynamics [dai'nxmiks] динаміка популяцій
posture ['pOsCq] *n* постава
upright ['Aprait] ~вертикальна постава
precursor [pri'kq:sq] *n* попередник, передвісник
predator ['predqtq] *n* хижак
pressure ['preSq] *n* тиск
osmotic [Oz'mqutik] ~осмотичний тиск
prey [prei] *n* здобич, жертва хижака
primary production первинна продукція
primate ['praimeit] *n* примат
primer ['praimq] *n* праймер

primordial [prai'mO:diql] *adj* зачатковий, примордіальний
prion ['praiqn] *n* пріон
procambium [prqu'kxmbiqm] *n* прокамбій
producer [prq'dju:sq] *n* продуцент
progeny ['prOGini] *n* потомство
prognathic [prOgnx'Tik] *adj* прогнатичний
prokaryotic [prqu"kxri'Otik] *adj* прокаріотичний
prophase ['prqu"feiz] *n* профаза
protein ['prquti:n] *n* протеїн, білок
protista [prqu'tistq] *n* протисти, найпростіші
protoderm ['prqutq"dq:m] *n* протодерма
protostome ['prqutq"stqum] *n* первинний рот
pseudocoel ['sju:dqu"si:l] *n* несправжня порожнина тіла
radioisotope ["reidiqu'aisqtqup] *n* радіоізотоп
ratfish ['rxt"fiS] *n* хімера (риба)
reproduction ["ri:prq'dAkSqn] *n* розмноження, відтворення
nonsexual [nOn'sekSuql] ~ нестатеве розмноження
sexual ['sekSuql] ~ статеве розмноження
reptile ['reptail] *n* плазун, рептилія
respiration ["respq'reiSqn] *n* дихання
responsiveness [ri'spOnsivnqs] *n* здатність реагувати
ribosome ['raibq"squm] *n* рибосома
ribonucleic acid ["raibqunju:'kli:ik 'xsid] *n* рибонуклеїнова кислота
RNA *n* РНК див., ribonucleic acid
root [ru:t] *n* корінь
~ cap [kxp] кореневий чохлик
~ hair [heq] кореневий волосок
fibrous ['faibrqs] ~ system мичкувата коренева система
tap [txp] ~ system стрижнева коренева система
salamander ['sxlq"mxndq] *n* саламандра
saline ['seilain] 1) *adj* солоний; 2) *n* солоне озеро, солончак
saliva [sq'laivq] *n* слина
salmon ['sxmqn] *n* лосось, сьомга
sample ['sa:mp(q)l] *n* проба, зразок, екземпляр
saprobe ['sxprqub] 1) *n* сапрофаг; 2) *adj* сапробний
saprophyte ['sxprqu"fait] *n* сапрофіт
sarcoplasmic reticulum *n* саркоплазматична сітка
scavanger ['skxvinGq] *n* тварина, яка живиться трупами
science ['saiqns] *n* наука

secrete [si'kri:t] *v* виділяти, секретувати
secretory [si'kri:tqri] *adj* видільний, секреторний
seed [si:d] *n* насіння
seedling ['si:dliN] *n* сіянець, проросток
sense [sens] *n* чуття
sensory apparatus *n* сенсорний апарат
sensory mechanism *n* механізм чутливості
sepal ['sep(q)l] *n* чашолисток
serum ['siqrqm] n *(pl sera* ['siqrq] сироватка
sessile ['sesail] *adj* сидячий, прикріплений
sex [seks] 1) *n* стать; 2) *adj* статевий
shark [Sa:k] *n* акула
shell [Sel] *n* черепашка, стулка, панцир
shoot [Su:t] *n* пагін
~ system ['sistem] пагонова система
skat [skxt] *n* скат (риба)
skeleton ['skelitqn] *n* скелет
skin [skin] *n* шкіра
skull [skAl] *n* череп
~ base [beiz] основа черепа
~ vault [vO:lt] склепіння черепа
slime [slaim] *n* слиз
slime mould слизовик
snake [sneik] *n* змія
social behaviour ['squSql bi'heivjq] соціальна поведінка
sociobiology ["squsiqbai'OlqGi] *n* соціобіологія
soil [sOil] *n* ґрунт
solution [sq'lu:Sqn] *n* розчин
solve [sOlv] *v* розчиняти
solvent ['sOlvqnt] *n* розчинник
somatic [squ'mxtik] *adj* соматичний
species ['spi:Si:z] *n* вид
sperm [spq:m] *n* сперма, сперматозоїд, спермій
spleen [spli:n] *n* селезінка
sponge [spAnG] *n* губка
spore [spO:] *n* спора
sporophyte ['spO(:)rqu"fait] *n* спорофіт
Squamate ['skweimeit] *n* лускаті
stance [stxns], [sta:ns] *n* поза, положення
upright ['Aprait] ~вертикальне положення

starch [sta:C] *n* крохмаль
stem [stem] *n* стебло
sternum ['stq:nqm] *(pl –na* [-nq]) грудина
stigma ['stigmq] *n* вічко, примочка (маточки)
strain [strein] *n* штам
sturgeon ['stq:Gqn] *n* осетр
style [stail] *n* стовпчик (бот.)
subcellular ["sAb'seljulq] *adj* субклітинний, внутрішньоклітинний
subclass ["sAb'kla:s] *n* підклас
succession [sqk'seSqn] *n* послідовність, сукцесія, сівозміна
substance ['sAbstqns] *n* речовина, субстанція
sucrose ['sju:krquz], [-krqus] *n* сахароза
sugar ['Sugq] *n* цукор
swim bladder *n* плавальний міхур
symbiont ['simbi"Ont] *n* симбіонт
symbiosis ["simbi'qusis], ["simbai'qusis] *n* симбіоз
symmetry ['simitri] *n* симетрія
bilateral [bai'lxtqrql] ~ білатеральна симетрія
radial ['reidiql] ~ радіальна симетрія
synergid [si'nq:"Gid], ['sinq:"Gid] *n* синергіда
tadpole ['txd"pqul] *n* пуголовок
tail [teil] *n* хвіст
tarsier ['ta:siq] *n* довгоп'ят
taxon ['txksOn] *n (pl taxa* ['txksq]) таксон, клас систематики
telophase ['telq"feiz] ['txksOn] *n* телофаза
template ['templit] *n* зразок, шаблон, трафарет
tendon ['tendqn] *n* сухожилля
tetrad ['tetrxd] *n* тетрада
thighbone ['Tai"bqum] *n* стегнова кістка
thumb [TAm] *n* великий палець; сук дерева
tissue ['tisju:], ['tiSu:] *n* тканина
connective [kq'nektiv] ~ сполучна тканина
vascular ['vxskjulq] ~ провідна тканина
toad [tqud] *n* ропуха
tooth [tu:T] *n (pl teeth* [ti:T]) зуб
totipotent [tqu'tipqtqnt] *adj* тотипотентний
trait [treit] *n* особливість, риса
transmit [trxnz'mit], [trAn'smit] *v* передавати в т.ч. по спадковості
triglyceride [trai'glisq"raid] *n* тригліцерид
trophic level *n* трофічний рівень

trunk [trANk] *n* стовбур (бот.), тулуб, тіло (зоол.)
tuatara ["tu:q'ta:rq] *n* туатара, гатерія
tumour ['tju:mq] *n* пухлина
benign [bi'nain] ~ доброякісна пухлина
malignant [mq'lignqnt] ~ злоякісна пухлина
turgor ['tq:gq] *n* тургор
turtle ['tq:t(q)l] *n* черепаха
twig [twig] *n* пагін, гілка
ultraviolet ["Altrq'vaiqlit] *adj* ультрафіолетовий
unicellular ["ju:ni'seljulq] *adj* одноклітинний
vaccine ['vxksi:n] *n* вакцина
vacuole ['vxkju"qul] *n* вакуоля
vascular ['vxskjulq] *adj* судинний
vascular system *n* провідна система (бот.), судинна система (зоол.)
vegetative ['veGitqtiv] *adj* вегетативний
ventricle ['ventrik(q)l] *n* шлуночок (серця, мозку)
vertebra ['vq:tibrq] *n (pl –brae* [-bri:]) хребець
vertebral column *n* хребет, хребтовий стовп
vertebrate ['vq:ti"breit], [-brit] *n* хребетна тварина
vesicle ['vesik(q)l] *n* пухирець
virion ['vairiqn] *n* віріон
viroid ['vairOid] *n* віроїд
virus ['vairqs] *n* вірус
xylem ['zailqm] *n* ксилема, деревина
yeast [ji:st] *n* дріжджі
yolk [jqulk] *n* жовток (яйця)
zoology [zqu'OlqGi], [zu:-] *n* зоологія
zygote ['zaigqut], [‘zig-] *n* зигота

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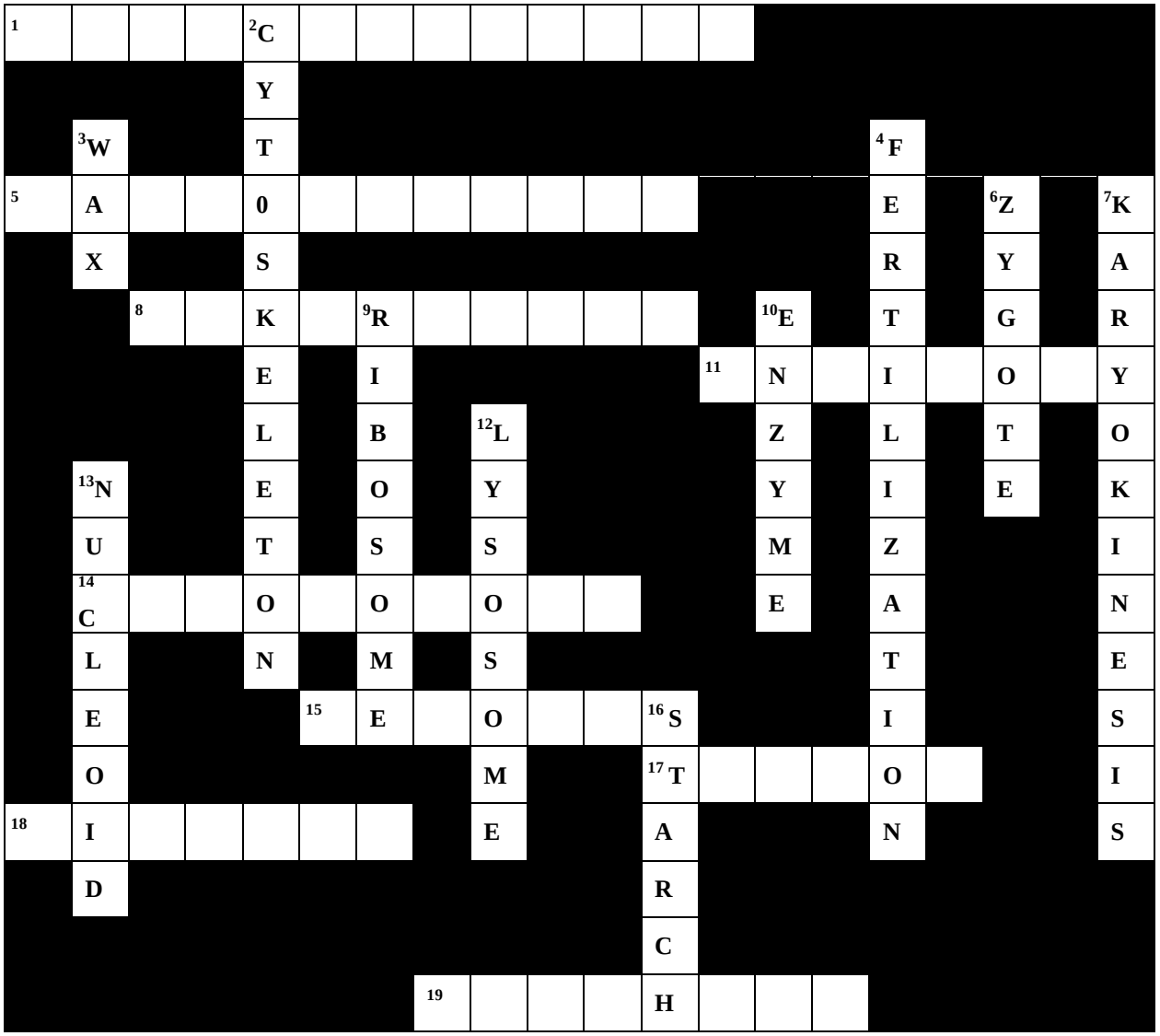
Appendix

REVISION AND ADDITIONAL PRACTICE 2

Additional Practice, Task IV (p.95)

Student B make the clues to the given answers for your partner to guess



TAPESCRIPTS

Unit I
Lesson 1. BIOLOGY – THE SCIENCE OF LIFE
Ex. I

At some time around 18 billion years ago, a mighty explosion is thought to have occurred; and all matter that was then present began to spread apart at a great rate. The universe is still expanding today. The noise of the original explosion—the "big bang"—can still be "heard" in the form of background radiation permeating all of space, a trace that appears as "snow" on a television receiver that is tuned to a channel that is not receiving a picture. The big bang sent gases hurtling in all directions—perhaps to expand until the end of time, perhaps to collapse together from gravitational attraction and then repeat the process in a never-ending cycle of bang and collapse. Some time after the bang, clouds of gases formed; later they collapsed upon themselves through gravitational attraction, forming the galaxies, which are great clusters of hundreds of billions of stars. Among the billions of galaxies is our own, the Milky Way.

Somewhat less than 5 billion years ago, toward the outer edge of the Milky Way, our solar system (the sun, the earth, and our sister planets) took form. A widely held current view is that most, if not all, planets were built up into clumps of solid matter by the gravitational attraction and aggregation of cold dust particles. As earth grew slowly by this process, the weight of the outer layers compressed the interior of the planet. The resulting pressures and the energy from radioactive decay heated the interior until it melted. In this viscous liquid, the settling of the heavier elements led to a fluid iron and nickel core with a radius of approximately 3700 kilometers. Around the core lies a 3000-kilometer-thick mantle of dense silicate materials. Over the mantle is a lighter crust, over 40 kilometers thick under the continents but thinning to 5 km in places under the oceans. Since earth's beginning, its crust has been in constant motion. Sea beds have been lifted up and folded into mountain ranges, then gradually eroded down into plains, which have been flooded again by the ocean.

At the time of the formation of the crust, earth's atmosphere, consisting largely of hydrogen, was lost because it could not be held by the gravitational field; that is, our planet was once a sterile, rocky ball with neither atmosphere nor oceans. Heavier gases, such as carbon dioxide and nitrogen from the mantle and crust, were held by earth's gravitational field, and gradually formed a new atmosphere. Water vapor from the interior condensed into seas. Lightning and other energy sources converted atmospheric gases into simple organic molecules, and these dissolved in the seas.

Ex. II

The oldest rocks we can find on earth (over 3.5 billion years old) bear traces of living things. Eventually, the primitive oceans teemed with life; but the land, which was bathed in deadly ultraviolet radiation coming from the sun, remained nearly as sterile as the moon.

Life was confined to depths below 5 meters (m) in the ocean, where it was protected from ultraviolet radiation by the absorbing shield of water, or to muds and shaded areas. As life continued, the atmosphere gradually changed: Photosynthesis by some of the creatures in the oceans, along with nonbiological events in the upper atmosphere, contributed to the production of oxygen gas. The oxygen, in turn, gradually contributed to an ozone layer in the upper atmosphere; and the ozone blocked some of the most damaging wavelengths of ultraviolet radiation. When this happened, life was able to spread to shallow coastal waters and eventually to the dry land itself, without the deadly effects of radiation damage.

Life evolved and the land was colonized long before the continents reached their present (and still-changing) positions. The positions of the continents in relation to one

another and their movements apart have had an important influence on the geography of life on earth. Throughout the history of the planet, there have been dramatic changes in global climates. Great ice ages developed, tying up huge quantities of water in glaciers, thus lowering sea levels and lowering the temperatures of both land and sea. During warmer epochs, the ice completely disappeared, and mild climates prevailed even at high latitudes. The last few million years of earth's history have been ones of great climatic changes, and it was during this period that Homo sapiens – the species that produced science – evolved.

Unit I
Lesson 2. LIFE
Ex. I, II.

A

For many years **a physiological definition** of life was popular. Life was defined as any system capable of performing a number of such functions as eating, metabolizing, excreting, breathing, moving, growing, reproducing, and being responsive to external stimuli. But many such properties are either present in machines that nobody is willing to call alive, or absent from organisms that everybody is willing to call alive. An automobile, for example, can be said to eat, metabolize, excrete, breathe, move, and be responsive to external stimuli. On the other hand, some bacteria do not breathe at all but instead live out their days by altering the oxidation state of sulfur.

B

The metabolic definition is still popular with many biologists. It describes a living system as an object with a definite boundary, continually exchanging some of its materials with its surroundings, but without altering its general properties, at least over some period of time. But again there are exceptions. There are seeds and spores that remain, so far as is known, perfectly dormant and totally without metabolic activity at low temperatures for hundreds, perhaps thousands, of years but that can revive perfectly well upon being subjected to more clement conditions.

C

A biochemical or molecular biological definition sees living organisms as systems that contain reproducible hereditary information coded in nucleic acid molecules and that metabolize by controlling the rate of chemical reactions using proteinaceous catalysts known as enzymes. In many respects, this is more satisfying than the physiological or metabolic definitions of life. There are, however, even here, the hints of counterexamples. There seems to be some evidence that a virus-like agent called scrapie contains no nucleic acids at all, although it has been hypothesized that the nucleic acids of the host animal may nevertheless be involved in the reproduction of scrapie.

D

A **genetic definition** of life describes it as a system capable of evolution by natural selection. This definition places great emphasis on the importance of replication. Indeed, in any organism enormous biological effort is directed toward replication, although it confers no obvious benefit on the replicating organism. Some organisms, many hybrids for example, do not replicate at all. But their individual cells do. The genetic definition has the additional advantage of being expressed purely in functional terms: it does not depend on any particular choice of constituent molecules. The improbability of contemporary organisms is so great that these organisms could not possibly have arisen by purely random processes and without historical

continuity. Fundamental to the genetic definition of life then is the belief that a certain level of complexity cannot be achieved without natural selection.

Unit I
Lesson 3. THE ORIGIN OF LIFE
Ex I. Life from Outer Space?

An idea that life did not originate on earth but rather emerged elsewhere in the solar system and was then transported to our planet has recently gained popularity. This is not entirely absurd; the most primitive bacteria and archaea have extreme environmental tolerances and some possibly could survive travel through space.
In 1996 a team of National Aeronautics and Space Administration (NASA) scientists announced tentative evidence of primitive life forms preserved in a 4.5-billion-year-old meteorite from Mars.

If the evidence holds up, scientists will have to seriously entertain the possibility that life on earth may have arisen first in Martian environments. Mars has much weaker gravity than the earth, making it easier for rock to be blasted into space off Mars than off the earth. Furthermore, because the earth has stronger gravity, it is more likely for the earth to capture a meteor than is Mars. We may all be the descendants of Martians.

Of course, it is entirely possible, and perhaps probable, that life may have arisen independently on the earth and Mars, especially if organic-rich comets were crashing into both planets about four billion years ago. Resolution of this question will come from: (1) continued chemical experiments on the molecular precursors of life; (2) planned exploration for Martian fossils at the beginning of the 21st century; and (3) continued searching for a source of regular, complicated radio signals from outer space. Discovery of an intelligent signal would confirm that there is cognizant life elsewhere and that there are many planets on which life originated independently.

Unit 2
Lesson 1. MACROMOLECULES
Ex I. Nucleotides

DNA molecules form from chains of building blocks called nucleotides. Each nucleotide consists of a sugar molecule called deoxyribose that bonds to a phosphate molecule and to a nitrogen-containing compound, known as a base. DNA uses four bases in its structure: adenine (A), cytosine (C), guanine (G), and thymine (T). The order of the bases in a DNA molecule—the genetic code—determines the amino acid sequence of a protein.

In the cells of most organisms, two long strands of DNA join in a single molecule that resembles a spiralling ladder, commonly called a double helix. Alternating phosphate and sugar molecules form each side of this ladder. Bases from one DNA strand join with bases from another strand to form the rungs of the ladder, holding the double helix together.

The pairing of bases in the DNA double helix is highly specific—adenine always joins with thymine, and guanine always links to cytosine. These base combinations, known as complementary base pairing, play a fundamental role in DNA's function by aiding in the replication and storage of genetic information. Complementary base pairing also enables scientists to predict the sequence of bases on one strand of a DNA molecule if they know the

order on the corresponding, or complementary, DNA strand. Scientists use complementary base pairing to help identify the genes on a particular chromosome and to develop methods used in genetic engineering.

Genes line up in a row along the length of a DNA molecule. In humans a single gene can vary in length from 100 to over 1,000,000 bases. Genes make up less than 2 percent of the length of a DNA molecule. The rest of the DNA molecule is made up of long, highly repetitive nucleotide sequences. Once dismissed as "junk" DNA, scientists now believe these nucleotide sequences may play a role in the survival of cells. Identifying the function of these sequences is a thriving field of genetics research.

Ex. II. Cellulose

Cellulose is the chief constituent of the cell wall of all plant cells. In plants, cellulose is normally combined with woody, fatty, or gummy substances. With some exceptions among insects, true cellulose is not found in animal tissues. Microorganisms in the digestive tracts of herbivorous animals break down the cellulose into products that can then be absorbed. Cellulose is insoluble in all ordinary solvents and may be readily separated from the other constituents of plants. Depending on its concentration, sulfuric acid acts on cellulose to produce glucose, soluble starch, or amyloid; the last is a form of starch used for the coating of parchment paper. When cellulose is treated with an alkali and then exposed to the fumes of carbon disulfide, the solution yields films and threads. Rayon and cellophane are cellulose regenerated from such solutions. Cellulose acetates are spun into fine filaments for the manufacture of some fabrics and are also used for photographic safety film, as a substitute for glass, for the manufacture of safety glass, and as a molding material. Cellulose ethers are used in paper sizings, adhesives, soaps, and synthetic resins.

Unit 2
Lesson 2. CELL AS THE BASIC UNIT OF LIFE
Ex. I, II. Origin of the Eukaryotes

In years past, biologists tried to grow chloroplasts or mitochondria in culture, outside the cells that they normally inhabit. These organelles are about the size of bacteria; they contain ribosomes and DNA; they divide within the cell—might they not be treated like little cells in their own right? Although all such efforts at organelle culture failed, they nurtured thoughts about another important question: How did the eukaryotic cell arise in the first place? Prokaryotic cells are generally much simpler in structure, since they lack membrane-bounded organelles. Prokaryotic fossils can be found in sediments well over 3 billion years old, whereas the earliest known eukaryotic fossils date back to only 1.4 billion years ago. It is generally agreed that eukaryotes evolved from prokaryotes. But how?

One of the suggestions is referred to as the endosymbiotic theory of the origin of eukaryotes. Lynn Margulis of Boston University proposed the following idea. Picture a time, well over a billion years ago, when only prokaryotes inhabited earth. Some of them got their food by absorbing it directly from the environment, others were photosynthetic, and still others fed by eating their prokaryotic neighbors. Suppose that an occasional small prokaryote was ingested by a larger one but did not get digested, so that it sat trapped within the larger cell. Suppose further that the smaller prokaryote survived there and that it divided at about the same rate as the larger one, so that successive generations of the larger prokaryote continued to be inhabited (or infected) by the offspring of the smaller one. We would call this endosymbiosis: "living within" another cell or organism.

Modern scientists have some reasons to hypothesize that those little prokaryotes "eaten" by the larger prokaryotes could have become the first chloroplasts and mitochondria. On the other hand it must be emphasized that mitochondria and chloroplasts are not enough to make a prokaryote into a eukaryote. We must still account for the origin of the nuclear envelope, as well as for other important structures including those responsible for nuclear division. Thus far, the endosymbiotic theory is incomplete, although suggestions have been made for its extension to deal with the origin of other eukaryotic organelles. Is the endosymbiotic theory true? We do not yet know, and certainly it has not yet been proved. A number of compelling objections to the theory have been raised, among them the fact that the DNA responsible for the synthesis of most of the enzymes in chloroplasts and mitochondria resides in the nucleus. However the matter may ultimately be resolved, the endosymbiotic theory is a good example of creative biological thinking; and it gives us a useful perspective on the structures, functions, and origins of the mitochondria and chloroplasts.

Unit 2
Lesson 3. CELL STRUCTURE
Ex. II. Movement in Cells

Many unicellular organisms swim, glide, thrash, or crawl to search for food and escape enemies. Swimming organisms often move by means of a flagellum, a long tail-like structure made of protein. Many bacteria, for example, have one, two, or many flagella that rotate like propellers to drive the organism along. Some single-celled eukaryotic organisms, such as euglena, also have a flagellum, but it is longer and thicker than the prokaryotic flagellum. The eukaryotic flagellum works by waving up and down like a whip. In higher animals, the sperm cell uses a flagellum to swim toward the female egg for fertilization.

Movement in eukaryotes is also accomplished with cilia, short, hairlike proteins built by centrioles, which are barrel-shaped structures located in the cytoplasm that assemble and break down protein filaments. Typically, thousands of cilia extend through the plasma membrane and cover the surface of the cell, giving it a dense, hairy appearance. By beating its cilia as if they were oars, an organism such as the paramecium propels itself through its watery environment. In cells that do not move, cilia are used for other purposes. In the respiratory tract of humans, for example, millions of ciliated cells prevent inhaled dust, smog, and microorganisms from entering the lungs by sweeping them up on a current of mucus into the throat, where they are swallowed. Eukaryotic flagella and cilia are formed from basal bodies, small protein structures located just inside the plasma membrane. Basal bodies also help to anchor flagella and cilia.

Still other eukaryotic cells, such as amoebas and white blood cells, move by amoeboid motion, or crawling. They extrude their cytoplasm to form temporary pseudopodia, or false feet, which actually are placed in front of the cell, rather like extended arms. They then drag the trailing end of their cytoplasm up to the pseudopodia. A cell using amoeboid motion would lose a race to a euglena or paramecium. But while it is slow, amoeboid motion is strong enough to move cells against a current, enabling water-dwelling organisms to pursue and devour prey, for example, or white blood cells roaming the blood stream to stalk and engulf a bacterium or virus.

Ex. III

An animal cell typically contains several types of membrane-bound organs, or organelles. The nucleus directs activities of the cell and carries genetic information from generation to generation. The mitochondria generate energy for the cell. Proteins are manufactured by ribosomes, which are bound to the rough endoplasmic reticulum or float free in the cytoplasm. The Golgi apparatus modifies, packages, and distributes proteins while lysosomes store enzymes

for digesting food. The entire cell is wrapped in a lipid membrane that selectively permits materials to pass in and out of the cytoplasm.

Unit 2
Lesson 4. CELL DIVISION
Ex. II

The cell nucleus contains a collection of interacting proteins that control cell division. Sometimes called the cell cycle clock, this group of proteins interprets incoming messages at several checkpoints in the cell division cycle. At these checkpoints, the clock evaluates the health of the cell. If conditions are right, the clock activates certain mechanisms that trigger the cell to enter the next stage of the cell cycle. If conditions are not right, certain tumor suppressor genes produce proteins that prevent the cell from proceeding with cell division.

If the cell cycle clock detects DNA damage in a cell, a tumor suppressor gene called p53 prevents the cell from reproducing until the damage is repaired. If the cell is unable to repair the DNA damage, p53 instructs the cell to undergo programmed cell death, or apoptosis, putting a stop to runaway cell division before it starts. Programmed cell death is a normal part of cell life and is tightly controlled by many genes, primarily p53.

A normal cell has a life span of about 40 cell divisions. This life span is controlled in part by telomeres, protective segments at the ends of the cell's DNA. Telomeres shorten with each cell division until they can no longer protect the DNA. At this point cell division severely damages the DNA, ultimately killing the cell. This normal process ensures that older cells, which may have accumulated mutations, no longer reproduce. Cancer cells escape this protective mechanism by producing a protein called telomerase. Telomerase extends the length of telomeres indefinitely, rendering the cells immortal and capable of never-ending cell division.

These cells can grow on top of each other, creating a mass of abnormal cells, called a tumor. There are two general types of tumors. Benign tumors do not invade other tissues and are limited to one site, making surgical removal possible and the odds for a full recovery excellent. Some benign tumors are quite harmless and are not surgically removed unless they are unsightly or uncomfortable. Other benign tumors are thought to be precursors to cancerous, or malignant, tumors. Unlike benign tumors, cancers invade surrounding tissues and spread to other parts of the body. This spreading is called metastasis, and it occurs in two stages: first, the extension of the cancer cells into surrounding tissues and then their entry into either the bloodstream or the lymphatic system.

The exact nature of cellular transformation into the cancerous state is not yet known. Three possible causes of the transformation are accumulated mutations, the activation of one or more normally "silent" genes, and induction by an oncogenic virus. It is also known that Cancer can be caused by certain physical and chemical agents, called carcinogens.

Studies of cancer show that some people are more likely to develop the disease than others. The incidence of cancer varies enormously among different regions. Differences also occur within populations. Cancer rates vary between sexes, races, and socioeconomic groups. Although people of all ages develop cancer, most types are more common in people over the age of 50. Cancer usually develops gradually over many years, the result of a complex mix of environmental, nutritional, behavioral, and hereditary factors. Scientists do not completely understand the causes of cancer, but they know that certain lifestyle choices can dramatically reduce the risk of developing most types of cancer. Not smoking, eating a healthy diet, and exercising moderately for at least 30 minutes each day reduce cancer risk by more than 60 percent.

Ex. III

For reasons not well understood, cancer rates vary by gender, race, and geographic region. For instance, more males have cancer than females, and African Americans are more likely to develop cancer than persons of any other racial and ethnic group in North America. Cancer rates also vary globally—residents of the United States, for example, are nearly three times more likely to develop cancer than are residents of Egypt. The highest death rate from all cancers in males is 272 per 100,000 men in Hungary while the lowest death rate of 80 men per 100,000 is found in Mauritius, an island off the coast of eastern Africa. For women the highest cancer rate is 140 per 100,000 women in Denmark compared to only 63 per 100,000 women in Azerbaijan. The figures for the United States are 156 per 100,000 men and 108 per 100,000 women. For particular cancers, the difference between countries may be as high as 40-fold. Differences also occur within populations.

Scientists called epidemiologists study particular populations to identify why cancer rates vary. One method they use is to compare behavior and characteristics such as the gender, age, diet, or race of cancer patients to those of healthy people. Population studies provide useful information about risk factors that increase the likelihood of developing cancer.

Unit 3

Lesson 1. THE PROTISTA

Ex. I, II. Malaria

Malaria is a serious, even deadly protozoan infection that has left its mark on human history. Today, in many tropical parts of the world, it continues to threaten human health. Worldwide, 150 million people a year suffer from malaria. In tropical Africa, more than a million children die each year of the infection.

Symptoms and Course of Infection

Malaria starts with chills and violent trembling and then progresses to high fever and delirium. The person sweats profusely, is completely exhausted, and has a dangerously enlarged spleen. The disease strikes in a relentless cycle, with symptoms returning every 2 to 4 days. Within weeks, the sufferer either dies of circulatory system collapse or overcomes the parasite. A person whose immune system fights off the infection may feel well for months and then become ill again. Repeated infections with the malaria parasite can lead to severe anemia, a decrease in the concentration of red blood cells in the bloodstream. The malaria parasite consumes or renders unusable the proteins and other vital components of the patient’s red cells.

A cycle of malaria begins when an infected female mosquito bites a human. The insect's saliva contains an anticlotting agent, as well as sporozoites, which are small, haploid cells of *Plasmodium falciparum, vivax, malariae, ovale,* and others. The sporozoites enter the human host's liver cells, where they divide rapidly and form structures called merozoites. Some merozoites reinfect liver cells, and others infect blood cells. For the next 2 to 3 days, the merozoites enlarge and divide, finally bursting from the red blood cells and infecting other cells. The rush of merozoites, burst red blood cells, and toxins cause severe chills and fever.

Ex. III. Malaria. Eradication

People were able to treat malaria long before they understood the infective cycle. In the sixteenth century, Peruvian natives gave Jesuit missionaries on their way to Europe their secret malaria remedy — the bark of the cinchona tree. It was not until 1834, though, that French chemist Pierre Joseph Pelletier extracted the active ingredient from cinchona bark: quinine, which is still used in some forms, in addition to many other drugs developed to keep pace with *Plasmodium's* evolving resistance to various drugs. In 1955, the World Health Organization

announced an eradication campaign against malaria; by 1976, it admitted failure. Malaria had actually spread through developing nations as people cleared land for farming.

Although we have moderately effective ways to prevent and treat malaria, stemming the illness is very challenging, for biological as well as sociological reasons. Not only does *Plasmodium* continue to develop drug resistance, but governments of developing nations of Africa and Southeast Asia cannot afford expensive surveillance and treatment programs.

Still, certain measures can lower the risk of contracting malaria:

- a drug called mefloquine can prevent malaria when administered weekly for 2 years and can kill parasites within 48 hours;
- bednets soaked in insect repellent keep mosquitoes away;
- screens on windows and doors help keep out mosquitoes;
- wearing long pants and long sleeves, especially during the evening, helps prevent mosquito bites.

Unit 3
Lesson 2. THE BACTERIA
Ex. I. The Best-Known Prokaryote: Escherichia Coli

Without a doubt the best understood of all living creatures is a humble bacterium living in our intestinal tract: Escherichia coli – or, as it is commonly known, E. coli. This rod-shaped bacterium is about 2 μm in length and 0.8 μm in diameter, giving it a volume of about 1 μm^3 and a weight of approximately 10^{-12}g (one-millionth of one-millionth of a gram). Thus it is about 100 times larger than the smallest living cells, the mycoplasmas. Within its tiny body, E. coli contains from 1 to 4 identical molecules of DNA and about 15,000-30,000 ribosomes. Immediately outside the plasma membrane is a cell wall about 10 nm thick, and projecting from the cell are flagella and pili. The flagella gather into a bundle and push the bacterium at a speed that if magnified to human dimensions would correspond to 30 miles per hour! Every second or so, the bundle of flagella separates and reforms, causing the cell to change its direction. The E. coli cell consists of approximately 70 percent water, 15 percent protein, 1 percent DNA, 3 percent carbohydrate, 2 percent lipid, and 1 percent simple ions such as K^+ (potassium), as well as small amounts of other substances. The genetic material of E. coli consists of approximately 1/500 as much DNA as is contained in a single cell of a human being. Nonetheless, as relatively simple as it is, each prokaryotic cell of E. coli makes thousands of kinds of specific proteins.

Several features make this bacterium a very favorable subject for biological experimentation. As noted, it is very small. Under the best conditions, it can divide once every 20 minutes, whereas most animal cells require about 1 day to go through a division cycle. Because of this rapid division, immense populations of E. coli can be grown very quickly. Its nutritional requirements are simple: just water, some mineral ions, and an energy source such as glucose. Unlike some bacteria, most varieties of E. coli do not present a great health hazard, so it can be grown without extensive precautions. Many differing genetic strains with known characteristics are readily available. As a result of these and other advantages, E. coli has been used in countless investigations of genetics, biochemistry, and other areas of biology.

Unit 3
Lesson 3. VIRUSES
Ex. II, III. *Sick Bacteria?*

Cholera can kill in mere days. *Cramps*, *vomiting*, fever, and *watery diarrhea* that can *deplete* a human body of 10 to 15 liters of fluid rapidly progress to *circulatory shock* and collapse. Because cholera is a food- or water-borne bacterial infectious disease, it isn't surprising

that it has *devastated* towns and cities. Many cholera epidemics have swept Asia, the Middle East, Europe, and Africa, and today the disease is epidemic in areas of Central and South America and has appeared in Texas and Louisiana.

The bacterium *Vibrio cholerae* causes cholera. The infection spreads when fecal matter from infected persons *contaminates a water supply*, or when people eat shellfish that came from contaminated water. The bacteria use hairlike structures on their surfaces, called pili, to adhere to the mucosal lining of the person's *small intestine*, where they secrete a toxin (poison). When the toxin enters intestinal cells, it causes water and *chloride ions to leak out* and prevents *sodium ions* from entering. The result — massive, life-threatening diarrhea.

Sometimes infection by *V. cholerae* has no effect on a person or produces only *mild symptoms*. At other times, the infection is swiftly and painfully *lethal*. Why the difference? *V. cholerae* that kill do so because they *harbor a viral infection* themselves.

Bacterial cells, like other cells, can become infected with viruses. Viruses that infect bacteria are called *bacteriophages*, or phages for short. Researchers recently discovered that *V. cholerae* that are pathogenic harbor a phage *bearing a gene* that enables them to manufacture a toxin—and this toxin causes the symptoms of cholera in humans. The phage also passes along genes to the bacteria that enable phage to spread to other bacteria.

Ex. IV

Cholera vaccines have never worked well, and the discovery that it isn't the bacterium itself, but *a genetic stowaway*, that causes the illness explains why. In fact, researchers working on developing a cholera vaccine discovered the phage because their work was not progressing well.

A vaccine is a disabled form of a pathogen, or even just a piece of it that is sufficient to stimulate a human *immune response*. The observation that various bits of *V. cholerae* did not protect against the deadly diarrhea suggested that the bacterium was *acquiring its virulence* elsewhere. Using an electron microscope, vaccine researchers identified a newly seen phage. It grabs the bacterium's pili and inserts itself into the cell, along with its deadly gene.

The discovery of the pili *route* to infection explained previous research showing that the same bacterial gene controls both cholera toxin production and pili structure. Experiments further *revealed* that when this gene is mutated, the cell fails to grow pili—but also never manufactures cholera toxin. Withot pili, the virus can't enter, and the bacterium never receives instructions to produce the cholera toxin.

Identifying the agent directly responsible for cholera, and learning how it enters bacterial cells, is expected to finally *set* vaccine developers *on the right track*. They can now focus on the true cause of cholera—not bacterium, but a virus.

Unit 4
Lesson 1. VASCULAR PLANTS

Ex. II. The ferns.

When I was a small child, my family had a large potted fern on each side of a fireplace. I became quite attached to the plants, and believing I was removing a “disease”, I carefully scraped off the little brownish patches that appeared from time to time on the lower surfaces of the leaves. It wasn’t until I got to college I learned that instead of controlling a disease, I had inadvertently been frustrating the sex life of my favourite plants.

If we could take a worldwide opinion poll about ornamental plants, ferns undoubtedly would rank high in popularity. In fact, in some parts of the world, it is difficult to find a

household without at least one fern either inside or out in the garden. Their leaves are so infinitely varied in form and aesthetically pleasing that Thoreau, an American philosopher and naturalist, was once moved to state, "God made ferns to show what He could do with leaves."

Ex. III. Structure and form

The approximately 11,000 known species of fern vary in size from tiny floating forms less than one centimeter in diameter to giant tropical tree ferns up to 25 meters tall. Fern leaves are megaphyls (leaves associated with leaf gaps and having branching veins) that are commonly referred to as fronds. They are typically divided into smaller segments feathery in appearance, but some are undivided, pleated, or tongue-like, and others resemble a four-leaf clover or grow in such a way as to form "nests". In the tropics, the "nest" ferns often accumulate enough humus to provide food and shelter for huge earthworms that are up to 0,6 meters long. Since ferns require external water for sexual reproduction, they are most abundant in wetter tropical and temperate habitats, but a few are adapted to drier areas.

Ex. IV. Ecological review

The ferns and their relatives were the first land plants with significant internal tissues for conducting water and roots absorbing water and nutrients, morphological innovations that increased the environments in which these ancient plants could live. In the ancient geological period known as the Carboniferous, giant horse tails and club mosses grew in great abundance in swampy areas. The biomass produced by these plants accumulated in huge deposits. The lack of oxygen inhibited bacteria-mediated decay of the plant biomass, which was eventually transformed into coal. These coal deposits represent large quantities of carbon dioxide removed from the ancient atmosphere by ferns and their relatives. The reintroduction of this carbon dioxide into the atmosphere in modern times, as we burn coal, may produce rapid climate change.

Unit 4
Lesson 2. DEVELOPMENT OF GAMETORHYTES IN ANGIOSPERMS
Ex, I, II. Fruit

After fertilization, the ovary of a flowering plant (together with its seeds) develops into a fruit. Because a fruit arises only from floral parts, it can occur only on a flowering plant, that is, on an angiosperm. A fruit may consist only of the mature ovary and its seeds, or it may include other parts of the flower or structures closely related to it.

Fruits play a major role for reproduction because they are often adapted to dispersal of the seeds over substantial distances. A number of trees, including ash, elm, maple, and tree of heaven, produce a dry, winged fruit called a samara. A samara spins like a helicopter blade and while whirling downward, holds the fruit aloft long enough to for it to be blown some distance from the parent tree. The dandelion fruit is another that is marvelously adapted for dispersal by wind. Water is the agency through which some fruits are dispersed. Coconuts have been spread in this way from island to island in the Pacific. Still other fruits travel by hitching rides with animals – either inside them or outside them. The latter is exemplified by burdocks, which have hooks capable of adhering to animal fur, and by other prickled, barbed, hairy, or sticky fruits. Fleshy fruits, such as all the familiar berries, tend to be eaten by mammals or birds; and their seed travel safely through the digestive tract or are regurgitated, in either case being deposited elsewhere.

Ex. III.

What do we plant when we plant the tree?
We plant the ship, which will cross the sea.
We plant the mast to carry the sails;
We plant the planks to withstand the gales –
The keel, the keelson, the beam, the knee;
We plant the ship when we plant the tree.

What do we plant when we plant the tree?
We plant the houses for you and me.
We plant the rafters, the shingles, the floors,
We plant the studding, the lath, the doors,
The beams, the siding, all parts that be;
We plant the house when we plant the tree.

What do we plant when we plant the tree?
A thousand things that we daily see;
We plant the spire that out-towers the crag,
We plant the staff for our country's flag,
We plant the shade from the hot sun free;
We plant all these when we plant the tree.

(Henry Abbey)

Unit 4
Lesson 3. ANIMALS

Ex. II, III. New Life-Form Discovered

Scientists in Denmark have discovered a new life-form that dwells on the lips of lobsters. The jug-shaped creature is so unlike any other known animal, it merits an entire new classification, or phylum, the discoverers reported in the journal Nature.

At one end, the multicelled creature has an adhesive disk that attaches it to the mouth parts of the host lobster. At the opposite end, the microscopic animal has a ring-shaped mouth lined with tiny hairs, or cilia, that draw water and nutrients into a funnel that leads to its gut.

The species name for the lone member of the new phylum is Symbion pandora. Symbion refers to the creature's symbiotic relationship with its lobster host while pandora refers to the part of the organism's life cycle that reminded its discoverers of the mythical Pandora's box.

What researchers know so far of the creature's life cycle is that it involves several stages, including an asexual stage and a sexual stage. While adhered to the lobster's lips, for example, the feeding S. pandora reproduces asexually. A larva, called a Pandora larva, develops inside the adult by a process of asexual budding, which makes it a genetic clone of its parent. Then, as the adults do periodically, the parent molts, shedding its upper half, including the nervous system and a disintegrated mouth and gut. Along with the body parts, the larva escapes—just like the objects that flew out of Pandora's box. The larva then settles nearby on the lobster's lips, and begins feeding.

Meanwhile, the adult's lost organs are replaced by new ones that began forming inside it long before they were needed. While regeneration of lost organs is typical of many known

species, it is highly unusual for the replacement organs to begin developing before the older ones are lost, according to the Danish scientists.

The sexual stage of reproduction appears to be triggered when the host lobster is about to shed its entire skin, mouthparts and all. During this stage, some of the mature, feeding symbionts that have adhered to the lobster's lips begin growing within their bodies what is called a dwarf male. This male emerges with nothing to it but a brain and reproductive organs, and lives only to breed. The tiny male seeks another feeding symbiont that carries within it a developing female. The dwarf latches onto the other feeding symbiont and deposits its sperm to fertilize the eggs of the female within. This produces a free-swimming individual that can seek new lobster mouths to colonize. Once attached to the new crustacean, the fledgling develops into the feeding stage and the bizarre life cycle is repeated.

Unit 4
Lesson 4. PHYLUM CHORDATA
Ex, II, III, IV. Animal Rights

Some people believe that animals have rights just as human beings do. Advocates of animal rights have different views and approaches to the issue. While some animal rights activists, such as Australian philosopher Peter Singer, advocate total animal liberation, many animal welfare organizations take a more moderate approach, working for practical improvement of the relationship between animals and humans. Organizations in the United States concerned with the protection of animals include the American Society for the Prevention of Cruelty to Animals (ASPCA), the Humane Society of the United States (HSUS), and People for the Ethical Treatment of Animals (PETA).

Scientific researchers use animals in biomedical and veterinary research aimed at improving human health and the welfare of other animals. Successful medical treatments, including antibiotics and vaccines, have been developed through animal experimentation. Many scientists argue that animal experimentation remains a crucial tool for the investigation and treatment of serious diseases such as cancer, acquired immunodeficiency syndrome (AIDS), and heart disease. However, animal rights activists have protested against various forms of animal experimentation, noting that procedures such as vivisection ignore the capacity of animals to feel pain. They also object to toxicity testing performed on animals to help determine whether cosmetics and other products are safe for human use. Laws exist in many countries to regulate the use and treatment of laboratory animals in scientific industries and in education.

The use of animals in sports has resulted in many cases of animal injury and death. Laws on badger baiting, dog fighting, and deer and stag hunting vary from country to country. Bullfighting has been banned in certain countries, but in Spain it remains a traditional spectator event. Animal rights advocates have expressed concern over the conditions in many zoos and circuses where animals are kept, claiming that animals in these facilities are forced to live in unnatural habitats and climates, with unsuitable housing and inadequate space. Other critics argue that such conditions promote abnormal animal behavior such as pacing. Zoos maintain, however, that their institutions provide educational, zoological, and conservational benefits. Many cases of cruelty and neglect of animals kept as pets have also been reported.

Animal rights advocates have long campaigned against the use and treatment of animals in the fur industry. Fox and mink are bred in group captivity on fur farms, mostly in the countries

of Scandinavia. Animal rights advocates argue that this practice may cause stress to the animals as these species are solitary by nature. Treatment of animals on fur farms is generally subject to legislation, and the use of furs from endangered species is banned in many countries.

Concern by society over the treatment of animals has surrounded various other practices, including whaling, seal fishing, the ivory trade, the use of rhinoceros horns in Chinese medications, the use of animals in contemporary art, and the catching of dolphins in tuna-fishing nets. Different countries have passed various laws on these issues, and international discussions have taken place on the ethics and legal issues involved. The ethics of killing animals considered pests—for example, sewer rats, house mice, and garden slugs—are less commonly questioned.

Unit 5
Lesson 1. ANTHROPOGENESIS
Ex. II, III, IV. Neanderthals Were Not Close Relations, DNA Testing Finds

In a *milestone achievement* for the study of ancient genetic material, German and American scientists *extracted* enough hereditary information from Neanderthal bone to allow a comparison to the modern human genetic code.

The scientists' results, *reported* in the journal Cell, suggested that Neanderthals are rather distant relations of modern humans and probably *diverged from the lineage* leading to modern humans about 550,000 to 690,000 years ago.

Neanderthals were larger and more muscular than modern humans and are believed to have lived in Europe and western Asia from 300,000 years ago to as recently as 30,000 years ago. Archaic human beings (Homo sapiens) and modern human beings (Homo sapiens sapiens), who emerged at least 90,000 years ago, are believed to have *coexisted* with Neanderthals in Europe. Whether and to what extent these two lineages *intermingled* has been a subject of debate.

The new *genetic evidence* supported the idea that Neanderthals became extinct without *interbreeding* with modern humans. Researchers at the University of Munich in Germany and at Pennsylvania State University in State College were able to extract deoxyribonucleic acid from a Neanderthal arm bone. This was the first time that DNA was successfully *retrieved* from a Neanderthal fossil.

The bone sample was from the first Neanderthal *specimen* ever found, which was uncovered in 1856 in the Neander Valley near Dusseldorf, Germany. Based on bone structure, this Neanderthal fossil is believed to be between 30,000 and 100,000 years old.

The German and American scientists *pulverized* a small amount of the rare and valuable bone and were able to extract several small fragments of mitochondrial DNA. Because mitochondrial DNA has a high mutation rate, it is very useful for comparing genetic similarities and differences over generations. However, experts *cautioned* that because this DNA is inherited only from the mother, it is possible that *matings* between Neanderthal men and human women occurred. Such interbreedings would be *undetectable* in an examination of mitochondrial DNA.

By *overlapping* the small fragments of Neanderthal DNA and using a technique known as *polymerase chain reaction* to make many copies of the molecules, the scientists were able to identify a sequence of 378 base pairs in a specific region of the Neanderthal DNA. This area, called hypervariable region 1, is known to show changes over many generations. In general, the greater the dissimilarity in this region between two species, the more *remote* the relation is thought to be.

The researchers compared the Neanderthal DNA sequence to sequences in the same region of DNA for 994 modern human lineages, which included Australians, Pacific Islanders, Africans, Asians, Native Americans, and Europeans. The Neanderthal DNA sequence differed from all the modern human DNA by either 27 or 28 base pairs. In comparison, modern human sequences in this region of DNA differ from each other *on average* by 8 base pairs. As a result, the researchers concluded that Neanderthals and modern humans are distant relations. *Extrapolating* from their findings, the study authors estimated that Neanderthals split from early modern humans 550,000 to 690,000 years ago. The work indicates that although human beings and Neanderthals coexisted for many thousands of years, they probably did not interbreed and Neanderthals are not in our direct *line of descent.*

Unit 5
Lesson 2. EVOLUTION
Ex. II, III. Charles Darwin

Charles Robert Darwin, a British scientist who laid the foundation of modern evolutionary theory, was born in Shrewsbury, Shropshire, England, on February 12, 1809. He was the fifth child of a wealthy and sophisticated English family. After graduating from the elite school at Shrewsbury in 1825, young Darwin went to the University of Edinburgh to study medicine. In 1827 he dropped out of medical school and entered the University of Cambridge, in preparation for becoming a clergyman of the Church of England. There he met two stellar figures: Adam Sedgwick, a geologist, and John Stevens Henslow, a naturalist. Henslow not only helped build Darwin's self-confidence but also taught his student to be a meticulous and painstaking observer of natural phenomena and collector of specimens. After graduating from Cambridge in 1831, the 22-year-old Darwin was taken aboard the English survey ship Beagle, largely on Henslow's recommendation, as an unpaid naturalist on a scientific expedition around the world.

Darwin's job as naturalist aboard the Beagle gave him the opportunity to observe the various geological formations found on different continents and islands along the way, as well as a huge variety of fossils and living organisms. In his geological observations, Darwin was most impressed with the effect that natural forces had on shaping the earth's surface.

At the time, most geologists adhered to the so-called catastrophist theory that the earth had experienced a succession of creations of animal and plant life, and that each creation had been destroyed by a sudden catastrophe. In the view of the catastrophists, species were individually created and unchangeable for all time. Aboard the Beagle, Darwin realized that some of his own observations of fossils and living plants and animals cast doubt on the view that species were specially created. He noted, for example, that certain fossils of supposedly extinct species closely resembled living species in the same geographical area. In the Galapagos Islands, off the coast of Ecuador, he also observed that each island supported its own form of tortoise, mockingbird, and finch; the various forms were closely related but differed in structure and eating habits from island to island. Both observations raised the question, for Darwin, of possible links between distinct but similar species.

After returning to England in 1836, Darwin began recording his ideas about changeability of species in his Notebooks on the Transmutation of Species. By 1838 he had arrived at a sketch of a theory of evolution through natural selection and continued working on the theory for the next two decades. Darwin's theory was first announced in 1858 in a paper presented at the same time as one by Alfred Russel Wallace, a young naturalist who had come independently to the theory of natural selection. Darwin's complete theory was published in 1859, in On the Origin of

Species. Often referred to as the "book that shook the world," the Origin sold out on the first day of publication and subsequently went through six editions.

Darwin's theory of evolution by natural selection is essentially that, because of the food-supply problem, the young born to any species intensely compete for survival. Those young that survive to produce the next generation tend to embody favourable natural variations — the process of natural selection — and these variations are passed on by heredity. Therefore, each generation will improve adaptively over the preceding generations, and this gradual and continuous process is the source of the evolution of species. Natural selection is only part of Darwin's vast conceptual scheme; he also introduced the concept that all related organisms are descended from common ancestors. Moreover, he provided additional support for the older concept that the earth itself is not static but evolving.

The reaction to the Origin was immediate. Some biologists argued that Darwin could not prove his hypothesis. Others criticized Darwin's concept of variation, arguing that he could explain neither the origin of variations nor how they were passed to succeeding generations. This particular scientific objection was not answered until the birth of modern genetics in the early 20th century. The most publicized attacks on Darwin's ideas, however, came not from scientists but from religious opponents because he denied the special creation of humankind and seemed to place humanity on a plane with the animals; both of these ideas were serious contradictions to orthodox theological opinion.

Despite all criticism, the importance of Darwin's work was well recognized by his contemporaries; Darwin was elected to the Royal Society (1839) and the French Academy of Sciences (1878). He was also honoured by burial in Westminster Abbey after he died in Downe, Kent, on April 19, 1882.

Unit 5
Lesson 3. GENETICS
Ex. II, III. Genetic Disorders in Humans

Thousands of inherited diseases caused by altered genes and chromosomal abnormalities affect humans. These disorders cause problems such as physical deformities, metabolic dysfunction, and developmental problems. Medical surveys indicate that roughly 1 percent of newborns in the United States have a single-gene defect. As many as 1 baby in 200 is born with a chromosomal abnormality serious enough to produce physical defects or mental retardation.

It is misleading to say that a person "inherits the gene" for a disease, since humans are born with the same number and types of genes. We inherit allele forms of specific genes, and these alleles may be defective. Most of the known inherited genetic disorders are caused by the mutation of a single gene, resulting in alleles that produce disease. These defects often produce disturbances in the body's biochemical processes, such as inhibiting the action of an important enzyme or stimulating the overproduction of a harmful substance. Frequently the consequences of such problems can cause severe disability or be fatal.

Many single-gene disorders follow Mendelian patterns of inheritance. A mother and father each pass an allele for a specific gene on to a child. If one of the alleles is defective and causes disease, the child will develop the disease according to a dominant-recessive pattern of inheritance. For example, cystic fibrosis (CF), a metabolic disorder that causes a progressive loss of lung function, is caused by a mutation in the recessive allele of a gene responsible for regulating salt content in the lungs. The recessive allele is unable to direct the production of a key protein, resulting in a salt imbalance that causes thick, suffocating mucus to build up in the

lungs. If a baby inherits the defective allele from just one parent, no disease results. But the infant who inherits the defective allele from both parents will be born with the disease.

In other cases, a single dominant allele causes genetic disease. Huntington's disease, a condition characterized by involuntary movements, dementia, and eventually death, is caused by the inheritance of a pair of alleles in which a defective allele dominates the normal allele for the gene. An affected parent has a 50 percent chance of passing the defective allele to a child. A child who inherits the dominant defective allele from just one parent will develop the disease.

Other inherited genetic diseases are caused by defects in the genes found on the X chromosome. Hemophilia, the inability of the blood to clot and heal a wound, is caused by a defect in an allele located on the X chromosome that helps produce proteins involved in the clotting process. Women who inherit this defective allele usually have the normal allele on their second X chromosome, which produces enough of these clotting proteins for the body to remain healthy. Women who inherit this faulty allele have a 50 percent chance of passing the defective allele on to their children. Males who inherit this defective allele do not have a normal version of the allele on their Y chromosome and so cannot produce clotting proteins to heal wounds. Hemophiliacs are almost always males who have inherited an X chromosome with the faulty allele from their mother.

Other genetic disorders arise due to the inheritance of an abnormal number of chromosomes or a defective chromosome structure. These chromosomal abnormalities have a devastating impact: Many fetuses with such defects, particularly those with missing chromosomes, will die prenatally, resulting in miscarriage. In other cases, newborns with chromosomal abnormalities suffer from physical problems or varying degrees of mental retardation. Down syndrome occurs when an individual's cells carry an extra copy of chromosome 21. People born with this condition have characteristic facial features, short stature, severe developmental disabilities, and a shortened life expectancy.

Unit 5
Lesson 4. ECOLOGY
Ex. II. III. Ecosystem Development

The orderly replacement of one ecosystem by another is a process known as ecosystem development, or ecological succession. Succession occurs when a sterile area, such as barren rock or a lava flow, is first colonized by living things or when an existing ecosystem is disrupted, as when a forest is destroyed by a fire. The succession of ecosystems generally occurs in two phases. The early, or growth, phase is characterized by ecosystems that have few species and short food chains. These ecosystems are relatively unstable but highly productive, in the sense that they build up organic matter faster than they break it down. The ecosystems of the later, or mature, phase are more complex, more diversified, and more stable. The final, or climax, ecosystem is characterized by a great diversity of species, complex food webs, and high stability.

The major energy flow has shifted from production to maintenance.

Human interference in the development of ecosystems is widespread. Farming, for example, is the deliberate maintenance of an immature ecosystem — one that is highly productive but relatively unstable. Sound management of ecosystems for optimal food production should seek a compromise between the characteristics of young and mature ecosystems, and should consider factors that affect the interaction of natural cycles. Short-term production can be maximized by adding energy to the ecosystem in the form of cultivation and fertilization. Such efforts, however, can hinder efficient energy use in the long run by producing an imbalance of nutrients,

an increase in pollutants, or a heightened susceptibility to plant diseases as a consequence of intensive inbreeding of crops.

Although an awareness of the interdependence between human society and its environment was already prominent in ancient philosophy and religion, the formulation of the basic principles of systems ecology as a scientific discipline began in the late 19th century. During the second half of the 20th century, the study of ecosystems has become increasingly sophisticated and is now instrumental in the assessment and control of the effects of agricultural development and industrialization on the environment. On farms, for instance, it has shown that optimal long-term production of pasturage requires a moderate grazing schedule in order to ensure a steady renewal of the moisture and nutrient content of the soil and has emphasized the need for multiple-use strategies in the cultivation of arable lands. Systems ecology has been concerned with the consequences of accumulated insecticides and has provided a way of monitoring the climatic effects of atmospheric dust and carbon dioxide released by the burning of fossil fuels (e.g., coal, oil, and natural gas). It has helped to determine regional population capacities and has furthered the development of recycling techniques that may become essential in humanity's future interaction with the environment.