

**ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ
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Кафедра лингвистики

**ПРОБЛЕМЫ ЭКОЛОГИИ В СОВРЕМЕННОМ МИРЕ:
учебно-методическое пособие для студентов медицинских вузов**

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Учебное пособие по английскому языку предназначено для студентов
медицинских и фармацевтических вузов и колледжей, обучающихся по
специальности фармация, лечебное дело, медико-профилактическое дело,
педиатрия. Представленная в пособии тематика текстов позволит студентам
сформировать навыки понимания и перевода аутентичной литературы с
опорой на знание профессиональной лексики и грамматических структур,
характерных для научного стиля.

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Предисловие

Целью данного пособия является углубленное изучение студентами терминологической лексики, развитие навыков чтения текстов на основе изученной лексики и грамматики с последующим обсуждением прочитанного в форме беседы на определенную тему. Пособие состоит из двух частей. В первой части (11 тем) рассматриваются вопросы использования нанотехнологий в различных отраслях медицины. Вторая часть (10 тем) посвящена проблемам экологии. Каждый раздел включает основной и дополнительный текст, предтекстовые и послетекстовые упражнения, направленные на изучение и отработку грамматических структур, развитие навыков изучающего чтения, а также интерпретации текста на английском языке.

Введение

Учебное пособие по английскому языку предназначено для студентов медицинских и фармацевтических вузов и колледжей, обучающихся по специальности фармация, лечебное дело, медико-профилактическое дело, педиатрия. Пособие направлено на повторение и закрепление основ грамматики, освоение общенаучной и общемедицинской лексики, развитие навыков чтения аутентичного текста. Оно может быть использовано как для работы в аудитории, так и для контролируемой самостоятельной работы. Представленная в пособии тематика текстов позволит студентам сформировать навыки понимания и перевода аутентичной литературы с опорой на знание профессиональной лексики и грамматических структур, характерных для научного стиля.

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NANOTECHNOLOGY: WHAT WILL IT MEAN

Nanotechnology will make us healthy and wealthy though not necessarily wise. In a few decades, this emerging manufacturing technology will let us inexpensively arrange atoms and molecules in most of the ways permitted by physical law. It will let us make supercomputers that fit on the head of a pin and fleets of medical nanorobots smaller than a human cell able to eliminate cancer, infections, clogged arteries, and even old age. People will look back on this era with the same feelings we have toward medieval times – when technology was primitive and almost every one lived in poverty and died young.

Besides computers billions of times more powerful than today's, and new medical capabilities that will heal and cure in cases that are now viewed as utterly hopeless, this new and very precise way of fabricating products will also eliminate the pollution from current manufacturing methods. Molecular manufacturing will make exactly what it is supposed to make, no more and no less, and therefore won't make pollutants.

When nanotechnology pioneer Eric Drexler first dared to publish this vision back in the early 1980s, the response was skeptical, at best. It seemed too good to be true, and many scientists pronounced the whole thing impossible. But the laws of physics care little for either our hopes or our fears, and subsequent analysis kept returning the same answer: it will take time, but it is not only possible but almost unavoidable.

The progress of technology around the world has already given us more precise, less expensive manufacturing technologies that can make an unprecedented diversity of new products. Nowhere is this more evident than in computer hardware: computational power has increased exponentially while the finest feature sizes have steadily shrunk into the deep submicron range.

PART I

UNIT 1.NANOTECHNOLOGY

Nanotechnology is the manipulation of matter on an atomic and molecular scale that is the manipulation of matter with at least one dimension sized from 1 to 100 nanometers. Nanotechnology employs quantum mechanical effects that are important at this scale. Thus “nanotechnologies” as well as “nanoscale technologies” refer to the broad range of research and applications whose common trait is size. Because of the variety of potential industrial and military applications, governments have invested billions of dollars in nanotechnology research. Through its National Nanotechnology Initiative, the USA has been invested 3.7 billion dollars. The European Union has invested 1.2 billion and Japan 750 million dollars.

Nanotechnology as defined by size is naturally very broad, including fields of science as diverse as surface science, organic chemistry, molecular biology, semiconductor physics, etc. The associated research and applications are equally diverse, ranging from extensions of conventional device physics to completely new approaches based upon molecular self-assembly, from developing new materials with dimensions on the nanoscale to direct control of matter on the atomic scale.

One nanometer (nm) is one billionth of a meter. The name combines the prefix nano- (from the Ancient Greek *nanos*, “dwarf”) with the name meter (“unit of measurement”).

By comparison, typical carbon-carbon bond lengths, or the spacing between these atoms in a molecule, are in the range 0.12-0.15 nm, and a DNA double-helix has a diameter around 2 nm. On the other hand, the smallest cellular life-forms, the bacteria of the genus *Mycoplasma*, are around 200 nm in length. By convention, nanotechnology is taken as the scale range 1 to 100 nm. The lower limit is set by the size of atoms since nanotechnology must build its devices from atoms and molecules. The upper limit is more or less arbitrary but is around the size that phenomena not observed in larger structures start to become apparent and can be made use of in the nano device. These new phenomena make nanotechnology distinct from devices which are merely miniaturized versions of an equivalent macroscopic device; such devices are on a larger scale and come under the description of micro-technology.

Helpful words and word combinations

nanotechnology – нанотехнология

manipulation – манипуляция

scale – шкала, масштаб

nanometer – нанометр

employ – использовать, нанимать на работу

refer – относиться, иметь отношение

broad – широкий

range – спектр, ряд, серия, цепь

research – исследование, исследовать

application – применение

common – общий, простой

trait – черта, особенность
variety –разнообразие
military –военный
initiative –инициатива
define –определять, давать определение
include –включать в себя
diverse –противоречивый, разнообразный
surface –поверхность; поверхностный
associate –связывать, соотносить
extension –продление, вытягивание
conventional –обычный, основанный на договоренности
device –устройство, прибор
approach –подход, точка зрения
self-assembly –самоорганизация
combine –сочетать, соединять
dwarf – карлик, гном
measurement – измерение
length –длина
spacing –измерение пространства, пространственные размеры
DNA –ДНК (дезоксирибонуклеиновая кислота)
helix –спираль
cellular –клеточный
bacteria –бактерии
genus –сорт; вид, род
convention – договор, обычай, принятая практика
arbitrary –произвольный, случайный
distinct –отличный, отличающийся
miniaturized –миниатюризированный
macroscopic –макроскопический

Exercises

1. Answer the following questions on the text.

- 1) What is the common trait of the research and applications which belongs to nanotechnology?
- 2) Why do governments invest billions of dollars in nanotechnology research?
- 3) What fields of science does nanotechnology include?
- 4) How long is one nanometer?
- 5) What is “nano”?
- 6) What are the typical carbon-carbon bond lengths?
- 7) How large is the bacteria of the genus Mycoplasma?
- 8) How is the lower limit of nano dimension defined?
- 9) What is the difference between nanotechnology and micro-technology?

2. Match up the two parts of the sentences.

- | | |
|--|---|
| 1) “Nanotechnologies” as well as “nanoscale technologies” refer to | a) around 200 nm in length.
b) the broad range of research and |
|--|---|

- 2) Through its National Nanotechnology Initiative, the USA has invested
- 3) The name combines the prefix nano- (from the Ancient Greek nanos, “dwarf”) with
- 4) A DNA double-helix has
- 5) The smallest cellular life-forms, the bacteria of the genus Mycoplasma, are
- 6) The lower limit is set by the size of atoms since

- applications whose common trait is size.
- c) 3.7 billion dollars.
 - d) nanotechnology must build its devices from atoms and molecules.
 - e) the name meter (“unit of measurement”).
 - f) a diameter around 2 nm.

3. Say if the statement is true or false.

- 1) Nanotechnology employs quantum mechanical effects.
- 2) Governments have invested millions of dollars in nanotechnology research.
- 3) Nanotechnology as defined by size is naturally very broad.
- 4) The associated research and applications range from extensions of conventional device physics to completely new approaches.
- 5) One nanometer (nm) is one millionth of a meter.
- 6) Nanotechnology is taken as the scale range 1 to 100 m.

4. Translate the following sentences into English.

- 1) Нанотехнология есть манипуляция материальным объектом, у которого размер хотя бы одной стороны не выше от одного до ста нанометров.
- 2) Нанотехнология использует эффекты квантовой механики, которые оказываются важными для данной шкалы.
- 3) Через Национальную нанотехнологическую инициативу США инвестировали 3,7 миллиарда долларов.
- 4) Исследования и способы применения включают в себя множество аспектов – от разработки новых материалов с размерами, соотносимыми с наномасштабом, до прямого управления материей на атомном уровне.
- 5) Один нанометр (нм) равен одной миллиардной метра.
- 6) Мельчайшие клеточные формы жизни имеют длину порядка двухсот нанометров.
- 7) В соответствии с принятой традицией нанотехнология относится к объектам размером от одного до ста нанометров.
- 8) Нанотехнология должна создавать свои устройства из атомов и молекул.
- 9) Верхний предел более-менее произволен.
- 10) Верхний предел формируется около размеров, при которых тот или иной феномен, незаметный в более крупных структурах, становится различимым и может быть использован в наноустройстве.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) What does the term “nanotechnology” refer to?
- 2) What fields of science can nanotechnology be used in?
- 3) What examples of nano-phenomena can be given?
- 4) How do the scientists define the limits of nanotechnology?

6. Render the text.

UNIT 2. THE IMPACT OF NANOTECHNOLOGY

Materials reduced to the nanoscale can show different properties compared to what they exhibit on a macro scale, enabling unique applications. For instance, opaque substances, such as copper, can become transparent; stable materials, such as aluminum, can turn combustible; insoluble materials, such as gold, may become soluble. A material such as gold, which is chemically inert at normal scales, can serve as a potent chemical catalyst at nanoscales.

Modern synthetic chemistry has reached the point where it is possible to prepare small molecules to almost any structure. These methods are used today to manufacture a wide variety of useful chemicals such as pharmaceuticals or commercial polymers. This ability raises the question of extending this kind of control to the next larger level, seeking methods to assemble these single molecules into supramolecular assemblies consisting of many molecules arranged in a well defined manner.

The impact of nanotechnology extends from its medical, ethical, mental, legal, and environmental applications, to such as engineering, biology, chemistry, computing, materials science, military applications, and communications.

Major benefits of nanotechnology include improved manufacturing methods, water purification systems, energy systems, physical enhancement, nanomedicine, better food production methods and nutrition.

Potential risks include environmental, health, and safety issues; transitional effects such as displacement of traditional industries as the products of nanotechnology become dominant; military applications such as biological warfare and implants for soldiers; and surveillance through nanosensors, which are concern to privacy rights advocates. These may be particularly important if potential negative effects of nanoparticles are overlooked.

Helpful words and word combinations

impact – удар, воздействие, влияние

reduce – сокращать, уменьшать

enable – делать возможным

unique – уникальный

opaque – непрозрачный

copper – медь

transparent – прозрачный

combustible – воспламеняемый, горючий

insoluble – нерастворимый

inert – инертный

potent – сильный, мощный

catalyst – катализатор

synthetic – синтетический

variety – разнообразие

pharmaceuticals – изделия фармацевтической промышленности

polymer – полимер

extend – простираться, вытягиваться

seek – искать

assemble – собирать, монтировать
supramolecular – супермолекулярный
arrange – организовывать
ethical– этический
mental– умственный
legal – юридический
environmental– имеющий отношение к окружающей среде
engineering – строительство
purification –отчистка
enhance –увеличивать, улучшать, повышать
health– здоровье
safety – безопасность
issue – проблема, тема
displacement – перемещение
dominant – доминирующий
warfare – война
implant –имплант
surveillance – надзор, наблюдение
concern – озабоченность
privacy – безопасность частной жизни, частная жизнь
advocate – защитник; защищать
overlook – недосмотреть

Exercises

1. Answer the following questions on the text.

- 1) What happens to copper when it is reduced to nanoscale?
- 2) What properties does aluminium acquire when it is reduced to nanoscale?
- 3) How do gold's properties change when it is reduced to nanoscale?
- 4) What point has modern synthetic chemistry reached?
- 5) What is a supramolecular device?
- 6) Where does the impact of nanotechnology extend?
- 7) What are the benefits of nanotechnology?
- 8) What are the potential risks of the nanotechnology?
- 9) How can these risks show in the military sphere?
- 10) What are the privacy rights advocates concerned about?

2. Match up the two parts of the sentences.

- | | |
|--|--|
| <ol style="list-style-type: none"> 1) Materials reduced to the nanoscale can show 2) Opaque substances, can become 3) It is possible to prepare 4) This ability raises the question of extending 5) These single molecules can be assembled into 6) These may be particularly important if | <ol style="list-style-type: none"> a) small molecules to almost any structure. b) different properties compared to what they exhibit on macroscale. c) potential negative effects of nanoparticles are overlooked. d) supramolecular assemblies consisting of many molecules. e) this kind of control to the next-larger level. |
|--|--|

f) transparent.

3. Say if the statement is true or false.

- 1) Gold, which is chemically inert at nanoscales, can serve as a potent chemical catalyst.
- 2) Modern synthetic chemistry has reached the point where it is possible to prepare small molecules to almost any structure.
- 3) These methods are used today to manufacture a limited variety of useful chemicals.
- 4) The impact of nanotechnology extends to fields such as engineering, biology, chemistry, computing, materials science, military applications and communications.
- 5) Major benefits of nanotechnology include improved manufacturing methods, water purification systems, energy systems, physical enhancement, nanomedicine, better food production methods and nutrition.
- 6) Potential risks exclude environmental, health, and safety issues.

4. Translate the following sentences into English.

- 1) Алюминий может стать воспламеняемым.
- 2) Сейчас возможно изготавливать маленькие молекулы с почти любой структурой.
- 3) Эти методы используются сегодня для изготовления большого разнообразия полезных химикатов, таких как продукция фармацевтической промышленности или промышленные полимеры.
- 4) Мы ищем методы, чтобы составлять из этих молекул супермолекулярные объединения.
- 5) Эти объединения состоят из множества молекул, организованных четко определенным образом.
- 6) Основную пользу нанотехнологии приносят в сфере улучшения методов производства, создания систем очистки воды и энергетических систем.
- 7) Потенциальные риски включают в себя замену традиционных отраслей промышленности.
- 8) Продукты нанотехнологий становятся доминирующими.
- 9) Военные последствия нанотехнологий включают в себя биологические войны и импланты для солдат.
- 10) Они станут особенно важными, если оставить без должного внимания негативные последствия использования наночастиц.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) How are the properties of materials transformed at nanoscale?
- 2) What kinds of molecules can be manufactured at nanoscale?
- 3) What are the benefits of nanotechnologies?
- 4) What are potential risks of nanotechnologies?

6. Render the text.

UNIT 3.CELLS

The cell is considered to be the smallest structure in biology that has all the properties of living things and an understanding of cells and the basics of cell structure and function is critical to making sense out of biology.

All cells at their essence have at least three things in common:

Cell membrane. All cells have a cell membrane. The cell membrane is selectively permeable in that it allows some materials to pass into or out of the cell but not others.

Cytoplasm. Cells are filled with a complex collection of substances in a water based solution. This substance is called cytoplasm. Across all cells there are a number of common features to all cell cytoplasm. For example all cells have ribosomes. Also, in all cells the first steps in cellular respiration take place in the cytoplasm.

DNA. All cells contain DNA. In the simplest cells, the DNA is free in the cytoplasm. In some cells such as those making up our body the DNA is isolated from the cytoplasm in a special structure called a nucleus.

Cell theory is really important because it provided, and still provides one of the great unifying theories in biology: one that says in spite of all the vast diversity of organisms, they are united at a very fundamental level, namely the presence of cells.

In the living world there are two basic types of cells, prokaryote and eukaryote cells.

Prokaryotic cells include what we commonly refer to as bacteria. Prokaryotic cells have DNA but it is not isolated from the rest of the cell inside of a nucleus. Instead the DNA is a single loop free in the cytoplasm. In addition prokaryotes often have small loops of DNA called plasmids which can be transferred to other cells.

Eukaryotic cells generally are larger and more complex than prokaryotic cells. Eukaryotic cells have a true nucleus containing the DNA as well as various other membrane bound organelles. Some of these organelles are pretty much universal in eukaryotes. These include mitochondria, rough and smooth ER, the nucleus. Other organelles are restricted to one or more kingdoms. For example chloroplasts are restricted to the Kingdoms Protista and Plantae.

Helpful words and word combinations

cell – клетка

critical – решающий, критический

makesense – понимать, осмысливать

essence – суть, существо

membrane – мембрана

selectivity – избирательно

permeable –проницаемый

cytoplasm –цитоплазма

solution – раствор

feature –черта, особенность

ribosome –рибосома

respiration – дыхание

provide – предоставлять

unifying – объединяющий
inspiteof – несмотря на
diversity – разнообразие
prokaryote – прокариот (доядерный организм)
eukaryote – эукариот (организм, обладающий оформленным клеточным ядром, отграниченным от цитоплазмы ядерной оболочкой)
bacteria – бактерии
loop – петля
plasmids – плазмиды
organelle – органелла, органоид
mitochondria – митохондрия
rough – грубый
smooth – гладкий
ER – эндоплазматический ретикулум (эндоплазматическая сеть)
roughER – гранулярный эндоплазматический ретикулум
smoothER – агранулярный (гладкий) эндоплазматический ретикулум.
restrict – ограничивать
kingdom – царство, королевство
chloroplast – хлоропласт
Protista – протисты (простейшие одноклеточные организмы)
Plantae – растения

Exercises

1. Answer the following questions on the text.

- 1) What is the smallest structure in biology?
- 2) Why is the understanding of cells critical to making sense out of biology?
- 3) How many common features do cells have?
- 4) What helps the cell let some materials in and out?
- 5) What is cytoplasm?
- 6) How is the DNA positioned in the simplest cells?
- 7) How is the DNA isolated from the cytoplasm in more complex cells?
- 8) Why is the cell theory so important?
- 9) How many types of cells are there in the living world?
- 10) What living creatures belong to Prokaryotic cells?

2. Match up the two parts of the sentences.

- | | |
|--|--|
| <ol style="list-style-type: none"> 1) The understanding of cells is 2) The cell membrane is 3) Cells are filled with a complex collection of 4) Across all cells there are a number of 5) Cell theory is really important because it 6) Some of these organelles are | <ol style="list-style-type: none"> a) common features to all cell cytoplasm. b) provided, and still provides one of the great unifying theories in biology. c) universal in eukaryotes. d) critical to making sense out of biology. e) selectively permeable. f) substances in a water based solution. |
|--|--|

3. Say if the statement is true or false.

- 1) All cells have a cell membrane.
- 2) Cells are filled with a complex collection of substances in a water based solution.
- 3) In the complex cells, the DNA is free in the cytoplasm.
- 4) In the living world there are two basic types of cells, prokaryote and eukaryote cells.
- 5) Prokaryotic cells include what we commonly refer to as mammals.
- 6) Eukaryotic cells have no nucleus containing the DNA.

4. Translate the following sentences into English.

- 1) Клетка считается мельчайшей биологической структурой, которая имеет все свойства живого организма.
- 2) Клеточная мембрана избирательно проницаема.
- 3) Клетки наполнены сложной смесью субстанций в растворе, основанном на воде.
- 4) От клетки к клетке существует ряд общих черт, относящихся к клеточной цитоплазме.
- 5) Все клетки имеют рибосомы.
- 6) Первые этапы дыхания клетки осуществляются в цитоплазме.
- 7) В некоторых клетках, таких, как, например, те, из которых состоит наше тело, ДНК изолирована от цитоплазмы в специальной структуре, именуемой ядром.
- 8) В живом мире существуют два базовых типа клетки – прокариоты и эукариоты.
- 9) Эукариоты, как правило, больше и сложнее прокариотов.
- 10) Например, хлоропласты встречаются только в царствах простейших и растений.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) What is the structure of the cell?
- 2) How is DNA positioned in various types of the cell?
- 3) What are Prokaryotic cells?
- 4) What are Eukariotic cells?

6. Render the text.

UNIT 4.NEURONS

Cells of the nervous system, called nerve cells or neurons, are specialized to carry “messages” through an electrochemical process. The human brain has approximately 100 million neurons.

Neurons come in many different steps and sizes. Some of the smallest neurons have cell bodies that are only 4 microns wide. Some of the biggest neurons have cell bodies that are 100 microns wide.

Neurons are similar to other cells in the body because they are surrounded by a cell membrane, they have a nucleus that contains genes. They also contain cytoplasm, mitochondria and other organelles. Neurons also carry out basic cellular processes such as protein synthesis and energy production.

However, neurons differ from other cells in the body because they have specialized cell parts called dendrites and axons. Dendrites bring electrical signals to the cell body and axons take information away from the cell body.

Neurons communicate with each other through an electrochemical process.

Neurons can also be classified by the direction that they send information. Sensory neurons send information from sensory receptors (e.g., in skin, eyes, nose, tongue, ears) toward the central nerve system. Motor (or efferent) neurons send information away from central nervous system to muscles or glands. Interneurons send information between sensory neurons and motor neurons. Most interneurons are located in the central nervous system.

Neurons are the oldest and longest cells in the body. You have many of the same neurons for your whole life. Although other cells die and are replaced, many neurons are never replaced when they die. In fact, you have fewer neurons when you are old compared to when you are young.

Neurons can be quite large – up to feet long.

Helpful words and word combinations

nervous – нервный

nerve – нерв

neuron – нейрон

electrochemical –электрохимический

brain – мозг

approximately– приблизительно

micron – микрон

dendrite –дендрит (ветвящийся отросток нервной клетки)

axon – аксон (нейрит, осевой цилиндр, отросток нервной клетки)

communicate –общаться, сообщаться

receptor –рецептор

motor – мотор; моторный

efferent – центробежный

muscle – мышца

gland – железа

interneuron –интернейрон

Exercises

1. Answer the following questions on the text.

- 1) How do we call cells of the nervous system?
- 2) What are neurons specialized to do?
- 3) What size are the neurons?
- 4) What size are the biggest neurons?
- 5) What is the structure of the neuron?
- 6) What makes neurons different from other cells in the body?
- 7) What is the function of dendrites?
- 8) How do neurons communicate with each other?
- 9) Are dead neurons replaced?
- 10) How many neurons are there in the human brain?

2. Match up the two parts of the sentences.

- | | |
|---|--|
| <ol style="list-style-type: none">1) The human brain has2) Some of the biggest neurons have3) Neurons carry out basic cellular processes such as4) Neurons differ from other5) Neurons communicate with6) Most interneurons are located in | <ol style="list-style-type: none">a) cells in the body because they have specialized cell parts called dendrites and axons.b) approximately 100 billion neurons.c) the central nervous system.d) each other through an electrochemical process.e) protein synthesis and energy production.f) cell bodies that are 100 microns wide. |
|---|--|

3. Say if the statement is true or false.

- 1) The human brain has approximately 10 billion neurons.
- 2) Neurons are different from other cells in the body because they are not surrounded by a cell membrane, they have no nucleus that contains genes.
- 3) Neurons differ from other cells in the body because they have specialized cell parts called dendrites and axons.
- 4) Dendrites bring electrical signals to the cell body and axons take information away from the cell body.
- 5) Motor neurons send information away from muscles or glands to the central nervous system.
- 6) Interneurons send information between sensory neurons and motor neurons.

4. Translate the following sentences into English.

- 1) Некоторые из самых маленьких нейронов имеют тела толщиной в 4 микрона.
- 2) Некоторые из самых больших нейронов имеют тела толщиной в 100 микронов.
- 3) В нейронах также протекают базовые клеточные процессы, такие как синтез белка и производство энергии.
- 4) Дендриты проводят электрические сигналы к телу клетки, а аксоны переносят информацию от тела клетки.
- 5) Нейроны также могут классифицироваться в соответствии с направлением, по которому они посылают информацию.

- 6) Сенсорные нейроны посылают информацию от сенсорных рецепторов по направлению к центральной нервной системе.
- 7) Моторные нейроны посылают информацию от сенсорных рецепторов по направлению к центральной нервной системе.
- 8) Большинство интернейронов локализовано в центральной нервной системе.
- 9) Нейроны – самые старые и самые длинные клетки тела.
- 10) Нейроны могут быть достаточно длинными – до нескольких футов.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) What is the basic structure of the neuron?
- 2) What are the functions of different types of neurons?
- 3) How are neurons classified?
- 4) What are the specific features of neurons that make them different from other cells?

6. Render the text.

UNIT 5. BLOOD CELLS

A blood cell is a cell normally found in blood. In mammals, these fall into three general categories: red blood cells, white blood cells and platelets. Together, these three kinds of blood cells add up to a total 45% of the blood tissue by volume, with the remaining 55% of the volume composed of plasma, the liquid component of blood.

Red blood cells primarily carry oxygen and collect carbon dioxide through the use of hemoglobin, and have a lifetime of about 120 days. They have the job alongside the white blood cells of protecting the healthy cells.

White blood cells are cells of the immune system involved in defending the body against both infectious disease and foreign materials. Five different and diverse types of white blood cells exist. They live for about 3 to 4 days in the average human body, including the blood and lymphatic system.

Platelets, or thrombocytes, are very small, irregularly shaped cell fragments. The average lifespan of platelet is normally just 5 to 9 days. Platelets are a natural source of growth factors. They circulate in the blood of mammals and are involved in hemostasis, leading to the formation of blood clots. Platelets release thread-like fibers to form these clots.

If the number of platelets is too low, excessive bleeding can occur. However, if the number of platelets is too high, blood cells can form (thrombosis), which may obstruct blood vessels and result in such events as a stroke, myocardial infarction, pulmonary embolism – or blockage of blood vessels to other parts of the body, such as the extremities of the arms or legs.

Platelets release a multitude of growth factors which play a significant role in the repair and regeneration of connective tissues.

Helpful words and word combinations

blood – кровь

mammal – млекопитающее

platelet – тромбоцит

volume – объем

plasma – плазма

liquid – жидкость

primarily – в первую очередь

oxygen – кислород

carbondioxide – двуокись углерода

hemoglobin – гемоглобин

immune – иммунная

foreign – чужой

diverse – разнообразный

average – средний

thrombocyte – тромбоцит

irregularly – неправильно оформленный

fragment – фрагмент

lifespan – срок жизни

circulate – циркулировать

homostasis – гемостаз, остановка кровотока
clot – сгусток крови, тромб
thread – нить
fiber – волокно
excessive – избыточный
occur – случаться, происходить
thrombosis – тромбоз
obstruct – препятствовать, блокировать
vessel – сосуд (кровеносный)
stroke – удар
myocardial – относящийся к миокарду
infarction – инфаркт
pulmonary – легочный
embolism – эмболия, закупорка сосудов
blockage – блокирование
extremity – удаленная часть
multitude – множество
repair – ремонт
regeneration – регенерация
connective – соединительная
tissue – ткань

Exercises

1. Answer the following questions on the text.

- 1) Where are blood cells normally found?
- 2) What are categories of blood cells are there?
- 3) What is plasma?
- 4) What is the function of red blood cells?
- 5) How long do the red blood cells live?
- 6) What is the function of the white blood cells?
- 7) How many types of white blood cells are there?
- 8) What is the average lifespan of a platelet?
- 9) What happens if the number of platelets is too high?

2. Match up the two parts of the sentences.

- | | |
|---|--|
| <ol style="list-style-type: none"> 1) Together, these three kinds of blood cells add up to 2) Red blood cells have a lifetime of 3) White blood cells defend by body against 4) Five different and diverse types of 5) If the number of platelets is 6) Platelets release | <ol style="list-style-type: none"> a) too low, excessive bleeding can occur. b) both infections disease and foreign materials. c) thread-like fibers to form these clots. d) a total 45% of the blood tissue by volume. e) white blood cells exist. f) about 120 days. |
|---|--|

3. Say if the statement is true or false.

- 1) Red blood cells primarily carry nitrogen and collect carbon dioxide through the use of hemoglobin.
- 2) White blood cells are found throughout the body, including the blood and lymphatic system.
- 3) Platelets, or thrombocytes, are very small, regularly small, regularly shaped cells?
- 4) The average lifespan of a platelet is normally just 5 to 9 years.
- 5) Platelets release thread-like fibers to form these clots.
- 6) Thrombosis may obstruct blood vessels and result in such events as a stroke, myocardial infarction, pulmonary embolism.

4. Translate the following sentences into English.

- 1) Клетка крови, как правило, находится в крови.
- 2) Плазма является жидким компонентом крови.
- 3) Красные кровяные клетки и белые кровяные клетки защищают здоровые клетки.
- 4) Существуют 5 различных и разнообразных видов белых кровяных клеток.
- 5) Белые кровяные клетки можно найти в любой части тела, включая кровь и лимфатическую систему.
- 6) Средняя продолжительность жизни тромбоцита составляет от пяти до девяти дней.
- 7) Тромбоциты – естественный источник факторов роста.
- 8) Тромбоциты производят похожие на нить волокна для формирования этих сгустков.
- 9) Если количество тромбоцитов слишком мало, может произойти избыточное кровотечение.
- 10) Факторы роста играют значительную роль в заживлении и регенерации соединительной ткани.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) What are the functions of red blood cells?
- 2) What are the functions of white blood cells?
- 3) What are the functions of platelets?
- 4) What problems arise in case people have a deficit or an excess of platelets?

6. Render the text.

UNIT 6.GENETICS

Genetics is the study of genes, and studies what genes are and how they work. Genetics shows how and why living organisms inherit features from their ancestors: for example, children usually look like their parents because they have inherited their parents' genes. Genetics tries to identify which features are inherited, and explain how these features pass from generation to generation.

In genetics, a feature of a living thing is called a "trait". Some traits are part of an organism's physical appearance; such as a person's eye-color, height or weight. Other sorts of traits are not easily seen and include blood types resistance to diseases. The way our genes and environment interact to produce a trait can be complicated. For example, the chance of somebody dying cancer or heart disease seems to depend on both their genes and their lifestyle.

Genes are made from a long molecule called DNA, which is copied and inherited across generations. DNA is made of simple units that line up in a particular order within this large molecule. The order of these units carries genetic information, similar to how the order of letters on a page carries information. The language used by DNA is called the genetic code, which allows the genetic machinery to read the information in the genes in triplet sets of codons. This information is the instructions for constructing and operating a living organism.

The information within a particular gene is not always exactly the same between one organism and another, so different copies of a gene do not always give exactly the same instructions. Each unique form of a single gene is called an allele. As an example, one allele for the gene for hair color could instruct the body to produce a lot of pigment, producing black hair, while a different allele of the same gene might give garbled instructions that fail to produce any pigment, giving white hair. Mutations are random changes in genes, and can create new alleles. Mutations can also produce new traits, such as when mutations to an allele for black hair produce a new allele for a white hair. This appearance of new traits is important in evolution.

Helpful words and word combinations

genetics – генетика

gene –ген

inherit – наследовать

ancestor – предок

generation – поколение

trait – черта, особенность, признак

blood –кровь

resistance – сопротивление, сопротивляемость

disease – болезнь, заболевание

complicate – усложнять

cancer –рак

depend–зависеть

lifestyle – стиль жизни, образ жизни

order – порядок

code – код

machinery – механизм

triplet – триплет, тройка

codon – кодон, единица генетического кода
allele – аллель, аллельный ген, аллеломорф
pigment – пигмент
garbled – искаженный, фальсифицированный
mutation – мутация
random – произвольный
evolution – эволюция

Exercises

1. Answer the following questions on the text.

- 1) What does genetics study?
- 2) What does genetics show?
- 3) How is a feature of a living thing called in genetics?
- 4) What traits of a living thing can be inherited?
- 5) What is a gene?
- 6) What are genes made from?
- 7) What is the language used by DNA called?
- 8) In what way is the genetic information coded?
- 9) What is the unique form of a single gene called?
- 10) How does mutation work?

2. Match up the two parts of the sentences.

- | | |
|--|---|
| 1) Children usually look like their parents because they | a) a particular order within this large molecule. |
| 2) Genetics tries to explain how these features | b) have inherited their parents' genes. |
| 3) The way our genes and environment interact to produce | c) pass from generations to generation. |
| 4) The chances of somebody dying of | d) genes, and can create new alleles. |
| 5) DNA is made of simple units that line up in | e) cancer or heart disease seems to depend on both their lifestyle. |
| 6) Mutations are random changes in | f) a trait can be complicated. |

3. Say if the statement is true or false.

- 1) Genetics is the study of genes, and studies what genes are and how they work.
- 2) Children usually look like their parents because the parents have inherited their genes.
- 3) Some traits are easily seen and include blood types or resistance to diseases.
- 4) The genetic code allows the genetic machinery to read the information in the genes in triplet sets of codons.
- 5) An allele for the gene for hair color could instruct the body to produce a lot of pigment, producing black hair.
- 6) The appearance of new traits is unimportant in evolution.

4. Translate the following sentences into English.

- 1) Генетика пытается определить, какие признаки наследуются.

- 2) Некоторые признаки являются частями физического облика организма, такими как цвет глаз, рост или вес.
- 3) Способы, которыми наши гены и окружающая среда взаимодействуют, чтобы произвести признак, могут быть сложными.
- 4) Шансы человека умереть от рака или сердечного заболевания, похоже, зависят как от генов, так и от образа жизни.
- 5) Гены создаются на основе молекулы, именуемой ДНК, которая копируется и наследуется от поколения к поколению.
- 6) Язык, используемый ДНК, называется генетическим кодом.
- 7) Порядок этих элементов несет генетическую информацию, подобно тому, как несет информацию порядок букв на листе бумаги.
- 8) Эта информация является инструкцией, предназначенной для создания живого организма и управления им.
- 9) Каждая уникальная форма конкретного гена именуется аллелем.
- 10) Мутации, которым подвержен аллель, отвечающий за черный цвет волос, порождают новый аллель, который отвечает за белый цвет волос.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) What does genetics study?
- 2) What types of inherited traits are there?
- 3) What is DNA and how does it work?
- 4) What is an allele and how does it function?

6. Render the text.

UNIT 7. GENES AND INHERITANCE

Genes are inherited as units, with two parents dividing out copies of their genes to their offspring. It looks like mixing two hands of cards, shuffling them, and then dealing them out again. Humans have two copies of each of their genes, and make copies that they put into eggs or sperm – but they only include one copy of each type of gene. The eventually resulting child has the same number of genes as his or her parents, but for any gene one of the two copies from the father, and one from the mother.

The effects of this mixing depend on the types (the alleles) of the gene. If the father has two copies of an allele for red hair, and the mother has two copies for brown hair, all their children get the two alleles that give different instructions, one red hair and one for brown. The hair color of these children depends on how these alleles work together. If one allele overrides the instructions from another, it is called the dominant allele, and the allele that is overridden is called the recessive allele. In the case of a daughter with alleles for both red and brown hair, brown is dominant and she ends up with brown hair.

Although the red color allele is still there in this brown-haired girl, it doesn't show. This is the difference between what you see on the surface (the traits of an organism, called its phenotype) and the genes within the organism (its genotype). In this example you can see the allele for brown B and the allele for red b. The brown-haired daughter has the "brown hair phenotype" but her genotype is Bb, with one copy of the B allele, and one of the b allele.

Now imagine that this woman grows up and has children with brown hair man who has a Bb genotype. Her eggs will be a mixture of two types, one sort containing the B allele, and one sort the b allele. Similarly, her partner will produce the mix of two types of sperm containing one or the other of these two alleles. When the transmitted genes are joined up in their off-spring, these children have a chance of getting either brown or red hair, since they could get a genotype of BB = brown hair, Bb = brown hair or bb = red hair. In this generation, therefore a chance of the recessive allele showing itself in the phenotype of the children – some of them may have red hair like their grandfather.

Many traits can be inherited in a more complicated way than the example above. This can happen when there are several genes involved, each contributing a small part to the end result. Tall people tend to have tall children because their children get a package of many alleles that each contribute a bit to how much they grow. However, there are not clear groups of "short people" and "tall people", like there are groups of people with brown or red hair. This is because of the large number of genes involved; this makes the traits very variable and people are of many different heights. Despite a common misconception, the green/ blue eye traits are also inherited in this complex inheritance model. Inheritance can also be complicated when the trait depends on interaction between genetics and environment. For example, malnutrition does not change traits like eye color, but can stunt growth.

Helpful words and word combinations

divide – разделять

offspring – отпрыск, потомок

hands – колода карт

cards – карты

shuffle – тасовать
deal– сдавать карты
humans –человеческие существа
egg –яйцо, яйцеклетка
sperm– сперма
eventually –постепенно, в конечном итоге
override –перевешивать, быть более важным, значительным
dominant – доминантный
recessive – рецессивный
phenotype – фенотип
genotype – генотип
mixture – смесь
endresult – конечный результат
tend –стремиться к чему либо, иметь тенденцию
involve– вовлекать
despite – несмотря на
misconception – неверное представление
malnutrition – недоедание
stunt – задерживать, останавливать
growth – рост

Exercises

1. Answer the following questions on the text.

- 1) In what way are genes inherited?
- 2) How many copies of each of their genes do humans have?
- 3) What does the hair color of humans depend on?
- 4) What is the dominant allele?
- 5) What is the recessive allele?
- 6) Why is it so difficult to foresee the specific traits inherited from the ancestors?
- 7) Why do tall people tend to have tall children?
- 8) What does the appearance of a trait depend on?
- 9) How does the environment affect the genetic code?
- 10) How does malnutrition affect growth?

2. Match up the two parts of the sentences.

- | | |
|---|---|
| <ol style="list-style-type: none"> 1) An egg and sperm join to form 2) The eventually resulting child has 3) The effects of this mixing depend on 4) The hair color of children depends on 5) Children get a package of many alleles that each contribute 6) Inheritance can also be complicated when | <ol style="list-style-type: none"> a) a bit to how much they grow. b) a complete set of genes. c) the trait depends on interaction between genetics and environment. d) the types of the gene. e) the same number of genes as his or her parents. f) how the alleles work together. |
|---|---|

3. Say if the statement is true or false.

- 1) An egg and sperm join to form a complete set of genes.
- 2) If one allele overrides the instructions from another, it is called the recessive allele.
- 3) The allele that is overridden is called the dominant allele.
- 4) Many traits are inherited in a very complicated way.
- 5) Tall people tend to have tall children because their children get a package of many alleles that each contributes a bit to how much they grow.
- 6) Inheritance can be complicated when the trait does not depend on interaction between genetics and environment.

4. Translate the following sentences into English.

- 1) Это похоже на то, когда вы смешиваете две колоды карт, и тасуете их, а потом снова раздаете.
- 2) Получающийся в конечном итоге ребенок имеет такое же количество генов, как и его родители.
- 3) Результат смешивания зависит от типа (аллелей) гена.
- 4) Все их дети получают два аллеля, в которых зафиксированы разные типы инструкций.
- 5) Цвет волос у этих детей зависит от того, как эти аллели работают вместе.
- 6) Это случается тогда, когда в процесс вовлечено много его генов, каждый из которых вносит свой вклад к конечный результат.
- 7) Не существует чистых групп «низких людей» и «высоких людей».
- 8) Это делает признак очень изменчивым, а люди сильно различаются по высоте роста.
- 9) Наследственность также может быть осложненной, когда признак зависит от взаимодействия генетики и окружающей среды.
- 10) Например, недостаточное питание не изменяет такие признаки, как цвет глаз, но может приостановить рост.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) What factors affect the genetics of a child?
- 2) How do we acquire the color of the hair?
- 3) What is the basic mechanism of inheritance?
- 4) What factors lead the evolution?

6. Render the text.

UNIT 8.GENETIC ENGINEERING

Genetic engineering, also called genetic modification, is the direct manipulation of an organism's genome using biotechnology. New DNA may be inserted in the host genome by first isolating and copying the genetic material of interest using molecular cloning methods to generate a DNA sequence, or by synthesizing the DNA, and then inserting this construct into the host organism. Genes may be removed, or "knocked out", using a nuclease. Gene targeting is a different technique that uses homologous recombination to change an endogenous gene, and can be used to delete a gene, remove exons, add a gene, or introduce point mutations.

An organism that is generated through genetic engineering is considered to be a genetically modified organism (GMO). The first GMOs were bacteria in 1973; GM mice were generated in 1974. Insulin-producing bacteria were commercialized in 1982 and genetically modified food has been sold since 1994.

Genetic engineering techniques have been applied in numerous fields including research, agriculture, industrial biotechnology, and medicine. Enzymes used in laundry detergent and medicines such as insulin and human growth hormone are now manufactured in GM cells, experimental GM cell lines and GM animals such as mice or zebrafish are being used for research purposes, and genetically modified crops have been.

Plants have been modified for insect protection, herbicide resistance, virus resistance, enhanced nutrition, tolerance to environmental pressures and the production of edible vaccines. Most commercialized GMOs are insect resistant and/or herbicide tolerant crop plants. Genetically modified animals have been used for research, model animals and the production of agricultural or pharmaceutical products. They include animals with genes knocked out, increased susceptibility to disease, hormones for extra growth and the ability to express proteins in their milk.

Helpful words and word combinations

engineering – инженерия

modification – модификация

manipulation – манипуляция

genome – геном

biotechnology – биотехнология

insert – вводить, внедрять, вставлять

host – хозяин

isolate – изолировать

material of interest – целевой материал

cloning – клонирование

generate – производить, генерировать

sequence – последовательность, цепочка

synthesize – синтезировать

construct – конструктор; нечто, произведенное исследователем или технологом

remove – удалять, выводить

knockout – выбивать, вышибать

nuclease – нуклеаза (фермент, катализирующий расщепление нуклеиновых кислот, в том числе и ДНК)
targeting – наведение на цель, поиск цели
homologous– гомологический, соответственный, соотносящийся
recombination – рекомбинация, перестройка
endogenous – эндогенный, имеющий внутреннее происхождение
delete– стирать, удалять
exon – экзон (кодирующий фрагмент молекулы ДНК)
pointmutations – целевые мутации
mice – мыши
insulin – инсулин
commercialized –коммерциализированный
apply – применять
enzyme – энзим (фермент, белок, который играет роль катализатора в биохимических реакциях)
laundry – прачечная, стирка
detergent – моющее средство
hormone – гормон
manufacture – производить
cellline – клеточная линия (группа клеток, поддерживаемая в культуре путем пересевов в размножающемся состоянии)
zebrafish – полосатый данио
crop – урожай, зерновые культуры
insect – насекомое
herbicide – гербицид
virus – вирус
tolerance – терпимость
edible –съедобный
vaccine –вакцина
susceptibility –восприимчивость
extra –избыточный
express– отдавать полностью
protein– протеин, белок

Exercises

1. Answer the following questions on the text.

- 1) What is genetic engineering?
- 2) How can new DNA be inserted in the host genome?
- 3) How can genes may be removed?
- 4) What is gene targeting?
- 5) What is a genetically modified organism?
- 6) When was the first GMO manufactured?
- 7) What fields can genetic engineering techniques be applied to?
- 8) Why do genetic engineers modify plants?
- 9) What are genetically modified animals used for?

10) What are the risks of genetic engineering?

2. Match up the two parts of the sentences.

- | | |
|--|---|
| 1) Gene targeting is a different technique that uses | a) sold since 1994. |
| 2) Genetically modified food has been | b) genes knocked out and increased susceptibility to disease. |
| 3) Insulin and human growth hormone are now | c) homologous recombination to change an endogenous gene. |
| 4) Plants have been modified for | d) insects resistant and/ or herbicide tolerant crop plants. |
| 5) Most commercialized GMO'S are | e) manufactured in gm cells. |
| 6) They include animals with | f) insect protection. |

3. Say if the statement is true or false.

- 1) Genes may be removed, or “knocked out”, using a nuclease.
- 2) Gene targeting can be used to delete a gene, remove exons, add a gene, or introduce point mutations.
- 3) An organism that is generated through genetic engineering is considered to be a genetically modified organism.
- 4) Genetic engineering techniques have been applied in numerous fields including research, agriculture, industrial biotechnology, and sports.
- 5) Enzymes used in laundry detergent and medicines such as insulin and human growth hormone are now manufactured in prison cells.
- 6) Most commercialized GMOs are insect resistant and/ or herbicide tolerant crop plants.

4. Translate the following sentences into English.

- 1) Гены могут быть удалены или «выбиты» с помощью нуклеазы.
- 2) Первыми генно-модифицированными организмами были бактерии, полученные в 1973 году.
- 3) Генетически измененная пища продается с 1994 года.
- 4) Экспериментальные генно-модифицированные клеточные линии и животные, такие как мыши и полосатый данио, используются в исследовательских целях.
- 5) Растения модифицируются с целью защиты от насекомых, выработки сопротивляемости к гербицидам и вирусам.
- 6) Большинство коммерческих генно-модифицированных организмов – это зерновые культуры, способные сопротивляться насекомым и терпимые к гербицидам.
- 7) Генетически измененные животные использовались для исследований.
- 8) Они включают в себя животных с удаленными генами.
- 9) Они так же включают в себя животных с повышенной восприимчивостью к заболеваниям, гормонами избыточного роста и способностью полностью отдавать белок в молоке.
- 10) Генная инженерия также называется генной модификацией.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) How do the scientists deal with genes?

- 2) What were the first genetically modified organisms?
- 3) What are the benefits of GMO?
- 4) What are the risks of genetic engineering?

6. Render the text.

UNIT 9. BACTERIA

Bacteria (one of them is a bacterium) are very small organisms. Almost all bacteria are so tiny they can only be seen through a microscope. Bacteria are made up of one cell, so they are a kind of unicellular organism. They are among the simplest single-celled organisms on Earth, and were one of the earliest forms of life. They include a number of extremophiles who live in extreme habitats.

There are probably more individual bacteria than any other sort of organism on the planet. Most bacteria live in the ground or in water, but many live inside or on the skin of other organisms, including humans. There are about ten times as many bacterial cells as human cells in each of our bodies. Some bacteria can cause diseases, but others can help us in everyday activities like digesting food. Some even work for us in factories, producing cheese and yogurt.

A bacterium reproduces (creates more bacteria) by dividing in half and creating two “daughter” cells. Each daughter is identical in a shape to the parent, but smaller.

Bacteria do not have sexes, but they do collect and transmit DNA by several types of horizontal gene transfer. It is this which permits them to pass resistance to antibiotics from one strain to another. The complete DNA sequence is known for many bacterial strains.

Bacteria vary widely in size and shape, but in general are at least ten times larger than viruses. A typical bacterium is about one micrometer in diameter, so a thousand bacteria lined up would be one millimeter long. There are about five nonillion bacteria on Earth.

Bacteria are identified and grouped by their shapes. Bacilli are rod-shaped, cocci are ball-shaped, spirilla are spiral-shaped and vibrio are shaped like a comma or boomerang.

Pathogenic bacteria, the harmful kind, enter the human body from the air, water or food. Once inside, these bacteria attach themselves to or invade specific cells in our respiratory system, digestive tract or any open wound. There they begin to reproduce and spread while using the human body as a source of their own nutrients and energy.

Helpful words and word combinations

bacterium – бактерия

single – единственная, одинокая

extremophile –экстримофил (организм, существующий в экстремальных условиях)

extreme – исключительный, экстремальный

habitat – место обитания

digest –переваривать

reproduce –воспроизводить

identical – идентичный

sex –пол

horizontal –горизонтальный

antibiotics –антибиотики

strain – штамм (чистая культура вирусов, бактерий, других микроорганизмов или культура клеток, изолированная в определенное время и в определенном месте)

virus – вирус

nonillion –нониллион (в Англии – 10 в степени 54, в США – 10 в 30-й степени)

group – группа; группировать

bacilli – бациллы (**bacillus** - бацилла)
rod-shaped – в форме палочки
cocci – кокки
spirilla – спириллы (**spirillum** – спирилла)
spiral – спираль; спиралевидный, спиральный
vibrio– вибрион
boomerang– бумеранг
pathogenic – патогенный, болезнетворный
attach – прикреплять, прилагать
invade – завоевывать, захватывать
digestive – пищеварительный
wound– рана
spread – распространяться
nutrients–питательные вещества

Exercises

1. Answer the following questions on the text.

- 1) What is the average size of bacteria?
- 2) What structures do bacteria consist of?
- 3) What is the extremophile?
- 4) Where do bacteria prefer to live?
- 5) How many bacteria are there in the human body?
- 6) What role do bacteria play in our life?
- 7) How do bacteria reproduce?
- 8) How do bacteria transfer DNA?
- 9) In what way are bacteria identified and grouped?
- 10) How can bacteria enter the human body?

2. Match up the two parts of the sentences.

- | | |
|---|---|
| <ol style="list-style-type: none"> 1) Bacteria are made up of one cell, so they are 2) Most bacteria live in the ground or in water, but many live inside 3) A bacterium reproduces by dividing in 4) Bacteria collect and transmit DNA by 5) There are about 6) Bacteria are identified and grouped by | <ol style="list-style-type: none"> a) half and creating two “daughter” cells. b) five nonillion bacteria on earth. c) their shapes. d) several kinds of horizontal gene transfer. e) the skin of other organisms, including humans. f) the skin of other organisms, including humans. g) a kind of unicellular organism. |
|---|---|

3. Say if the statement is true or false.

- 1) Almost all bacteria are so huge they can only be seen through a telescope.
- 2) Most bacteria live in the ground or in water, but many live inside or on the skin of other organisms, including humans.
- 3) Each daughter bacterium is identical in shape to the parent, but larger.
- 4) A typical bacterium is about one meter in diameter.

- 5) Pathogenic bacteria, the harmful kind, enter the human body from the air, water or food.
- 6) Once inside, these bacteria attach themselves to or invade specific cells in our respiratory system, digestive tract or any open wound.

4. Translate the following sentences into English.

- 1) Они находятся среди самых простых одноклеточных организмов на Земле и были одной из самых ранних форм жизни.
- 2) Они включают ряд экстримофилов, которые живут в экстремальных условиях обитания.
- 3) В каждом из наших тел бактерий в десять раз больше, чем человеческих клеток.
- 4) Для многих бактериальных штампов выявлены полные цепочки ДНК.
- 5) Бактерии значительно различаются по размеру и форме.
- 6) Типичная бактерия имеет диаметр в один микрометр.
- 7) Тысяча бактерий, вытянутых в ряд, будет длиной один миллиметр.
- 8) Бактерии идентифицируются и группируются в соответствии с их формой.
- 9) Бациллы имеют форму палочки, кокки – шара, спириллы – спирали, а вибрионы имеют форму запятой или бумеранга.
- 10) Патогенные бактерии, относящиеся к опасному типу, проникают в человеческое тело из воздуха, воды или пищи.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) Where do bacteria live?
- 2) What role do bacteria play in our life?
- 3) What is the structure of the bacterium?
- 4) How do bacteria reproduce?

6. Render the text.

UNIT 10. THE ECONOMIC IMPORTANCE OF BACTERIA

The economic importance of bacteria derives from the fact that bacteria exploited by humans in a number of beneficial ways. Despite the fact that some bacteria play harmful roles, such as causing disease and spoiling food, the economic importance of bacteria includes both their useful and harmful aspects.

Bacteria are used in genetic engineering. Here pieces of DNA (genes) are introduced into a host by means of a carrier (vector) system, and bacteria may play the role of this carrier. The foreign DNA becomes a permanent feature of the host, being replicated and passed on to daughter cells along with the rest of its DNA. Bacterial cells are transformed and used in production of commercially important products. The examples are production of human insulin (used against diabetes), human growth hormone, and infections which can be used to help fight viral diseases.

Some bacteria living in the gut of cattle, horses and other animals secrete cellulase, an enzyme that helps in the digestion of the cellulose contents of plant cell walls. Cellulose is the major source of energy for these animals. Generally plant cells contain cellulose. The bacteria present in the stomach of cattle will help in the digestion of cellulose.

Escherichia coli that lives in the human large intestine synthesizes vitamin B and releases it for human use. Similarly, Clostridium butylicum is used for commercial preparation of riboflavin, and vitamin B.

Bacteria can also be used in a place of pesticides in the biological pest control. This commonly uses Bacillus BT, a soil dwelling bacterium. This is used as an insecticide under trade names such as Dipel and Thuricide. Because of their specificity, these pesticides are regarded as environmentally friendly, with little or no effect on humans, wildlife, pollinators, and most other beneficial insects.

Helpful words and word combinations

importance – важность

derive – выводить, производить на основе

beneficial – благоприятный, полезный

spoil – портить

carrier – носитель, переносчик

vector – переносчик

permanent – постоянный

replicate – воспроизводить, копировать

insulin – инсулин

diabetes – диабет

infection – инфекция

viral – вирусный

gut – кишечник

cattle – рогатый скот

secrete – выделять

cellulase – целлюлоза (фермент, расщепляющий целлюлозу)

stomach – желудок

Escherichiacoli –кишечная палочка
intestine – кишечник
clostridiumbutycticum – бактерия семейства клостридий
riboflavin – рибофлавин
vitamin – витамин
pesticide – пестицид
pest – вредитель, паразит
dwelling – живущий, приспособленный для проживания
insecticide – инсектицид
trade – торговля; торговый
specificity – специфичность
wildlife – дикая жизнь, дикая природа
pollinator – опылитель

Exercises

1. Answer the following questions on the text.

- 1) What is the economic importance of bacteria derived from?
- 2) How does genetic engineering employ bacteria?
- 3) What is a vector, and how does it work?
- 4) What products do genetic engineers manufacture in collaboration with bacteria?
- 5) What enzyme is produced by bacteria living in the gut of cattle, horses and other animals?
- 6) Why is cellulose so important for animals?
- 7) What bacteria do help synthesize vitamin B?
- 8) What bacteria do participate in synthesizing vitamin B?
- 9) How do people employ bacteria in biological pest control?
- 10) Why are Dipel and Thuricide regarded as environmentally friendly?

2. Match up the two parts of the sentences.

- | | |
|--|--|
| <ol style="list-style-type: none"> 1) The economic importance of bacteria derives from 2) Bacteria are used in 3) The foreign DNA becomes 4) The examples are production of 5) The bacteria present in the stomach of cattle will help in 6) This bacterium is used as | <ol style="list-style-type: none"> a) the digestion of cellulose. b) a permanent feature of the host. c) the fact that bacteria are exploited by humans in a number of beneficial ways. d) an insecticide under trade names such as dipel and thuricide. e) human insulin. f) genetic engineering. |
|--|--|

3. Say if the statement is true or false.

- 1) The economic importance of bacteria includes both their useful and harmful aspects.
- 2) Bacterial cells are transformed used in production of commercially important products.
- 3) Cellulose is the major source of vitamins for these animals.
- 4) Generally plant cells contain cellulose.
- 5) Bacteria can also be used in the place of pesticides in the economic pest control.
- 6) Dipel and Thuricide are regarded as environmentally hostile.

4. Translate the following sentences into English.

- 1) Бактерии могут играть роль этого переносчика.
- 2) Чужая ДНК репродуцируется и передается дочерним клеткам вместе с их собственным ДНК.
- 3) Бактериальные клетки трансформируются и используются в производстве коммерчески важных продуктов.
- 4) Инфекции могут быть полезны как в помощь в борьбе с вирусными заболеваниями.
- 5) Кишечная палочка синтезирует витамин В и выделяет его для использования человека.
- 6) Бактерии также могут использоваться в биологическом контроле вредителей.
- 7) Эта техника обычно использует таблицу ВТ, бактерию, живущую в почве.
- 8) Эта бактерия используется как инсектицид под именами торговых марок, таких как Дайпель и Турицайд.
- 9) Эти пестициды считаются безопасными для окружающей среды.
- 10) Они оказывают небольшое влияние или вообще не оказывают такового на людей, дикую природу, опылителей и большинство других полезных насекомых.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) How do they use bacteria in genetic engineering?
- 2) What useful products and medications are produced with bacteria's help?
- 3) How do bacteria help breed and feed animals?
- 4) What are the new methods of the best controls which employ bacteria?

6. Render the text.

PART II

UNIT 11. THE VIRUS

The virus is an invasive biological agent that reproduces inside the cells of living hosts. When infected by a virus, a host cell is forced to produce many thousands of identical copies of the original virus, at an extraordinary rate. Unlike most living things, viruses do not have cells that divide; new viruses are assembled in the infected host cell. Over 5,000 species of viruses have been discovered.

The origins of viruses are unclear: some may have evolved from plasmids – pieces of DNA that can move between cells – while others may have evolved from bacteria. A virus consists of two or three parts: genes, made from either DNA or RNA, long molecules that carry genetic information; a protein coat that protects the genes; and in some viruses, an envelope of fat that surrounds and protects them when they are not contained within a host cell. Viruses vary in shape from the simple helical and icosahedral to more complex structures. Viruses are about 1/100 the size of bacteria.

Viruses spread in many different ways. Just as many viruses are very specific as to which host species or tissue they attack, each species of virus relies on a particular method for propagation. Plant viruses are often spread from plant to plant by insects and other organisms, known as vectors. Some viruses of animals, including humans, are spread by exposure to infected bodily fluids. Viruses such as influenza are spread through the air by droplets of moisture when people cough or sneeze. Viruses such as norovirus are transmitted via contaminated hands, food and water. Rotavirus is often spread by direct contact with infected children. The human immunodeficiency virus, HIV, is transmitted by bodily fluids. Others, such as the Dengue virus, are spread by blood-sucking insects.

Viral infections can cause disease in humans, animals and even plants. However, they are usually eliminated by the immune system, conferring lifetime immunity to the host for that virus. Antibiotics have no effect on viruses, but antiviral drugs have been developed to treat life-threatening infections. Vaccines that produce lifelong immunity can prevent some viral infections.

Helpful words and word combinations

invasive – захватнический, проникающий внутрь

agent – агент, деятель

infect – заражать

extraordinary – исключительный, выдающийся

species – вид живого организма; виды

discover – обнаруживать

evolve – развертывать, раскрывать; развивать, выводить

plasmids – плазмиды; факторы наследственности; расположение в клетках вне хромосом, генетические факторы клеточных органелл

RNA – РНК (рибонуклеиновая кислота)

envelope – оболочка, конверт; обертывать, оборачивать

helical – спиральный, спиралевидный
icosahedral – двадцатигранный, икосаэдральный, икосаэдрический
tissue – ткань
propagation – воспроизведение, размножение
exposure – подвергание воздействию
influenza – инфлюэнца, грипп
droplet – капелька
moisture – влага
cough – кашель
sneeze – насморк, чихание
norovirus – норовирус (причина эпидемий желудочно-кишечных заболеваний небактериальной природы)
via – посредством, через
contaminate – загрязнять
rotavirus – ротавирус (поражает слизистую желудка и тонкого кишечника с возникновением гастроэнтерита)
immunodeficiency – иммунодефицит
Dengue – денге (вирус, вызывающий лихорадку Денге, острое вирусное заболевание, протекающее с лихорадкой, менингитом, воспалением суставов и сыпью)
suck – сосать
eliminate – уничтожать, искоренять
immune – иммунная
confer – передавать, сообщать
immunity – иммунитет
antibiotics – антибиотики
threaten – угрожать

Exercises

1. Answer the following questions on the text.

- 1) How does virus reproduce?
- 2) Do viruses have cells?
- 3) What is the origin of viruses?
- 4) How many parts are there in the virus?
- 5) How are viruses shaped?
- 6) How are plant viruses spread?
- 7) How are viruses of influenza transmitted?
- 8) What role do contaminated hands play in transmitting viruses?
- 9) How do people get the human immunodeficiency virus?
- 10) How can viruses be eliminated?

2. Match up the two parts of the sentences.

- | | | |
|---|--|---|
| <ol style="list-style-type: none"> 1) A host cell is forced to produce 2) Some viruses may have evolved from 3) Viruses vary in shape from the simple helical and icosahedral to | | <ol style="list-style-type: none"> a) the air by droplets of moisture when people cough or sneeze. b) many thousands of identical copies of the original virus. |
|---|--|---|

- | | |
|--|---|
| <p>4) Plant viruses are often spread from plant by</p> <p>5) Viruses such as influenza are spread from plant by</p> <p>6) The human immunodeficiency virus, HIV is</p> | <p>c) transmitted by bodily fluids.</p> <p>d) plasmids.</p> <p>e) more complex structures.</p> <p>f) insects and other organisms, known as vectors.</p> |
|--|---|

3. Say if the statement is true or false.

- 1) The virus is an invasive biological agent that reproduces outside the cells of living hosts.
- 2) Over 5,000 species of viruses have been discovered.
- 3) Viruses are about 1/10 the size of bacteria.
- 4) Some viruses of animals, including humans, are spread by exposure to infected bodily fluids.
- 5) Rotavirus is often spread by direct contact with infected children.
- 6) The Dengue virus is spread by blood-sucking vampires.

4. Translate the following sentences into English.

- 1) Клетка-хозяин вынуждена производить многие тысячи идентичных копий изначального вируса с необычайной скоростью.
- 2) Новые вирусы располагаются в зараженной клетке-хозяине.
- 3) Оболочка жира обволакивает и защищает вирусы, когда они находятся вне клетки-хозяина.
- 4) Некоторые вирусы могли развиваться из плазмидов – фрагментов ДНК, которые способны передвигаться между клетками.
- 5) Многие вирусы специфичны в отношении тех видов живых организмов или типов тканей, которые они атакуют.
- 6) Каждый тип вирусов полагается на специфический метод размножения.
- 7) Такие вирусы, как вирус гриппа, распространяются по воздуху с капельками жидкости, когда люди кашляют и чихают.
- 8) Вирус Денге распространяется кровососущими насекомыми.
- 9) Вирусная инфекция может вызвать заболевания у людей, животных и даже растений.
- 10) Антибиотики у людей не оказывают никакого воздействия на вирусы.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) What are the origins of viruses?
- 2) How do the viruses spread?
- 3) How can viruses be eliminated?
- 4) What is the structure of the virus?

6. Render the text.

UNIT 12.ECOLOGY

Ecology is a branch of science that studies the ways in which plants and animals interact with one another and with their surroundings. The origins of ecology lie in the natural history studies of the Greeks, particularly the philosopher and scientist Theophrastus.

Ernst Haeckel, a German zoologist, invented the word “ecology” in 1869. It comes from the Greek words *oikos*, which means “household”, and *logos*, which means “discourse” or “study”. In “The Riddle of the Universe”, Haeckel applied the term *oekologie* to the “relation of the animal both to its organic as well as its inorganic environment.”

For many years, ecology was an obscure branch of biology. In the late twentieth century, however, as environmentalism became a popular movement, ecology moved to the forefront of public opinion and also rose to prominence as a discipline. Some of the late twentieth and early twenty-first centuries’ thorniest problems – expanding populations, food scarcity, and environmental pollution – were and are essentially the problems of ecology.

Ecologists study organisms in various kinds of environments by looking for patterns of interaction. An organism’s environment includes both other organisms and physical surroundings. It involves relationships among individuals within a population and among individuals of different populations. These interactions among individuals, among populations, and between organisms and their environment form ecological systems, or ecosystems.

Closely related to ecology are conservation biology and environmental science. Ecology, the science, studies ecosystems at multiple levels and scales in space and time. Ecosystems have proved to be often quite complicated and resist analysis. Experiments in the field are difficult, and the system may be partly chaotic.

In part because of such complications ecology has become the focus of a particular set of discussions related to science, technology, and ethics. The term ecological ethics may, for instance, call for doing ethics in the light of what ecologists have found in their studies of the world. Perhaps it is appropriate, at times, for humans to imitate the way ecologies themselves function, or look toward ecosystems as fundamental goods to be appreciated and preserved. Given these associations, ecology can also be seen as a part of philosophy.

Helpful words and word combinations

branch - ветвь, направление, отрасль, сфера

interact- взаимодействовать

surroundings - окружение, окружающая среда

origins- истоки (происхождения)

particularly - особенно, в особенности

discourse - разговор, исследование, дискурс

apply - применять

organic - органический

inorganic - неорганический

obscure - неясный, тёмный, скрытый

forefront - передний край

publicopinion - общественное мнение

prominence – важность, существенное значение
thorniest – самый острый (от thorn – колючка)
pollution - загрязнение
essentially – существенно, существенным образом
pattern – модель, схема, способ
involve – вовлекать, привлекать
ecosystem – экосистема
conservation – сохранение, сбережение
multiple – множественный, многоуровневый
scale – шкала, масштаб
chaotic – хаотичный, хаотический
focus – фокус, центр внимания
ethics – этика
callfor – взывать (к ч.-л.), обязывать, требовать
appropriate – соответствующий, достаточный
fundamental – фундаментальный
appreciate – высоко оценивать, ценить, хвалить

Theophrastus – Теофраст (Феофраст), древнегреческий философ (371 г. до н. э. – между 288 г. до н. э. и 285 г. до н. э.); разносторонний учёный; является наряду с Аристотелем основателем ботаники и географии растений

Ernst Haeckel – Эрнст Геккель (1834 – 1919), немецкий естествоиспытатель и философ
“The Riddle of the Universe” – нем. „Welträtsel“, «Загадки мира» (1899) – один из главных научных трудов Геккеля

Exercises

1. Answer the following questions on the text.

- 1) What does ecology study?
- 2) Where do the origins of ecology lie?
- 3) Who invented the word “ecology”, and what does this word mean?
- 4) What problems of the late twentieth and early twenty-first centuries deal with ecological issues?

2. Match the parts of the sentences to each other.

- | | |
|---|---|
| <ol style="list-style-type: none"> 1) Ernst Haeckel, a German zoologist, 2) In the late twentieth century environmentalism 3) An organism’s environment includes 4) Closely related to ecology are 5) Ecosystems | <ol style="list-style-type: none"> a) studies ecosystems at multiple levels and scales in space and time. b) invented the word “ecology” in 1869. c) conservation biology and environmental science. d) both other organisms and physical surroundings. e) have proved to be often quite complicated and resist analysis. f) became a popular movement. |
|---|---|

3. Say if the statement is true or false.

- 1) Ecology is a branch of arts that depicts the ways in which plants and animals interact with one another and with their surroundings.
- 2) The word “ecology” comes from the Latin word *oikos*, which means “house”.
- 3) For many years, ecology was an obscure branch of biology.
- 4) An organism’s environment includes both other organisms and physical surroundings.
- 5) Closely related to ecology are conservation biology and environmental science.
- 6) Ecology has become epicenter of a certain set of debates related to science, technology, and ethics.

4. Translate the following sentences into English.

- 1) Эрнст Геккель, немецкий зоолог, изобрёл слово «экология» в 1869 году.
- 2) Геккель применил этот термин к отношениям между животным и его окружением.
- 3) Так как идеология защиты окружающей среды стала популярным движением, экология выдвинулась на передний край в общественном мнении.
- 4) Среда, окружающая организм, включает как другие организмы, так и физическую среду.
- 5) Эти взаимодействия формируют экологические системы, или экосистемы.
- 6) Экология изучает экосистемы на многих уровнях и в различных масштабах в пространстве и времени.
- 7) Эксперименты в полевых условиях сложны, а системы могут быть частично хаотичными.
- 8) Экология стала центром ряда специальных обсуждений, имеющих отношение к вопросам этики.
- 9) Мы рассматриваем экосистемы как достойные уважения фундаментальные ценности.
- 10) С учётом этих ассоциаций экология может также рассматриваться как часть философии.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) The origins of ecology.
- 2) Why are ecological issues so widely discussed today?
- 3) Ecology and its relations to other fields of science.

6. Render the text.

UNIT 13. HOW DOES ECOLOGY AFFECT YOU?

What is ecology and how does it affect you? Simply speaking, ecology is the term for the scientific studies that are done on the earth and everything that affects it. This includes wildlife, humanity, nature and in some cases environmental issues. These studies are done from a variety of different viewpoints and by using many different techniques. Ecology covers a broad area of studies and research that provides information on how organisms interact and affect each other and the chemical and physical environment of each.

When you ask different people the question “what is ecology”, you could get many different answers. This is because ecology is such a broad area to cover. You may be told that it is the study of humanity and its impact on the earth or that it is the evolution of the human race. Evolution is the result of environmental changes over time and it has an impact on every living creature.

Ecology is the study of the global patterns that occur within the boundaries of the biosphere and that is the answer that you will get from many scientists when you ask, what is ecology? Still yet another scientist would answer the question “what is ecology” by saying it is the study of wildlife and organism and their effects on the environment. All of these answers are correct because ecology is a huge subject that can’t be narrowed down to just a few topics.

Having an understanding of ecology is critical to the survival of the human species. With populations increasing and natural resources running thin, the more we learn the better we will be able to make the changes needed to preserve the natural resources for the generations of the future.

Studying ecology requires many experiments that are conducted in laboratories and out in the field. These experiments help scientists to learn about the environment, natural resources and more. The importance of ecology has grown enormously just over the last few years and will surely continue to grow in the future.

So what is ecology? You might say it is the answer to many problems that now face the environment due to all the changes that have taken place over the centuries. Ecology analyzes each element of the ecosystem and everything it consists of. It teaches how all living things, no matter how large or small, affect everything else in the world.

To find the answers needed to the many problems humanity now faces and to ensure the future of generations to come, the study of ecology is imperative. There is so much to be learned from the environment and every creature that inhabits the earth.

Helpful words and word combinations

affect – оказывать воздействие

wildlife – дикая природа

humanity – человечество

issue – пункт, вопрос, проблема

variety – разнообразие

viewpoint – точка зрения

cover – покрывать, освещать

provide – предоставлять

broad – широкий

impact – удар, воздействие
evolution – эволюция
creature – создание, существо
global – всемирный, глобальный
occur – случаться, происходить
boundary – граница
biosphere – биосфера
huge – огромный, гигантский
narrow – узкий, сужать
survival – выживание
species – вид, виды
run thin – истощаться
generation – поколение
require – требовать
conduct – проводить, вести, руководить
resource – источник, ресурс
face – сталкиваться с ч.-л.
due to – благодаря ч.-л., из-за ч.-л.
consist of – состоять (из)
ensure – обеспечивать
imperative – настоятельный, необходимый
inhabit – населять

Exercises

1. Answer the following questions on the text.

- 1) What spheres of life does ecology study?
- 2) What is evolution, from the point of view of ecology?
- 3) Can ecology be narrowed down to just a few topics, and why?
- 4) Why is an understanding of ecology critical to the survival of the human species?
- 5) In what places are ecology experiments conducted?
- 6) What does ecology analyze, and what does it teach us?
- 7) What do generations to come have to do with today's problems?
- 8) What is wildlife?
- 9) What information does ecology provide?
- 10) Why are there so many different answers to the question "what is ecology"?

2. Match the parts of the sentences to each other.

- | | |
|---|---|
| <ol style="list-style-type: none"> 1) These studies are done from 2) You may be told that it is the study of 3) All of these answers are correct because 4) Ecology analyzes each element of 5) These experiments help scientists to learn about 6) There is so much to be learned from | <ol style="list-style-type: none"> a) the environment and every creature that inhabits the earth. b) the environment, natural resources and more. c) humanity and its impact on the earth or that it is the evolution of the human race. d) a variety of different viewpoints and by using many different techniques. |
|---|---|

- e) the ecosystem and everything it consists of.
- f) ecology is a huge subject.

3. Say if the statement is true or false.

- 1) Ecology covers a broad area of studies and research that provides information on how organisms interact and affect each other.
- 2) Evolution is the result of environmental changes over time and it has no impact on every living creature.
- 3) All of these answers are correct because ecology is an unimportant subject that can be narrowed down to just a few topics.
- 4) Studying ecology requires many experiments that are conducted in laboratories and out in the field.
- 5) The importance of ecology has grown down just over the last few years and will surely continue to decrease in the future.
- 6) Ecology analyzes each element of the ecosystem and everything it consists of.

4. Translate the following sentences into English.

- 1) Данные исследования проводятся на основе целого ряда разнообразных подходов и с использованием многочисленных различных техник.
- 2) Экология охватывает широкую сферу научных разработок и исследований, которые предоставляют информацию о том, как взаимодействуют организмы.
- 3) Это происходит потому, что экология представляет собой столь широкую сферу рассмотрения.
- 4) Эволюция есть результат изменений окружающей среды, происходящих с течением времени.
- 5) Экология есть исследование глобальных моделей, которые реализуются в границах биосферы.
- 6) Все эти ответы являются правильными, поскольку экология является значительным по объёму предметом, который не может быть сведён только к нескольким темам.
- 7) Обладание пониманием того, что есть экология, существенно важно для выживания человека как вида.
- 8) Эти эксперименты помогают учёным получать сведения об окружающей среде, природных ресурсах и о многом другом.
- 9) Экология даёт решения для многих проблем, которые сейчас стоят перед окружающей средой.
- 10) Мы должны найти решения, необходимые для многих проблем, с которыми человечество сейчас столкнулось лицом к лицу.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) What approaches are there to defining the word “ecology”?
- 2) Why is the study of ecology critical to our survival?
- 3) What experiments in the open field are carried out by the ecologists?

6. Render the text.

UNIT 14. ECOLOGY PROBLEMS

Ecology problems are being studied by scientists from around the world. The world itself is facing a number of very risky changes that could potentially destroy life on the planet. While many scientists believe that changes can still be made to stop the deconstruction and to repair the problems, many others believe some areas are lost. For example, in the global ecology, many species have gone extinct long before they were discovered and marveled at. At the same time, many medications and unique plants have been lost because their habitats have been destroyed, and with them the healing powers that so many people need have disappeared.

There are ecology problems on a grand scale. In ecology, the study is of animals and plants and the interactions they have with each other and the environment around them. By studying this information, scientists can better understand the roles that each organism and microorganism has on the next. In addition, they can see what problems exist, especially those caused by humans. Anytime humans come into contact with an ecosystem, they leave changes and they disrupt the ecosystem in many ways. In some situations, this is very deep damage. In others it is minor. Yet, ecology problems happen in most situations.

Two of the largest ecology problems have to do with the global ecology or the way that the ecosystems on the planet interact with each other. These problems are ozone depletion and global warming, two very different problems equally troubling.

Global warming is an ecology problem that is caused by the buildup of gasses (which hold in heat) in the atmosphere. Global warming is often called a greenhouse effect. In a greenhouse, to grow the plants, but it is unable to escape again. This is similar to what is happening on a global scale with global warming.

The other large ecology problems centre on ozone depletion. This is different from global warming because here you have the actual destruction of the ozone layer. Many chemicals cause this because they interact with the ozone. They in effect leave a hole that lets in UV rays.

These ecology problems are very serious and both are a threat to life on Earth. The more people study and get to know what is happening, the better decisions they can make for the future. For many people, these seem like problems for someone else to deal with, but in effect, they have a direct effect on you, and every person can help.

Helpful words and word combinations

risky - рискованный

potentially – потенциально

destroy – разрушать

deconstruction – разрушение, деконструкция

repair – исправление, починка, ремонт; ремонтировать

marvel – восхищаться

medications – лекарственные средства

unique – уникальный

habitat – место обитания

healing – излечивающий, целебный

grand – громадный, огромный

microorganism – микроорганизм

exist – существовать
cause – причина; быть причиной
humans – люди, человеческие существа
anytime – в какое бы время
come into contact – вступать в контакт
disrupt – прерывать, разрушать
damage – вред; причинять вред, разрушения
minor – малый, незначительный
ozone – озон
depletion – уменьшение, истощение
warming – потепление
buildup – увеличение, наращивание
hold in – удерживать
heat – тепло, жар
greenhouse – теплица, парник
escape – избегать, убежать, спастись
layer – слой
let in – впускать
UV – ультрафиолетовый (от ultraviolet)
ray – луч
threat – угроза; угрожать

Exercises

1. Answer the following questions on the text.

- 1) What do scientists think about the possibility of repairing the ecology problems that we face?
- 2) What happened to many unique species?
- 3) Why were many medications and unique plants lost?
- 4) What can scientists better understand by studying the ecology information?
- 5) What happens when humans come into contact with ecosystems?
- 6) What are the two largest problems that have to do with the global ecology?
- 7) What is global warming caused by?
- 8) How do we often call the global warming?
- 9) What is the ozone depletion?
- 10) What are the dangers of the ozone depletion?

2. Match the parts of the sentences to each other.

- | | |
|---|---|
| <ol style="list-style-type: none"> 1) Many species have gone extinct long before 2) Some medications and unique plants have been lost because 3) By studying this information, scientists can better understand the roles that 4) Anytime humans come into contact with an ecosystem, they leave 5) In a greenhouse, heat is allowed to 6) Many chemicals cause this because they | <ol style="list-style-type: none"> a) each organism and microorganism has on the next. b) they were discovered and marveled at. c) come into the greenhouse, to grow the plants, but it is unable to escape again. d) their habitats have been destroyed. e) interact with the ozone. f) changes and they disrupt the ecosystem in many ways. |
|---|---|

3. Say if the statement is true or false.

- 1) The world itself is facing a number of very risky changes that could potentially destroy life on the planet.
- 2) Two of the largest ecology problems are ozone depletion and global warming.
- 3) Global warming is an ecology problem that is caused by the buildup of water in the atmosphere.
- 4) Global warming is often called a madhouse effect.
- 5) The ozone depletion is different from global warming because here you have the actual destruction of the nitrogen layer.
- 6) Many chemicals interacting with the ozone leave a hole that lets in UV rays.

4. Translate the following sentences into English.

- 1) В то время как многие учёные верят, что могут быть предприняты изменения, способные решить проблемы, многие другие полагают, что некоторые сферы уже утрачены.
- 2) Существуют экологические проблемы огромного масштаба.
- 3) К тому же они могут видеть существующие проблемы, особенно те, что созданы людьми.
- 4) В некоторых ситуациях это очень глубокие разрушения.
- 5) Две самые значительные экологические проблемы имеют отношение к глобальной экологии.
- 6) Глобальное потепление – это экологическая проблема, вызванная накоплением газов в атмосфере.
- 7) Тепло позволяет войти в парник, способствовать выращиванию растений, но он не может покинуть парник.
- 8) Это подобно тому, что во всемирном масштабе происходит с глобальным потеплением.
- 9) Другие серьёзные экологические проблемы сосредоточены вокруг истощения озонового слоя.
- 10) Чем больше люди изучают и понимают причины происходящего, тем лучшие решения они могут принять на будущее.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) What is acid rain?
- 2) How do humans affect the world's ecology?
- 3) What are the two most important ecology problems?

6. Render the text.

UNIT 15. GLOBAL ECOLOGY: THE HUMAN EFFECT

The global ecology is the study of the plants and animals, and how they are related to each other. The entire globe is considered one large ecosystem, where everything within it affects all the others. Those who study global ecology take the time to understand what interactions happen and what the effect of those interactions means to the next set of animals. The studying of this ecology is an amazing one, since the study encompasses everything from the largest oaks to the very smallest of organisms called microorganisms. Yet, there is a very problematic area to be seen here, too. Humans have their footprint on the global ecology and it has not left a good result.

In global ecology, the biome is studied. This is an ecological unit that is made up of many ecosystems (small living environments) and those small ecosystems interact with each other in the biome. In the global ecology, there are nine terrestrial biomes:

- ✓ Mountain
- ✓ Rainforest
- ✓ Grassland
- ✓ Coniferous Forest
- ✓ Savanna
- ✓ Temperate Forest
- ✓ Tundra
- ✓ Desert
- ✓ Mediterranean

There are also aquatic biomes:

- ✓ Freshwater
- ✓ Open ocean
- ✓ Coral reef
- ✓ Coastal waters

There are many others as well.

What's the human effect on each of these biomes? There is a significant effect in play in most of them unfortunately. Global ecology has studied and seen the many different ways that people have harmed these fragile ecosystems and biomes.

Pollution is one of the largest and most obvious of problems to the biomes since it has destroyed many of the habitats of animals around the world. Many of these have been destroyed so much so that they can no longer be repaired.

Medicines have been lost and many species have become extinct due to the loss of these ecosystems. Many of these species have been never discovered in some of the densely forested areas.

Resources that were once very abundant and were providing life to the planet's animals and plants have been wiped out. Natural resources of other types are at a crucial point of running out.

Scientists believe that the great expanse of the global ecology will be affected by all of these changes and many more. Ecology remains one of the most important areas of study because of the hope that it will gain a better understanding of the impact people have on the environment so that future destruction can be avoided, and perhaps even that some of the global ecology that has been lost can be repaired or bettered.

Helpful words and word combinations

relate – относиться, иметь отношение
entire – целый, полный
consider – считать, полагать, оценивать
amazing – удивительный
encompass – окружать, заключать, выполнять
oak – дуб
footprint – след (ноги)
biome – биом
unit – единица (измерения), элемент, устройство
terrestrial – земной, относящийся к земной территории
rainforest – тропический лес
grassland – степь
coniferous – хвойный, шишконосный
savanna – саванна
temperate – умеренный
tundra – тундра
Mediterranean – средиземноморский
aquatic – водный
coral – коралл; коралловый
reef – риф
coastal – прибрежный, береговой
in play – в действии, в игре
unfortunately – к сожалению
harm – приносить вред, вредить
fragile – хрупкий
obvious – очевидный
medicines – медикаменты
discover – находить, обнаруживать
densely – тесно, густо, плотно
abundant – изобилующий
wipeout – стирать, уничтожать
crucial – имеющий существенное значение
run out – лишаться, истощать(ся)
expanse – рост, простор, распространение
gain – приобретать
avoid – избегать
better – более хороший; улучшать

Exercises

1. Answer the following questions on the text.

- 1) What does the global ecology study?
- 2) What does the studying of the global ecology encompass?
- 3) What is the most problematic area of the global ecology?
- 4) What is the biome?
- 5) What biomes are there in the global ecology?
- 6) What is the effect of pollution on the global ecology?
- 7) What has happened to the natural resources in the recent decades?
- 8) Due to what have many medicines and species of animals been lost?
- 9) What do scientists believe may happen to the global ecology in the nearest future?
- 10) Why does ecology remain one of the most important areas of study?

2. Match the parts of the sentences to each other.

- | | |
|---|---|
| 1) Those who study global ecology take the time to understand | a) a crucial point of running out. |
| 2) In global ecology, | b) the impact people have on the environment. |
| 3) Pollution is one of the largest and most obvious of | c) the biome is studied. |
| 4) Many of these species have been never discovered in | d) what interactions happen and what the effect of those interactions means to the next set of animals. |
| 5) Natural resources of different types are at | e) some of the densely forested areas. |
| 6) In future ecology will gain a better understanding of | f) problems to the biomes. |

3. Say if the statement is true or false.

- 1) The global ecology is the study of the planet's plants and animals, and how they are related to each other.
- 2) Humans have left their footprint on the global ecology and it has left a good result.
- 3) In the global ecology, there are seven terrestrial biomes.
- 4) Pollution is one of the largest and most obvious of problems to the biomes.
- 5) Once abundant, some resources that were providing life to the planet's animals and plants have been wiped out.
- 6) Some of the global ecology that has been lost can never be repaired or bettered.

4. Translate the following sentences into English.

- 1) Весь земной шар считается одной большой экосистемой, где каждый оказывает воздействие на всех прочих.
- 2) Те, кто изучает глобальную экологию, прилагают усилия, чтобы понять, какие взаимодействия там происходят.
- 3) Тем не менее, существует ещё одна проблемная зона, на которую следует обратить внимание.
- 4) Биом – это экологическая единица, которая состоит из множества экосистем.
- 5) Каков эффект воздействия человеческих существ на каждый из этих биомов?
- 6) Глобальная экология изучила множество различных способов, которыми люди

приносили вред этим хрупким экосистемам и биомам?

- 7) Оно разрушило многие сферы обитания животных по всему миру.
- 8) Лекарственные средства были утрачены, и многие виды исчезли из-за потери этих экосистем.
- 9) Природные ресурсы прочих типов находятся в критической точке исчезновения.
- 10) Экология остаётся одной из наиболее важных сфер изучения.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) What is the global ecology?
- 2) What biomes are there in the world?
- 3) What dangers do these biomes face?

6. Render the text.

UNIT 16. MICROBIAL ECOLOGY: WHAT IS IT?

Microbial ecology is an important study that looks at the relationship that the microorganisms living throughout Earth have with the environment around them as well as their relationship with each other. In this study, all three major domains of life are considered. This includes Bacteria, Archaea, and Eukaryota and also looks at viruses. You may be wondering what the importance of microbial ecology is. The fact is, these very small microorganisms are found in virtually all areas of the environment, including the most extreme conditions such as lakes of acid and deep within the ocean.

Microbial ecology is quite fascinating. This study focuses on the composition as well as the physiology of these tiny beings. In doing so, people seek to learn more about how they live and what they do that affects the world around us. Most scientists believe that microorganisms cover the entire world in some form. Yet, knowing they are there is only the start. The fact is, it is estimated that scientists and researchers only know about a small fraction of them, just one percent even.

These diverse creatures are powerfully important to the rest of the planet. Microbial ecology studies this importance. Microorganisms are known to be able to withstand some of the hardest of environments. For example, you can find them in high temperatures even those that are over 100 degrees C. Additionally, microorganisms have been found in geysers, in oil wells and in high saline locations, or water that is high in alkalinity or acidity. The importance of these small creatures is evident in the way they affect the whole biosphere. They are often called the backbone of the zones where light is not found.

How is microbial ecology important to conservation and environment protection? There are several ways, but microorganisms are readily used in microbial biodegrading. For example, they are often used to help break down pollution that is found in soils and sediment. They can also be used in marine environments to improve the overall quality of the location. Since they are able to degrade toxic waste, they are incredibly important.

A good example of how microbial ecology works is in an oil spill. Since petroleum oil is a toxic chemical, and therefore destroys the environment, these organisms can be used to rectify the situation. They can rebuild the area by removing the oil pollution from the natural habitats.

Microbial ecology is a science that's always being studied. With the understanding of this type of microorganism, scientists hope to be able to improve the overall well-being of the planet.

Helpful words and word combinations

microbial – микробный

throughout – повсеместно

major – главный

domain – царство

bacteria – бактерия

virus – вирус

wonder – чудо; удивляться

virtually – фактически, поистине

composition – состав, композиция

physiology – физиология

tiny – крохотный
being – существо
estimate – оценивать
fraction – часть, фракция
percent – процент
diverse – многообразный, разнообразный, разный
withstand – противостоять, выдерживать
geyser – гейзер
oil – нефть; нефтяной
well – скважина
saline – солевой, солёный, содержащий соль
alkalinity – щёлочность
acidity – кислотность
evident – очевидный
biosphere – биосфера
backbone – хребет, позвоночник
zone – зона
readily – с готовностью
soil – почва
sediment – отложения
marine – морской
degrade – деградировать
waste – отходы, отбросы
incredibly – невероятно
spill – проливание, разлив; проливать
petroleum – бензин
chemical – химикат; химический
destroy – разрушать
rectify – очищать
Archaea – Археи, домен (надцарство) живых организмов, на молекулярном уровне заметно отличающихся как от бактерий, так и от эукариотов
Eukaryota – Эукариоты, домен живых организмов, объединяющий все живые организмы, клетки которых содержат ядра (в том числе растения, грибы и животные)

Exercises

1. Answer the following questions on the text.

- 1) What does the microbial ecology look at?
- 2) What three main domains of life are considered by the microbial ecology?
- 3) Where can be microbes found?
- 4) What does microbial ecology focus on?
- 5) How much of the whole lot of microbes do we know?
- 6) What conditions can microbes withstand?
- 7) Where are microorganisms used?
- 8) What role do they play in fighting the pollution?
- 9) What dangers do petroleum spills incur?

10) How do microorganisms deal with those?

2. Match the parts of the sentences to each other.

- | | |
|--|---|
| 1) These very small microorganisms are found in | a) the oil pollution from the natural habitats. |
| 2) People seek to learn more about | b) the most extreme conditions such as lakes of acid and deep within the ocean. |
| 3) These diverse creatures are powerfully important to | c) geysers, in oil wells and in high saline locations. |
| 4) Microorganisms have been found in | d) the rest of the planet. |
| 5) They are often called the backbone of | e) how they live and what they do that affects the world around us. |
| 6) They can rebuild the area by removing | f) the zones where light is not found. |

3. Say if the statement is true or false.

- 1) The three major domains of life are Bacteria, Archaea, and Eukaryota.
- 2) Microbial ecology focuses on the composition as well as the physiology of microorganisms.
- 3) Scientists and researchers only know about a small fraction of microorganisms, just two percent.
- 4) Microorganisms are known to be able to withstand some of the hardest of environments.
- 5) Microorganisms are often used to help break down pollution that is found in soils and sediments.
- 6) Petroleum oil is a toxic chemical, and therefore it improves the environment.

4. Translate the following sentences into English.

- 1) Вы можете спросить, в чём состоит важность экологии микроорганизмов.
- 2) Эти очень маленькие микроорганизмы найдены фактически во всех зонах окружающей среды.
- 3) Люди стремятся узнать больше о том, как они живут и что они делают такого, что оказывает воздействие на мир вокруг нас.
- 4) Тем не менее знание этого является только началом.
- 5) Например, вы можете найти их при высоких температурах, даже таких, что превышают 100 градусов по Цельсию.
- 6) Важность этих маленьких созданий очевидна в том, как они оказывают воздействие на всю биосферу.
- 7) Насколько экология микроорганизмов важна для сохранения и защиты окружающей среды?
- 8) Они также могут использоваться в морской среде для улучшения общего качества данной сферы.
- 9) Так как они способны разлагать токсичные отходы, они невероятно важны.
- 10) Экология микроорганизмов – наука, которая изучалась всегда.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) Spheres where microbes be found.
- 2) The importance of microorganisms to the environment.
- 3) Microbial ecology as a science.

6. Render the text.

UNIT 17. DIFFERENT TYPES OF ENVIRONMENTAL POLLUTION

Environmental pollution is definitely a serious threat for the entire world in this age of development and industrialization. The pollution in developed cities is rising at a fast pace according to the reports of several environmental scientists. Environmental protection is the need of the hour, and countries across the world are working on developing technologies imposing certain restrictions to reduce or control environmental pollution. There have been many meetings on the international level between executives and ministers of different nations to curb environmental pollution. However, being aware of the different types of environmental pollution is essential before we adopt measures to deal with it. So, what are those?

Among the different types of environmental pollution, noise pollution is one of the major types. Any kind of undesirable and loud noise which can be disturbing for human beings and cause health hazards is known as noise pollution. Controlling noise pollution is totally in the hands of human beings because it is totally because of activities such as noise of airplanes, vehicle noise, machinery noise, noise due to different construction activities, noise of crowd, etc. Noise pollution can be especially dangerous for patients in critical conditions. Silence zones at the right place and implementation of the set rules can help to lower the adverse effects of noise pollution greatly.

No less dangerous is soil pollution. Contamination of the soil or land because of improper or incorrect agricultural techniques, dumping of chemical wastes by factories and industries are responsible for soil pollution. Deforestation done in huge amounts is also equally responsible for soil pollution. Certain mining activities are also believed to cause land pollution. These environmental pollution facts must have helped you realize the real causes of different types of environmental pollution.

Thermal pollution is characterized by excessive heat and is mainly the result of deforestation and power plants. Scientists also speak about personal pollution, meaning the harmful effect of a bad and improper lifestyle on the human body which can lead to diseases and disorders. Smoking, drinking and irregular eating habits are the main causes of personal pollution.

Actually, any sphere of life can suffer from various types of pollution. But all living creatures on the earth are affected by air and water pollution, as well as by radioactive pollution and plastic pollution.

Helpful words and word combinations

definitely – определённо

industrialization – индустриализация

need – нужда, требование

impose – вводить, вносить, внедрять

restrictions – ограничения

executive – исполнитель, менеджер

curb – сдерживать, обуздывать

aware – осознающий

essential – существенный

adopt – принимать (законы)

noise – шум
undesirable – нежелательный
hazard – риск, опасность
vehicle – колёсное транспортное средство
implementation – введение, внедрение
contamination – загрязнение
improper – неправильный
dumping – сваливание, аварийная выгрузка
mining – относящийся к горному делу
thermal – температурный, термальный
excessive – избыточный
power plant – электростанция
disorder – расстройство
suffer – страдать
radioactive – радиоактивный
plastic – пластиковый, пластмассовый

Exercises

1. Answer the following questions on the text.

- 1) Who reports on the rising pace of pollution in developed cities?
- 2) What are countries across the world working on in order to combat pollution?
- 3) Who meets on the international level to work out measures aiming at curbing environmental pollution?
- 4) What is noise pollution and what is it caused by?
- 5) Who is noise pollution especially dangerous to?
- 6) How can people lower the adverse effects of noise pollution?
- 7) What is contamination of the soil or land caused by?
- 8) What is thermal pollution and what is it caused by?
- 9) What do scientists mean when they speak about personal pollution?
- 10) What types of pollution are all living creatures on the earth affected by?

2. Match the parts of the sentences to each other.

- | | |
|--|---|
| <ol style="list-style-type: none"> 1) The pollution in developed cities is rising at a fast pace according to 2) Being aware of the different types of environmental pollution is essential before we adopt 3) Silence zones at the right place and implementation of the set rules can help to lower 4) Deforestation done in 5) Environmental pollution facts must have helped you realize 6) Thermal pollution is characterized by excessive heat and is mainly the result of | <ol style="list-style-type: none"> a) deforestation and power plants. b) the reports of several environmental scientists. c) the real causes of different types of environmental pollution. d) the adverse effects of noise pollution greatly. e) huge amounts is also equally responsible for soil pollution. f) measures to deal with it. |
|--|---|

3. Say if the following statements are false or true.

- 1) The pollution in developed cities is rising at a fast pace due to the reports of several environmental scientists.
- 2) There have been many meetings on the international level between executives and ministers of different nations to curb environmental pollution.
- 3) Silence zones at the right place and implementation of set rules can help to increase the adverse effects of noise pollution greatly.
- 4) Deforestation done in huge amounts is also equally responsible for soil pollution.
- 5) Thermal pollution is characterized by excessive cold and is mainly the result of deforestation and power plants.
- 6) Actually, any sphere of life can suffer from various types of pollution.

4. Translate the following sentences into English.

- 1) Страны по всему миру работают над разработкой технологий, налагающих определённые ограничения с целью сократить или поставить под контроль загрязнение окружающей среды.
- 2) Осознать наличие различных видов загрязнения окружающей среды важно перед тем, как принимать меры воздействия на них.
- 3) Среди различных видов загрязнения окружающей среды шумовое загрязнение является одним из главных.
- 4) Любой вид нежелательного или громкого шума может оказаться раздражающим для людей и быть причиной риска для здоровья.
- 5) Шумовое загрязнение может быть особенно опасным для больных в критическом состоянии.
- 6) Не менее опасно и загрязнение почвы.
- 7) Загрязнение почвы или земли в силу применения неверных или неточных сельскохозяйственных технологий, захоронение химических отходов фабриками несут ответственность за загрязнение почвы.
- 8) Определённые виды деятельности в горнодобывающей промышленности также считаются причиной загрязнения земель.
- 9) Курение, выпивка и привычка нерегулярно питаться являются главными причинами «загрязнения» человека.
- 10) Все живые существа на земле испытывают воздействие загрязнения воздуха и загрязнения воды.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) The causes and effects of noise pollution.
- 2) Why is soil pollution so dangerous?
- 3) Thermal pollution and its effects on the earth.

6. Render the text

UNIT 18. WHAT IS AIR POLLUTION?

Air pollution is a substance introduced into the air, like chemicals, biological pollutants, or particles, which damage environments, or cause harm to living organisms.

These pollutants can be caused by stationary or moving sources. The examples of stationary sources are huge factories, and coal and mining industries. However, the more damaging sources of pollution are the moving ones, like different types of motor vehicles. These can include boats, automobiles, busses, trains, and aircrafts.

Pollution in the air is harmful to the environment, and also to all of our bodies. If you continuously breathe in pollutants, it can lead to severe respiratory disease, and in some cases premature death. Air pollution is a major cause of lung cancer and heart disease. It is best to try to avoid living in areas that are near high traffic roads, and large factories, if you already have respiratory problems or respiratory disease.

People in big cities rarely find themselves asking the question “What is air pollution?” because they have things like smog to constantly remind them about it. Smog is a form of outdoor pollution that is on a large scale. This terrible form of pollution can form when exhaust from vehicles mixes with pollution from industries. Usually during the summer months is when cities experience smog.

During the cold months of the year cities can get a different kind of pollution such as carbon monoxide, or particulate air pollution. The reason for either type of pollution getting trapped in the city is due to something called temperature inversion. This inversion is caused when air near the earth surface is much colder than the air right above it. When this temperature inversion occurs, then the pollution can't rise and be dispersed away from the city. That inversion can happen in any season, and that smog is a major form of air pollution.

If you are going to move, say, to Los Angeles, you should know that it's a leading city, in America, for smog concentration. Some of the metropolitan areas there, like Los Angeles, Orange County, and Riverside are the worst to live in if you want to breathe clean air. Knowing answers to what is air pollution is just the first step to making life, and the air we breathe better. Using pollution reducing methods will help everyone breathe a little easier.

Helpful words and word combinations

particle – частица

stationery – стационарный, неподвижный

moving – движущийся

coal – уголь; угольный

motor – мотор, двигатель

aircraft – воздушное судно

breathe – дышать, вдыхать

severe – суровый, жестокий

respiratory – респираторный

premature – преждевременный

lung – лёгкое

cancer – рак (болезнь)

traffic – уличное движение

smog – смог (от fog туман и smoke дым)
exhaust – выброс
carbon – углерод
monoxide – окись, монооксид
particulate – состоящий из частиц
trap – капкан; попадать в капкан
inversion – инверсия
surface – поверхность
disperse – рассредоточиваться, распространяться
concentration – концентрация
metropolitan – относящийся к крупным городам

Exercises

1. Answer the following questions on the text.

- 1) What substances form the air pollution?
- 2) What stationary sources contribute to the air pollution?
- 3) What moving sources of the air pollution are there?
- 4) What can breathing in pollutants lead to?
- 5) What is the best way to try to avoid the air pollution?
- 6) Why do people in big cities rarely ask the question “What is air pollution?”?
- 7) What is smog made of?
- 8) What is temperature inversion?
- 9) Why is it so dangerous to live in Los Angeles?
- 10) What pollution reducing methods can there be?

2. Match the parts of the sentences to each other.

- | | |
|---|---|
| 1) These pollutants can be caused by | a) a leading city, in America, for smog concentration. |
| 2) Air pollution is a major cause of | b) exhaust from vehicles mixes with pollution from industries. |
| 3) This terrible form of pollution can form when | c) air near the earth surface is much colder than the air right above it. |
| 4) The temperature inversion is caused when | d) stationary or moving sources. |
| 5) That inversion can happen in any season, and | e) lung cancer and heart disease. |
| 6) If you are going to move, say, to Los Angeles, you should know that it's | f) that smog is a major form of air pollution. |

3. Say if the following statements are false or true.

- 1) The examples of moving sources are huge factories, and coal and mining industries.
- 2) Pollution in the air is most friendly to the environment, and also to all of our bodies.
- 3) Smog is a form of outdoor pollution that is on a large scale.
- 4) Usually during the summer months is when cities experience smog.
- 5) The reason for either type of pollution getting trapped in the city is due to something called temperature inversion.

6) Knowing answers to what is air pollution is just the first step to making life, and the air we breathe worse.

4. Translate the following sentences into English.

- 1) Эти загрязняющие вещества могут производиться статичными или движущимися источниками.
- 2) Тем не менее, более опасными источниками загрязнения являются движущиеся, такие как различные виды транспортных средств с моторами.
- 3) Если вы постоянно вдыхаете загрязняющие вещества, это может привести к суровым респираторным заболеваниям, а в некоторых случаях к преждевременной смерти.
- 4) Загрязнение воздуха – это главная причина рака лёгких и сердечных заболеваний.
- 5) В течение холодных месяцев года города могут получить другой тип загрязнения, такой, как загрязнение окисью углерода или взвешенными частицами.
- 6) Когда происходит эта температурная инверсия, загрязнения не могут подняться вверх и быть рассеянными вдали от города.
- 7) Эта инверсия может произойти в любое время года, и данный смог является главным видом загрязнения воздуха.
- 8) Лос-Анджелес – это ведущий по концентрации смога город в Америке.
- 9) Некоторые из столичных зон – худшие для жизни, если вы хотите дышать свежим воздухом.
- 10) Использование методов снижения загрязнения поможет всем дышать немного легче.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) Different sources of pollution.
- 2) What does pollution consist of?
- 3) Pollution and health care.

6. Render the text

UNIT 19. WATER POLLUTION

Whenever we use personal-care products and household cleaning products – whether they be laundry detergent, window cleaner, shampoo, conditioner, toothpaste or mouthwash – we should realize that almost all of it goes down the drain when we do laundry, wash our hands, brush our teeth, bathe, or do any of the other things that use household water. Similarly, when we take medications, we eventually excrete the drugs in altered or unaltered form, sending the compounds into the waterways.

Studies have shown that up to 90% of your original prescription passes out of you unaltered. Animal farming operations that use growth hormones and antibiotics also send large quantities of these chemicals into our waters.

Unfortunately, most wastewater treatment facilities are not equipped to filter out personal care products, household products, and pharmaceuticals, and a large portion of the chemicals passes right into the local waterway.

Study of the effects of these chemicals getting into the water is just beginning, but examples of problems are now shown up regularly. Scientists are finding fragrance molecules inside fish tissues. Ingredients from birth control pills are thought to be causing gender-bending hormonal effects in frogs and fish. The chemical nonylphenol, a remnant of detergent, is known to disrupt fish reproduction and growth.

But the major source of water pollution is, certainly, sewage. In developing countries, an estimated 90% of wastewater is discharged directly into rivers and streams without treatment. Even in modern countries, untreated sewage, poorly treated sewage, or overflow from undercapacity sewage treatment facilities can send disease-bearing water into rivers and oceans. In the US, 850 billion gallons of raw sewage is sent into US rivers, lakes, and bays every year by leaking sewer systems and inadequate combined sewer / storm systems that overflow during heavy rains. Leaking septic tanks and other sources of sewage can cause groundwater and stream contamination.

Beaches also suffer the effects of water pollution from sewage. About 25% of the beaches in the US are put under water pollution advisories or are closed each year. It's clear that sewage is part of the problem, even in what is supposedly the most advanced country in the world.

Helpful words and word combinations

personal-care – относящийся к личной гигиене и сохранению здоровья

household – домашнее хозяйство; относящийся к заботе о доме

laundry – стирка, прачечная

detergent – моющее средство

shampoo – шампунь

conditioner – кондиционер

mouthwash – полоскание для рта

drain – дренажная система

eventually – в конечном итоге

excrete – выделять

drug – лекарство

alter – изменять

waterway – водный путь
original – изначальный
prescription – предписание (врача), лекарство по рецепту
farming – относящийся к фермерству
growth – рост
hormone – гормон
antibiotics – антибиотики
wastewater – сточная вода
treatment – обработка
facility – средство
equip – оборудовать
filter – фильтр; фильтровать
pharmaceuticals – фармакологические средства
fragrance – аромат
molecule – молекула
tissue – ткань (биологическая)
ingredient – ингредиент
birth – рождение
gender-bending – изменяющий половые признаки
frog – лягушка
nonylphenol – токсичный химикат, сохраняющийся в водной среде
remnant – остаток
disrupt – нарушать, разрушать, прерывать
sewage – канализация
discharge – выбрасывать
stream – поток
poorly treated – плохо обработанная
overflow – избыток, перелив
under-capacity – с недостаточной мощностью
disease-bearing – несущий в себе болезнь
gallon – галлон
leak – протекать
inadequate – несоответствующий
sewer / storm – сочетающий свойства канализационных и ливневых систем
septic – септик
tank – бак, контейнер
groundwater – подземные воды
beach – пляж
advisory – информационное сообщение, сводка, предупреждение об опасности

Exercises

1. Answer the following questions on the text.

- 1) What personal-care products and household cleaning products may be the cause of water pollution?
- 2) How much of the medicinal original prescription passes out into the sewage system?

- 3) How does animal farming contribute to the water pollution?
- 4) Why do all these dangerous chemicals go into water?
- 5) What alien molecules do scientists find in fish?
- 6) How do chemicals affect frogs?
- 7) What is the major source of water pollution?
- 8) How much of the untreated wastewater is discharged directly into rivers and streams in developing countries?
- 9) How much of raw sewage is sent into US rivers, lakes, and bays every year?
- 10) To what extent do American beaches suffer from the sewage discharges?

2. Match the parts of the sentences to each other.

- | | |
|---|---|
| <ol style="list-style-type: none"> 1) Whenever we use personal-care products and household cleaning products, almost all of it 2) Animal farming operations that use 3) Most wastewater treatment facilities 4) Scientists are finding 5) Untreated sewage 6) Beaches also suffer | <ol style="list-style-type: none"> a) can send disease-bearing water into rivers and oceans. b) goes down the drain. c) growth hormones and antibiotics also send these chemicals into our waters. d) the effects of water pollution from sewage. e) are not equipped to filter out personal care products. f) fragrance molecules inside fish tissues. |
|---|---|

3. Say if the following statements are false or true.

- 1) When we take medications, we eventually excrete the drugs in altered or unaltered form, sending the compounds into the airways.
- 2) Most wastewater treatment facilities are not equipped to filter out personal care products.
- 3) Ingredients from birth control pills are thought to be causing gender-bending hormonal effects in frogs and fish.
- 4) In developing countries, an estimated 25% of wastewater is discharged directly into rivers and streams without treatment.
- 5) Leaking septic tanks and other sources of sewage can cause groundwater and stream contamination.
- 6) About 90% of the beaches in the US are put under water pollution advisories or are closed each year.

4. Translate the following sentences into English.

- 1) Когда мы принимаем медицинские препараты, мы, в конечном итоге, выделяем лекарства в изменённой или неизменённой форме, отправляя этот состав в водные пути.
- 2) Исследования показали, что до 90% изначально прописанного вам выходит из вас неизменённым.
- 3) Большинство устройств по обработке сточных вод не оборудовано таким образом, чтобы отфильтровывать продукты ухода за телом, средства по уходу за домом, а также фармакологические средства.
- 4) Большая часть химических веществ идёт прямо в местные водные пути.

- 5) Химикат нонилфенол, остаточный элемент моющих средств, известен тем, что нарушает размножение и рост рыб.
- 6) Но главный источник загрязнения воды, это, конечно, канализация.
- 7) Около 80 миллиардов галлонов необработанных канализационных стоков ежегодно отправляется в американские реки, озёра и заливы.
- 8) Протекающие баки-септики и иные источники канализационных стоков могут вызвать загрязнение подземных вод и рек.
- 9) Пляжи страдают от результатов загрязнения воды канализационными стоками.
- 10) Ясно, что канализационные стоки есть часть проблемы даже в стране, которая, как считается, является самой передовой в мире.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) Chemicals used at home as the source of water pollution.
- 2) How does water pollution affect animal world?
- 3) Sewage and its effect on waterways.

6. Render the text

UNIT 20. EFFECTS OF RADIOACTIVE POLLUTION

The source of radioactive pollution is mostly manmade. Radioactive substances are those which have the ability to emit high energy particles, like alpha and beta particles and gamma rays. Radioactive substances are unstable in nature and are continuously emitting these particles in order to gain some stability. When we are talking about the effects of these emissions on the environment and living beings of the earth.

Radioactive pollution is rising because of the increase in radioactivity uses. It occurs mostly from the waste products that are left behind after the use of radioactive substances. These materials are disposed off without any precautionary measures to isolate the emissions, which then contaminate the air, soil and water. Large amount of radioactive waste is generated from nuclear reactors used in nuclear power plants and for many other purposes. It may occur during extraction and refining of the radioactive material. Nuclear accidents and nuclear explosions are two of the worst man-made sources of radioactive pollution.

Radioactive emissions from nuclear weapons are considered as the most harmful for the environment, as they stay in the atmosphere for as long as a hundred years. Thus, it affects several generations. Similarly, the radioactive substances from the land surface may flow down to the water and remain there for years to come. It causes harm to the aquatic animals. Thus, we can say that radioactive pollution has a destructive effect on the entire ecosystem.

When the soil gets contaminated by radioactive substances, it is transferred to the plants growing on it. It can lead to genetic mutation of the plants' DNA and affect its normal functioning. Some of the plants may die after such exposure while others may develop weak seeds. When any part of the contaminated plant, including the fruits is consumed by human beings, it causes serious health risks.

The effects of radioactive pollution on human beings often vary from mild to severe, and it largely depends on the level of exposure to the emissions. Among the particles emitted from these substances, the effect of alpha particles is the lowest and the gamma rays are the most dangerous. When the human body is exposed to radiation, then it reacts with its biological molecules, and ions are formed in the process. This leads to the formation of a large number of free radicals that destroy vital molecular components like proteins, enzymes, nucleic acids, etc. Low levels of exposure on a small portion of the body may just affect the cell membranes and cause mild skin irritation. Other immediate effects of short span exposure of nuclear radiation are nausea, vomiting, diarrhea, loss of hair and nails, bruises due to subcutaneous bleeding, etc.

Long term exposure has far more serious health effects. It has a serious threat to various systems of the body that include the cardiac system, neurological system and reproductive system. The radioactive rays can cause irreparable damage to the DNA molecules and lead to a life-threatening condition. It causes genetic mutations that promote the growth of cancerous cells in the body. The effects of genetic mutation tend to pass on to the future generations as well. In other words, if the parents are exposed to nuclear radiation, then their child could be born with genetic birth defects and retardation.

Most of these effects of radioactive pollution do not show up immediately, but have severe long term health consequences. Therefore, it is imperative that some measures be taken to minimize radioactive pollution.

Helpful words and word combinations

radioactive – радиоактивный
emit – выпускать, испускать
alpha – альфа
beta – бета
gamma – гамма
unstable – нестабильный
continuously – постоянно
stability – стабильность
dispose off – избавляться (от)
precautionary – предупредительные, предохранительные
measure – мера, средство
isolate – изолировать
generate – производить
nuclear – ядерный
reactor – реактор
extraction – добыча
refining – обогащение
explosion – взрыв
transfer – передавать, переводить
genetic – генетический
mutation – мутация
exposure – демонстрация, подвержение (какому-л. воздействию); выставление, оставление (на солнце, под дождём)
seed – семя
consume – потреблять
vary – быть разнообразным
radiation – радиация
free radicals – свободные радикалы
protein – белок
enzyme – фермент
nucleic – нуклеиновый
cell – клетка (биологическая)
membrane – мембрана
irritation – раздражение
immediate – непосредственный
span – промежуток
vomiting – рвота
diarrhea – понос
nail – ноготь
bruise – синяк, кровоподтёк
subcutaneous – подкожный
bleeding – кровотечение
cardiac – сердечный
neurological – неврологический

reproductive – репродуктивный

irreparable – невозможный

defect – дефект

retardation – замедление

minimize – минимизировать

DNA – ДНК, дезоксирибонуклеиновая кислота, один из двух типов нуклеиновых кислот, обеспечивающих хранение, передачу из поколения в поколение и реализацию генетической программы развития и функционирования живых организмов. Основная роль ДНК в клетках – долговременное хранение информации о структуре РНК (рибонуклеиновой кислоты) и белков.

Exercises

1. Answer the following questions on the text.

- 1) Who is responsible for the radioactive pollution on the earth?
- 2) What are radioactive substances characterized by?
- 3) Why is radioactive pollution rising?
- 4) What radioactive emissions are the most harmful and why?
- 5) What happens with the soil when it gets contaminated by radioactive substances?
- 6) What are the effects of radioactive pollution on human beings?
- 7) How does DNA react to excessive radiation?
- 8) What happens to children whose parents were exposed to excessive radiation?
- 9) How do effects of radioactive pollution show up?
- 10) What measures should be taken to minimize radioactive pollution?

2. Match the parts of the sentences to each other.

- | | |
|---|---|
| 1) Radioactive substances are those which have | a) the cardiac system, neurological system and reproductive system. |
| 2) Large amount of radioactive waste is generated from | b) human beings, it causes serious health risks. |
| 3) Radioactive pollution has | c) the ability to emit high energy particles. |
| 4) When any part of the contaminated plant, including the fruits is consumed by | d) nuclear reactors used in nuclear power plants and for many other purposes. |
| 5) When the human body is exposed to radiation, then it reacts with | e) a destructive effect on the entire ecosystem. |
| 6) It has a serious threat to various systems of the body that include | f) its biological molecules, and ions are formed in the process. |

3. Say if the following statements are false or true.

- 1) Radioactive pollution is rising because of the increase in radioactivity uses.
- 2) Radioactive pollution may occur during extraction and refining of any material.
- 3) Nuclear accidents and nuclear explosions are two of the worst man-made sources of radioactive pollution.
- 4) Some of the plants may die after such exposure while others may develop weak seeds.

- 5) The effects of genetic mutation never pass on to the future generations.
- 6) Most of these effects of radioactive pollution show up immediately, but have no health consequences.

4. Translate the following sentences into English.

- 1) Источник радиоактивного загрязнения, в основном, создан человеком.
- 2) Радиоактивное заражение происходит в основном от отходов, которые остаются после использования радиоактивных веществ.
- 3) От этих материалов избавляются без всяких мер предосторожности, позволяющих изолировать выбросы.
- 4) Большие объёмы радиоактивных отходов производятся ядерными реакторами, используемыми на атомных электростанциях и для многих других целей.
- 5) Радиоактивные вещества с поверхности суши могут стекать в воду и оставаться там и в будущие годы.
- 6) Это причиняет вред водным животным.
- 7) Когда почва загрязняется радиоактивными веществами, они передаются растениям, которые на ней растут.
- 8) Низкие уровни воздействия на небольшом участке тела могут просто оказать воздействие на клеточные мембраны и вызвать лёгкое раздражение кожи.
- 9) Радиационные лучи могут причинить невосполнимый вред молекулам ДНК и привести к созданию условий, угрожающих жизни.
- 10) Поэтому так важно, чтобы были приняты меры с целью минимизации радиоактивного загрязнения.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) Physical properties of radioactive substances and radioactive pollution.
- 2) Damages caused by radioactive pollution to plants and animals.
- 3) Why is radioactive pollution dangerous to man?

6. Render the text

UNIT 21. POLLUTION CONTROLS

Although people in general and economists in particular agree that we must control pollution of our environment, there is little agreement as to how this should be done.

The measures to control the pollution are divided into two groups. First, there exist different regulatory standards based on the idea of the “best available” technology for all sorts of pollution in every industry. But as each pollutant has many sources, national agencies that are supposed to ban pollution have to establish numerous maximum discharge standards for any of them.

Old sources of pollution (old factories, for example) can follow less strict standards than those devised for new sources, as it is considered more expensive to modernize an old factory than to introduce pollution control devices into a new one. Moreover, discharge standards for sources that already exist, as well for new sources, are more onerous in places with a higher-quality environment that is with cleaner air, cleaner water, etc.

The regulations of pollution may be established by the federal government. Usually they are very expensive. For example, direct expenditures for compliance with vehicle standards in the USA totaled an estimated \$14 billion in 1988, costs shouldered primarily by consumers.

The market-based approach to control pollution is less burdensome for taxpayers and the government. This approach is based on market incentives to reduce pollution, which fall into two groups: pollution fees and so called “marketable permits”.

The first are taxes on polluters that are set proportionally to the amount they discharge into air, water, or local landfill.

Marketable permits are discharge licenses. Polluters can buy and sell them to meet the control levels established by the governments. Marketable permits, actually, allow manufacturers to pollute the environment up to a certain level, and within the whole industry emitters may pollute over the control level as long as other polluters compensate by polluting less. The government decides on the desired level of pollution and the initial distribution of pollution rights within an industry, the latter then being redistributed among all the enterprises concerned.

Helpful words and word combinations

in general – в общем

in particular – в особенности

divide – делить, разделять

regulatory – регулирующие

standard – стандарт

agency – агентство

ban – запрещать

establish – устанавливать

numerous – многочисленные

strict – строгие

devise – разрабатывать

device – устройство

onerous – обременительный, затруднительный

federal – федеральный

expenditures – расходы

compliance – соответствие
shoulder – выносить на плечах
primarily – преимущественно, главным образом
market-based – основанный на рыночных механизмах
burdensome – обременительный
taxpayer – налогоплательщик
marketable – имеющий хождение на рынке
permit – разрешение
tax – налог
proportionally – пропорционально
license – лицензия
manufacturer – производитель
polluter – загрязнитель
compensate – компенсировать
initial – начальный
enterprise – предприятие

Exercises

1. Answer the following questions on the text.

- 1) What do people in general and economists in particular agree upon?
- 2) How many groups are the measures to control the pollution divided into?
- 3) Why do national agencies supposed to ban pollution have to establish numerous maximum discharge standards?
- 4) Why do old sources of pollution follow less strict discharge standards?
- 5) How does higher-quality environment affect the pollution discharge standards?
- 6) What institutions establish the regulations of pollution?
- 7) Why is the market-based approach to control pollution more preferable for taxpayers?
- 8) What are the market-based instruments to control pollution?
- 9) What are taxes on pollution?
- 10) How do “marketable permits work?”

2. Match the parts of the sentences to each other.

- | | |
|---|--|
| 1) Each pollutant has | a) discharge licenses. |
| 2) Old sources of pollution can follow | b) the federal government. |
| 3) The regulations of pollution may be established by | c) the amount they discharge into air, water, or local landfill. |
| 4) Taxes on polluters are set proportionally to | d) the desired level of pollution and the initial distribution of pollution rights within an industry. |
| 5) Marketable permits are | e) many sources. |
| 6) The government decides on | f) less strict standards. |

3. Say if the following statements are false or true.

- 1) As each pollutant has many sources, national agencies that are supposed to ban pollution have to establish numerous maximum discharge standards for any of them.

- 2) Discharge standards are more onerous in places with a low-quality environment.
- 3) Direct expenditures for compliance with vehicle standards in the USA totaled an estimated \$14 in 1988.
- 4) The market-based approach to control pollution is less burdensome for taxpayers and the government.
- 5) Marketable permits are discharge licenses.
- 6) The industry itself decides on the desired level of pollution and the initial distribution of pollution rights within an industry.

4. Translate the following sentences into English.

- 1) Меры по контролю за загрязнением окружающей среды подразделяются на две группы.
- 2) Существуют различные регулирующие стандарты, основанные на идее «наилучшим образом доступной» технологии для всех видов загрязнения окружающей среды во всех отраслях промышленности.
- 3) Старые источники загрязнения (старые фабрики, например) могут следовать менее строгим стандартам, чем те, что разработаны для новых источников.
- 4) Обычно они очень дорогие.
- 5) Этот подход основан на рыночной мотивации, направленной на сокращение уровней загрязнения.
- 6) Налоги на ответственных за загрязнение окружающей среды устанавливаются пропорционально объёмам, которые они выбрасывают в атмосферу, воздухе или на местную свалку.
- 7) Ответственные за загрязнение окружающей среды могут покупать и продавать находящиеся на рынке разрешения, чтобы удовлетворить контрольным уровням, устанавливаемым государствами.
- 8) Находящиеся на рынке разрешения фактически позволяют производителям загрязнять окружающую среду до определённого уровня.
- 9) В рамках целой отрасли ответственные за загрязнение окружающей среды могут делать это сверх установленного уровня до тех пор, пока прочие компенсируют это, выбрасывая меньше отходов.
- 10) Права на загрязнение в рамках одной отрасли перераспределяются между всеми заинтересованными предприятиями.

5. Working in pairs, make up micro-dialogues on the following topics.

- 1) Different types of measures aiming at reduction of pollution.
- 2) Taxes and pollution.
- 3) Marketable permits as the means to control the level of pollution.

6. Render the text

Texts for rendering into English

1. Нанотехнология

Совокупность методов и приемов, применяемых при изучении, проектировании, производстве и использовании структур, устройств и систем, включающих целенаправленный контроль и модификацию формы, размера, интеграции и взаимодействия составляющих их наномасштабных элементов (1 – 100 нм) для получения объектов с новыми химическими, физическими, биологическими свойствами. Нанотехнология все более проявляет себя как область исследований, критически важная для обеспечения серьезных научных прорывов, которые могут иметь огромное значение для развития биомедицины, робототехники, электроники, машиностроения, систем диагностики. Следует отметить, что в популярной прессе термин «нанотехнологии» иногда употребляется в отношении любых субмикронных процессов, включая литографию. Поэтому, говоря о реальной нанотехнологии, процессы которой осуществляются на молекулярном уровне, многие ученые начинают использовать термин «молекулярная нанотехнология».

2. Два Стиля Технологии

Наша современная технология основывается на древней традиции. Тридцать тысяч лет назад обтёсывание камня было высокой технологией. Наши предки брали камни, содержащие триллионы триллионов атомов, и удаляли слои, содержащие миллиарды триллионов атомов, чтобы сделать их наконечники для стрел. Они делали прекрасную работу с мастерством, трудновоспроизводимым сегодня. Также они делали рисунки на стенах пещер во Франции распылением краски, используя свои руки и трафареты. Позже они делали горшки обжиганием глины, потом - бронзу, обжигая породу. Они придавали бронзе форму, выковывая её. Они делали железо, потом сталь, и придавали им форму, нагревая, выковывая и снимая стружку.

Древний стиль технологии, который можно проследить от чипов кремня до кремниевых чипов, обращается с атомами и молекулами в больших совокупностях; назовём это балк-технологией (bulk - оптовый). Новая технология будет манипулировать индивидуальными атомами и молекулами, под контролем и прецизионно, - назовём такую технологию молекулярной. Она изменит наш мир в большем количестве областей, чем мы можем вообразить.

Микросхемы имеют части, измеряемые в микрометрах, то есть в миллионных долях метра, но молекулы измеряются в нанометрах (в тысячу раз меньше). Мы можем использовать термины "нанотехнология" и "молекулярная технология" взаимозаменяемо для описания нового вида технологии. Разработчики новой технологии будут строить и наносхемы, и наномашинны.

3. Молекулярная технология сегодня

Одно из определений машины по словарю - "любая система, обычно из твердых частей, сформированных и связанных так, чтобы изменять, передавать и направлять используемые силы определенным способом для достижения определенной цели, такой как выполнение полезной работы". Молекулярные машины подходят под это определение вполне хорошо.

Чтобы представить себе эти машины, нужно сначала дать наглядное представление о молекулах. Мы можем изобразить атомы как бусинки, а молекулы как группы бусинок, подобно детским бусам, соединённым кусочками нитки. На самом деле, химики иногда представляют молекулы наглядно, строя модели из пластмассовых бусинок (некоторые из которых связаны в нескольких направлениях чем-то, подобным спицам в наборе Tinkertoy). Атомы имеют круглую форму подобно бусинам, и хотя молекулярные связи - не кусочки нитки, наша картинка, как минимум, даёт важное представление о том, что связи могут быть порваны и восстановлены.

Вещи вокруг нас действуют как они действуют в зависимости от того, как ведут себя их молекулы. Воздух не держит ни форму, ни объем, потому что молекулы двигаются свободно, сталкиваясь и отскакивая рикошетом в открытом пространстве. Молекулы воды держатся вместе в процессе перемещения, поэтому вода сохраняет постоянный объём в процессе изменения своей формы. Медь сохраняет свою форму, потому что её атомы связаны друг с другом в определённую структуру; мы можем согнуть её или ковать её, потому что её атомы скользят друг относительно друга, оставаясь при этом связанными вместе. Стекло разбивается, когда мы ударяем по нему молотком, потому что его атомы отделяются друг от друга раньше, чем начинают скользить. Резина состоит из цепочек перекрученных молекул, подобно клубку веревок. Когда её растягивают и отпускают, её молекулы распрямляются и сворачиваются опять. Эти простые молекулярные схемы образуют пассивные вещества. Более сложные схемы образуют активные наномашинки живых клеток.

Биохимики уже работают с этими машинами, которые в основном состоят из белка - основного строительного материала живых клеток. Эти молекулярные машинки имеют относительно немного атомов, и они имеют бугорчатую поверхность, подобно объектам, сделанным склеиванием вместе горстки мраморных шариков. Также многие пары атомов связаны связями, которые могут сгибаться и вращаться, поэтому белковые машинки необычно гибки. Но подобно всем машинам, они имеют части различной формы и размеров, которые выполняют полезную работу. Все машинки используют группы атомов в качестве своих частей. Просто белковые машинки используют очень маленькие группы. Биохимики мечтают о проектировании и создании таких устройств, но есть трудности, которые ещё необходимо преодолеть. Инженеры используют лучи света, чтобы наносить схемы на кремниевые чипы, но химики вынуждены использовать намного более сложные методы, чем этот. Когда они комбинируют молекулы в различных последовательностях, у них есть ограниченный контроль над тем, как молекулы соединяются. Когда биохимикам нужны сложные молекулярные машинки, они по-прежнему должны заимствовать их из клеток. Однако продвинутое молекулярное машинное дело, в конечном счете, позволит им строить наносхемы или наномашинки так же просто и непосредственно, как сейчас инженеры строят микросхемы и моечные машинки. После этого прогресс станет впечатляюще стремительным.

Генные инженеры уже показывают путь. Обычно, когда химики делают молекулярные цепи, называемые "полимерами", - они сваливают молекулы в сосуд, где они в жидкости сталкиваются и связываются случайным образом. Появляющиеся в результате цепи имеют различные длины, а молекулы связываются без какого-либо определённого порядка.

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