МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
Відкритий міжнародний університет розвитку людини «Україна»

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PROFESSIONAL ENGLISH: EDUCATION AND ECOLOGY, BIO- AND NANOTECHNOLOGIES

ПРОФЕСІЙНА АНГЛІЙСЬКА: ОСВІТА ТА ЕКОЛОГІЯ, БІО- ТА НАНОТЕХНОЛОГІЇ

Посібник
для вивчення і використання англійської мови
для студентів інженерних та біомедичних спеціальностей

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This book sections are devoted to education, ecology, and biology, contain text, relevant lexical and grammatical exercises, texts for classroom reading according to the curriculum, and also terms list. Section devoted to nanotechnology composed of 9 authentic thematic texts accompanied by mini-dictionary and a number of exercises allowing students to expand their vocabulary, to speak out different models, and to enhance communication skills.

For students of engineering and biomedical fields. Students will be able to use the guide for self-study.

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Розділи, присвячені освіті, екології та біології, містять текстові матеріали, відповідні лексичні та граматичні вправи, тексти для аудиторного читання згідно з навчальною програмою, а також список термінів. Розділ, присвячений нанотехнологіям, складено з 9 автентичних тематичних текстів, споряджених міні – словником та низкою вправ, які дозволять студентам розширити свій словарний запас, відпрацювати різні розмовні моделі, активізувати комунікативні навички.

Для студентів інженерних та біомедичних спеціальностей. Студенти зможуть використовувати посібник для самостійного опрацювання.

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CONTENTS

ВСТУП

Інженерна освіта, екологія та нанотехнології – одні з найновіших та найперспективніших галузей теоретичної та прикладної науки, сучасного виробництва, які вже знайшли широке застосування в різних сферах наукових досліджень та виробництва. Створення сучасних, еколого безпечних об’єктів розмірами в декілька нанометрів і можливість управління ними та їхніми властивостями стали привабливими, корисними й незамінними в медицині, електроніці, космічних технологіях, матеріалознавстві тощо.

INTRODUCTION

Engineering education, ecology, and nanotechnologies are among the newest and most promising fields of theoretical and applied science, and also of advanced industry, being widely used in various fields of scientific research and industrial production. Creation of modern, ecologically safe objects sized of a few nanometers, and also the ability to control them and their properties, are were attractive, useful, and indispensable in medicine, electronics, space technology, materials science etc.

I EDUCATION AND ECOLOGY

UNIT 1.1

Exercise 1. *Learn the following words and word combinations:*

well-known scientist	-	відомий вчений
state figure	-	державний діяч
design bureau	-	конструкторське бюро
to take pride in smth	-	пишатися чимось
Graduate	-	випускник
corresponding member	-	член-кореспондент
to add to smth	-	збільшувати, примножувати
to make a significant contribution to smth	-	робити значний вклад
Recognition	-	визнання
the humanities	-	гуманітарні дисципліни
environmental protection	-	захист довкілля
extramural training	-	заочне навчання
post-graduate training	-	післядипломне навчання
pre-higher-school training	-	довузівська підготовка
assistant professor	-	доцент
training (educational) process	-	навчальний процес
state prize	-	державна премія
flight simulator	-	авіатренажер
on-board system	-	бортова система
hangar	-	ангар
hostel	-	гуртожиток
profound knowledge	-	глибокі знання
sports activities	-	зайняття спортом
hang-gliding	-	дельтапланеризм
to be in favour	-	користуватися успіхом

Exercise *2. Make a "map ” of your knowledge about The National Aviation University. Answer the questions: What do I know about: 1) the history of the University; 2) the number of students and teaching staff: 3) the institutes the University includes; 4) modern facilities the University has; 5) the institute I study in.*

Exercise *3. Read, translate the text and check your knowledge.*

The National Aviation University

The National Aviation University (NAU) is one of the largest aviation higher educational establishments in the world. Dozens of thousands of specialists working both in Ukraine and more than 100 other countries were trained there. Among them there are well-known scientists, industry leaders, state and military figures. They are at the head of airlines, factories and design bureaus, various organizations and services, without which neither aviation nor other sectors of economy can function successfully. At present the university provides training to 26 thousand students including foreign students from 40 countries of the world. Scientific and pedagogical schools established at the university make it possible to train not engineering specialists only, but economists, lawyers, environmentalists, translators, psychologists, sociologists as well.

The university dates back to August 1933, when the Aviation Faculty separated from Kyiv Polytechnical Institute and Kyiv institute of Civil Air Fleet emerged. During the years of its existence this educational institution has become a real cradle of aviation specialists, having trained thousands of aviation specialists for both Ukraine and other countries of the world. Many graduates continue working at their native university, adding to its glory. At present the university is led by N.Kulick, a doctor of engineering sciences, a professor.

Because of the national and international recognition of the university's achievements and its great contribution to the development of national higher education and science, the university was awarded the status of National Higher Educational Institution by the Decree of the President of Ukraine L.Kuchma in September 2000.

The university contains fourteen institutes. They are: the Aerospace Institute, the Institute of the Humanities, the Institute of Electronics and Control Systems, the Institute of Computer Technologies, the Institute of Information-Diagnostic Systems, the Institute of Air and Space Law, the Institute of Management and Economics, Land Use and Information Technologies Institute and the Institute of Ecological Safety etc.

The other six institutes are: the ICAO institute, the Institute of New Technologies, Kyiv Institute of Management and Information Technologies, the Institute of Extramural and Distant Training, the Institute of Post-Graduate Training, and the Institute of Pre-Higher School Training. There are two faculties that do not belong to any institute. They are: the Foreign Students Faculty and the Faculty of Military Training.

Teaching at the university is performed by a highly skilled scientific and pedagogical team including 9 academicians, 12 corresponding members of the National Academy of Sciences of Ukraine, 32 academicians of academies of special sciences, 185 doctors of science, professors, about 600 candidates of science and assistant professors. Leading experts of airlines and industrial enterprises are involved in the training process. The teaching staff includes 18 winners of state prizes, 17 merited workers of science and engineering of Ukraine.

45 planes and helicopters, 42 aviation engines, 3 complex flight simulators, 240 on-board systems, modeling stands and about 1600 modem computers are used in the training process. The scientific and technical library has about 2.5 million books. The university has a training aerodrome, unique hangar, radio equipment, aerodynamic and training complexes.

The life of our students is very interesting. Profound knowledge obtained during lectures and practical training gives them an opportunity to participate in scientific conferences and competitions where they show excellent results. Many students receive rector's grants and other prizes as awards for their achievements in studies and active participation in the social life of the university.

The university sports centre provides excellent opportunities for sports activities. All the teams of

our university in various kinds of sports participate actively in city and national competitions and have been many time winners. A yachting, an aircraft modelling, and a hang-gliding clubs are in great favour with the university staff and students.

The motto of the National Aviation University that to considerable extent reflects its life and activities is: VIVERE! V1NCERE! CREARE! - LIVE! WIN! CREATE!

Exercise 4. *Answer the following questions.*

1. When was the university founded?
2. What kind of specialists has it been training since its foundation?
3. Who is the present rector?
4. When and why was the university awarded the status of National Higher Educational Institution?
5. How many and what institutes train specialists at present?
6. What other educational institutions are incorporated in the university?
7. How many students study at the university now?
8. What is the university teaching staff known for?
9. What facilities are used in the training process at the university?
10. What is in great favour with the university staff and students?

Exercise 5. *State whether the following sentences are true or false. ('orrect the false ones.*

1. Scientific and pedagogical schools established at the university make it possible to train not only engineering specialists, but agronomists, doctors, actors, TV and radio anchormen. 2. The university dates back to April 1933, when the Aviation Faculty separated from Kyiv Higher Military School of Aviation Engineers. 3. The university was awarded the status of National Higher Educational Institution by the Decree of the Cabinet of Ministers of Ukraine in September 2002. 4. The scientific and technical library has about 2.5 million books. 5. Originally the university was called Kyiv Institute of Civil Air Fleet.

Exercise 6. *Make up sentences putting the words in the correct order.*

1. was/ in/ 1933/ the University/ August/ founded
2. companies/ they/ design bureaus/ educational institutions/ and/ aircraft/ organizations/ head/ factories
3. the University/ pride/ its/ graduates/ in/ takes
4. scientific and pedagogical/ teaching/carried out/a highly skilled/ is/ by/ team
5. receive/ in studies/ their outstanding achievements/ many students/ н і lot 's grants/ for/ as awards/ other prizes/and

Exercise 7. *Translate into English.*

1. Десятки тисяч спеціалістів, які працюють в Україні і понад 100 зарубіжних країн, пройшли підготовку в Національному Авіаційному Університеті. 2. Серед них є відомі вчені, керівники промисловості, державні та військові діячі. 3. Багато випускників НАУ продовжують працювати у рідному університеті, примножуючи його славу. 4. До навчального процесу в університеті залучаються провідні фахійвці авіакомпаній та промислових підприємств. 5. Професорсько-викладацький склад налічує 18 лауреатів державних премій та 17 заслужених працівників науки і техніки України. 6. Університет надає всім бажаючим (provides all those willing) можливість підготуватися до вступу в Інститут довузівської підготовки.

Exercise 8. *Make up as many questions to the following sentences as possible.*

1. Now graduates of the National Aviation University head airlines, factories, design bureaus, and educational institutions. 2. Leading experts of airlines and industrial enterprises are involved in the training process. 3. The university's sports centre provides excellent opportunities for sports activities. 4. All the teams of our university in various kinds of sports participate actively in city and national competitions.

Exercise 9. *Read information about the institute you've chosen and advertise it for those willing to enter the institute.*

Exercise 10. *Read information about the institute you've chosen and advertise it for those willing to enter the institute.*

The Institute of Ecological Safety

The Institute of Ecological Safety was formed on the bases of the Faculty of Ecological Safety during its reorganization in 2010. Soon it became one of the leading institutes of the university providing training for more than 1100 students. The institute laboratories are equipped with hi-fi technologies providing great possibilities for scientific research.

The Institute of Ecological Safety contains six main departments. The team of teachers includes about 50 professors, doctors of science and 90 candidates of science. The Institute is led by O.I. Zaporozhets, a doctor of engineering sciences, a professor. Students are pursuing their degrees in 7 majors.

Students study four fields. The first of them is Chemical technology and engineering (majors: Chemical technology of fuels and carbon materials; Chemical technology of polymers). Oil and its products are very important as the main resources for energetic safety of any society, both today and in the future. Chemistry is the basic science; it has close ties with many different branches of industry. The producing of every material good is not possible without knowing chemical processes. Discovering new methods for producing polymers and on their base the creating of new polymer materials and compositional polymer materials together with precise working out their technology is one of the goals of modem chemical engineering. So, graduating in this field, students become real specialists in all this urgent problems and solve them with great and significant results.

The second field is Biotechnology (majors: ecological biotechnology; biotechnology of biologically active substances). Modem biotechnology helps a lot in providing the humanity with food, medicines, and the means for fighting the harmful consequences of transformation of environment.

The third one is Ecology (major: ecology, environment protection and management). Active human activity has become a reason for transformation of environment. Today the changes in nature have gained the status of those threatening the future existence of the man kind and are assisted by many ecological crises. The experts of this field have enough knowledge to solve these problems.

The fourth field is Geodesy and Land-use system (majors: organization of land exploitation and cadastre, geoinformational systems and technologies). The students are concerned with the physical, chemical, and biological processes that govern natural and agricultural ecosystems. Graduates qualify for effective soil and land management.

Exercise 11. *Fill in the gaps with the following words and word combinations.*

(takes pride, head, design, exchange, !Polit!, graduates, fuel and lubricant materials, August 1933, leaders, state, construction, Institute, well- known, institutions, designer, V.Chelomey, interesting)

The University dates back to _____. It has trained thousands of _____who work in Ukraine and other countries of the world. Among them are _____ scientists, industry

_____, military and _____ figures. They _____ aircraft companies, _____ bureaus, educational _____ and organizations. The University _____in its graduates who include the well-known scientist and _____ of space-rocket system, _____ . Students _____ between NAU and universities in Germany and China is increasing. The life of the students is _____. The University has its own KVN team, dance ensemble _____, students' amateur theatre. The of Ecological Safety includes the following specialties: _____, design, ecology, technology and technological equipment of airports, and_____.

Exercise 12. *Translate into English paying special attention to the italicized words.*

1. Вони пишаються своїми досягненнями. 2. Коли було засновано цей університет? 3. Для розв'язання цієї задачі було залучено багато спеціалістів. 4. Цю роботу виконує наша фірма. 5. Борис Патон, так само, як і його батько Євген Патон, є відомими українськими вченими. 6. Це збільшує наші шанси. 7. Останнім часом комп'ютерні ігри набули великої популярності не лише серед дітей, а й дорослих. 8. Українські пілоти навчаються на сучасних літаках і вертольотах. 9. Студенти нашого університету отримують гарні знання англійської мови.

UNIT 1.2
HIGHER EDUCATION IN THE UK AND US

Exercise 1. *Read, translate the text and make a comparative table of higher education in the UK and Ukraine.*

Higher Education in the UK

The British Government is committed to improving education and training for 16- to 19-year-olds and considers that a high level of cooperation between the education system and business is necessary to maintain Britain's position as a leading industrial and trading nation. Rapid technological change and intense international cooperation mean that education must be closely matched to the needs of the economy. More emphasis is being given to science, engineering, technology and vocational courses.

Higher education in England has several branches: colleges of education that mostly prepare students to be teachers, polytechnics that usually prepare students for some kind of career and universities. Virtually all higher education is selective, usually depending on how well a student does in GCE, "A" level (the General Certificate of Education, "Advanced" level). However, good exam results alone are not enough. Universities choose their students after interviews. For all British citizens a place at a university brings with it a grant from their local education authority.

The academic year in Britain's universities. Polytechnics, Colleges of Education is divided into three terms, which usually run from the beginning of October to the middle of December, from the middle of January to the end of March, and from the middle of April to the end of June or the beginning of July.

After three years of study a university graduate will leave with the Degree of Bachelor of Arts, Science, Engineering, Medicine etc. Later he may continue to take a Master's Degree and then a Doctor's Degree. Research is an important feature of university work. The Polytechnics like the universities offer first and higher degrees. Colleges of Education provide two-year courses in teacher education or sometimes three years if the graduate specializes in some particular subject.

There are 46 universities in Britain. The oldest and best-known universities are located in Oxford, Cambridge, London, Leeds, Manchester, Liverpool, Edinburgh, Southampton, Cardiff, Bristol,

Birmingham. English universities greatly differ from each other. They differ in dates of foundation, size, history, traditions, general organization, methods of instruction, and students' way of life.

Some school leavers choose to go to a further education college where they can follow a course in typing, engineering, town planning, cooking or hairdressing, full-time or part-time. Further education colleges have strong ties with commerce and industry. There is an interesting form of studies, which is called the Open University. It is intended for people who study in their own free time and who attend "lectures" by watching television and listening to the radio. They keep in touch by phone or letter with their tutors and attend summer schools.

Exercise 2. Give Ukrainian equivalents:

be committed to; maintain position; give emphasis to; commercial application; do well in; take a Master's Degree; offer first and higher degrees; provide two-year courses in; specialize in some particular subject; go to a further education college; follow a course in typing or engineering full-time or part-time; attend "lectures" by watching television; keep in touch by phone.

Exercise 3. Answer the following questions to the text.

1. Why is the British Government committed to improving education?
2. What branches does higher education in England have HAS?
3. What careers are students trained for?
4. What is implied by "higher education in Britain is selective"?
5. What is the academic year in Britain's universities like?
6. What degree will a university graduate leave with after three years of study?
7. What is the duration of the teacher-training course provided at Colleges of Education?
8. What is the Open University known for?

Exercise 4. Comment upon the statements.

1. No man is bom wise or learned. 2. If a thing is worth doing at all it is worth doing well. 3. Some read to think - these are rare; some to unite - these are common; and some to talk, - and these form the great majority. 4. Science is organized knowledge. 5. By doing nothing we leam to do ill.

Exercise 5. Read the text and put *7* special questions to the text.

The Universities of Oxford and Cambridge

The oldest universities of Oxford and Cambridge were founded in the two towns towards the end of the twelfth century. The story of the University in Cambridge begins in 1209 when several hundred students and scholars arrived in the little town of Cambridge. These students were all churchmen and had been studying in Oxford, at the city of well-known schools.

There were many quarrels with the townsfolk, for the University wanted to be independent of the Town. Side by side with the fight for freedom from Town rule and another for liberty from Church rule the University became its own master at last in 1500. Now at Oxford and Cambridge the colleges are self-governing institutions.

In those early days student life was very different from what it is now. Students were of all ages and came from everywhere. The students were armed; some robbed the people of the countryside.

Students were forbidden to play games, to sing (except religious hymns), to hunt or fish, or even to dance. All the lessons were in the Latin language which students had to speak even among themselves.

Many great men studied at Cambridge and Oxford, among them Bacon the philosopher, Milton the poet, Newton the scientist, and John Galsworthy the writer.

The universities have their own traditions, which they preserve carefully. A student must wear a

cap and gown - it is a custom from the time when students were clergymen. If a student disobeys this regulation he must pay a fine. Students correctly dressed have their meals in the College diningroom and mustn't be late for dinner. Sporting activities are very numerous and popular there.

Exercise 6. *Read and translate the text.*

Higher Education in the United States

The United States leads all industrial nations in the proportion of young men and women who receive higher education. Americans place a high value on higher education. This attitude goes back to the country's oldest political traditions. People in the United States have always believed that education is necessary for maintaining a democratic government. Besides, for 'ionic careers - law, medicine, education, and engineering - a college * donation is a necessary first step.

The system of higher education in the United States is complex. It ' omprises four categories of institutions: (1) the university which may contain i'-vcral colleges for undergraduate students seeking a bachelor's (four-year) degree and one or more graduate schools for those seeking a master's or a doctoral degree; (2) the four-year undergraduate institution - the college - most of which are not part of a university; (3) the technical training institution providing courses from six months to four years in duration and training students in a variety of skills, from hair styling through business accounting to computer programming; (4) and the two-year or community college from which students may enter many professions or may transfer to four-year colleges or universities.

Depending on the source of its funding any of these institutions may be either public or private, there being no clear distinction in terms of quality of education offered. However this is not to say that all institutions enjoy equal prestige or that there are no material differences among them. Both public and private colleges depend on three sources of income: student tuitions, endowments (gifts made by wealthy benefactors) and government funding. Some endowments are very large: Harvard, Princeton, Yale Universities have more than a thousand million dollars each. Public institutions receive a larger portion of public-tax money than do private schools.

In an American university, each college and graduate school has its own curriculum. At the undergraduate level there may be some courses that a student has to take (e.g. classes in world history, math, writing or research). But students do select their "major" (the field in which they want their degree), plus a number of "electives"(courses that are not required but that students may choose). Typically, an undergraduate student has to earn a certain number of "credits" (about 120) in order to receive a degree at the end of four years of college. Credits are earned by attending lectures (or lab classes) and by successfully completing assignments and examinations.

Exercise 7. Match the entries of the left-hand column with their Ukrainian equivalents in the right-hand column:

place a high value	можливості для досліджень
seek a degree	доступ до компютера
transfer to a university	державні установи
source of funding	високо цінувати
clear distinction	перевестись до університету
student tuition	здобувати ступінь
endowment	джерело фінансування
benefactor	приватні навчальні заклади
public institutions	прийняття внесення до списку
private institutions	вклад, пожертва
access to a computer	чітка відмінність
complete assignments	
enrollment	
research facilities	

плата за навчання
виконувати завдання
доброчинець, благодійник

Exercise 8. *Distribute the following words according to the part of speech into separate groups; define their suffixes where possible; translate them.*

Those, engineering, among, its, wealthy, and, contain, typically, from, oldest, this, benefactor, of, thousand, may, variety, enrollment, for, access, million, transfer, endowment, in, enjoy, equal, industrial, no, four, about, public, duration, source, be, institution, higher, successfully.

Exercise 9. *Comment on:*

a) why Americans place a high value on higher education;
b) why they try to learn in advance about entrance requirements and l he degrees offered;
c) what the system of obligatory, major and elective courses means;
d) why they are interested if a college or a university is a public institution or a private one;
e) why students seek the most respected universities.

Exercise 10. *Give a heading to each paragraph of the text Ex. 6.*

Exercise 11. *Read the text and compare high education in UK and t IS. Put down the results into two columns.*

Higher Education in US

There is no national system of higher education in the United States. Instead, there are over 2,100 separate institutions ranging from two-year 'junior" colleges to complex universities and from technical institutes to t Inssical liberal arts colleges. These institutions maybe small or large, rural m urban, private or public, religious or secular, highly selective or open to ill Basically, however, American higher education developed its own pattern I'V I lie adaptation of two traditions: the collegiate tradition of England and the university tradition of the Continent Colleges.

The college course of study, at first three years in length, was soon extended to four years, and the classes are uniformly known as the freshman, the sophomore, the junior and the senior.

The degrees of Bachelor of Science (B.S.), Bachelor of Philosophy (Ph.B.), and Bachelor of Letters (B.L.) are often conferred by colleges upon students who have pursued systematic courses of study which do not include Greek or the amount of Latin, required for the degree of Bachelor of Arts.

The methods of instruction in the universities are the lecture, discussion and work in laboratory or seminary - the latter transplanted from the German universities. The degree of Master of Arts is conferred upon students who, after one year of university residence and study, pass certain prescribed examinations.

The academic year is usually of nine months duration, or two semesters of four and a half months each. Classes usually begin in September and end in June. Of course, there are many variations on this, with summer sessions offered in almost all major institutions.

During one term or semester, a student will study, concurrently, four or five different subjects. The students' progress is often evaluated through quizzes (short oral or written tests), term papers, and a final examination in each course. Each part of a student's work in a course is given a mark which helps to determine his final grade. A student's record consists of his grade in each course. This system is unlike that of most European countries.

College grades, determined by each instructor on the basis of class work and examinations, are

usually on a five point scale, with letters to indicate the levels of achievement. "A" is the highest mark, indicating superior accomplishment, and the letters go through B, C, D, to E or F, which denotes failure.

UNIT 1.3
ECOLOGY AND ECOSYSTEMS

Exercise 1. *Translate the words and find their synonyms and antonyms if possible.*

Coin (v), living thing, external conditions, affect (v), interaction, examine (v), sustain (v), virtually, film, type, producer, consumer, decomposer, provide (v), require (v).

Exercise 2. *Read and translate the text, find the words from Ex.l and define their meaning.*

Ecology and Ecosystems

Ecology is the science that tries to answer such questions about how nature works. In 1869 German biologist Ernst Haeckel coined the term *ecology* from two Greek words: *oikos,* meaning "house" or "place to live", and *logos,* meaning "study of.

Ecology is the study of living things in their home or environment: all the external conditions and factors, living and nonliving that affect an organism. In other words, ecology is the study of interaction between organisms and their living and nonliving environment. Scientists usually cany out this study by examining different ecosystems: forests, deserts, grasslands, ponds, lakes, oceans or any organisms interacting with one another and with their nonliving environment.

The Earth has several major parts that play a role in sustaining life. We are part of what ecologists call the biosphere - the living and dead organisms found near the earth's surface. Virtually all life on earth exists in a thin film of air, water and rock in a zone extending from about 61 meters below the ocean surface to 6,000 meters above sea level.

The living organisms that make up the biosphere interact with one another, with energy from the sun, and with various chemicals in the atmosphere, hydrosphere and lithosphere. This collection of organisms interacting with one another and their nonliving environment is called the ccosphere. The goal of ecology is to learn how the ecosphere works.

Ecosystems consist of various nonliving and living components. The nonliving or *abiotic* components include various physical and chemical factors. Among physical factors affecting ecosystems are sunlight and shade, temperature, precipitation, wind, soil, fire, etc. Major chemical factors include: level of water and air in soil, level of nutrients, level of toxic substances, sanity of water and some others.

The major types of organisms that make up the living or *biotic* components are usually classified as producers, consumers and decomposers. This classification is based on organism's general nutritional habits. Green plants are producers as they make the organic nutrients through photosynthesis. Only producers can make their own food. They provide food directly or indirectly for animals and decomposers. We get nutrients either by rating plants or by eating animals that feed on plants.

Organisms that get the nutrients and energy they require by feeding . illicr directly or indirectly on producers are called consumers or heterotrophs (other-feeders).

Some consumers feed on living plants and animals; the others feed on small fragments of dead plants and animals matter, called detritus. Detritus consumers, called decomposers, digest dead tissue or wastes and absorb their soluble nutrients. Decomposers consist of two classes: called bacteria and fungi. Bacteria and fungi decomposers in turn are an important source of food for organisms such as worms and insects living in the soil and water.

There is no waste in functioning biological communities; the wastes of one form of life are food

or nutrients for other forms of life. This is how no-waste-in-nature principle works.

Exercise 3. *Study the definitions of the following words:*

Ecology - study of the interaction of living organisms with each other and with their environment; study of the structure and functions of nature.

Ecosystem - community of organisms interacting with one another and with chemical and physical factors making up their environment.

Nutrient - element or compound needed for the survival, growth and reproduction of a plant or an animal.

Organism - any form of life.

Photosynthesis - complex process that takes place in cells of green plants. Radiant energy from the sun is used to combine carbon dioxide ($C0_2$) and water (H_20) to produce oxygen (0_2) and simple nutrient, such as glucose ($C_6H,_20_6$).

Exercise 4. *Write out the international words and give their meanings.*

When you are reading, you will come across unfamiliar words. It is often possible to guess the meaning of these words if you understand the way words in English are generally formed. An English word can be divided into three parts: a prefix, a stem and a suffix. ”Pre-“ means “before”; a prefix, therefore, is what comes before the stem. A suffix is what is attached to the end of the stem.

Prefixes usually change the meaning of the word; for example, UN- changes a word to the negative. Suffixes, on the other hand, change the word from one part of speech to another. For example, -ly added to the adjective “quick” gives the adverb “quickly”. Let us now consider some suffixes and their usual meanings.

Exercise 5. *Study these tables and try to find additional examples.Use your dictionary if necessary.*

SUFFIX MEANING EXAMPLES

Noun-forming suffixes

-ance	State	substance, performance
-ence	quality of	existence, consequence
-er, -or	a person who a thing which	originator, polluter producer, consumer
-(a)tion	the act of	pollution, contamination
-ist (-yst)	a person who	ecologist, analyst
-ness	condition of	cleanliness
-ion	action / state	conversion
-ing	Activity	damaging
-ment	state / action	environment, development
-ity	state / quality	activity, community
-ian	pertaining to	academician
-ism	condition / state	magnetism, organism

-dom	domain / condition	freedom
-ship	condition /state	relationship, friendship
-ary	condition /state	binary

Verb-forming suffixes

- **ize (- ise)**	to make	organize, characterize
- **ate**		formulate, automate
- **fy**		simplify, purify
- **en**		harden, widen

Adverb-forming suffixes

- **ly**	in the manner	environmentally, definitely,

Adjective-forming suffixes

- **al**	have the quality of	logical, environmental
- **ar**		circular
- **ic**		dynamic, organic
- **ical**		ecological, chemical
- **able**	capable of being	comparable, capable
- **ible**		divisible
- **ous**	like, full of	dangerous, poisonous
- **ious**		religious
- **ful**	characterized by	helpful, useful
- **less**	Without	helpless, careless, useless
- **ish**	Like	yellowish
- **ed**	having quality of	called
- **ive**	to make or do	interactive
- **ing**		poisoning, living

Exercise 6. *Write out from the text all the words with prefixes and suffixes? define their pert of speech and give their meaning.*

Exercise 7. *Give derivatives of these words:*

to exist	to pollute	to occupy
to include	to form	to exploit
to act	to create	Nature
to exploit	to define	Chemical
to develop	to relate	Energy

Exercise 8. *Read, translate and memorize the following adverbs.* Relatively, sufficiently, severely, conversely, satisfactorily, similarly, extremely, largely, increasingly, finally, probably,

directly, seriously, hitherto.

Exercise 9. *Give the Infinitive of the following verbs.*

Told, gave, known, made, led, came, thought, taken, called, climbed, put, written, included, defined, saw.

Exercise 10. *Before reading the text memorize words and word combinations.*

before the coming of life	-	до появи життя
to derive energy	-	одержувати (діставати) енергію
a bleak place	-	гола місцевість
hostile and barren	-	ворожий та неродючий
the first evidence of life	-	перші прояви життя
outer layer	-	зовнішній шар
energy diverting skin	-	оболонка яка відхиляє енергію
continuous cycling of matter	-	безперервний кругообіг речовин
self-reproducing	-	самовідтворювання
a few kinds	-	декілька різновидів
continued existence	-	тривале існування
Vegetational	-	рослинний
cellular in nature	-	клітинний по природі
enclosing membrane structure	-	відгороджена мембранна структура
remains	-	рештки
single-celled organism	-	одноклітинний організм
in association with	-	у зв’язку із
for convenience	-	задля зручності
beyond this level	-	за цим рівнем (понад)
stated another way	-	інакше кажучи
to grade	-	сортувати, розміщувати за рангом
fungus (pl. fungi)	-	грибок
to acquire	-	набувати, одержувати
blob	-	крапля, кулька
to teem (with)	-	кишіти, бути багатим (на щось)

Exercise 11. *Read and translate the text.*

Global Ecosystem

The biosphere is a global ecosystem composed of living organisms (biota) and the abiotic (non-living) factors from which they derive energy and nutrients. Before the coming of life, the Earth was a bleak place, a rocky globe with shallow seas and a thin band of gases - largely carbon dioxide, carbon monoxide, molecular nitrogen, and water vapour. It was a hostile and barren planet. This strictly inorganic state of the Earth is called the geosphere; it consists of the lithosphere (the rock and soil), the hydrosphere (the water), ;ind the atmosphere (the air). Energy from the Sun relentlessly bombarded the surface of the primitive Earth, and in time - millions of years - chemical and physical actions produced the first evidence of life: formless, jellylike blobs that could collect energy from the environment and produce more of their own kind. This generation of life in the thin outer layer of the geosphere established what is called the biosphere, the "zone of life," an energy- diverting skin that uses the matter of the Earth to make living substance.

The biosphere is a system characterized by the continuous cycling of matter and an

accompanying flow of solar energy in which certain large molecules and cells are self-reproducing. Water is a major predisposing factor, for all life depends on it. The elements carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur, when combined as proteins, lipids, carbohydrates, and nucleic acids, provide the building blocks, the fuel, and the direction for the creation of life. Energy flow is required to maintain the structure of organisms by the formation and splitting of phosphate bonds.

< Organisms are cellular in nature and always contain some sort of enclosing membrane structure, and all have nucleic acids that store and transmit genetic m formation. All life on Earth depends ultimately upon green plants, as well as upon water. Plants utilize sunlight in a process called photosynthesis to I induce the food upon which animals feed and to provide, as a by-product, ",\ygcn, which most animals require for respiration.

At first, the oceans and the lands were teeming with large numbers of a few kinds of simple single-celled organisms, but slowly plants and animals of increasing complexity evolved. Interrelationships developed so that certain plants grew in association with certain other plants, and animals associated with the plants and with one another to form communities of organisms, including those of forests, grasslands, deserts, dunes, bogs, rivers, and lakes. Living communities and their nonliving environment are inseparably interrelated and constantly interact upon each other. For convenience, any segment of the landscape that includes the biotic and abiotic components is called an ecosystem. A lake is an ecosystem when it is considered in totality as not just water but also nutrients, climate, and all of the life contained within it. A given forest, meadow, or river is likewise an ecosystem.

One ecosystem grades into another along zones termed ecotones, where a mixture of plant and animal species from the two ecosystems occurs. A forest considered as an ecosystem is not simply a stand of trees but is a complex of soil, air, and water, of climate and minerals, of bacteria, viruses, fungi, grasses, herbs, and trees, of insects, reptiles, amphibians, birds, and mammals. Stated another way, the abiotic, or nonliving, portion of each ecosystem in the biosphere includes the flow of energy, nutrients, water, and gases and the concentrations of organic and inorganic substances in the environment. The biotic, or living, portion includes three general categories of organisms based on their methods of acquiring energy: the primary producers, largely green plants; the consumers, which include all the animals; and the decomposers, which include the microorganisms that break down the remains of plants and animals into simpler components for recycling in the biosphere.

Aquatic ecosystems are those involving marine environments and freshwater environments on the land. Terrestrial ecosystems are those based on major vegetational types, such as forest, grassland, desert, and tundra. Particular kinds of animals are associated with each such plant province. Ecosystems may be further subdivided into smaller biotic units called communities. Examples of communities include the organisms in a stand of pine trees, on a coral reef, and in a cave, a valley, a lake, or a stream. The major consideration in the community is the living component, the organisms; the abiotic factors of the environment are excluded. A community is a collection of species populations. In a stand of pines, there may be many species of insects, of birds, of mammals, each a separate breeding unit but each dependent on the others for its continued existence. A species, furthermore, is composed of individuals, single functioning units identifiable as organisms. Beyond this level, the units of the biosphere are those of the organism: organ systems composed of organs, organs of tissues, tissues of cells, cells of molecules, and molecules of atomic elements and energy. The progression, therefore, proceeding upward from atoms and energy, is toward fewer units, larger and more complex in pattern, at each successive level.

Exercise 12. *Write out verb forms except the verb to be and define their tense and voice forms, give the Infinitive.*

Example: was given — Past Simple, Passive Voice - to be given.

Exercise 13. *The following Participles I and II are used in the function of an attribute. Translate them and find in the text the sentences where they are used.*

Characterized, accompanying, predisposing, increasing, involving, composed, associated, called, given, termed, based on, contained, considered.

Exercise 14. *Find in the text the sentences where the following predicates are used, point out the Tense and Voice, translate the sentences:*

... is called, consists of, bombarded, established, are excluded, uses, provide, is required, were teeming, are interrelated, is considered, is composed, are associated, may be subdivided.

Exercise 15. *Give Ukrainian equivalents to the following expressions. Find them in the text and compose your own sentences with these expressions.*

Abiotic factors, water vapour, the surface of the primitive Earth, in lime, of their own kind, solar energy, to transmit genetic information, respiration, interrelationship, living communities, primary producers, consumers, to break down, to be subdivided, the major consideration.

Exercise 16. *Give Ukrainian equivalents to these adverbs. Find in the test above sentences where they are used.*

Largely, strictly, relentlessly, ultimately, slowly, inseparably, constantly, simply.

Exercise 17. *Define the tense of the predicate and make the following sentences interrogative and negative.*

1. Ecosystems may be further subdivided into smaller biotic units culled communities. 2. The living portion includes three general categories of organisms based on their methods of acquiring energy. 3. At first, the oceans iiiul die lands were teeming with large numbers of a few kinds of simple ingle-celled organisms. 4. The Earth was a bleak place before the coming of life. 5. This strictly inorganic state of the Earth is called the geosphere. 6. The geosphere consists of the lithosphere, the hydrosphere, and the atmosphere. 7. Energy from the Sun bombarded the surface of the primitive Earth. 8. The generation of life in the thin outer layer of the geosphere established the biosphere.

Exercise 18. *Put all types of questions to the following sentences:*

1. This article focuses on the makeup of the biosphere. 2. The characteristics and dynamics of biological populations are dealt with in this article. 3. Due attention was also given to the processes that produced such patterns. 4. Other points included the cyclic flow of materials needed for life. 5. Ecology deals with the interrelations of organisms with their environment and each other. 6. Further treatment of the various aquatic environments is provided in ocean, lake and river.

Exercise 19. *Answer the following questions.*

1. What is the biosphere composed of?
2. What did bombard the surface of the primitive Earth?
3. What is the biosphere characterized by?
4. What do organisms always contain?
5. How do plants utilize sunlight?
6. What were the oceans and the lands teeming with?
7. How are living communities and their nonliving environment interrelated?
8. How do living communities and their nonliving environment interact?
9. What is a forest considered as an ecosystem?

10. What does the abiotic portion of each ecosystem include?
11. What does the biotic portion of each ecosystem include?
12. How may ecosystems be subdivided?
13. What is a community?
14. What is the progression toward at each successive level?
15. What are terrestrial ecosystems based on?
16. What are the primary producers?
17. What are the consumers?

Exercise 20. *Give definitions of:*

The lithosphere		animals
The hydrosphere		by-product
The atmosphere	is	the air.
A community		a process,
Photosynthesis		microorganisms,
Oxygen	are	the rock and soil,
Abiotic		the water,
Primary producers		a collection,
Decomposers		nonliving,
Consumers		green plants.

Exercise 21. *Do the following tasks first in writing then orally.*

1. Describe the primitive Earth. 2. Characterize the biosphere. 3. Describe the evolution of simple organisms. 4. Prove that lake is ecosystem. 5. Prove that forest is ecosystem. 6. Say what the abiotic portion of ecosystem includes. 7. Say what the biotic portion includes. 8. State the community. 9. Describe aquatic ecosystem.

Exercise 22. *Make up the annotation to the following text in English and retell the text "Global Ecosystem*

UNIT 1.4
BIOSPHERE

Exercise 1. *Before reading the text memorize words and word combinations.*

surface	-	поверхня
adjacent	-	сусідній
entire	-	суцільний, повний
complex	-	складний
envelope	-	оболонка, обгортка
nutrition	-	харчування
breeding	-	розмноження, виведення
decay	-	гниття
mankind	-	людство
common	-	загальний, звичайний
population	-	населення
term	-	вислів

to denote	-	позначати
community	-	спільність, спільнота

Exercise 2. *Translate the following words paying attention to the meanings of the suffixes and prefixes. Memorize the words.*

a) to specialize (v), specialist *(n),* speciality *(n),* special *(adj),* specialization *(n),* especially *(adv).*
b) science *(n),* scientist *(n),* scientific *(adj),* scientifically *(adv).*
c) to include (v), to exclude (v), to conclude (v), inclusion *(n),* inclusive *(adj).*
d) indifference *(n),* indifferent *(adj),* indifferently *(adv).*
e) to resemble (v), resemblance *(n).*
f) to engage (v), engagement *(n)*
g) to value (v), value («), valuable *(adj).*
h) to construct (v), construction *(n),* constructive *(adj).*
i) importance *(n),* important *(adj).*
j) to develop (v), developer *(n),* development *(n).*

Exercise 3, *Give derivatives of the following verbs. Translate them.*

To accord, to solve, to act, to exist, to form, to prove, to discuss, to compose, to explain, to prevent.

Exercise 4. *These words from the text can be used as verbs and as nouns. Translate them and give other words from the dictionary of such a kind.*

Express, result, change, act, term, function, form, release.

Exercise 5. *Find in the text and write out the words which consist of two words (for example — limestone).*

Exercise 6. *Give the Infinitive of the following verbs.*

Told, gave, known, made, led, came, thought, taken, called, climbed, put, written, included, defined, saw.

Exercise 7. *Read and translate the text.*

Biosphere

The biosphere is the surface zone of the Earth and adjacent atmosphere, in which organic life exists. It includes the low part of the atmosphere, the entire hydrosphere down to its maximum depth, soils, and the lithosphere. According to V.I.Vernadskyi the biosphere is the “field of the existence of living matter”. According to “Britanica encyclopedia”, the biosphere is the complex of physical, chemical, and biotic factors that act upon an organism or an ecological community and ultimately determine its form and survival.

Academician V.I.Vemadskyi is the originator of the modem theoiy of biosphere. The biosphere is an earth’s envelope - complex in composition, constmction and organization. It includes all living organisms, biogenous (coal, petroleum, limestones, etc.), inert and bioinert (formed with the aid of living organisms) substances, and also the substance of cosmic origin. The biosphere includes all living organisms interacting with the physical environment of the Earth and living in the hydrosphere, atmosphere, and lithosphere.

Migration of chemical elements in the biosphere is associated with the vital functions of living

organisms, their breathing, nutrition, breeding, death, and decay. The living matter changes the history of all chemical elements and acts as a deep, powerful geological process.

As a result of the technogenic activity of mankind, the biosphere of Earth is radically transformed and becomes, as defined by I. V.Vernadskyi, the noosphere, a sphere of mind. Noosphere (from Greek noos, "mind"), in theoretical biology, is that part of the world of life that is strongly affected by man's conceptual thought. The noosphere, as proposed by scientific theorists, is the level of the intellect, as opposed to the geosphere, or nonliving world, anti the biosphere, or living world. The noosphere is a fundamentally new phrase in the development of biosphere. It means harmony between man and his environment, the end of pollution, the exploitation of natural resources. The creation of the noosphere is the common way to our future. It is a new geological phenomenon on our planet. In the noospere, the man for the first becomes the greatest geological power.

The living organisms in the biosphere can be studied at the levels of populations and ecosystems. A study of the relations of organisms to one another and to their abiotic environment at the level of species populations, mil biogeocenosis is called ecology, or a more simple term, environmental biology. Ecology is the study of the structure and function of nature. The main (mills of modem ecology include study of anthropogenic changes in the man's i uvironment. In ecology the term population is used to denote a group of organisms occupying a specific geographic area.

The community of individual and the nonliving (abionic) environment functioning together is an ecological system or ecosystem. Plants can exist only by receiving carbon dioxide, water, oxygen, mineral salts. Organisms capable of synthesizing organic nutrients from inorganic substance with use of min energy are termed autotrophs. And those doing it with the use of energy released by chemical reactions are known as hemotrophes. The organisms feeding on ready organic substances are called heterotrophic organisms.

The autotrophs and hemotrophes producing an organic substance from inorganic compounds are termed producers. Consumers are organisms feeding on an organic substance and transforming it into new forms. The biomass is expressed in dry weight of living matter in term of a given area. The quantity of organic matter (in the form of living matter, stored food, waste products) or its equivalent in dry matter, carbon, or energy content which is accumulated during a given time period or in a given territory, is known as biological productivity.

Exercise 8. *Give Ukrainian equivalents to the following expressions. Find them in the text and compose your own sentences with these expressions.*

Adjacent atmosphere, entire hydrosphere, according to, ecological community, ultimately, survival, nutrition, conceptual thought, exploitation of natural resources, creation, common way, population, inorganic compounds, consumer, biological productivity.

Exercise 9. *Write out verb forms except the verb to be and define their tense and voice forms, give the Infinitive.*

Example: was given - Past Simple, Passive Voice - to be given.

Exercise 10. *Define the tense of the predicate and make the following sentences interrogative and negative.*

1. The quantity of organic matter or its equivalent in dry matter is known as biological productivity. 2. The biosphere is an earth's envelope - complex in composition, construction and organization. 3. The biosphere includes all living organisms, biogenous, inert and bioinert substances.

Exercise 11. *Underline the subject and the predicate of the sentences and put possible questions*

to all members of the sentence.

1. The biosphere includes all living organisms interacting with the physical environment of the Earth and living in the hydrosphere, atmosphere, and lithosphere. 2. The autotrophs and hemotrophes producing an organic substance from inorganic compounds are termed producers. 3. The living organisms in the biosphere can be studied at the levels of populations and ecosystems.

Exercise 12. *Complete the sentences using the words:*

powerful, the structure, feeding, goals, the history, substance, the levels, changes, an ecological community, activity of mankind, radically, complex

1. Consumers are organisms feeding on an organic ... and transforming it into new forms. 2. The organisms ... on ready organic substances are called heterotrophic organisms. 3. The living organisms in the biosphere can be studied at ... of populations and ecosystems. 4. Ecology is the study of ... and function of nature. 5. The main ... of modem ecology include study of anthropogenic ... in the man's environment. 6. The living matter changes ... of all chemical elements and acts as a deep, ... geological process. 7. As a result of the technogenic ... , the biosphere of the Earth is ... transformed. 8. The biosphere is the ... of physical, chemical, and biotic factors that act upon an organism or ... and ultimately determine its form and survival.

Exercise 13. *Answer the following questions.*

1. Who is the originator of the theory of biosphere?
2. What is biosphere according to V.I.Vernadskyi?
3. What does biosphere include?
4. What does biogenous include?
5. What are the vital functions of living organisms?
6. How does the living matter act?
7. Why is the biosphere of the Earth radically transformed?
8. How did V.I.Vernadskyi define the biosphere?
9. What does noosphere mean?
10. Where does the man become the greatest geological power?

11 .At what levels can the living organisms be studied?

12. What is called ecology?
13. What do the goals of ecology include?
14. What is an ecological system?
15. How can plants exist?
16. What is termed autotrophs?
17. What is termed producers?
18. What is termed consumers?
19. What is known as biological productivity?

lixcrcise 14. *Give definitions of:*

The biosphere is ....

The biomass is ....

The atmosphere is ....

The population is ....

The hydrosphere is ....

The ecosystem is ....
The lithosphere is ....
Autotrophs are ....
Biogenous includes ...
Hemotrophs are ...
The noosphere is ...
Heterotrophs are ...

Exercise 15. *Retell the text "Biosphere"*

Exercise 16. *Copy out the new words. Read and translate the following article orally or in writing.*

Contribution to Food Chain

Because angiosperms are the most numerous component of the terrestrial environment in terms of biomass and number of individuals, they provide an important source of food for animals and other living organisms. Organic compounds (carbon-containing compounds, principally carbohydrates) not only are used by the plant itself for synthesizing cellular structures and for fueling their basic metabolisms but also serve as the only source of energy for most heterotrophic organisms. (Heterotrophs require an organic source of carbon that has originated as part of another living organism, in contrast to autotrophs, which require only an inorganic source of carbon - $C0_2$).

Solar energy is trapped by the photosynthetic pigments in the plant cells and converted into chemical energy, which is stored in the tissues of the plant. The trapped energy is transferred from one organism to the next as herbivores consume the plant, carnivores consume herbivores, and so on up the food chain. In a temperate forest, one angiosperm tree supports many thousands of animals (the majority being insects, birds, and mammals), a relationship that underscores the basic importance of the angiosperms to the food chain. The angiosperm body contributes to the food chain in many ways. The vegetative parts (the non-reproductive organs, such as stems and leaves) are consumed by, and support, plant-eating animals. Vast numbers of insects and other invertebrates depend on shoots for food during all or part of their life histories. The reproductive organs (flowers, fruits, and seeds) also provide an energy source for many animals. The pollen supports many pollinating insects, particularly bees. The flowers provide food from floral nectaries that secrete sugars and amino acids. Nectar-feeding animals include many insect groups (bees, butterflies, flies), many mammal groups (bats, small rodents), and birds.

Fruit is the principal food for many bats, birds, mammals, and even some fish. Seeds are also an important food source for many animals, particularly birds. These animals often carry the fruits and seeds of the angiosperms they consume to new areas, where the angiosperms propagate. Another aspect of angiosperm diversity is found in the production of secondary compounds, such as alkaloids. Some insects successfully store llicse secondary compounds in their tissues and use them as protection from predation. As the principal component of the terrestrial biosphere, the angiosperm flora determines many features of the habitat, some of which are available food, aspects of the forest canopy, and grazing land. They supply nesting sites and materials for a wide range of birds and mammals, and they are the principal living spaces for many primates, reptiles, and amphibians.

Exercise 17. *Make up the food chain.*

Exercise 18. *Give the list of plants and animals mentioned in the text.*
Add which you know.

Exercise 19. *Make up the annotation to the article "Contribution to Food Chain ". You can also make the summary*

UNIT 1.5
THE EARTH'S POPULATION.
MAN AND ENVIRONMENT

Exercise 1. *Before reading the text memorize words and word combinations.*

exploration	-	дослідження
adverse effect	-	несприятливий вплив
take into account	-	брати до уваги
be concerned	-	непокоїтися, стосуватися
turn into	-	перетворюватися
threaten	-	погрожувати, загрожувати
destroy	-	руйнувати, ламати, істотний
essential	-	суттєвий
exist	-	існувати, жити
disastrous	-	згубний
safe	-	надійний, неушкоджений
suitable	-	придатний відповідний
meet the needs	-	задовольняти потреби
purposeful	-	цілеспрямований
self-regulation	-	саморегулювання
harmful	-	шкідливий, згубний
warn	-	попереджати, застерігати
consequences	-	наслідки
interference	-	втручання
desert	-	пустеля, пустельний, безлюдний
impact	-	вплив, зіткнення
to exert impact (influence)	-	вплинути
earthquake	-	землетрус
flood	-	повінь, затопляти
drought	-	посуха
species	-	вид, рід, різновид
far from	-	зовсім ні, аж ніяк
on the whole	-	в цілому, загалом
no longer	-	більше не
fraught	-	повний, сповнений
massive	-	великий, широкомасштабний, сильний

Exercise *2. Read the international words and give their meanings. Pay attention to the parts of speech.*

Solar *a,* energy *n,* fatal *a,* radically *adv,* negative *a,* economic *a,* biosphere *n,* result *n,* ecological *a,* technicism *n,* oases *n, pi,* objectively *adv,* component *n,* transform v, typhoon *n,* magnetic *a,* radioactivity *n,* cosmic *a,* system *n,* biological *a,* compensate v, ecologist *n.*

Exercise 3. *Give adjectives of the following nouns. Translate them.* Disaster, care, ecology, environment, harm, purpose, nature.

Exercise 4. *Give the verbs of which the following nouns are formed. Translate them.*

Pollution, interaction, exploration, interference, extinction, activity, depletion, radiation, transformation, production, regulation, existence, consideration.

Exercise 5. *Give derivatives of the following verbs. Translate them.*

To solve, to exist, to prove, to discuss, to explain, to prevent.

Exercise 6. *Give the Infinitive of the following verbs.*

Became, known, made, led, came, thought, taken, called, put, written, included, defined, saw, arisen, uncontrolled, shown, concerned, met, meant.

Exercise 7. *Read, translate and memorize the following adverbs. Find in the text the sentences in which they are used.*

Infinitely, radically, objectively, carelessly, adversely, vitally, irreversibly, carefully, increasingly.

Exercise 8. *Read and translate the text.*

Man and Environment

Human progress has reached the stage of intensive exploration of nuclear and solar energy, the World Ocean and outer space. It is evident now, however, that often man is adversely affecting the environment and his activity is sometimes fraught with fatal consequences.

It is becoming increasingly clear that man cannot and must not use his tremendous power so carelessly, infinitely interfere in nature and radically try to change it, without taking into account possible negative effects of his economic activity. The more material wealth people create, the more they realize that they cannot but be concerned about how the biosphere is changing us a result of productive activity. Current ecological research shows, that man, wlicn overconcerned with technicism, far from turning deserts into oases, i mi turn oases into deserts, threatening to destroy everything on earth, if he continues exerting mostly uncontrolled impact on the biosphere.

In the 19th century and even in the first half of the 20th century, material production did not require taking into account the consequences . In< h man's interference in nature may have in the distant future, and it was not considered an objectively essential condition for the existence of the whole of mankind, whereas, in the second half of the 20th century such a consideration is becoming vitally important.

Hence man should carefully study the impact of his activity on various components of the surrounding nature. It is not only possible but in i necessary to transform the wild natural environment, which often has a disastrous effect on man (earthquakes, typhoons, hurricanes, floods, droughts, magnetic and solar storms, as well as radioactivity, cosmic radiation, etc.) into a safe environment suitable for man and meeting his needs. This means that the ecological problem is not simply the problem of environmental pollution and other adverse effects of man's economic activity, but the problem of turning man's uncontrolled impact on nature into a purposeful and planned interaction with the latter.

Of course, the biosphere as a complex system also possesses enormous possibilities for self-regulation. Despite the fact that certain biological species, i.e., individual elements of the biosphere, may become extinct as a result of various impacts thereon, it is still capable on the whole of existing and developing. The impact of industry on the biosphere is compensated for by the inner resources of homeostatic self-organization.

Today, however, this impact has reached such proportions that the biosphere's inner resources can no longer compensate for society's harmful influence on the environment, both on individual species and on all of life on earth without help from the outside. Many ecologists consider that the disappearance of particular living species constitutes the main ecological and social problem of the day. The world's famous biologists warn that the present situation is fraught with the extinction of animals and plants on a scale much greater than their both natural and man-caused extinction during the preceding millions of years.

If this massive biological depletion of the Earth's resources goes on uncontrolled for several decades to come, the world environment will change irreversibly. All this means that at present there has arisen a pressing necessity to change the character of the interaction between man and nature.

Exercise 9. *Give Ukrainian equivalents to the following expressions. Find them in the text and compose your own sentences with these expressions.*

Intensive exploration, outer space, fraught with fatal consequences, productive activity, uncontrolled impact on the biosphere, the distant future, essential condition, the whole of mankind, surrounding nature, wild natural environment, environmental pollution, purposeful interaction, enormous possibilities, harmful influence, both on individual species and on all of life, the extinction of animals and plants, man-caused extinction, biological depletion, several decades.

Exercise 10. *Give English equivalents to the following expressions. Find them in the text.*

Сповнений невідворотних наслідків, необмежено втручатися у природу, людина, яка дуже стурбована техніцизмом, погрожуючи знищити усе на землі, брати до уваги наслідки, у далекому майбутньому, життєво важливий, заради існування усього людства, володіти великими можливостями, незважаючи на те що. Все ж здатна існувати, внутрішні ресурси, вичерпування, спричинене людиною.

Exercise 11. *Pay attention to the meanings of the following words.*

a) human progress — прогрес (людського) суспільства
b) activity - діяльність
c) effect – результат, наслідки, вплив
d) realize – розуміти, усвідомлювати, здійснювати, виконувати
e) complex – складний, важкий
f) individual – окремий, людина
g) situation – обставини, положення
h) scale – масштаб, розмір
i) decade - десятиріччя
j) character - характхер, особливість

Exercise 12. *Give Ukrainian equivalents to the following compound nouns:*

self-regulation, self-organization, self-ignition (запалювання), self-purification, self-pollution, self-help, self-monitoring (контроль)

Exercise 13. *Write out verb forms except the verb to be and define their tense and voice forms, give the Infinitive.*

Example: was given - Past Simple, Passive Voice - to be given.

Exercise 14. *Define the tense of the predicate and make the following* M *ntcnces interrogative and*

negative.

1. The massive biological depletion of the Earth's resources goes on uncontrolled for several decades to come. 2. The world environment will change irreversibly. 3. All this means that there has arisen a pressing necessity to change the character of the interaction between man and nature. 4. In the 19th century material production did not require taking into account the consequences of man's interference in nature. 5. In the second half of the 20th cenlury such a consideration is becoming vitally important.

Exercise 15. *Underline the subject and the predicate of the sentences and put possible questions to all members of the sentence.*

1. Human progress has reached the stage of intensive exploration of nuclear and solar energy. 2. Often man is adversely affecting the environment. 3.His activity is sometimes fraught with fatal consequences.

Exercise 16. *Answer the following questions.*

1. What has human progress reached?
2. How is man affecting the environment?
3. What is becoming increasingly clear?
4. What must people take into account?
5. Why is the biosphere changing?
6. When did not material production require taking into account the consequences of man's interference in nature?
7. What happened in the second half of the 20th century?
8. What should man carefully study?
9. What has a disastrous effect on man?
10. Is ecological problem simply the problem of environmental pollution?
11. What does the biosphere possess as a complex system?
12. What is the impact of industry on the biosphere compensated by?
13. What do many ecologists consider?
14. What do the world's famous biologists warn?
15. When will the world environment change irreversibly?

Exercise 17. *Read the text once more and find phrases concerning the negative influence of men's activity on biosphere.*

Exercise 18. *Discuss the following problems:*

1. What is the main problem of ecology?
2. What is the difference in points of view on nature:

- in 19th century?
- at the beginning of the 20th century?
- in the second part of the 20th century?
- at the beginning of the 21st century?

UNIT 1.6
SOCIETY AND NATURE

Exercise 1. Before reading the text memorize words and word combinations.

complicated	-	складний, ускладнений
unity	-	єдність, цілісність
die world outlook	-	світогляд
Insoluble	-	нерозв'язний, непорушний
inevitable	-	неминучий
perish	-	гинути, помирати, губити
cause	-	спричиняти, задавати
ensure	-	забезпечувати, гарантувати
approach	-	підхід
provide	-	постачати, забезпечувати
improve	-	поліпшувати, удосконалювати
living standard	-	життєвий рівень
affect	-	впливати, уражати
destructive	-	руйнівний
fuel	-	паливо
soil	-	грунт
survive	-	вижити
reduce... to	-	зводити (до чогось)
rather... than	-	переважно
twofold	-	подвійний, здвоєний
at one's disposal	-	в чиємусь розпоряджені
vehicle	-	засіб пересування, транспорт
power	-	приводити в дію (в рух)

Exercise 2. *Read the international words and give their meanings. Pay attention to the parts of speech.*

Restoration *n,* biosocial *a,* methodology *n,* theoretical *a,* global *a,* ideologist *n,* civilization *n,* urban *a*, demographic *a,* optimization *n,* optimize e, optimistic *a*, fact *n,* rational *a,* formulate *v,* sphere *n,* filter v, exploit v, mechanical *a,* transformation *n.*

Exercise 3. *Give adjectives of the following adverbs. Translate them.*

Primarily, purely, locally, largely, chemically, mechanically, hutiically, steadily, chiefly, originally, inevitably, destructively.

Exercise 4. *Give the verbs of which the following nouns and adjectives are formed. Translate*

them.

Relation, non-renewable, protection, relationship, pollutant, conservation, improvement, restoration, formulation, optimization, cooperation, improvement, preservation, transformation, contribution.

Exercise 5. *Translate the following words paying attention to the meanings of the suffixes and prefixes. Define what part of speech these derivatives belong to. Memorize the words.*

a) to destroy - without destroying - destruction - destructive - destructively - undestroyable;

b) (will) contribute - by contributing - when contributing - contribution; c) (can) provide - by providing - while providing - provision;

d) to weigh - weighing - its weight - weightless - weightlessness - weighty;

e) to depend - depending - dependence - independence - dependent - independent - independently;

f) (must) support - by supporting - their support - unsupported;

g) realize - realization - realizable;

h) simple - simply - simplicity - simplify - simplification;

i) to vary - variation - variety - various - variable.

Exercise 6. *Match the synonyms.*

1. protection	1. understand
2. harmful	2. impact
3. essential	3. complicated
4. present *adj.*	4. effect
5. realize	5. enormous
6. exploration	6. explain
7. influence *n*	7. decade
8. tremendous	8. regard
9. complex *adj.*	9. clean
10. consider	10. conservation
11. interpret	11. research
12. ten years	12. adverse
13. result	13. necessary
14. pure	14. current

Exercise 7. *Give Ukrainian equivalents to the following pairs of words paying attention to the negative prefixes and suffixes:*

Soluble - insoluble; careful - careless; finite - infinite; pure - impure; harmful - harmless; appearance - disappearance; controlled - uncontrolled; balance - unbalance; equilibrium - disequilibrium; suitable - unsuitable.

Exercise 8. *Read and translate the text.*

Society and Nature

What are the major aspects and ways of solving this most complicated problem at the beginning of the 21st century - the restoration of the unity between man and nature, the problem of turning the material production from a purely technical and social element into a biosocial one, into a means of the purposeful transformation of the biosphere?

A scientific understanding of the essence of the relation between society and nature, correct from

the point of view of the world outlook and niclliodology, can serve as a general theoretical foundation for solving the ecological problem.

Some of the scientists regard the ecological problem as one of the insoluble global problems of our time. Some of them even say that human civilization will inevitably perish as a result of industrial, urban, vehicular, mul demographic pollution of the environment and the depletion of nonrenewable natural resources.

On the other hand, many scientists often reduce the whole environmental problem only to pollution. The solution of the environmental problem is interpreted rather as the protection of nature primarily against pollution caused by economic and demographic growth than as the optimization of the interaction between nature and society ensuring mankind's social and economic progress.

Some countries regard environmental protection as an organic condition for and an important component of solving key socio-economic problems, steadily improving the people's living standards and upgrading the mode of life. The rational utilization of resources and the conservation of nature are a matter of general state policy in these countries.

All the problems concerning the interaction of man and nature are now of international mportance. The pollution of the Ocean by one particular country affects fishing in other countries, often very far away. Pollutants coming from industrial centres in Germany, Belgium and France filter down in Scandinavia or Eastern Europe and affect forests and fish in ponds and lakes there.

The problem of "Man and the Biosphere" or solution of pressing global problems can and must be solved by the efforts of all countries by means of cooperation, long-term coordinated development plans for all countries.

Exercise 9. *Match the definitions:*

a) ecological problem;
b) global;
c) non-renewable resources;
d) cooperation;
e) optimization of the interrelation of society and nature;

1. working or acting together for a common purpose;
2. the problem of the interrelation of society and nature;
3. the way and means of restoring equilibrium between society and nature;
4. world-wide;
5. natural resources that cannot be renewed.

Exercise 10. *Give Ukrainian equivalents to the following expressions and use them in your own sentences:* as a whole, as well as, except for, in spite of.

Exercise 11. *Define the tense of the predicate and make the following sentences interrogative and negative.*

1. Some of the scientists have regarded the ecological problem as one of the insoluble global problems of our time. 2. Human civilization will inevitably perish as a result of industrial and demographic pollution of the environment. 3. Many scientists often reduced the whole environmental problem only to pollution.

Exercise 12. *Underline the subject and the predicate of the sentences and put possible questions to all members of the sentence.*

1. Human civilization can inevitably perish as a result of the depletion of non-renewable natural resources. 2. The solution of the environmental problem is interpreted as the protection of nature primarily against pollution. 3. Pollution is caused by economic and demographic growth. 4. The optimization of the interaction between nature and society has ensured mankind's social and economic progress.

Exercise 13. *Complete the sentences.*

1. Some countries regard environmental protection as ... .
2. An important component of solving socio-economic problems is ... .
1. Other countries regard environmental protection as steadily ....
4. The rational utilization of resources and the conservation of nature are ...
.S. The problems concerning the interaction of man and nature are ... .
6. The pollution of the Ocean by one particular country affects ....
7. Pollutants coming from industrial centres in Germany and France filter down ....
8. The problem of "Man and the Biosphere" must be solved by the efforts of all countries by means of....

Exercise 14. *Put the sentences in the correct grammatical form.*

1. The problem of solution of pressing global problems can (to solve) by the efforts of all countries. 2. The rational utilization of resources (to be) a matter of general state policy in these countries. 3. The pollution of the Ocean by different countries already (to affect) fishing in many countries, often very far away. 4. Pollutants usually (to come) from industrial centres in Germany, Belgium and France. 5. Pollutants (to filter down) in Eastern Europe and (to affect) forests and fish in ponds and lakes there in late 1990s.

Exercise 15. *Answer the following questions.*

1. What can serve as a general theoretical foundation for solving the ecological problem?
2. What do some of the scientists regard the ecological problem as?
3. Why can the human civilization inevitably perish?
4. How is the solution of the environmental problem interpreted?
5. What do some countries regard environmental protection as?
6. What is a matter of general state policy in these countries?
7. What is now of international importance?
8. What does the pollution of the Ocean by one particular country affect?
9. What affects forests and fish in ponds and lakes in Scandinavia or Eastern Europe?
10. How can the solution of pressing global problems be solved?

Exercise 16. *Make up the annotation to the following text in English. Retell the text "Society and Nature ".*

Exercise 17. *Read the following paragraphs of the text and place them in the logic order. Translate the text. Give the title to it.*

1. How different the situation is in our modern industrial society, in which more and more people live in cities, far removed from nature, and in which man's technology tends to seem more important than nature's processes. With great amounts of power at their disposal, men now exploit earth resources'on a large scale, often very destructively, and not just for their own use but to sell to others for profit They can transform these resources chemically as well as mechanically, so that they lose all resemblance to their original forms. To the users, therefore, they seem less and less like the gifts of nature and more and more

like man's own product.

2. Man's mastery over the earth, however, makes him more and more its slave. It makes him not less dependent on the earth but more so, as he draws from it increasing amounts and varieties of resources to meet the growing per capita needs of a growing population,

3. And now in this age of space exploration it would seem that at last man has thrown off his age-old dependence on the earth. Let it not be forgotten, however, that the vehicles that carry men into space are made of earth materials and powered by earth fuels and that the spacemen survive only because their vehicles and their space suits provide them with a little piece of environment basically like that on earth - except for the weightlessness.

4. "Mother Earth" we call her, as from her soil, water, rocks, and air come all the materials that support our bodies and build our civilizations. In recent times, however, realization of this dependence has tended to decrease.

5. Thus, in spite of man's growing power and his increasingly great contributions toward his own support, he still needs earth materials and earth conditions. As Goethe said of the artist, so we can say also of mankind as a whole, that he "has a twofold relation to nature; he is at once her master and her slave...".

6. Primitive man's small and simple demands on Mother Earth were made directly. He took from his own immediate locality the materials that would meet his own immediate needs, and he used them largely in their original form.

II BIOLOGY

UNIT 2.1
BIOLOGY

Exercise 1. *Before reading the text memorize words and word combinations.*

to include	-	включати
lo derive	-	походити
subdivision	-	підрозділ
condition	-	умова
right amount of pressure	-	достатній тиск
alive	-	живий
much in common	-	багато спільного
resemblance	-	подібність, схожість
living substance	-	жива речовина
property	-	властивість
cell	-	клітина
to take place	-	відбуватися
respiration	-	дихання
digestion	-	травлення
reproduction	-	відтворення
likeness	-	схожість
apparent	-	видимий, очевидний
conscious	-	свідомий
to be engaged	-	займатися
mankind	-	людство
to solve	-	вирішувати
contribution	-	сприяння, внесок
food supply	-	постачання їжі
disease	-	хвороба
to cure	-	лікувати
to prevent	-	запобігіти
invisible	-	невидимий
naked eye	-	неозброєне око
fascinating	-	захоплюючий
record	-	запис, записувати
observation	-	спостереження
conclusion	-	висновок

Exercise 2. *Write out the international words and give their meanings.*

Exercise 3. *Translate the following words paying attention to the meanings of the suffixes and prefixes. Memorize the words.*

1. to specialize (v), specialist («), speciality (*n*), special *{adf),* specialization («), especially *(add).*

2. science (*n*), scientist *(n),* scientific *(adj),* scientifically *(adv).*
3. to include (v), to exclude (v), to conclude (v), inclusion *(n),* inclusive *(adj).*
4. indifference («), indifferent *(adj),* indifferently *(adv).*
5′. to resemble (v), resemblance *(n).*
6. to engage (v), engagement *(n)*
7. to value (v), value *(n),* valuable *(adj).*
8. to construct (v), construction («), constructive *(adj).*
9. importance (n), important *(adj).*
10. to develop (*v*), developer (n), development *(n).*

Exercise 4. *Give derivatives of the following verbs. Translate them.*

To solve, to exist, to prove, to discuss, to explain, to prevent.

Exercise 5. *Give the Infinitive of the following verbs.*

Told, gave, known, made, led, came, thought, taken, called, climbed, put, written, included, defined, saw.

Exercise 6. *Look through the text and try to get the gist. Then read and translate it.*

Biology

Biology is the science of living things. The word "biology" comes from two Greek words: bio — "life"' and logos — "discourse" or "study". Biology includes all the facts and principles which have been derived from a scientific study of living things. The special study of plants, called Botany, and of animals, called Zoology, are the two great subdivisions of the science of biology. Plants and animals are called organisms, so biology may also be defined as the science of organisms.

Life exists in many places on the earth, often in spite of very difficult conditions. In the Arctic regions, the temperature may fall to 60 degrees below zero, while in deserts it may climb to over 120 degrees. Some animals live under the immense pressure of the deep seas, and others live near the tops of the highest mountains. But no matter where they exist, all living things must have certain necessary conditions. Let us see what these are: living things need oxygen, living things must have the right amount of pressure, living things must have water, living things need the proper temperature, living things must have food.

Most people think that plants are not alive in the same sense that animals are, or that there is some fundamental difference between plant and animal life. But this is not so. Plants and animals have much in common. Their more important points of resemblance are: 1) The living substance of plants and animals is organized into protoplasm. Protoplasm is the basic material of ail living systems and its general properties fundamentally the same in each system both in plants and animals. 2) The living matter is organized in both plants and animals into microscopic units called cells. 3) (ertain vital processes take place in plant bodies in the same manner as in animal bodies. These processes are respiration, digestion, assimilation, growth and reproduction. 4) Both animals and plants cannot live without water, air, f'ood, light and moderate amount of heat. They both are of different shapes, sizes and colours. In fact, the differences are not so many as the likenesses although they are more apparent, for only three are important, namely: plants are not conscious, they are unable to move about, they make their own food.

Biology is the science of life and people who are engaged in it are i ailed biologists. They study the

secrets of living things. Their discoveries are of great value to all mankind.

Biology tells us about our body: how it is constructed and how it functions. It gives us important information about other living things and how their lives affect mankind. A knowledge of biology will help you to keep healthy. It will be your guide in solving many of everyday living and scientific problems.

Biologists have made a great contribution to science. They have met eased our food supply, they have developed new and better varieties of plants and animals. Scientific methods of farming have given us much more lood. Biologists control many diseases. They have saved millions of lives by discovering the causes of these diseases and methods of prevention and cure. Vaccines, penicillin and sulfa are products of the biological laboratory.

Biologists have solved many mysteries of the body. They have discovered how blood circulates, how food is digested and many other secrets of life. They are now working in different fields of biology and their studies may lead to a solution of many problems.

A biologist's laboratory is a fascinating place. In it you may find a variety of plants and animals, some of which are invisible to the naked eye. There are powerful microscopes and other instruments. One of the most important tools of a scientist is his laboratory notebook. He always keeps very complete and accurate records of his observations and experiments.

In carrying out his work biologists use the scientific method that is:

1. They find out everything that is known about the problem by reading or by discussing the matter with others.

2. They think of several possible explanations or solutions. Some of these will prove to be wrong. One or more of the others may be right.

3. They test all the possibilities by experiments. They repeat the experiment several times. They make every effort to prevent errors.

4. When they have reached a conclusion, they inform other scientists who may repeat the work.

Exercise 7. *Write out verb forms except the verb* to be *and define their tense and voice forms, give the Infinitive.*

Example: was given — Past Simple, Passive Voice — to be given.

Exercise 8. *Give Ukrainian equivalents to the following expressions. Find them in the text and compose your own sentences with these expressions.*

1. in spite of;_____
2. no matter; _____
3. to be defined as; _____
4. in the same sense; _____
5. much in common; _____
6. to be the same in; _____
7. both in; _____
8. in the same manner;_____
9. to be so many as; _____
10. to be engaged in;_____
11. to be of great value; _____
12. to keep healthy;
13. to make a great contribution; _____

14. in carrying out;_____

Exercise 9. *Define the tense of the predicate and make the following sentences interrogative and negative.*

1. I'm studying biology.
2. He has solved this difficult problem.
3. He is a good biologist.
4. My teacher developed a new plant.
5. These scientists work on a very interesting problem.
6. They began to investigate this problem last year.
7. Animals and plants live under different conditions.
8. Life exists in many places on the earth.
9. Some animals can exist under the immense pressure of the deep seas.
10. Biologists have solved many mysteries of the body.
11. Students of the ecological faculty study different subjects.

Exercise 10. *Underline the subject and the predicate of the sentences and put possible questions to all members of the sentence.*

1. Most of the animals are of great importance for man.
2. Bodies of plants and animals contain inorganic substances.
3. We shall consider plants and animals together.
4. Biology has become more dependent on other sciences.
5. Certain vital processes take place in plant body every season.
6. These plants differ greatly in size.

Exercise 11. *Translate the following sentences into Ukrainian paying nttention to different meanings of the verbs "to be " and "to have* ".

a) We are selecting seeds. These plants are improved by us. Variations in plants are the basis for plant improvement. They are not at the University now, but they are to meet here. The crop yields are to be increased every year (annually).

b) He has made a very good report. He has a lot of literature on this subject. He has to translate a new article so he will have to work the whole evening.

c) You must read this book. You have to read this book. You should read this book. You are to read this book.

d) We have to develop new varieties. We had to adapt the plants to new conditions. We shall have to create suitable conditions for this experiment. Our teacher is to be here at 9 o'clock. The principle of isotope analysis can also be applied to cases where a greater number of substances are to be determined. This plant has to be treated with cold. We have to read much to became good specialists. These fruits are to be crossed. You ought to plant this seed in spring. The grain had to pass through a low temperature stage.

Exercise 12. *Translate the following sentences into Ukrainian.*

1. I like both of these plants.
2. He likes both the flowers and the leaves of this plant.
3. Both functions of this organ are important.

4. Both water and air are necessary for the living organists.
5. General properties of protoplasm are the same both in plants and animals.
6. Both plants and animals cannot live without water.
7. Both these plants are of the same shape and size.

Exercise 13. *Answer the following questions.*

1. What is biology? Define it.
2. What elements does living matter consist of?
3. What do living things need?
4. Are plants and animals similar in their fundamental composition?
5. What are the differences and similarities of animals and plants?
6. What does biology tell us about our body?
7. How can biology be defined?
8. What do biologists study?
9. What does the word “biology” mean?
10. Do plants and animals depend upon one another?
11. How do plants or animals differ from lifeless things?
12. What have biologists discovered?

Exercise 14. *Translate the following sentences into English.*

1. Біологія – це наука про живі організми.
2. Існує багато спеціальних галузей знань і багато аспектів і законів, у яких елементарна підготовка із загальної біології є необхідною.
3. Вивчаючи живі організми,ми вивчаємо зв'язок рослин і тварин із світом.
4. Загальна біологія поділяється на дві галузі – ботаніка та зоологія.
5. Усі організми можуть реагувати на зміни в навколишньому середвищі.
6. Базові знання з біології дають нам підгрунтя для розуміння будови та функцій нашого тіла.
7. Визначеня сутності життя – одне з головних завдань загальної біології.

Exercise 15. *Make up the annotation to the following text in English. Translate it.*

Живі організми можуть жити в різних умовах. Деякі існують при дуже високих температурах, а інші легко переносять сильні морози. Усі вони повинні були пристосуватися до навколишнього середовища.

Біологія вивчає життєві процеси як у тварин так і у рослин. Ці два великі підрозділи в біології називаються ботанікою та зоологією. Як рослини так і тварини повинні мати певні умови для існування. Як і рослини так і тварини не можуть жити без кисню, води, їжі та світла. Однакові життєві процеси відбуваються як у тварин так і у рослин. Ці процеси називаються диханням, травленням, ростом і розмноженням. Тварини реагують на зовнішні подразнення через нервову систему та органи чуттів. Рослини також пристосовуються до навколишнього середовища і реагують на зовнішній вплив. Однак механізми реакції у відповідь на подразнення у рослин дуже відрізняються від механізмів тварин.

Exercise 16. *Retell the text* “Biology”.

Exercise 17. *Read and translate the article. Give its annotation.*

Classification in Biology

Biology is the study of living things and their vital processes. The Held deals with all the physicochemical aspects of life. As a result of the modem tendency to unify scientific knowledge and investigation, however, there has been an overlapping of the field of biology with other scientific disciplines. Modem principles of other sciences - chemistry and physics, for example - are integrated with those of biology in such areas as biochemistry and biophysics. Because biology is such a broad subject, it is subdivided into separate branches for convenience of study.

Despite apparent differences, all the subdivisions are interrelated by basic principles. Thus, though it was once the custom to separate the study of plants (botany) from that of animals (zoology), and the study of the structure of organisms (morphology) from that of function (physiology), the current practice is to investigate those biological phenomena that all living things have in common. Biology is often approached today on the basis of levels that deal with fundamental units of life. At the level of molecular biology, for example, life is regarded as a manifestation of chemical and energy transformations that occur among the many chemical constituents that comprise an organism. As a result of the development of more powerful and precise laboratory instruments and techniques, it is now possible to understand and define more exactly not only the invisible ultimate physiochemical organization (ultrastructure) of the molecules in living matter but also how living matter reproduces at the molecular level.

Cell biology, the study of the fundamental unit of structure and function in a living organism, may be said to have begun in the 17th century, with the invention of the compound microscope. Before that, the individual organism was studied as a whole (organismic biology), an area of research still regarded as an important level of biological organization. Population biology deals with groups or populations of organisms that inhabit a given area or region. Included at this level are studies of the roles that specific kinds of plants and animals play in the complex and self-perpetuating interrelationships that exist between the living and nonliving world, as well as studies of the built-in controls that maintain these relationships naturally.

These broadly based levels may be further subdivided into such specializations as morphology, taxonomy, biophysics, biochemistry, genetics, eugenics, and ecology. In another way of classification, a field of biology may be especially concerned with the investigation of one kind of living thing - e.g., botany, the study of plants; zoology, the study of animals; ornithology, the study of birds; ichthyology, the study of fishes; mycology, the study of fungi; microbiology, the study of microorganisms; protozoology, the study of one-celled animals; herpetology, the study of amphibians and reptiles; entomology, the study of insects; and physical anthropology, the study of man.

Exercise 18. *Turn the following sentences from passive into active voice.*

1. Biology is subdivided into separate branches for convenience of study.
2. Modem principles of chemistry and physics are integrated with those of biology in such areas as biochemistry and biophysics.
3. Biology is often approached today on the basis of levels that deal with fundamental units of life.
4. Before that, the individual organism was studied as a whole.
5. These broadly based levels may be further subdivided into morphology, taxonomy, biophysics,

biochemistry, genetics and ecology.

UNIT 2.2
HISTORY OF BIOLOGY

Exercize 1. *Before reading the text memorize words and word combinations.*

remarkable	-	видатний, дивовижний
leap	-	стрибок, перешкода
creative mind	-	творичий розум
appropriate	-	відповідний
inquiring mind	-	допитливий розум
remain neglected	-	залишатися знехтуваним
insight	-	прониклівість, раптовий здогад
to yield	-	давати (врожай)
subcellular	-	внутрішньоклітинний
dissemination of ideas		розповсюдження ідей

Exercise 2. *Read and translate the text.*

History of Biology

There are moments in the history of all sciences when remarkable progress is made in relatively short periods of time. Such leaps in knowledge result in great part from two factors: one is the presence of a creative mind ~ a mind sufficiently perceptive and original to discard hitherto accepted ideas and fonnulate new hypotheses; the second is the technological ability to test the hypotheses by appropriate experiments. The most original and inquiring mind is severely limited without the proper tools to conduct an investigation; conversely, the most sophisticated technological equipment cannot of itself yield insights into any scientific process. An example of the relationship between these two factors was the discovery of the cell. For hundreds of years there had been speculation concerning the basic structure of both plants and animals.

Not until optical instruments were sufficiently developed to reveal cells, however, was it possible to formulate a general hypothesis, the cell theory, that satisfactorily explained how plants and animals are organized. Similarly, the significance of Gregor Mendel's studies on the mode of inheritance in the garden pea remained neglected for many years, until technological advances made possible the discovery of the chromosomes and the part they play in cell division and heredity. Moreover, as a result of the relatively recent development of extremely sophisticated instruments, such as the electron microscope and the ultracentrifuge, biology has moved from being a largely descriptive science - one concerned with entire cells and organisms - to a discipline that increasingly emphasizes the subcellular and molecular aspects of organisms and attempts to equate structure with function at all levels of biological organization.

Seventeenth-century advances in biology included the establishment of scientific societies for the dissemination of ideas and progress in the development of the microscope, through which man discovered a hitherto invisible world that had far-reaching effects on biology. Systematizing and classifying, however, dominated biology throughout much of the 17th and 18th centuries, and it was during this time that the

importance of the comparative study of living organisms, including man, was realized. During the 18th century the long-held idea that living organisms could originate from nonliving matter (spontaneous generation) began to crumble, but it was not until after the mid-19th century that it was finally disproved by Louis Pasteur. Biological expeditions added to the growing body of knowledge of plant and animal forms and led to the 19th-century development of the theory of evolution. The 19th century was one of great progress in biology: in addition to the formulation of the theory of evolution, the cell theory was established, the foundations for modern embryology were laid, and the laws of heredity were discovered.

Just as the 19th century can be considered the age of cellular biology, the 20th century has been characterized by developments in molecular biology. By utilizing modem methods of investigation, such as X-ray diffraction and electron microscopy, to explore levels of cellular organization beyond that visible with a light microscope - i.e., the ultrastructure of the cell - new concepts of cellular function have been produced. Not only has the study of the molecular organization of the cell probably had the greatest impact upon biology during the 20th century, but it also has led directly to the convergence of many different scientific disciplines in order to acquire a better understanding of life processes. Another 20th-century development has been the realization that man is as dependent upon the Earth's natural resources as are other animals. The progressive destruction of the environment can be attributed, in part, to an increase in population pressure as well as to certain technological advances. Thus, though lifesaving advances in medicine have resulted in a dramatic drop in the death rate, they have also been a factor contributing to the explosive increase in the human population. Moreover, chemical contaminants being introduced into the environment by manufacturing processes, pesticides, automobile emissions, and other means are seriously endangering all forms of life. It is for these reasons that biologists are beginning to pay much greater attention to the relationships of living things to each other as well as to their biotic and abiotic environments.

Exercise 3. *Read, translate and memorize the following adverbs. Find in the text the sentences in which they are used.*

Relatively, sufficiently, severely, conversely, satisfactorily, similarly, extremely, largely, increasingly, finally, probably, directly, seriously, hitherto.

Exercise 4. *Write out from the text above all Past Participles and determine their functions (attributive or part of the predicate).*

Exercise 5. *Put the sentences into the correct grammar form.*

1. The most original and inquiring mind (to limit) without the proper tools to conduct an investigation. 2. For hundreds of years there (to be) speculation concerning the basic structure of both plants and animals.

3. Biology (to move) from being a largely descriptive science to a discipline that (to emphasize) the subcellular and molecular aspects of organisms.

4, Biological expeditions (to add) to the growing body of knowledge of plant mid animal forms. 5. The 20th century (to characterize) by developments in molecular biology. 6. New concepts of cellular function (to produce). 7. Another 20th-century development (to be) the realization that man is as dependent upon the Earth's natural resources as are other animals. X. Biologists (to begin) to pay much greater attention to the relationships of living things to each other.

Exercise 6. *Complete the sentences.*

1. Remarkable progress is made in ...
2. The most sophisticated technological equipment cannot of itself yield ...
3. Seventeenth-century advances in biology included the establishment...
4. Biological expeditions led to the 19th-century development...
5. In the 19th century the cell theory ...
6. In the 19th century the foundations for modem embryology ...
7. In the 19th century the laws of heredity ...

Exercise 7 *Characterize the development of biology in different centuries:*

- *in the 17th*
- *in the 18th*
- *in the 19th*

Exercise 8. *Put the words in the correct order to make sentences.*

1. history , of, moments, There, are, all, in, the, sciences, remarkable, is, progress, periods, made, in, when, relatively, short, of, time.
2. inquiring, without, most, The, mind, and, is, severely, limited, the proper, investigation, tools, conduct, original, an, to.
3. in, microscope, the, of, the, advances, Seventeenth-century, biology, the included, establishment, of, progress, societies, and, in, scientific, development,.
4. biology, of, the, throughout, 17th, Systematizing, dominated, much, and, classifying, 18th, and, centuries.
5. methods, been, produced, utilizing, By, modern, of, such, as, X-ray, and, electron, microscopy, new, diffraction, cellular, investigation, concepts, function, have, of.

Exercise 9. *Complete, read and translate the text.*

unpredictable demons, cause, dissected, causality, thought, biological infonnation, supernatural, emergence, effect, observation, assumed

The Greco-Roman World

Although the Babylonians, Assyrians, Egyptians, Chinese, and Indians amassed much ____, they lived in a world believed to be dominated by_____and spirits. Hence, learned men in these early cultures directed their studies toward an understanding of the , rather than the natural, world. Anatomists, for example, _____ animals not to gain an understanding of their structure but to study their organs in order to predict the future. With the _____ of the Greek civilization, however, these mystical attitudes began to change.

Around 600 BC there arose a school of Greek philosophers who believed that every event has a _____ and that a particular cause produces a particular ___. This concept, known as _____, had a profound effect on subsequent scientific investigation. Furthermore, these philosophers _____the existence of a "natural law" that governs the universe and can be comprehended by man through the use of his powers of _____ and deduction. Although they established the science of biology, the greatest contribution the Greeks made to science was the idea of rational

Exercise 10. *Read, translate and give the annotation of the article.*

The Renaissance (Resurgence) of Biology

Beginning in Italy during the 14th century there was a general ferment within the culture itself, which, together with the rebirth of learning (partly as a result of the rediscovery of Greek work), is referred to as the Renaissance. Interestingly, it was the artists, rather than the professional anatomists, who were intent upon a true rendering of the bodies of animals and men and thus were motivated to gain their knowledge firsthand by dissection. No individual better exemplifies the Renaissance than Leonardo da Vinci, whose anatomical studies of the human form during the late 1400s and early 1500s were so far in advance of the age that they included details not recognized until a century later. Furthermore, while dissecting animals and examining their structure, Leonardo compared them to the structure of man. In doing so he was the first to indicate the homology between the arrangements of bones and joints in the leg of the human and that of the horse, despite the superficial differences.

Homology was to become an important concept in uniting outwardly diverse groups of animals into distinct units, a factor that is of great agnificance in the study of evolution. Other factors had a profound effect upon the course of biology in the 1500s, particularly, the introduction of printing around the middle of the century, the increasing availability of paper, and the perfected art of the wood engraver, all of which meant that illustrations as well as letters could be transferred to paper. In addition, after die Turks had conquered Byzantium in 1453, many Greek scholars took refuge in the West; the scholars of the West thus had direct access to

the scientific works of antiquity, rather than indirect access through Arabic translations.

Exercise 11. *The following text is grammatically incorrect. Make the necessary correction.*

The Study of the Reproduction and Development of Organisms

A question posed by Aristotle were whether the embryo are preformed and therefore only is enlarges during development or whether it differentiates from an amorphous beginning. Two conflicting schools of thought had been being based on this question: the preformation school maintained that the egg is contains a miniature individual that develops into (he adult stage in the proper environment; the epigenesis school believed that the egg are initially undifferentiated and that development occurs as a series of steps. Prominent supporters of the preformation doctrine, which will widely held until the 18th century, included Malpighi, Swammerdam, and Leeuwenhoek. In the 19th century, as criticism of preformation mounted, Karl Ernst von Baer, an Estonian embryologist, was provided the final evidence against the theory. His discovery of the mammalian egg and his recognition of the formation of the germ layers out of which the embryonic organs develop is laiding the foundations of modem embryology.

Exercise 12. *Read quickly, try to catch the main information and retell the text.*

Revitalization of Anatomy

Italy, during the Middle Ages, became the most active scientific centre, although its major interests were concentrated on agriculture and medicine. A development of particular significance at this time was the introduction of dissection into medical schools, a step that revitalized the study of anatomy. Because of what it reveals about medieval anatomy in general, the work of Mondino dei Liucci, the most famous of the Italian anatomists at the beginning of the 14th century, is particularly important. First, because there was no way of preserving cadavers, organs that spoiled quickly had to be dissected rapidly. Furthermore, it was the custom for the teacher to leave the actual dissection to an

underling, who, not wishing to offend the teacher, agreed with all of his statements.

Thus, although Mondino performed all of his own dissections and, from his observations, could have corrected the errors of the Greeks and Arabs, he did not choose to contradict any of the authorities. Even when the authorities contradicted themselves, Mondino sought to harmonize their views. Perhaps Mondino exemplifies the difficulty that was so characteristic of the era; namely, the problem of breaking away from established authority.

UNIT 2.3
MOLECULAR BIOLOGY.
THE CELL

Exercise 1. *Look through the text and try to get the gist. Then read and translate it.*

Molecular Biology

Molecular biology is a field of science concerned with studying the chemical structures and processes of biological phenomena at the molecular level. Of growing importance since the 1940s, molecular biology developed out of the related fields of biochemistry, genetics, and biophysics. The discipline is particularly concerned with the study of proteins, nucleic acids, and enzymes - i.e., the macromolecules that are essential to life processes. Molecular biology seeks to understand the three-dimensional structure of these macromolecules through such techniques as X-ray diffraction and electron microscopy.

The discipline particularly seeks to understand the molecular basis of genetic processes; molecular biologists map the location of genes on specific chromosomes, associate these genes with particular characters of an organism, and use recombinant-DNA technology to isolate and modify specific genes. In its early period during the 1940s, the field was concerned with elucidating the basic three-dimensional structure of proteins. Growing knowledge of the structure of proteins in the early 1950s enabled the structure of deoxyribonucleic acid (DNA) - the genetic blueprint found in all living things to be described in 1953.

Further research enabled scientists to gain an increasingly detailed knowledge not only of DNA and ribonucleic acid (RNA) but also of the chemical sequences within these substances that instruct the cells and viruses to make proteins. Molecular biology remained a pure science with few practical applications until the 1970s, when certain types of enzymes were discovered that could cut and recombine segments of DNA in the chromosomes of certain bacteria. The resulting recombinant-DNA technology became one of the most promising branches of molecular biology because it promised the ability to modify the genetic sequences that determine the basic characters of plants and animals.

Exercise 2. *Answer the questions.*

1. What is molecular biology?
2. What fields did molecular biology develop out of?
1. What is the discipline concerned with?
4. What does the discipline seek to understand?
5. What is one of the main promising branches of molecular biology?

Exercise 3. *Before reading the following text memorize words and word combinations.*

choice	-	вибір
significance	-	значення, важливість
cork slice	-	скибка кори коркового дерева
to appear	-	з'являтися
row	-	ряд
to remind	-	нагадувати
the tiers of monks' cells	-	ряди (яруси) келій монахів
to survive	-	виживати
to convey	-	перевозити, передавати
feather	-	пір'я
fish scale	-	луска риби
mold	-	пліснява
successors	-	наступник, спадкоємець
excretion	-	виділення
tissue	-	тканина
advanced	-	передовий
dense	-	густий, щільний
nucleus	-	ядро
layer	-	шар
thread-like fibers	-	ниткоподібні волокна
abandoned	-	занедбаний, покинутий

Exercise 4. *Write out from the text the international words and give their meanings.*

Exercise 5. *Translate and memorize the following words paying attention to the suffixes and prefixes.*

1. to signify (v), significance *(n),* significant *(adj);*
2. to decompose (v), composer («), composition *(n),* decomposition («);
3. to connect (v), connection *(n),* connective *(adj);*
4. to orginize (v), orginezer *(n),* organization *(n);*
5. to arrange (v), arrangement *(n);*
6. to generalize (v), generalization *(n),* generality *(n),* general *(adj);*
7. concept *(n),* conception *(n);*
8. accurate *(adj),* accuracy *(n),* accurately *(adv);*
9. to actualize (v), actuality *(n),* actual *(adj),* actually *(adv);*
10. attention *(n),* attentive *(adj),* attentively *(adv);*
11. to brief (v), brief *(n),* brief (adj), briefly *(adv).*

Exercise 6. *Underline suffixes and prefixes which have negative meaning. Define part of speech. Translate the words.*

Inconvenient, unfavourable, inorganic, invisible, countless, unpleasant, disintegration, helpless, deformation, useless, irregular, insoluble.

Exercise 7. *Form verbs from the following nouns. Translate them. Classification - to classify - класифікувати*

Organization _____
Development_____
Division _____
Change _____
Use _____
Appearance _____
Usefulness _____
Observation _____
Composer _____

Exercise 8. *Look through the text and try to get the gist. Then read and translate it.*

The Cell

The unit of protoplasmatic organization is the cell. The word “cell” is not a very good choice in this connection, but it has significance in the history of biology. The name was given by Robert Hooke. One of the first scientists having used a newly developed biological tool, the microscope, to the tiny divisions that he saw in these slices of cork. The cork slice through his microscope, appeared to be made up of many small compartments, arranged m rows, and reminded him of the tiers of monks’ cells in English monasteries, lie therefore called each compartment a cell and the name has survived, ill hough it does not accurately convey the picture of a living unit. What I looke actually saw in the nonliving wall which had once surrounded the living protoplasm, was not protoplasm itself. His microscopic studies of some oilier materials, such as feathers, fish scales, molds, snow crystals and fabrics, brought him closer to the sight of living cells but not close enough to see the living substance.

Observations of the classical microscopists and those of their successors on individual cells as parts of organisms, both plant and animal, led to one of the greatest and for a time most useful of biological generalizations, the cell theory. This concept was first brought to general attention in 1838.

It was a natural actuate of the many observations that had been made during the early part of the nineteenth and the preceding centuries.

All living things are composed of cells. Very simple organisms such as yeast and bacteria consist of only one cell. They are one-celled or unicellular organisms. A large organism, such as a human being, contains billion upon trillions of cells and is called a multicellular organism. A drop of blood, for instance, contains about forty billion cells. And there are thousands of drops of blood in the average man.

Despite its small size, each cell is a tiny drop of life. Some cells can exist independently, and do, as in the case of bacteria. Human cells, however, have lost that ability. They depend on one another and specialize in one function or another. Some cells specialize in photosynthesis, some in digestion, some in excretion and some in reproduction.

Groups of cells of a similar shape, size and function form a tissue. When tissues of different types are grouped together for a common function they form an organ. Groups of cells, taken all together, are more advanced than single cells, even if the latter are more independent.

The living matter inside a cell is called protoplasm. The protoplasm is divided into parts. Near the center of the cell is a part which is denser and thicker than the rest of the cell. It is the nucleus. The rest of the cell is cytoplasm.

Like any other living things, cells grow and multiply. Most cells multiply by dividing down the middle. Then there are two cells where only one existed a moment before. The cell nucleus is in charge of seeing that cell division takes place properly. The cytoplasm takes care of the day-by-day life of cell. Cells in different parts of the body vary in their shape according to the work they must do. Fat cells are just tiny blocks of fat surrounded by a thin layer of protoplasm. The red cells of the blood are little disks that contain a protein called hemoglobin, which carries oxygen to all other cells of the body. Red blood cells are so simple, they don't even have a nucleus and so cannot grow or divide.

Nerve cells have irregular shapes with long thread-like fibers sticking out of them. Impulses and sensations travel along those fibers. Muscle cells are long and thin. They can contract into short, thick cells whenever necessary.

Some cells are so specialized that they have abandoned almost everything but their main function. They have even lost the ability to multiply. A baby is bom with all the brain cells, for instance, that it will ever have. Still other cells are always growing. The cells of the skin grow and divide throughout life.

Exercise 9. *Find pairs of synonyms, translate them.*

Exact, concept, brief, result, immense, to exist, fundamental, tiny, sort, disease, idea, shortly, conclusion, great, to live, basic, kind, illness, similarity, to make a voyage, likeness, precise, to travel, tool, instrument, small.

Exercise 10. *Translate into Ukrainian and memorize the synonyms.*

to consist of
to be composed of складатися з
to be made up of

1. All living things are composed of cells.
2. Multicellular organisms are made up of a number of cells.
3. The human being is made up of about 50 000 000 000 000 cells.
4. Microorganisms are made up of single cells, they are unicellular organisms.
5. Tissues consist of groups of cells of similar shape, size and function.

Exercise 11. *Give Ukrainian equivalents to the following expressions. Find them in the text and make up your own sentences with these expressions.*

1. yeast _____
2. sticking out _____
3. avarage man _____
4. the latter _____
5. to be in charge of seeing _____
6. throughout life _____
7. by dividing _____
8. for instance _____
9. to be made up of _____

Exercise 12. *Translate into Ukrainian paying attention to degrees of comparison.*

1. Nucleus is denser and thicker than the rest of the cell.

2. Groups of cells, taken all together, are more advanced than single cells.
3. Single cell are more independent than groups of cells taken together.
4. The human being is more complex and advanced than a bacterium.

Exercise 13. *Change subordinate clouses to Participle constructions.*

1. While he was walking in the street he met his friend.
2. When I rest after my work I read a newspaper.
3. The books were returned to the library when they had been read by students.
4. The instruments will be spoiled if they are left in the open air.
5. After the student had been examined he went home.

Exercise 14. *Answer the following questions.*

I. What are the living things composed of?
2'. What are unicellular organisms?
3. Which organisms are called multicellular?
4. How many cells does a drop of blood contain?
5. Can human cells live independently?
6. Why have they lost that ability?
7. What does a cell consist of?
8. What are the main functions of a cell?
9. What shapes do different cells of the body have and why?
10. Why cannot red blood cells grow and divide?
II. Which human cells have lost the ability to multiply?

Exercise 15. *Describe different kinds of cells completing the sentences by words from the text.*

9. Red blood cells are ...
10. Muscle cells are ...
11. Fat cells are tiny ...
12. Nerve cells have ...

Exercise 16. *Translate the following text in writing paying attention to Participles.*

Cells, Tissues, Organs and Systems

With few exceptions, protoplasm is organized into microscopically visible units called cells. Cells are the smallest living units (except for the viruses). They are variously shaped, have a considerable range of size, and are associated in different ways. They all have structural features in common.

In some instances single cells constitute entire organisms, each such cell carrying on all the life processes. Or small numbers of cells may be associated in colonies. In these colonial groups all cells appear similar and have the same function. In other aggregation of cells there is often division of labour, particular cells being more concerned with some life functions than with others.

This division of labour becomes increasingly important in the higher forms of life which have great structural complexity. In these higher plants and animals the cells are organized into tissues, or groups of ceils with similar structure and functions. Combinations of tissues make up organs with more or less distinct functions. In the animals, which are functionally more complicated in systems, or groups of organs that are collectively responsible for certain functions.

Exercise 17. *Translate the following texts into Ukrainian. Pay attention to Participles:*

11. 1. He is doing research in the field of biology. 2. While doing research he suggested a new theory. 3. The leading scientists of the world doing research in this field came to the conference. 4. The technology applied improved the quality of the experiment. 5. The result obtained showed that I was right. 6. The invited delegates were told about the work of our institute. 7. The data collected helped me in my work. 8. He was invited to this conference. 9. When invited I always came. 10. Having been invited beforehand he had a lot of time to prepare his report. 11. Having come into the room the lecturer began his lesson. 12. Having used a new method scientists obtained good results. 13. Scientists must concentrate their efforts on the aspects of science having the greatest promise for the future. 14. The results being obtained at this laboratory are of great importance. 15. Being asked to give the material and some pictures for publication he did it with pleasure.

12. 1. The exercises having been written in pencil, we had to rewrite them. 2. The problem having been solved, we could carry on the necessary experiment. 3. Having returned from the expedition he began preparing a report about his work. 4. My friend having returned from the expedition, we shall see him in our laboratory in a few days. 5. He was asked a great many questions, some of them being very difficult to answer. 6. The first part of the work having been finished, the results were published in a scientific journal. 7. Having been shown the journal, he asked his friend if he could lend him the book for a few days. 8. Being well written, the article was short and clear. 9. The article being well written, he read it with pleasure. 10. Our work having been completed, he made a report at the scientific conference of the students. 11. The problem having been approached from different points of view, its practical significance was stressed again. 12. The report having aroused a great interest both among the students and the specialists, the latter took part in the discussion too.

Exercise 18. *Are the following statements true or false? Correct the false statements. Use phrases given below.*

on the contrary; *I don't believe that;*
to my mind; it is considered that; as it known

These tiny things never grow. — On the contrary, they eat and grow, travel and multiply.

2. Bodies of both plants and animals consist of cells.
3. The size and shape of plants are different, but their protoplasm are similar.
4. Plastids, the minute cell bodies are in the nucleus.
5. The nucleus is different from protoplasm in that its proteins are less complex.
6. Vacuoles appear only when the cell enlarges.
7. The cells of many flowers are coloured with pigments in the cell sap.
8. The cell wall is surrounded by a thin cellulose layer.

Exercise 19. *Fill in the gaps with the following words. Translate the sentences.*

vacuole, cell, minute, property, protoplasm, hereditary, droplet, cell wall, to be recognized

1. The early microscopists were fascinated with the world of _____ plants and animals unseen before.
2. The properties which we associated with life are the properties of _____ that is differentiated into cytoplasm, nucleus and plastids.
3. In the development of the plant cell _____ filled with “cell sap” appears.
4. Fine _____of water are usually dispersed in fatty materials.

5. The jelly-like part of the _____which was named protoplasm is not a single chemical substance
6. _____ resemblances and dissimilarities reappear in succeeding generations.
7. In some cells _____ may retain its central position, supported by cytoplasmic strands.
8. The properties of the microscopically visible parts of plant – the protoplasmic structures and are determined in part by the kinds of molecules of which they are composed.
9. Oxygen and hydrogen are gases with specific _____.
10. When treated a diluted solution of iodine? starch grains may _____ by their various shades of blue and purple.

Exercise 20. *Make up short dialogues of the following situations.*

1. Ask your friend if there is any difference between a green plant cell and animal cell, and between a cell membrane and a cell wall. Discuss his answer.
2. A new student joined your group. He had studies at the Physical faculty. He doesn't know anything about the cell theory. Tell him all you know about it.
3. A space craft carried some substance to the Earth from another planet. Examining it under the microscope you saw a cell. What conclusion can you draw from this fact?
4. When the cells are placed under the microscope they will die, if they become dry. From your knowledge of protoplasm explain the reason for this.
5. Some old scholars were convinced that protoplasm has a nucleus structure, other said it is fibrillar, the third group tried to prove that it is cellular. All of them were mistaken. Why so?

Exercise 21. *Make up the annotation to the following text in English.*

Клітина - це первинна жива система, що складається з двох основних частин – цитоплазми і ядра. Вона є основою будови, розвитку, життєдіяльності всіх тваринних і рослинних організмів. Клітини, з яких складається живий організм, не є ідентичними, проте мають багато спільних ознак. Це доводить єдність походження всіх живих організмів, що населяють землю.

Клітини, що складають бактерії, є самостійними організмами. На відміну від них клітини, що входять до складу багатоклітинних організмів, є взаємозалежними частинками цілісної системи. Основна будова тваринних і рослинних клітин дуже схожа, але останні відрізняються деякими особливими рисами. У тварин, наприклад, відсутні мікроскопічні клітинні оболонки, а всі рослинні клітини оточені добре виявленими целюлозними стінками, які можуть мати складну бцдову і включати різні органічні і неорганічні речовини.

Клітина, як жива система, підтримує і відновлює свою цілісність, адаптується до умов середовища і виконує різні функції за рахунок речовини і енергії, що поповнюються з навколишнього середовища. Будь-яка клітина, будучи високорганізованою живою матерією, має складний хімічний склад. Саме внутрішня структура клітини забезпечує взаємодію одних ферментів і розбіжність інших, завдяки чому біохімічні реакції протікають узгоджено і в певній послідовноті.

UNIT 2.4
MICROBES

Exercise 1. Before reading the text memorize words and word combinations.

seldom - рідко

to surround	-	оточувати
to share	-	ділитися з кимось
indeed	-	насправді
to multiply	-	множити збільшувати
moisture	-	волога
to prevent (from)	-	запобігати
to absorb	-	поглинати
activity	-	діяльність
decay	-	гниття, розпад
to purify	-	очищувати
creature	-	створіння, істота
to magnify	-	збільшувати
inch	-	дюйм

Exercise 2. Give Ukrainian equivalents to the following word combinations.

1) to prevent from _____
2) a simple way of _____
3) to bring about _____
4) to keep free from _____
5) to be concerned with _____
6) to have a chance _____
7) to be safe from _____
8) to vary in size _____
9) as ... as _____
10) to observe through a microscope _____

Exercise 3. *Give all possible derivatives of the following verbs. Define parts of speech to which they belong.*

1) to surround _____
2) to remove _____
3) to mean _____
4) to travel _____
5) to multiply _____
6) to cover _____
7) to resist _____
8) to purify _____
9) to absorb _____
10) to require _____
11) to observe _____
12) to produce _____
13) to act_____
14) to prevent _____
15) to power_____

Exercise 4. *Find in the text and write out adverbs with the suffix -ly.*

Exercise 5. *Read and translate the text.*

Microbes

Microbes are little things we seldom see. Billions of microbes surround us everywhere. They even

share with us the food we eat. When we wash our hands with soap we remove only nine out of every ten. The name «microbe» comes from two Greek words meaning «small» and «life». It's a good name for them, because they are very much alive and very small indeed. They are far too small for our eyes to see.

These tiny little things eat and grow, travel and multiply, and live lives as real as those of any other plants or animals. They live in almost every sort of place: in water, in soil, in air, on dust, in milk and other food, in and on our bodies. We have discovered them by the work they do, and by observing them through powerful microscopes.

Microbes require warmth, moisture, air, and food. Some get their food from dead material, such as plant and animal remains and from soil; others from living plants or animals. As the latter take food from living things, they prevent them from growing normally. In animals they frequently cause disease and death. Microbes have a very simple way of eating: they just absorb the food into any part of their bodies.

Microbes vary in size and activity. A few microbes bring us disease and spoil our food. But far more microbes are our friends. Some of them bring about the decay of animal and plant remains. They keep the world free from being full of refuse. Others purify the soil for our crops, help us in making butter and cheese, leather and tobacco, and even our bread.

We are most concerned with harmful microbes that cause disease in the hiunan body. Some of these enter wounds in the skin and grow and multiply in the blood. As they do so, they produce poisons which may travel throughout the body and bring about death. Fortunately, most of these microbes ’have little chance of living or multiplying if the person is in good health.

These tiny creatures were first discovered almost three hundred years ago through a microscope which magnified them one hundred and sixty times. Nowadays it is usual to magnify them one thousand times, and the microcamera can photograph them.

If twenty-five thousand microbes could be made to stand in a straight line, they would measure one inch. Of course, scientists have an accurate way of measuring them - they use microns. A micron is one-thousandth part of a millimetre. Each hair on your head is about sixty microns thick, and the average microbe is about one micron in diameter. Some are much larger - twenty five microns, and some are much smaller - one fifth of a micron.

If we want to be safe from harmful microbes, we must learn to avoid them, to kill them and to resist them. We avoid them by keeping away from diseased people, breathing as pure air as can be found, using safe foods and drinks. We may kill microbes by using soap, by letting direct sunlight into our rooms, by boiling water or food and sometimes by freezing it. We can resist them better if we go in for sports in all kinds of weather and in every season.

Exercise 6. *Give English equivalents to the following word combinations.*

1) викликати хворобу _____
2) вимагати тепло та їжу_____
3) спостерігати в мікроскоп_____
4) мати змогу жити _____
5) дуже простий спосіб_____
6) значно більше_____
7) заважати росту_____
8) такий же чистий, як _____

9) (бути) різного розміру_____

Exercise 7. *Choose the necessary word from the two given in brackets.*

1. They live in almost (every, each) sort of place.
2. Microbes require (warm, warmth)
3. Harmful microbes prevent plant from (growth, growing) normally.
4. Microbes have a vary (easy, simple) way of eating.
5. We go in for sports in all (types, kinds) of weather.

Exercise 8. *Paraphrase the following sentences using the words in the right column instead of the words in the left column.*

many more	*far more*
to cause	*to bring about*
to have a possibility	*to have a chance*
to be interested in	*to be concerned with*

1. Many more microbes are our friends.
2. They produce poisons which may cause death.
3. Microbes have no possibility of living and multiplying if the person is in good health
4. We are interested in the cause of this disease.

Exercise 9. *Fill in the prepositions or adverbs if necessary.*

1. They live _almost every sort__place: _ water,___soil, __ air, _ dust, __milk.
2. We have discovered them _____powerful microscopes.
3. Some get their food_____dead material.
4. They prevent living things _____growing normally.
5. Microbes have a very simple way_____ eating.
6. They vary_____ size and activity.
7. Microbes keep the world free _____ being full _____refuse.
8. Others purify the soil _____our crops, helping _____us to make butter and cheese, leather and tobacco.
9. Some _____these enter_____ wounds_____the skin and grow and multiply _____the blood.
10. We can resist them better we go_____sports_____all kinds _____ weather.

Exercise 10. *Write out from the text predicates in Passive Voice.*

Exercise 11. *Put the words given in brackets into correct order.*

1. We have discovered them (them, by, through, observing, microscopes, powerful).
2. Other purify the soil for our crops (in, help, making, butter, and, us, cheese).
3. They produce poisons, which (travel, throughout, may, the body).
4. If we want to be safe from harmful microbes (must, to, we, them, learn, avoid).
5. (better, we, them, resist, can) if we go in for sports in all kinds of weather.

Exercise 12. *Put the questions the answers to which are the following sentences.*

1. We can observe them through powerful microscopes.
2. They help us in making butter and cheese, leather and tobacco.

3. We may kill microbes by letting sunlight into our rooms.
4. They frequently cause disease.
5. Microbes require warmth, moisture, air, and food.
6. Microbes vary in size and activity.
7. Some of them enter wounds in the skin.
8. We avoid them by keeping away from diseased people.
9. Microbes may be killed by boiling water and food.

Exercise 13. *Translate the following sentences into English.*

1. Мільйони мікробів оточують нас всюди.
2. Коли ми миємо руки з милом, ми знищуємо тільки дев'ять мікробів з кожних десяти.
3. Слово «мікроб» походить від двох грецьких слів «малий» та «життя».
4. Мікроби мають дуже простий спосіб живлення – вони абсорбують поживні речовини всім організмом.
5. Деякі мікроби допомагають у виробництві масла, сиру, тютюну та навіть хліба.
6. Шкіра людини здатна вбивати мікроби за умови, що вона чиста.
7. Бактеріологія робить значні успіхи: ми дізнаємось багато нового про хвороботворні та корисні бактерії.

Exercise 14. *Answer the following questions.*

1. Where do microbes live?
2. What do microbes require?
3. What do they frequently cause in animals?
4. What does help to keep the world free from being full of refuse?
5. What do harmful microbes cause in the human body?
6. Are most of the microbes our friends or enemies?
7. What must we do to be safe from harmful microbes?
8. Why must we breathe as pure air as we can?
9. What is the origin of the word "microbe"?
10. When were microbes first discovered?
11. Can a microcamera photograph them nowadays?
12. How long is an average microbe?

Exercise 15. *Correct the wrong statements. Use phrases given below.*

on the contrary;
to my mind;
as it is known
I don't believe that;
it is considered that;

These tiny things never grow. - On the contrary, they eat and grow, travel and multiply.

1. It is impossible to observe microbes through powerful microscopes.
2. They do not require warmth and food.
3. They very seldom cause disease.
4. Very few microbes are our friends.

5. We cannot resist and kill microbes.
6. They do not take part in making butter, cheese, tobacco and bread.
7. Microbes have a very complicated way of eating.

UNIT 2.5
METABOLISM

Exercise 1. Before reading the text memorize words and word combinations.

to occur	-	траплятися, відбуватися
to proceed	-	продовжувати, (from) виходити, (to) переходити
to incorporate	-	змішувати(ся), обєднувати
to excrete	-	виділяти
manufacture	-	виробництво
to destroy	-	руйнувати
starch	-	крохмаль
acid	-	кислота
particularly	-	особливо, дуже, зокрема
significant	-	важливий, значний
tissue	-	тканина
storage	-	зберігання
peculiar	-	особливий, своєрідний

Exercise 2. *Translate the following pairs of words. Pay attention to negative prefixes.*

a) organic - inorganic; comparable - incomparable; accurate - inaccurate; capable - incapable; complete - incomplete; direct - indirect;

b) liberal - illiberal; logical - illogical; legal - illegal;

c) moral - immoral; movable - immovable; modest - immodest;

d) regular - irregular; resolute - irresolute.

Exercise 3.Complite the chart.

operation	-	to operate
chemical	-	_____
_____	-	to change
activities	-	_____
respiration	-	_____
_____	-	to mean
_____	-	to reserve
value	-	_____
_____	-	to compare

_____ - to imitate
reaction - _____

Exercise *4. Read and translate the text.*

Metabolism

We know that life consists of complex series of chemical changes occurring in the protoplasm. As life proceeds, food and other substances are built up or broken down or changed from one form to another. Materials from the environment are absorbed and incorporated in the protoplasm. Waste materials are excreted from it, and solid substances are changed to liquids and liquids to solids. The sum of all these chemical activities is know as «metabolism».

Those metabolic processes by which complex substances are built up from simpler ones are known under the term «anabolism». The manufacture of carbohudrates from water and carbon dioxide is a good example. The breaking down of complex substances, as in respiration, is known as «catabolism». The catabolic process, by which a complex food substance is changed into a simpler form, without being completely destroyed, is known as «digestion». By means of digestion, starches and celluloses are changed to sugars; fats are changed to amino acids. This process is particularly significant as it commonly changes insoluble substances into soluble ones. Soluble substances are transported to some other part of the plant body and absorbed by the tissues, which use them.

A plant has all its reserve food material in a soluble form all the time, and it is quickly used when food is needed. But for storage purposes, the insoluble forms, such as starches, fats, and some of the proteins, are very valuable to the plant. They are also comparatively stable and do not decompose readily. Metabolic changes of materials from one form to another occur during the normal life of the plant. Sometimes changes from soluble to storage form and back again may be repeated many times before the food is actually used in metabolism.

The living parts of a plant are chemical laboratory in which many kinds of changes are taking place. When we try to imitate these reactions in our laboratories we meet some of the most difficult problems of organic chemistry. Many of these changes are so specialized that we cannot repeat them at all. We can change starch to sugar by heating it with a small amount of an acid in the presence of water, and we can further break the sugar down into water and carbon dioxide by heating it is the presence of oxygen. But the building up of sugar from water and carbon dioxide, or of starch from sugar, is still impossible.

The living cell does this work by means of special chemical agents known as «enzymes». Very little was known about enzymes until the end of the nineteenth century. Between 1890 and 1900 a series of studies, made in various places, but largely in Germany, showed us the presence of these peculiar chemical substances.

Exercise 5. *Give Ukrainian equivalents to the following expressions. Find them in the text and compose your own sentences with these expressions.*

1) chemical changes _____
2) by means of _____
3) environment _____
4) to be changed _____
5) waste materials _____
6) insoluble substance _____
7) metabolic process _____

8) soluble substance _____
9) to break down _____
10) term _____
11) to be very valuable to _____
12) digestion _____

Exercise 6. *Find in the text sentences in which predicate is used in Passive Voice and underline the predicate. Use the following verbs in the sentences of your own using Passive Voice.*

Transport, decompose, buiid, adsorb, use, change, excrete.

Exercise 7. *Write out from the text sentences with predicate in Passive Voice (not less than 10). Transform Passive into Active where it is possible. Put five types of questions to both sentences.*

Exercise 8. *Put missed words and word combinations, using the text "Metabolism ".*

1. Life consists of complex series of ___ occurring in protoplasm.
2. In living organisms foods and other substances are built up or_____or changed from one form to another.
3. Waste materials _____ from living organisms.
4. Metabolism is the sum of all _____.
5. A good example of "anabolism" is the manufacture of ____from water and carbon dioxide.
6. The catabolic process by which a complex food substance is changed into _____ _ is known as "digestion".
7. Digestion is significant as it changes_____into soluble substances.
8. For storage purposes, the insoluble forms such as _____are very valuable to the plant.
9. Starches, fats and some proteins are comparatively stable and do not _____ readily.
10. Metabolic changes of materials from one form to another _____during the normal life of the plant.

Exercise 9. *Translate the following sentences using the active vocabulary.*

1. Процес травлення дуже важливий, оскільки завдяки йому нерозчинна речовина перетворюється в розчинну. 2. Навколишнє середовище має значний вплив на живі організми. 3. Якщо організм фунціонує нормально, продукти життєдіяльності за звичай легко видаляються з нього. 4. Крохмаль, жири та деякі білки є відносно стікими до розчинення. 5. Звичайно речовина знаходиться в одному з трьох станів: твердому, рідкому або газаподібному. 6. Білок являє собою сполуки амінокислот, що включають вуглець, водень та кисень. Під впливом різних факторів органічна речовина розкладається на більш прості елементи. 8. Нерозчинні форми речовини дуже цінні для ослин, тому що вони є резервним поживним матеріалом. 9. Життя – це складний ряд хімічних змін у протоплазмі. 10. Вуглеводень синтезується внаслідок взаємодії води та вуглекислого газу.

Exercise 10. *Answer the following questions.*

1. What can we call the living parts of a plant?

2. What changes take place in a chemical laboratory of a plant?
3. Can scientists imitate all chemical reactions in laboratory?
4. Can we change starch to sugar? If we can how?
5. How can we break down sugar into water & carbon dioxide?
6. Can scientists build up sugar from water & carbon dioxide or starches from sugar?
7. How does the living cell build up complex substances?
8. When were “enzymes” discovered?
9. Each enzyme can digest any substance in an organism, can not it?
10. How do temperature & freezing affect the work of enzymes?
11. What is the biological importance of enzymes?

Exercise 11. *See if the following is correct, if not give the right version. Use phrases given below.*

That's right
Exactly
Quite so
I can't agree with it.
That's wrong
I don't think so.

These tiny things never grow. - That’s wrong, they eat and grow, travel and multiply.

1. Life is a complex series of chemical changes occurring in the protoplasm.
2. The absorption of materials from the environment & their incorporations into the protoplasm is known as metabolism.
3. Anabolism is the breaking down of complex substances into the simple one.
4. Digestion is the catabolic process by which a complex food substance is changed into a simpler form without being completely destroyed.
5. By means of digestion sugars are changed to starches.
6. Reserve food materials in plants are in a solid form.
7. For storage purposes the insoluble forms are very valuable to the plant.

Exercise 12. *Find in the text the words corresponding to the following definitions.*

1. Material taken into an organism and used for growth and as a source of energy.
2. Complex colloidal living substances of plant and animal cell.
3. The liquid that falls as rain and forms rivers, lakes and seas.
4. A mass of cells forming a basic structural element of an animal or plant body.
5. Substance which is present in any living matter.

Exercise 13. *Look through the text and:*

- Explain the process of metabolism.
- Compare the process of anabolism with that of catabolism. Give the examples.
- Show the significance for an organism of the process called digestion.
- Speak about the role of soluble forms of food materials for the plant body.

UNIT 2.6
BIOCHEMISTRY

Exercise 1. *Read and translate the text.*

What is Biochemistry

Biochemistry is the application of chemistry to the study of biological processes at the cellular and molecular level. It emerged as a distinct discipline around the beginning of the 20th century when scientists combine chemistry, physiology and biology to investigate the chemistry of living systems.

Biochemistry is both a life science and a chemical science - it explores the chemistry of living organisms and the molecular bases for the changes occurring in living cells. It uses the methods of chemistry, physics, molecular biology and immunology to study the structure and behaviour of the complex molecules found in biological material and the ways these molecules interact to form cells, tissues and whole organisms.

Biochemists are interested, for example, in mechanisms of brain function, cellular multiplication and differentiation, communication within and between cells and organs, and the chemical bases of inheritance and disease. The biochemist seeks to determine how specific molecules such as proteins, nucleic acids, lipids, vitamins, and hormones function in such processes. Particular emphasis is placed on regulation of chemical reactions in living cells.

An essential science. Biochemistry has become the foundation for understanding all biological processes. It has provided explanations for the causes of many diseases in humans, animals and plants. It can frequently suggest ways by which such diseases may be treated or cured.

A practical science. Because biochemistry seeks to unravel the complex chemical reactions that occur in a wide variety of life forms, it provides the bases for practical advances in medicine, veterinary medicine, agriculture and biotechnology. It underlies and includes such exciting new fields as molecular genetics and bioengineering.

The knowledge and methods developed by biochemists are applied to in all fields of medicine, in agriculture and in many chemical and health related industries. Biochemistry is also unique in providing teaching and research in both protein structure/function and genetic engineering, the two basic components of the rapidly expanding field of biotechnology.

A varied science. As the broadest of the basic sciences, biochemistry includes many sub-specialities such as neurochemistry, bioorganic chemistry, clinical biochemistry, physical biochemistry, molecular genetics, biochemical pharmacology and immunochemistry. Recent advances in these areas have created links among technology, chemical engineering and biochemistry.

Exercise 2. *Give answers to the following questions.*

1. What does chemistry study?
2. What does biochemistry study?
3. What does physics study?
4. What does biophysics study?

Exercise 3. *Before reading the text memorize words and word*

to probe - досліджувати, зондувати

hereditary information	-	спадкова інформація
premise	-	передумаова
strand	-	нитка (ДНК)
undergo	-	піддаватися
intermediary action	-	проміжна реакція
surprisingly	-	несподівано
to occur	-	траплятися, відбуватися, спадати на думку
ailment	-	захворювання
alleviate	-	полегшувати, частково знімати (біль)
disruption	-	розрив
therapeutic agent	-	лікарський (терапевтичний) засіб
to reveal	-	виявляти, викривати
to devise	-	винаходити
to explore	-	досліджувати, визначати, з'ясовувати
to investigate	-	досліджувати, вивчати, простежувати
to underlie	-	лежати в основі

Exercise 4. *Look through the text and try to get the gist. Read and translate the text.*

Biochemistry

As understanding of inorganic chemistry grew during the 19th century, attempts to interpret the physiological processes of living organisms in terms of molecular structure and reactivity gave rise to the discipline of biochemistry. Biochemists employ the techniques and theories of chemistry to probe the molecular basis of life. An organism is investigated on the premise that its physiological processes are the cdnsequence of many thousands of chemical reactions occurring in a highly integrated manner. Biochemists have established, among other things, the principles that underlie energy transfer in cells, the chemical structure of cell membranes, the coding and transmission of hereditary information, muscular and nerve function, and biosynthetic pathways. In fact, related biomolecules have been found to fulfil similar roles in organisms as different as bacteria and human beings. The study of biomolecules, however, presents many difficulties. Such molecules are often very large and exhibit great structural complexity; moreover, the chemical reactions they undergo are usually exceedingly fast.

The separation of the two strands of DNA, for instance, occurs in one- millionth of a second. Such rapid rates of reaction are possible only through the intermediary action of biomolecules called enzymes. Enzymes are proteins that owe their remarkable rate-accelerating abilities to their three-dimensional chemical structure. Not surprisingly, biochemical discoveries have had a great impact on the understanding and treatment of disease. Many ailments due to inborn errors of metabolism have been traced to specific genetic defects. Other diseases result from disruptions in normal biochemical pathways. Frequently, symptoms can be alleviated by drugs, and the discovery, mode of action, and degradation of therapeutic agents is another of the major areas of study in biochemistry.

Bacterial infections can be treated with sulphonamides, penicillins, and tetracyclines, and research

into viral infections has revealed the effectiveness of acyclovir against the herpes virus. There is much current interest in the details of carcinogenesis and cancer chemotherapy. It is known, for example, that cancer can result when cancer-causing molecules, or carcinogens as they are called, react with nucleic acids and proteins and interfere with their normal modes of action. Researchers have developed tests that can identify molecules likely to be carcinogenic.

The hope, of course, is that progress in the prevention and treatment of cancer will accelerate as soon as the biochemical basis of the disease is more fully understood. The molecular basis of biologic processes is an essential feature of the fast-growing disciplines of molecular biology and biotechnology. Chemistry has developed methods for rapidly and accurately determining the structure of proteins and DNA. In addition, efficient laboratory methods for the synthesis of genes are being devised. Ultimately, the correction of genetic diseases by replacement of defective genes with normal ones may become possible.

Exercise 5. *Underline suffixes and prefixes, translate the following words paying attention to the meanings ofsuffixes and prefixes. Define parts of speech.*

1. to treat - treatment - treaty
2. to develop - development — developed - developing
3. to investigate - investigation - investigator
4. to act - action - to react - reaction -reactor
5. to employ - employment - unemployment - employer - employee
6. to degrade - degradation - degrading
7. to establish - establishment - established
8. to integrate - integer - integral - integration - integrated
9. to inform- information- informal(-ly) -informant -informative -informer
10. to transfer - transfer *(n)* - transferable
11. to relate - relation - relative - relativity - relationship
12. to separate - separation - separate *(ad/.)* - separatist
13. to interfere - interference - interfering
14. to interpret - interpretation - interpreter
15. to search - research - researcher
16. to identify - identification - identical - identify
17. to accelerate - acceleration - accelerator
18. to correct - correction - corrector - corrective - correctly

Exercise 6. *Give your own derivatives of the following verbs.* to apply

to emerge _____

to explore _____

to occur _____

to multiply _____

to determine _____

to expand _____

to create _____

Exercise 7. *Choose definitions to the following terms: element, analysis, enzyme, cellulose and protein.*

- The decomposition of a compound into simpler substances.
- A substance consisting only of atoms having the same atomic number.
- A protein molecule that has the ability (usually very pronounced and very specific) to catalyse a particular biologically important reaction.
- A very high molecular weight polymer of glucose, containing a type of linkage not easily split by hydrolysis.
- A type of molecule, vital to life, which consists of a long chain of amino acids connected to one another by amide linkage.

Exercise 8. *Give the definitions of the following terms.*
Heredity, biotechnology, environment, chemistry, amino acid, bacteria.

Exercise 9. *Explain the difference in meaning in these pairs of synonyms.*
behaviour - manner

to emphasise - to underline

to include - to involve

to treat - to cure

research - study

Exercise 10. *Rewrite the sentences using the words in brackets.*

1. Animal and plant life contains a wide variety of organic and inorganic compounds *(various).*
2. Biochemistry is the study of compounds involved in biological processes (*investigation).*
3. The field of biochemistry is one of the frontiers of science (*borderlines).*
4. Many marvellous discoveries are being made by biochemists (*wonderful).*
5. Biochemical methods are the basis for the new field of biotechnology (*foundation*).

Exercise 11. *Write down from the text four sentences with modal verbs (in Active and Passive Voice). Transform Active into Passive and vice versa if it is possible.*

Exercise 12. *Put five types of questions to the sentences.*

1. Efficient laboratory methods for the synthesis of genes are being devised.
2. The correction of genetic diseases by replacement of defective genes with normal ones may become possible.
3. Many ailments have been traced to specific genetic defects.
4. Other diseases result from disruptions in normal biochemical pathways.

Exercise 13. *Put as many as possible special questions to the sentence.*

Chemistry has developed methods for rapidly and accurately determining the structure of proteins and DNA in 1963.

Exercise 14. *Answer the following questions.*

1. What gave rise to the discipline biochemistry?
2. What have biochemists established?

3. What does the study of bio-molecules present?
4. What are enzymes?
5. What are the reasons of diseases and ailments?
6. What drugs treat bacterial infections?
7. What is a reason of cancer?
8. What methods has chemistry developed?
9. When will the progress in the prevention and treatment of cancer accelerate?

Exercise 15. *Compress the information contained in the text and render it in three sentences.*

The commonly accepted theory of enzyme behaviour is the *lock-and-key theory.* According to this theory, the enzyme has a definite three- dimensional structure arranged in a way that allows the substance molecule to fit into the structure. Only a specific kind of substance can fit into a given enzyme. Once the enzyme and substance form an aggregate, the substance is exposed for the reaction. Recall that a catalyst increases the rate of a reaction.

Enzymes allow metabolic reactions to readily occur at body temperature. Without enzymes these reactions would not occur fast enough to maintain life processes. After an enzyme-catalysed reaction occurs, the product moves away from the enzyme, leaving it unchanged and available to catalyse the reaction of another substrate molecule.

Exercise 16. *Create a short dialogue using expressions of contrasting ideas.*

Exercise 17. *Say whether the following statements are used correctly (true) or incorrectly (false). Correct the false sentences. Use phrases given below.*

That's right	I can't agree with it.
Exactly	That's wrong
Quite so	I don't think so.

These tiny things never grow. -
That's wrong, they eat and grow, travel and multiply.

1. Biochemists employ the techniques and theories of chemistry to probe the atomic basis of life.
2. Biochemists have established the principles that underlie energy transfer in cells.
3. In fact, related bio-molecules have been found to fulfil similar roles in organisms as different as bacteria and human beings.
4. The separation of the two strands of DNA occurs in one-millionth of a minute.
5. Enzymes are proteins that owe their remarkable rate-accelerating abilities to their two-dimensional chemical structure.
6. Some diseases result from disruptions in normal biochemical pathways.
7. Bacterial infections cannot be treated with sulfonamides and penicillins.
8. The molecular basis of biologic processes is an essential feature of the fast-growing disciplines of molecular biology and biotechnology.

Exercise 18. *Read and translate the article. Make its annotation.*

Biochemistry - Chemistry of Life Biochemistry studies (is the study of) the chemical substances and processes that occur in plants, animals, and microorganisms and of the changes they undergo during development and life. It deals with the chemistry of life, and as such it draws on the

techniques of analytical, organic, and physical chemistry, as well as those of physiologists concerned with the molecular basis of vital processes. All chemical changes within the organism - either the degradation of substances, generally to gain necessary energy, or the build-up of complex molecules necessary for life processes - are collectively termed metabolism.

These chemical changes depend on the action of organic catalysts known as enzymes, and enzymes, in turn, depend for their existence on the genetic apparatus of the cell. It is not surprising, therefore, that biochemistry enters into the investigation of chemical changes in disease, drug action, and other aspects of medicine, as well as in nutrition, genetics, and agriculture. The term biochemistry is synonymous with two somewhat older terms: physiological chemistry and biological chemistry. Those aspects of biochemistry that deal with the chemistry and function of very large molecules (e.g., proteins and nucleic acids) are often grouped under the term molecular biology. Biochemistry is a young science, having been known under that term only since about 1900. Its origins, however, can be traced much further back; its early history is part of the early history of both physiology and chemistry.

Exercise 19. Give the definitions of the following terms.

Metabolism, chemical change, chemical elements, biosynthesis, hemoglobin, hemophilia, protein.

Exercise 20. *Write a list of key words related to biochemistry.*

Exercise 21. *Give answers to the questions that follow.*

1. What does chemistry study?
2. What does biochemistry study?
3. What does physics study?
4. What does biophysics study?
5. What does biology study?
6. What does biotechnology study?
7. What does bioorganic chemistry study?

Exercise 22. *Match the words and phrases in column A with their Ukrainian equivalents in column B.*

A	B
Scientific research	Доцент з біохімії
Research study	Доцент з клітинної біології
Graduate work in biochemistry	Аспірант з біохімії
Biochemistry graduate student	Науковець-дослідник
A former undergraduate	Професор-дослідник
A research scientist	Наукове дослідження
Student research assistant	Наукове дослідження
Senior research scientist	Випускна робота з біохімії
Research professor	Аспірант з біохімії
Lead author	Студент-науковий співробітник
Assistant instructor	Експериментатор, дослідник
Assistant professor of biochemistry	Старший науковий співробітник

Postdoctoral researcher in biochemistry	Помічник викладача
Associate professor of cell biology	Колишній студент останнього курсу
Experimentalist	Автор-керівник

Exercise 23. Read and translate the article.

Precision Biochemistry Tracks DNA Damage in Fish

May 15, 2006-Like coalmine canaries, fish DNA can serve as a measure of the biological impact of water and sediment pollution or pollution clean-up. That is one of the conclusions of a new study by researchers from the Pacific Northwest Research Institute, Woods Hole Oceanographic Institution, the University of Maryland and the National Institute of Standards and Technology (NIST).

Research over the past several years has demonstrated the adverse effects of industrial pollutants in water and sediment on the health of fish in the lower Duwamish River. The Duwamish flows through an industrialized section of south Seattle, Wash., and in 2001 a section of the lower river was added to the Environmental Protection Agency's Superfund list because of contaminants including polychlorinated biphenyls, polycyclic aromatic hydrocarbons, mercury and other metals, and phthalates. In previous research on Duwamish fish, PNRI used an infrared spectroscopy method to document DNA damage in the gills of English sole.

In a new joint paper, the researchers report on several biomarkers, including pollution-induced P450 enzyme changes, and on infrared spectral analysis of DNA and measurements of specific modifications to DNA from fish gills and livers using liquid and gas chromatography combined with mass spectrometry. Precision chemical analysis techniques at NIST allowed the researchers to identify and measure damage to adenine and guanine, specific chemical components or bases of DNA, at extraordinarily low levels - five lesions out of a 100 million bases in one case. The results correlated well with earlier research and revealed similar damage to liver DNA (more likely tied to the fish's food) and gill DNA (more probably reflecting pollutants in water).

The results suggest that these DNA lesions, and others like them, can be used as very sensitive biomarkers to provide a direct measure of the impact of contaminants on fish populations. Moreover, since natural DNA repair processes may gradually reverse the damage in the absence of further insults, these biomarkers also might be used to help assess the efficacy of pollution remediation efforts. The work was funded in part by the National Institute of Environmental Health Sciences.

Exercise 24. *Divide the text above into sense parts. Write its plan. Give the summary of it.*

Exercise 25. *Contrast the following sentences using the following contrastive means: the difference is..., in contrast to..., as compared to..., while.*

1. Fats are solid. Oils are liquid.
2. Starch consists of glucose molecules bonded to form polymer molecules. Cellulose consists of b-glucose molecules bonded to form polymer molecules.
3. Proteins are polymers made up to amino acid monomers. Lipids are esters of glycerol and carboxylic acids.

Exercise 26. *Notice some words with unusual singular and plural forms that English borrowed from other languages (Greek and Latin).*

Singular	*Plural*	*Singular*	*Plural*
alumnus	alumni	datum	data
alga	algae	index	indices
analysis	analyses	medium	media
appendix	appendices	nucleus	nuclei
basis	bases	phenomenon	phenomena
crisis	crises	radius	radii
criterion	criteria	spectrum	spectra
curriculum	curricula	vita	vitae

Exercise 27. *Translate the wards of the same root. Construct a "word-flower" of their derivatives.*

a) define, definite, definitely, definition, definitive;
b) observe, observable, observance, observation, observational, observatory, observer;
c) period, periodic, periodical, periodically, periodicity.

Exercise 28. *Put all types of questions to the following sentences.*

1. The work described in the UGA paper represents a significant advance.
2. It is the first functional identification of Arabidopsis pectin using biochemical and functional genomic approaches.
3. The questions regarding pectin biosynthesis remain.
4. The identification of Arabidopsis pectin provides the molecular tools to begin to break through the bottleneck of our understanding of pectin synthesis.

Exercise 29. *Give examples from the text to prove the statement.* Discovery of new molecular tools for biosynthesis could lead to important advances in use of pectin in medicine, agriculture and industry.

Exercise 30. *Write a synopsis (конспект, короткий огляд, синопсис) of the text using the content words you have just written out and learned.*

Enzyme Action Creates Protein Linked to Alzheimer's Disease

August 15, 2005 - Researchers at Southwestern Medical Centre have defined a key step in the production of beta-amyloid, a short protein that is thought to be responsible for the development of Alzheimer's disease. Understanding this step may aid in the discovery of drugs that could help block the disease from developing. In Alzheimer's disease, too much beta- amyloid is produced by an enzyme, that has many other essential roles. As a result, simply blocking the whole enzyme knocks out many of its other functions - which is fatal to the organism.

Using cultured human and mouse cells, as well as test-tube assays, Southwestern researchers singled out how just one portion of the enzyme, a protein called nicastrin, is involved in the pathway that produces beta- amyloid, thereby leading to Alzheimer's disease. They hope next to work on ways to specifically block nicastrin. The study appears in the August 12 issue of the journal Cell.

"The work provides an attractive potential strategy for developing treatment for Alzheimer's disease," said Dr. Gang Yu, assistant professor in the Centre for Basic Neuroscience and of cell biology and senior author of the study. The research uncovered an "unprecedented mechanism of biochemistry," Dr. Yu said.

Nicastrin is a large protein that is a component of an enzyme called gamma-secretase, which is lodged in the cell's membrane. When it is at the cell surface, nicastrin sticks out into the area outside the cell. It has been thought to play a key role in the creation of a protein called amyloid-beta - the prime suspect for the damage Alzheimer's does to the brain - but the exact mechanism was unknown.

Dr. Yu and his colleagues found that nicastrin binds to several proteins lodged in the cell's membrane, including one called amyloid precursor protein, or APP. Nicastrin then guides membrane-bound proteins to the active area of gamma-secretase, which then splits tire proteins. APP, for example, is chopped into two parts: amyloid-beta, which is then shipped to the outside of the cell, and another part that remains inside. Amyloid-beta forms the plaques seen in brains afflicted with Alzheimer's.

"Actually, it's quite a simple mechanism," Dr. Yu said. "Hopefully, we can screen for compounds that can block this process and find the exact pathways and how it can be regulated in Alzheimer's disease." Now that nicastrin's function has been ascertained, it opens a way to block just the splitting of APP, leaving all the enzyme's other functions intact. For instance, it may be possible to generate chemical compounds that specifically prevent nicastrin from latching on to APP. If APP doesn't attach to nicastrin, APP remains intact and harmless. Meanwhile, nicastrin would be free to bind all the other essential proteins that it works on.

The study was supported by the National Institutes of Health, the American Health Assistance Foundation, the American Federation for Aging Research and the Alzheimer's Association.

Exercise 31. *Give the definitions of the following terms.*

Antibiotics, molecule, cell, drug, enzyme, organism.

Exercise 32. *Translate the following sentences paying attention to different meanings of the following words.*

To reduce – відновлювати, зменшувати, зводити, приводити (мат.).

Reduction – відновлення, зменшення, приведення (мат.).

1. Reduction is the chemical reaction of accepting electrons accompanied by reduction of valences.
2. Many metals are obtained from their ores in the process of reduction.
3. Carbon and its oxide are often used in metallurgy to reduce metals from their compounds.
4. This equation can be reduced to the following expression.
5. All the fractions in this expression must be reduced.
6. To solve the task it is necessary to reduce the fractions to the common denominator.

Exercise 33. *From the following choose the word which is most nearly the same in meaning to the italicised words.*

Common - public, various, difficult, general, usual, ordinary, frequent.

Quantity - quality, size, number, amount.

Branch - section, department, area, frame, field.

Arrange - to organize, to set in order, to link, to make agreement.
Success - failure, accomplishment, comfort, handy.

Exercise 34. *Put 10-12 special questions to the article to cover the general meaning if it.*

Exercise 35. *Discuss informative (змістовний) and evaluative (оцінний) aspects of the article given above.*

UNIT 2.7
BIOPHYSICS

Exercise 1. *Read and translate the text.*

What is Biophysics

Biophysics can be generally defined as the study of biological systems from the perspective of the physical sciences. This is the field of science that explains how physical phenomena like mechanics, electricity, magnetism, light, heat, and nuclear radiation affect/account for the structure and the function of biological systems. The field is divided into different areas of interest, including:

Bioenergetics
Biophysical Theory and Modelling
Cell Biophysics
Channels, Receptors, and Transporters
Electrophysiology
Muscle and Contractility
Nucleic Acids
Photobiophysics
Proteins
Spectroscopy, Imaging, and other Techniques

The study of biophysics is more than just learning a collection of facts. This discipline trains you to think through problems like a physical scientist, that is, to devise theoretical constructs that piece together what seems like many disconnected facts. It teaches you the discipline to ask yourself routinely "Does this hypothesis make sense given from what is known about the dynamics of this biological system? Can I make a theoretical prediction based on exact physical principles?" This attitude is becoming increasingly important in the biological sciences as the field attempts to deal with the overwhelming amount of microscopic information derived from advanced scientific instrumentation.

The medical field has long recognized that a broad strength in science is a necessary foundation for a successful medical care. This recognition is reflected in the widely used entrance test for medical schools where students are tested not only on biological concepts but also equally on chemistry (including organic chemistry) and physics (including modem physics). All these subjects are covered in a biophysics major. Furthermore, some medical schools are now changing their medical programs by emphasizing the same discovery and think-through approach to learning Medicine.

Exercise 2. Before reading the text memorize words and word combinations.

achievement	-	успіх, здобуток
anxious	-	стурбований, неспокійний
attribute	-	властивість, відносити
award	-	нагорода, нагороджувати
bacteriophage	-	бактеріофаг
chapter	-	розділ
collaboration	-	співробітництво
contribute	-	робити внесок, сприяти
concern	-	стосуватися, мати відношення
consider	-	розглядати, вважати, гадати
cornerstone	-	наріжний камінь
distinct	-	чіткий, особливий, окремий
emergence	-	поява, прояв
explanation	-	пояснення
impetus	-	поштовх, стимул
intractable	-	упертий, непоступливий
in terms of	-	у вигляді
mature	-	цілком розвинутися, достигнути
pose	-	ставити, розташовувати певним чином
recent	-	сучасний, недавній
solution	-	вирішення, розчин
spectacular	-	ефективний, захоплюючий
strengthen	-	підсилювати
subsume	-	відносити до певної категорії
unravel	-	розгадувати, пояснювати

Exercise 3. *Read, translate and discuss the following text.*

Biophysics

Biophysics is the discipline concerned with the application of the principles and methods of physics and the other physical sciences to the solution of biological problems. The relatively recent emergence of biophysics as a scientific discipline may be attributed, in particular, to the spectacular success of biophysical tools in unravelling the molecular structure of deoxyribonucleic acid (DNA), the fundamental hereditary material, and in establishing the precisely detailed structure of proteins such as hemoglobin in order that the position of each atom may be known. Biophysics and the intimately related subject molecular biology now are firmly established as cornerstones of modem biology.

Interest in biophysics at the Cavendish Laboratory resulted in a very important discovery, the structure of deoxyribonucleic acid (DNA), the genetic material. This achievement by a British biophysicist F. Crick was based on X-ray data obtained by Maurice Wilkins at King's College, London. When Crick first went to the Cavendish Laboratory for education in biophysics, he worked under Perutz's direction and began the collaboration that led to the establishment of the structure of DNA, for which Crick, Watson, and Wilkins later were awarded a Nobel Prize.

Much impetus for biophysical investigation following World War II came from the desire of physicists to move away from physics into biology; this drive was strengthened by the publication in 1944 of Erwin Schrodinger's

book "What Is Life?" Schrodinger, the Austrian physicist who contributed substantially to the development of wave mechanics, was anxious to determine whether biological events could be accounted for in terms of known laws of physics and chemistry, or whether a full explanation would require the formulation of physical laws not yet known to exist. Because biological reproduction seemed to pose intractable problems, he devoted a chapter of his book to a consideration of the gene.

The discussion was based on the model put forward by Max Delbruck, a physicist who had for some years been studying the genetics of viruses that infect bacteria (bacteriophages). Delbruck's summer course on bacteriophages in 1945 at Cold Spring Harbor in New York set in motion the chain of events that led to understanding the genetic code by which the sequence of the nucleotides in DNA is translated into the sequence of amino acids in a protein.

The use of bacteriophage also provided an opportunity for experiments with a primitive living organism that could be studied without anatomic complexities. This aspect of biophysics has become more biochemically oriented as it has developed and is now known as molecular biology; sometimes it is considered a distinct discipline, and other times it is subsumed under the biophysical sciences.

Exercise 4. *Form verbs from the following adjectives by adding suffixes:*

-en: hard, weak, deep, soft;
-fy: identical, simple, intense:
-ise: special, real, crystal, general.

Exercise 5. *Form the opposite of the following words by using prefixes:*

de-: to form, increase, compose;
dis-: to connect, order, like;
in-: capable, different, essential;
im-: probable, possible, practical, proper;
un-: able, certain, common, known.

Exercise 6. *Pick out from the text above the words that best keep the meanings of the following words:*

Milestone, modem, research, calculate, suggest, begin.

Exercise 7. *Translate the following adverbs and find in the text above the sentences in which they are used.*

Relatively, precisely, intimately, firmly, substantially

Exercise 8. Get to know different meanings of some English words.

challenge –виклик, претензія; викликати, заперечувати;
entity – організм, істота, суть, сутність, реальність;
ensemble – множина, єдине ціле, ансамбль;
ample – цілком достатній, багатий, просторий,докладний;
start-up – швидко рости, з'являтися, виникати;
benefit – здобувати вигоду (користь); перевага, благо, прибуток;
trigger off- ;приводити в дію;
dramatic – яскравий, хвилюючий, драматичний;
inspire – надихати, стимулювати, збуджувати; дихати;
ingenious - винахідливий, умілий, дотепний, оригінальний;
random - випадковий, зроблений навмання;
equation – рівняння, вирівнювання, узгодженість;
content – вміст, зміст, суть, обсяг, задоволення, задовольняти;
strive – докладати зусиль, намагатися; (for) боротися (за)
familiar – близький, добре обізнаний (поінформований);
diverse – різний, відмінний, різноманітний;
visionary – мрійник, уявний, примарний, непрактичний;
versatile – різносторонній, різнобічний, багатоцільовий;
astound – дивувати, уражати, приголомшувати;
revelation - відкриття; розкриття;
underlie – лежати в основі.

Exercise 9. *Give the definitions of the following terms.*

Phage, bacteriophage, activation energy, chromatid, hypothesis, magnification, mixture.

Exercise 10. *Be sure that you know the meanings of the following words and expressions. Translate the sentences.*

provided – забезпечили, дали
providing, provided – за умови, якщо
in order of – у порядку
in order to – для того щоб
order – порядок, послідовність, наказ, замовлення
to reduce – відновлювати, зменшувати, приводити (мат.)
reduction – відновлення, зменшення, приведення (мат.)

1. Proteins from animals and plants were an important food since they *provided* amino acids that were essential to the body in the production of needed proteins.
2. The relative weights of the gases indicate the relative weights of the molecules, *provided* Avogadro's hypothesis is applicable.
3. *Reduction* is a chemical reaction of accepting electrons accompanied by reduction of valences.
4. This equation can be *reduced* to the following expression.

5. The atoms of elements may be arranged in different ways *in order of* forming molecules of different types of matter.
6. The particles, which compose crystal, are arranged in an identifiable *order.*
7. *In order to* understand more recent developments in the biophysics, it is necessary to know something about radiant energy.

Exercise 11. *Answer the following questions.*

1. What is biophysics concerned with?
2. What is established as cornerstones of modem biology?
3. What did interest in biophysics result in?
4. What was the discovery of genetic material based on?
5. Under whose direction did F. Crick work?
6. What were Crick and Wilkins awarded?
7. What was the desire of physicists after World War II?
8. What did the Austrian physicist determine?
9. Who devoted a chapter of his book to a consideration of the gene?
10. Why did E. Schrodinger devote a chapter of his book to a consideration of the gene?
11. What has Max Delbruck been studying for some years?
12. Where is the sequence of the nucleotides of DNA translated?
13. What did the use of bacteriophage provide?
14. What has this aspect of biophysics become?
15. What is it considered?

Exercise 12. *The following sentences are grammatically incorrect. Make them correct and explain what you think is wrong with these sentences.*

Biophysics

The biophysical approach are unified at a consideration of biological problems in the light of physical concepts, so that biophysics shall be
interdisciplinary. Biophysics may arc thought ol as the central circle in a two- dimensional array of overlapping circles, which include physics, chemistry, physiology, and generals biology. Relations witli chemistry is mediated through biochemistry and chemistry; those with physiology, through neurophysiology and sensorys physiology. Biology, which may be viewing as a generals subject pervading biophysical studys, are evolving from a purelys descriptives sciences into a discipline increasingly devoted to understanding the nature of the prime movers of biologicals events. The evolution of biologys in these directions have receiveing great impetus from the biophysicals and biochemicals discoveries of the 20th century. An understanding of the physical principles governing biologicals effects are the proper end of biophysics.

Exercise 13. *Read and translate the text. Write out no less than 15 "key words" (the words that tell you what the passage topic is about), learn them.*

Biophysics: New Challenges for Physics

Recent progress in life sciences has demonstrated that the first decades of the new century are likely to be dominated by developments in this field. Since physics forms the bases of the life science evolution, the visionary guidance and assistance of physicists who have enjoyed a versatile training will be

needed. Perhaps the most easily recognizable example of this need for an interdisciplinary approach is the astounding revelation of the human genetic code, self-organized plan according to which self-reproducing entities, such as cells, form complex organisms. The underlying interactions are governed by physical principles.

An equally important challenge to physics is to clarify the way in which ensembles of cells, cells as individual entities, and their molecular constituents, function in their respective surroundings. Biophysics has thus become a central theme of the physics department, offering young students unique opportunities for study and ample openings for top-level research. Excellent job opportunities and the dynamics of Munich as a centre of biotechnology with its many start-up companies underline the attractiveness of the biophysics programs.

The role of the physical methods in the life sciences is manifested by modem techniques such as ultrasound, positron emission, X-ray and nuclear magnetic resonance tomography, light and electron microscopy, laser spectroscopy, X-ray structure analysis, and electrophysiological techniques. These techniques have benefited from more than half a century of research in physics and are the result of combining classical instrumentation with computational physics. The discoveries of these new physical methods have trigged off dramatic progress in life sciences.

At the same time there are also numerous examples originating from biology that have inspired new development in physics. The most prominent one is the discovery of the general energy conservation law by Robert Meyer and Hermann von Helmholtz and the theory of Brownian motion by Albert Einstein. Einstein's ingenious interpretation of the observation of the botanist Robert Brown that seeds perform random walks in water influenced the development of modem physics at the beginning of the last century nearly as much as Planck's equation describing black body radiation.

Nowadays, physicists do not content themselves with being the designers of new instrumentation but strive for a more active role in the search for universal physical principles governing the assembly and function of biomaterials. In order to be successful, it is absolutely necessary that physicists accept the complexity of biomaterials and become familiar with the principal questions of biology. The physicist's capacity to unravel universal laws governing complex processes or to develop new measuring techniques to test laws predicted by theory is urgently needed in life sciences.

Exercise 14. *Give all possible derivatives to the following verbs.*

to demonstrate _____
to dominate _____
to develop _____
to form _____
to evolve _____
to guide _____
to assist _____
to need _____
to clear _____
to discover_____ _____
to attract _____ _____
to complex _____ _____
to recognize _____
to educate _____
to define _____ _____

to explain_____
to inform _____ _____

Exercise 15. *Give English equivalents to the following terms.*
Заперечувати, сутність, виникати, користь, яскравий, дихати, зроблений навмання, узгодженість, задовольняти, близький, різноманітний, непрактичний, багатоцільовий, розкриття.

Exercise 16 Match *up the words with their meanings.*

a) Underlie	1) виклик
b) versatile	2) організм, істота
c) equation	3) швидко рости
d) revelation	4) здобувати вигоду
e) visionary	5) приводити в дію
f) content	6) стимулювати
g) challenge	7) випадковий
h) entity	8) рівняння
i) benefit	9) змість, суть
j) familiar	10) добре поінформований
k) diverse	11) різний, відмінний
l) random	12) мрійник
m) start-up	13) різнобічний
n) inspire	14) відкриття
o) trigger off	15) лежати в основі

Exercise 17. *Give Ukrainian equivalents to the following adverbs and adverbial phrases.*
Since, perhaps, according to, equally, at random, absolutely, urgently, consequently, directly, in general, in particular, enormously, easily.

Exercise 18. *Give synonyms to the following words.*
demonstrate _____
evolution _____
recognize_____
constituent_____
accept _____
research _____

Exercise 19. *Put five types of questions to given sentences.*
2. Physics forms the bases of the life science evolution.
3. Excellent job opportunities underline the attractiveness of the biophysics programs.
4. The role of the physical methods in the life sciences is manifested by modem techniques.
5. Seeds perform random walks in water.
6. Universal physical principles govern the assembly and function of biomaterials.

Exercise 20. *Give the definitions of the following terms.*
Structural formula, taxomony, variation, conservation, dominance.

Exercise 21. *Answer the following questions:*

1. What has recent progress in life sciences demonstrated?
2. What is the most recognizable example of the need for an interdisciplinary approach?
3. What is governed by physical principles?
4. Where do ensembles of cells function?
5. What modem techniques do you know?
6. What are these techniques the result of?
7. What has inspired new developments in physics?
8. What influenced the development of modem physics at the beginning of the last century?
9. What is necessary in order to be successful?
10. What is urgently needed in life sciences?

Exercise 22. *Complete the sentences:*
Life science is ...
Biology is ...
Physics is ...
Biophysics is ...
Ecologist is ...
Physicist is ...

Exercise 23. *Divide the text above into sense parts. Write its plan. Write a synopsis (резюме, конспект, короткий огляд, синопсис) of the text using the content words you have just written out and learned.*

Exercise 24. *Read the text and translate it in a written form.*

Biophysics. Relations With Other Disciplines

In the 17th century, with the invention of the microscope, which made possible study of the cellular level of organization, biology began to receive the benefits of scientific developments in physics. In the 18th century such developments in chemistry as a better understanding of the nature of oxygen, carbon dioxide, and water began to have important implications for biology. Today, through the disciplines of biochemistry and biophysics, both chemistry and physics have continued to make significant contributions to biology, particularly in the area of molecular biology.

Biology is also very closely related to the disciplines of medicine and agriculture, out of which it developed as an independent discipline. In a sense, the roles have been reversed in the 20th century, for it is basic research being conducted in biology that is contributing to major advances currently being made in medicine and agriculture.

It was biological research in the structure and function of viruses, for example, that led directly to the development of a vaccine against poliomyelitis. Another scientific discipline, that of geology, is closely related to the biological study of paleontology. The technique of radiocarbon dating, which was developed by chemists to determine the age of biological remains, has been of great use in the fields of archaeology and anthropology as well as biology. A new discipline, space biology, has arisen through the activities of the scientists and engineers concerned with the exploration of space.

The conceptual framework of biology has had to be altered to accommodate newly discovered facts. In the process biology has received contributions from and made contributions to many other disciplines, in the humanities as well as in the sciences.

Exercise 25. *Put no less than 15 questions of different type to the text.*

Exercise 26. *Choose the one word that best keeps the meaning of the original sentence.*

1. Some people believe that physics has little or no *relevance* to their daily life.
   a) attitude b) relation c) connection d) role
2. It is difficult to imagine our world without the *advances* made in physics in the last century.
   a) retreat b) progress c) success d) result
3. In industry, physicists help companies to *develop* novel materials.
   a) create b) design c) build d) make
4. The information revolution within which we are *currently* buffeted (SABFLABATH YUAPIB) would be impossible without physicists.
   a) current b) later c) now d) previously
5. Apart from such tangible (реальний, відчутний) innovations, physicists also play a major role in weather forecasting.
   a) except b) besides c) together d) despite
6. It is possible to be a physicist and earn SPECTACULARLY large salaries.
   a) apparently b) visibly c) obviously d) clearly
7. The theory might HELP physicist to find new forms of charge-parity violation.
   a) provide b) assist c) force d) stimulate

Exercise 27. Translate the following sentences. Be sure that you know the meaning of the following words.

Like – схожий, подібний.
Alike – схожий.
Liken – порівнювати, уподібнювати.
Unlike – несхожий, навідміну.
Likely - можливо (is likely to ...).
Unlikely – малоймовірно (is unlikely to ...).

1. LIKE charges repel and UNLIKE charges attract each other.
2. Copper LIKE all other metals is a good conductor of electricity.
3. Oxygen, UNLIKE nitrogen, is highly reactive.
4. In structure these molecules are much ALIKE.
5. The structure of these esters can be LIKENED to the shape of a crown.
6. Bioactive compounds are LIKELY to be used in drug manufacturing.
7. This new alloy is UNLIKELY to be very expensive.

Exercise 28. Read, translate and discuss.

Photosynthesis and Life

All living organisms on our Earth depend on photosynthesis. This process gives energy and ensures oxygen giving-off in the atmosphere. Photosynthesis is of primary importance for the mankind because the main fiiel we all use is of fossil origin.

Photosynthesis is the only natural process, which can trap the Sun energy. This is the process of transformation of light energy absorbed by organisms into energy of organic and inorganic compounds. The main role here is played by C02 reduction to hydrocarbons by means of energy of light.

Annual fixation of carbon in the process of photosynthesis constitutes $75x10^{12}$ kg. It is interesting to note that only 0.4% of the Sun radiation, which reaches our planet, have the wavelength necessary for photosynthesis and that life is supported by this extremely small amount of energy.

Potentially photosynthesis is an alternative source of energy, which can be used instead of exhausting gas and oil resources. Scientists try to model some stages of photosynthesis of plants in which water splits into hydrogen and oxygen. If they could simulate process in laboratory conditions, hydrogen' of water would be used as a fuel. There is no need to say that this energy would be ecologically safe.

Exercise 29. *Use these items for discussion.*

2. Can any substance substitute carbon in photosynthesis?
3. Photosynthesis must consist of two stages. What are they?
4. What would happen if there were no photosynthesis on the Earth?
5. Photosynthesis - a potential alternative source of energy.
6. Problem of the exhausting gas and oil resources.
7. Modelling photosynthesis processes in a laboratory.
8. Ecologically safe sources of energy.

Exercise 30. *Use suffix "-ly" to form adverbs of the following adjectives.*

External, internal, usual, frequent, chemical, large, main, principal, dear, interesting, fundamental, eventual, fortunate, organic, natural, biological, ecological, environmental.

Exercise 31. *Translate the following words. Mind the contrastive prefix "anti-". Coin some terms using "anti-". Check your "coinage" in the dictionary.*

Antibiotic, antibody, anticentre, anticlinal, anticyclone, antidote, antifebrile, antigen, antiflogistic, antipathy, antipole, antipyrine, antiseptic, antitoxic, antitoxin, antithesis.

Exercise 32. *Translate the terms with the prefix "a-". Compare its meaning with the meaning of the prefix "anti- ".*

Abiotic, asymmetry, asymmetric, acyclic, aclynic, achromatism, achromatic, amorphism, amorphic, aharmony.

Exercise 33. *Give definitions to the following words.*

To originate, to search, to oppose, to exist, to attempt, to recognize, to impress, to change, to explain, to manage, to convince.

Exercise 34. *From the following choose the word which is opposite in meaning to the following words.*

To accelerate - to spend, quicken, stop, continue, retard.

To continue - to remain, resume, persist, insist, cease.

To deceive - to mislead, understand, argue, tell the truth.

To find - to obtain, come recognize, lose.

Fortune - change, success, prosperity, state, misfortune.

Success - accomplishment, issue, competition, failure.

Exercise 35. *From the following choose the word, which is most nearly the same in meaning to the italicized word.*

Shape - size, external form, appearance, fragment, edge.
Subject - topic, substance, matter, theme, discussion, act, manner.
To reach - to succeed in touching, arrive at, follow, seek, move.
To change - to alter, fill, make different, maintain, keep.
To manage - to succeed in doing, ignore, persuade, conduct.
To convince - to satisfy, succeed, dispute, bring to a belief, debate.
To discover - to find out, cause, change, exhibit, make known.
To establish - to set up, postpone, found, avoid, fix.
To believe - to regard as true, think, comment.

Exercise 36. *Choose the one word that best keeps the meaning of the original sentence.*

1. The belief that gold could be made by the transmutation of other metals such as lead and mercury, *originated* from the teaching of Aristotle.
   a) came b) appeared c) was recorded d) was studied
2. Aristotle believed that all metals could be *changed* into gold.
   a) converted b) transmuted c) stimulated d) arranged
3. Alchemists were divided into two groups with *opposing* moral values.
   a) the same b) different c) similar d) perfect
4. An alchemist could *easily* demonstrate the apparent transmutation of metals by placing an iron nail into a copper sulphate solution.
   a) with difficulty b) readily c) hardly d) eagerly
5. There were many *tricks* witch alchemists used to give the illusion of a successful transmutation to gold.
   a) ways b) frauds c) possibilities d) explanations

Exercise 37. *Translate the following sentences. Be sure that you know the meanings of the following words.*

Throughout - у всіх відношеннях, усюди.
Through - через, крізь.
Though - все ж таки, однак, хоча.
Thorough - повний, досконалий, ретельний.

1. The investigation or experiment should be repeated, perhaps, hundreds of tines, for a *thorough* scientific experiment.
2. This idea, *though* wrong, is still rather important.
3. A solution is homogeneous because the substance, which is dissolved, is scattered evenly *throughout* the liquid.
4. Even *though* the particles in a liquid have freedom of motion, they are almost as close together as they can get at room temperature.
5. Any given molecule will collide with many other molecules, while making its way *through* the liquid.

Exercise 38. *Translate the following sentences. Be sure that you know the meanings of the following words.*

Rather – краще, швидше, досить, до деякої міри.
Rather ... than – скоріше … ніж.

1. Some of the elements are *rather* common and well known but quite a lot are man-made.
2. It is much better to use liquid hydrogen *rather than* compressed gas.
3. Usually, it is more useful to think of equations in terms of moles *rather than* molecules.

Exercise 39. *Translate the following sentences. Mind the meanings of the words "solve " and "solution*

To solve – вирішувати, розчиняти.

Solution – вирішення, розчин.

- Both pure substances and *solutions* are homogeneous.
- In nature, *solutions* are much more common than pure substances.
- The task of water purification in this region was finally *solved.*
- This substance *solves* readily.
- The *solutions* of many important questions in the field of environmental protection were fully approved.

Exercise 40. Adverb / adjective choice.

k) This substance is ____ (weak / weakly) soluble in acids.
l) Water is _____ - (essential / essentially) to all living organisms.
m) The gas is _____ (high / highly) toxic and should not be inhaled.
n) Silicon is never found in a _____(pure / purely) state.
o) We need a _____(neutral / neutrally) solution for this experiment.
p) _____ , (natural / naturally) this element occurs in a fixed state.
q) _____ , (industrial / industrially) hydrogen is used in welding and reducing oxides of metals.
r) Gases unlike liquids are_____ (good / well) compressible.
s) Water is used in _____ (large / largely) amounts for industrial needs.

Exercise 41. *Name the most famous scientists related to biophysics and great dates of biophysics mentioned in the article.*

UNIT 2.8
BIOTECHNOLOGY

Exercise 1. *Before reading the text memorize the following words and word combinations.*

to make products	-	виготовляти продукти
Diverse	-	різний
waste disposal	-	поховання відходів
Mining	-	видобування
ancient times	-	стародавні часи
Set	-	набір
Beneficial	-	вигідний
foreign substance	-	чужорідна речовина
to discard	-	скидати
Stalk	-	стебло

Degradation	-	розкладання, погіршення
Biodegradable	-	розкладаний мікроорганізмами
to join	-	з'єднуватися
wide spread	-	широко розповсюджений
Application	-	вживання
to treat	-	обробляти
low (high)-grade ore	-	низько (високо)-сортна руда
Deposits	-	поклади
Conventionally	-	звичайно
to exhaust	-	виснажувати (викидати)
to bleed	-	кровоточити
Tissue	-	тканина
blood-clotting	-	кровозгортаючий
Hamster	-	хом'як
to eliminate	-	усувати
Virulent	-	небезпечний
Release	-	вивільнення
Disastrous	-	згубний
Restriction	-	обмеження
to cite	-	цитувати
consequences	-	наслідки

Exercise 2. *Read and translate international words. Pay attention to what parts of speech they belong. Give derivatives.*

Sphere *n,* ordinary *a,* special *a,* synthesize v, demonstrate *v,* mobilize v, test *n,* biology *n.*

Exercise 3. *Read and translate the text.*

Biotechnology

Biotechnology is the manipulation of biological organisms to make products that benefit human beings. Biotechnology contributes to such diverse areas as food production, waste disposal, mining and medicine. Although biotechnology has existed since ancient times, some of its most dramatic advances have come in more recent years. Modem achievements include the transferal of a specific gene from one organism to another (by means of a set of genetic engineering techniques known as transgenic); the main tendency and growth of genetically uniform plant and animal cell cultures, called clones; and the fusing of different types of cells to produce beneficial medical products such as monoclonal antibodies, which are designed to attack a specific type of foreign substance.

Today biotechnology is applied in various fields. In waste management, for example, biotechnology is used to create new biodegradable materials. One such material is made from the lactic acid produced during the bacterial fermentation of discarded com stalks. When individual lactic acid molecules are joined chemically, they form a material that has the properties of plastics but is biodegradable. Wide spread production of plastic from this material is expected to become more economically valuable in the future.

Biotechnology also has applications in the mining industry. In its nahiral state, copper is found combined with other elements in the mineral chalcopyrite. The bacterium thiobacillus ferrooxidans can

use the molecules of copper found in chalcopyrite to form the compound copper sulfate. Which, in turn, can be treated chemically to obtain pure copper. This microbiological mining process is used only with low-grade ores and currently accounts for about 10 per cent of copper production in the United States. The percentage will rise, however, as conventionally mined high-grade deposits are exhausted. Procedures have also been developed for the use of bacteria in the mining of zinc, lead, and other metals.

The field of medicine employs some of the most dramatic applications in biotechnology. One advance came in 1986 with the first significant laboratory production of factor 8, a blood-clotting protein that is not produced, or has greatly reduced activity, in people who have hemophilia; as a result of this condition, hemophiliacs are at risk of bleeding to death after suffering minor cuts. In this biotechnological procedure, the human gene that codes for the blood-clotting protein is transferred to hamster cells grown in tissue culture, which then produce factor 8 for use by hemophiliacs. Factor 8 was approved for commercial production in 1992.

Some people, including scientists, object to any procedure that changes the genetic composition of an organism. Critics are concerned that some of the genetically altered forms will eliminate existing species, thereby upsetting the natural balance of organisms. There are also fears that recombinant DNA experiments with pathogenic microorganisms may result in the formation of extremely virulent forms, which, if accidentally released from the laboratory, will cause worldwide epidemics. Some critics cite ethical dilemmas associated with the production of transgenic organisms.

In 1976, in response to fears of disastrous consequences of unregulated genetic engineering procedures, the National Institute of Health created a body of rules governing the handling of microorganisms in recombinant DNA experiments. Although many of the rules have been relaxed over time, certain restrictions are still imposed on those working with pathogenic microorganisms

Exercise 4. *Give English equivalents to the following words.*

Спороба, зусилля; засіб; обмежувати; походити; співробітник; придумувати, винаходити; не підкорятися.

Exercise 5. *Pick out Ukrainian equivalents to the following English.*

1) animal protein
2) vegetable protein
3) wood wastes
4) artificial media
5) feed additive
6) full-valued food
7) all-powerful bacteria
8) modem technical means
9) underground explosion
10) повноцінна їжа
11) всесильні бактерії
12) тваринний білок
13) сучасні технічні засоби
14) рослинний білок
15) підземний вибух
16) поживний додаток

17) відходи деревини
18) штучне середовище

Exercise 6. *Consult the dictionary to get the definition of the words:*
Nutrient, harvest, fanning, bed, spark.

Exercise 7. *Write out from the text all the predicates in Passive Voice and Perfect Tenses (Active and Passive).*

Exercise 8. *Put five types of questions to the following sentences:*

1. Biotechnology contributes to such diverse areas as food production, waste disposal, mining and medicine.
2. Some of its most dramatic advances have come in more recent years.
3. Modem achievements include the transferal of a specific gene from one organism to another.
4. Factor 8 was approved for commercial production in 1992.
5. Some scientists object to any procedure that changes the genetic composition of an organism.
6. In 1976 the National Institute of Health created a body of rules.

Exercise 9. Answer the following questions.

1. What is biotechnology?
2. What do modem achievements include?
3. What are transgenics?
4. What is called clone?
5. Where is biotechnology applied today?
6. When does a material have the properties of plastics but is biodegradable?
7. Where does biotechnology also have applications?
8. What can be treated to obtain pure copper?
9. In the mining of what are bacteria used?
10. What does the field of medicine employ?
11. When was factor 8 approved for commercial production?
12. What do some scientists object?
13. What will cause world wide epidemics?
14. When did the National Institute of Health create a body of rules?

UNIT 2.9
BIOTECHNOLOGICAL SYSTEMS

Exercise 1. *Before reading the text memorize words and word combinations.*

desired products	-	бажані продукти
non-virulent strain	-	безпечний вид
plasminogen activator	-	плазмогенний активатор
digestive enzymes	-	травні ферменти
insufficiencies	-	недостатня кількість
intestinal tract	-	кишківник
heat and drought resistant	-	стійкий до спеки та посухи

starch content - вміст крохмалю

Exercise 2. *Write out from the text the international words and give their meanings.*

Exercise 3. *Give derivatives of the following verbs using as many suffixes and prefixes as possible. Translate them.*

to discuss _____
to apply _____
to produce _____
to search _____
to treat _____
to compose _____
to modify _____
to degrade _____
to develop _____

Exercise 4. *Look through the article and try to get the gist. Read and translate the text.*

Biotechnological Systems
(Applications of Biotechnology)

This discussion will focus on applications of biotechnology that use genetic engineering or rDNA technology. Genetic engineering technologies can be used to increase the amount of a protein or metabolite produced by an organism, to allow organisms that did not originally produce that protein or metabolite to do so, or toblock production of a protein or metabolite by an organism. rDNA technology allows researchers to move genetic information between unrelated organisms to produce desired products or characteristics or to eliminate undesired ones.

Medical Applications of Biotechnology

Biotechnological methods are now used to produce many proteins for pharmaceutical and other specialized purposes. A non-virulent strain of Escherichia coli bacteria, given a copy of the gene for human insulin, can make insulin; when the gene is “amplified” the bacterial cells produce large quantities of human insulin that are purified and used to treat diabetes in human beings. Human insulin, the first genetically engineered product to be produced commercially was approved for use in 1982. Since then, a number of other genetically engineered products have been approved, including human growth hormone, alpha interferon, recombinant erythropoietin and tissue plasminogen activator, and a variety of pharmacologic drugs. Microorganisms can also be engineered to produce digestive enzymes. In the future, these microorganisms could be colonized in the intestinal tract of persons with digestive enzyme insufficiencies. Similarly, persons with immune disorders could be treated with non-pathogenic microorganisms that have been genetically modified to produce antibodies.

Plant Food Applications

Biotechnology techniques are being applied to plants to produce plant materials with improved composition, Emotional characteristics, or organoleptic properties. Genetic modifications have produced fruits that can ripen on the vine for better taste yet have a longer shelf life through delayed pectin degradation or altered responses to the plant hormone ethylene. Among the first commercially available whole food products was the Flavr Savr slow- ripening tomato, which US Food and Drug Administration

(FDA) approved in May 1994; the gene for polygalacturonase, the enzyme responsible for softening, is turned off in this tomato.

Plants that are resistant to disease, pets, environmental conditions, or selected herbicides or pesticides are also being developed. A variety of squash that is resistant to two plants viruses was approved by FDA in 1994. In 1995, the Environmental Protection Agency (EPA) gave clearance for development of transgenic com seed, cotton seed, and seed potatoes that contain the genetic material to resist certain insects; FDA approved these biotechnology applications in 1994. The US Department of Agriculture (USDA) is considering herbicide-resistant soybeans and cotton seed for animal feed. The advantage of such products is that they allow the use of less toxic and more environmentally friendly herbicides and pesticides. Production of heat- and drought-resistant plants could bring agricultural opportunities to regions of the world currently unsuitable for raising food crops.

Plant foods with enhanced processing and/or nutritional characteristics are likely application of biotechnology. In 1992, Monsanto Company successfully inserted a gene from a bacterium into the Russet Burbank potato. This gene increases the starch content of the transgenic potato. Higher starch content reduces oil absorption during frying, thereby lowering the cost of frying French fries and chips and reducing the oil content in the finished product. In the future, such genetic applications as altering the fatty acid profile in oil seeds and producing wheat with no phenylalanine may be possible.

Exercise 5. *Give synonyms and antonyms of the following words. Consult the dictionary if necessary, give Ukrainian equivalents to them.*

	SYNONYM	ANTONYM
to focus		
non-virulent		
to use		
to increase		
amount		
to allow		
to move		
unrelated		
to eliminate		
undesired		
to make		
to amplify		
to purify		
to include		
disorder		
composition		

Exercise 6. *Review two kinds of Voice. What kind of Voice is more often used in the text above? Write down some examples.*

Exercise 7. *Put verbs in brackets into the correct grammar form.*

1. Genetic engineering technologies can be (to use) to increase the amount of a protein.
2. Biotechnological methods (to use) to produce many proteins by scientists in the XX centuries.

3. A non-virulent strain of Escherichia coli bacteria can (to make) insulin.
4. Human insulin (to approve) for use in 1982.
5. A number of other genetically engineered products (to approve) by the end of the last century.
6. The first food product (to be) a slow-ripening tomato.
7. FDA (to approve) some genetic materials in 1994.
8. The US Department of Agriculture is (to consider) herbicide-resistant soybeans and cotton seed for animal feed.
9. One of the uses of biotechnology in animal production (to be) the use of recombinant bovine somatotropin in dairy cows.
10. Recently microbes (to engineer) to produce amino acids for the synthesis of aspartame.
11. Production of heat-resistant plants (to bring) agricultural opportunities to regions currently unsuitable for raising food crops.
12. In the future, altering the fatty acid profile in oil seeds (to be) possible.

Exercise 8. *Put different types of questions to the following sentences.*

1. Plants resistant to disease, pets, or selected herbicides are being developed.
2. In 1992, Monsanto Company successfully inserted a gene from a bacterium into the potato.
3. This gene increases the starch content of the transgenic potato.
4. Higher starch content reduced oil absorption during frying.

Exercise 9. *Answer the following questions.*

1. What do applications of biotechnology use?
2. What is genetic engineering?
3. What is the main goal of biotechnology?
4. When do bacterial cells produce human insulin and what is its role?
5. What engineered products have been approved since 1982?
6. What is the role of digestive enzymes?
7. What plant materials do biotechnology techniques produce?
8. What was the first food product?
9. What plants are being developed and what are their properties?
10. When and where was a gene from a bacterium inserted?

Exercise 10. *Say whether the following statements are used correctly (true) or incorrectly (false). Correct the false sentences. Use phrases given below.*

That's right	I can't agree with it.
Exactly	That's wrong
Quite so	I don't think so.

These tiny things never grow. — That's wrong, they eat and grow, travel and multiply.

1. Genetic engineering technologies can be used to increase the amount of a protein or metabolite produced by an organism.
2. A virulent strain of Escherichia coli bacteria can make insulin.
3. Human insulin was approved for use in 1992.
4. Microorganisms can be engineered to produce digestive enzymes.
5. Among the first commercially available whole food products was the early-ripening tomato.

6. Production of heat- and drought-resistant plants could not bring agricultural opportunities to regions of the world currently unsuitable for raising food crops.
7. Plant foods with enhanced processing and nutritional characteristics are likely application of biotechnology.

UNIT 2.10
FOOD FACTORS

Exercise 1. *Before reading the text memorize words and word*

to fall ill (sick)	-	захворіти
Germ	-	ембріон, мікроб, зародок
Unable	-	нездатний, неспроможний
to have no room	-	не мати місця
Outstanding	-	видатний
Exponent	-	виконавець, тип
to prevent	-	запобігати
to cure	-	виліковувати
to cause	-	спричиняти, причина
to immerse	-	цікавити, захоплювати
to shrink (shrunk, shrunken)	-	стискати, збігатися

Exercise 2. *Translate the following words paying attention to the affixes and to which part of speech they belong.*

9. to plant (v), plant *(n),* plantation *(n)*
10. to prevent (v), prevention («), preventive *(n), (adj)*
11. to prepare (v), preparation *(n),* preparatory *(adj),* preparative *(adj)*
12. to cultivate (v), cultivation *(n),* cultivator *(n)*
13. to appreciate (v), appreciation *(n),* appreciable *(n)*
14. to mean (v), mean *(adj),* meaning *(ri),* meaningless *(adj).*

Exercise 3. *Remember the pronunciation of the following words, paying special attention to the stress in the noun and the corresponding verb.*

Nouns	*verbs*
Contact	to contact
Contrast	to contrast
Increase	to increase
Decrease	to decrease
Object	to object
Subject	to subject
Process	to process

Exercise 4. *Determine to what part of speech the following words belong. Underline the suffixes, give derivatives and translate the words.* Naturally, originator, prevention, cultivate, founder, researcher, favourable, preparation, division, usually, actually, arrangement, significance, solvent, solidification, relatives, accumulation, comparable.

Exercise 5. *Exclude suffixes and prefixes from the following words and determine to which part of speech they belong.*

Growth, unlucky, accomplishment, density, usefulness, illegal, occurrence, to mislead, failure, explorer, investigator, various, differential, indefinite, basic, careless, relatively, considerable, meaningless, invariable, appreciation, decomposition, irresponsible.

Exercise 6. *Add negative prefixes to the following words. Translate them.*

a) variable, convenient, direct, definite;

b) appreciated, favourable, natural, necessary, pleasant; composition, formation, increase, compose, advantage, cover, approval.

Exercise 7. *Read the text. Translate it paying attention to Passive Voice.*

Food Factors

In the Dutch East Indies in 1897 men on the plantations were falling sick with a strange nerve disease. They were unable to eat or hold their food. Their arms and legs became paralyzed and shrunken. So many were sick, that the hospitals had no more room for the victims of this disease, known as beriberi. The Dutch physician Dr. Christian Eijkman was sent from Holland to try to find out how to prevent and cure this disease. Eijkman was immersed in germ theory. He was sure that beriberi was a bacterial disease. He brought chickens with him and hoped to cultivate the germ in them. But in this he failed. However during the course of 1896 these chickens came down spontaneously with a disease very much like beriberi. Before Eijkman could do much about it, the disease vanished.

Searching for causes, he found out that a certain period of time the chicken had been fed on polished rice from the hospital stores and it was after that they sickened. Put back on commercial chicken food, they recovered. Dr. Eijkman also learnt that the favourite food of the people was white-polished rice. This was prepared by rubbing off the brown outer coating of the rice grains. Dr. Eijkman decided to try an experiment. He fed a number of hens with polished rice until they became paralyzed. The hens were then divided into two groups. One group, the control, was kept on the usual polished diet. The other group was given not only polished rice, but the outer brown rice, skin as well. In a short time, the control group which ate nothing but white rice died of beriberi. The test group that received the brown rice polishings was cured.

This was the first carefully controlled experiment showing that there was something in a food that could prevent a dangerous disease. Eijkman did not appreciate the true meaning of this at first. He thought there was a toxin of some sort in rice grains and that this was neutralized by something in the hulls. The hulls were removed when rice was polished, leaving the toxin in the polished rice unneutralized.

However, why assume the presence of two different unknown substances, a toxin and an antitoxin,

when it was only necessary to assume one: some food factor required in traces. The outstanding exponents of this latter view were Hopkins and a polish-bom biochemist Casimir Funk. Each suggested that not only beriberi, but also such diseases as scurvy, rickets were caused by the absence of trace of food factors.

Under the impression that these food factors belonged to the class of compounds known as “amines” Funk suggested these factors be named vitamins (life amines) and ever since the name was adopted.

Exercise 8. *Place the following words in pairs of antonyms and synonyms. Translate them.*

a) disease, to eat, to find out, to cure, spontaneously, to treat, to be cured, illness, to feed, to appraise, true, to search, grower, to discover, suddenly, to appreciate, to suppose, real, to fall ill, reason, to look for, to sicken, to catch cold, to recover, cause, plantator.

b) to be unable, former, to fall ill, careless, sick, to fail, presence, to be able, latter, antitoxin, to recover, toxin, healthy, to manage, absence, spontaneously, careful, continually.

Exercise 9. *Put 10 questions to the text above beginning them with What, When, Where, How.*

Exercise 10. *Make up the list of outstanding scientists and their discoveries.*

UNIT 2.11
GENETIC ENGINEERING.
NAMING AND APPLICATIONS

Exercise 1. *Read and translate the article.*

Introduction

"Genetic engineering", genetic modification ("GM"), and gene splicing (once in widespread use but now deprecated) are terms for the process of manipulating genes in an organism, usually outside of the organism's normal reproductive process. It often involves the isolation, manipulation and reintroduction of DNA into model organisms, usually to express a protein. The aim is to introduce new characteristics to an organism to increase its usefulness such as, increasing the yield of a crop species, introducing a novel characteristic, or producing a new protein or enzyme. Examples are the production of human insulin through the use of modified bacteria and the production of new types of experimental mice like the OncoMouse, (cancer mouse) for research, through genetic redesign. Since a protein is specified by a segment of DNA called a gene, future versions of that protein can be modified by changing the gene's underlying DNA. One way to do this is to isolate the piece of DNA containing the gene, precisely cut the gene out, and then reintroduce the gene (splice) into a different DNA segment. Daniel Nathans and Hamilton Smith received the 1978 Nobel Prize in physiology or medicine for their isolation of restriction endonucleases, which are able to cut DNA at specific sites. Together with ligase, which can join together fragments of DNA, restriction enzymes formed the initial basis of recombinant DNA technology.

Exercise *2. Before reading the text memorize words combinations.*

to claim	вимагати, заявляти
to question	запитувати, сумніватися
to argue	сперечатися, обговорювати
to resist	протидіяти

to tend	доглядати, схилятися
to cause	спричиняти, викликати
to object	протестувати, заперечувати
to deny	заперечувати
to serve society	слугувати суспільству
to abbreviate	скорочувати
Controversial	спірний, дискусійний
side effect	побічна дія, вплив, результат
Reluctance	небажання, несхильність
to favor	виявляти увагу, сприяти
Label	чіпляти ярлик, мічений
Husbandry	землеробство, ощадливість
Artificial	штучний
Manner	метод, спосіб
Implication	значення, смисл
as opposed to	на відміну від
Spread	поширення
Momentous	важливий, впливовий
Strand	нитка
to assume	набувати, приймати, вважати
Discrete	розрізнений, окремий
Literally	буквально, дослівно
Random	випадковий
to pose	ставити, пропонувати
Substantially	по суті, в основному
to enhance	поліпшувати, підвищувати
Eventually	зрештою, в результаті
to acknowledge	визнавати, усвідомлювати

Exercise *3. Give the definitions of the following terms.*
Genetic engineering, genetics, enzyme, cloning, heredity, pathogenic, point mutation, ribosome, transformation.

Exercise 4. *Look through the text and try to get the gist.*
Read the text once more and translate it.

Naming and Applications

Genetic modification or genetic manipulation are claimed to be neutral and possibly more technically correct terms for what is claimed, controversially, to be genetic engineering. Opponents question whether the concept of modification with its implications of progress is applicable here. Many opponents of the use of the term genetic engineering argue that the operations of genes in combination with cell biochemistry are rather poorly understood and sometimes lead to unexpected side effects. Reluctance to recognize this field as "engineering" has become popular in the antiglobalization movement

and safe trade movement, and is also widely held by most Green parties, and the major parties of France and Germany, which have resisted any agricultural policy favoring genetically modified food. These groups tend to resist the label “engineering” as applied to such genetic modification more strongly.

Defenders of the term genetic engineering argue that animal husbandry and crop breeding are also forms of genetic engineering that use artificial selection instead of modern genetic modification techniques. It is politics, they argue, not economics or science, that causes their work to be closely investigated, and for different standards to apply to it rather than to other fields of engineering. These scientists, however, do not object to the term genetic modification as applied to what they do, although it is sometimes used to deny them the status of professionals serving society in an ethical manner, which is one implication of the term “engineering”. The term "genetic engineering" is sometimes informally abbreviated as "genegineering." "Transgenic organism" is now the preferred term for genetically modified organisms with extra-genome information, as opposed to "genetically engineered" organisms.

One of the best known applications of genetic engineering is genetically modified organisms (GMOs). There are potentially momentous biotechnology applications of GM, for example oral vaccines produced naturally in fruit at very low cost. This represents, however, a spread of genetic modification to medical purposes and opens an ethical door to other uses of the technology to directly modify human genomes. These effects are often not traceable back to direct causes in the genome, but rather in the environment or interaction of proteins. The means by which genes (in fact DNA strands that are assumed to have discrete effects) are detected and inserted are inexact, including such means as coating gold particles with DNA to be inserted and literally firing it at strands of target DNA (see gene gun), which is guaranteed to cause insertions in at least some random locations, which can on rare occasion cause unplanned characteristics.

Similar objections apply to protein engineering and molecular engineering for use as drugs. However, a single protein or a molecule is easier to examine for quality control than a complete genome, and there are more limited claims made for the reliability of proteins and molecules, than for the genomes of whole organisms. While protein and molecule engineers often times acknowledge the requirement to test their products in a wide variety of environments to determine if they pose dangers to life, the position of many genetic engineers is that they do not need to do so, since the outputs of their work are substantially the same as the original organism which was produced by the original genome(s). An extreme ambition of some groups is human enhancement via genetics, eventually by artificial intelligence or molecular engineering.

Exercise *5. Give derivatives of the following verbs. Translate them.*

To move _____
to produce _____
to increase _____
to expect _____
to apply _____
to argue _____
to limit _____
to determine _____
to rely _____
to present _____
to occur _____

to insert _____
to object _____
to examine _____
to direct _____
to resist _____

Exercise 6. *Form verbs with the help of prefix RE- . Translate them.*

To read, write, elect, produce, pay, introduce, strict, design, open, assume, locate, present.

Exercise *1. Translate the following words paying attention to the meanings of the suffixes and prefixes, name the part of speech. Memorize the words.*

Modification, usually, reproductive, isolation, reintroduction, usefulness, characteristic, modify, experimental, specify, precisely, restriction, initial, manipulation, applicable, unexpected, widely, transgenic, scientist, informally, professionals, interaction, reliability, unplanned, requirement, enhancement, artificial, intelligence.

Exercise 8 .*Translate the following adverbs.*

Possibly, technically, controversially, poorly, widely, genetically, strongly, closely, informally, whether, instead of, however, although, sometimes, rather, while, via, substantially, eventually.

Exercise 9. *Give Ukrainian equivalents to the following expressions. Find them in the text and compose your own sentences with these expressions.*

Widespread use, reproductive process, the yield of the crop species, initial basis, concept of modification, safe trade movement, anti-globalization movement, artificial selection, ethical manner, artificial intelligence, at veiy low cost, discrete effects, to test products, at least, quality control.

Exercise 10. *Underline the subject and the predicate of the sentences and put possible questions to all members of the sentence.*

1. Many opponents of genetic engineering argue the operations with genes.
2. The operations of genes in combination with cell biochemistiy sometimes lead to unexpected side effects.
3. Reluctance to recognize this field as "engineering" has become popular in the anti-globalization movement.
4. Most Green parties, and the major parties of France and Germany, have resisted any agricultural policy favoring genetically modified food.
5. Oral vaccines are produced naturally in fruit at very low cost.
6. A single protein is examined for quality control.

Exercise 11. *Answer the following questions.*

1. What is genetic engineering?
2. What do many opponents argue?
3. What leads to unexpected side effects?
4. What is widely held by most Green parties?
5. What have the maj or parties of France and Germany resisted?
6. How is the term "genetic engineering" sometimes informally abbreviated as?
7. What do the defenders of the term genetic engineering argue?

8. What are biotechnology applications of GM?
9. Why do engineers acknowledge the requirement to test their products?

Exercise 12.*Divide the text above into sense parts. Write its plan. Write a synopsis (резюме, конспект, короткий огляд, синопсис) of the text using the content words you have just written out and learned.*

Exercise 13.*Read and translate the article.*

DNA was first isolated by Friedrich Miescher who discovered a substance he called "nuclein" in 1869. In 1929 this discovery was followed by Phoebus Levene's identification of the base, sugar and phosphate nucleotide unit. Levene suggested that DNA consisted of a string of nucleotide units linked together through the phosphate groups. However Levene thought the chain was short and the bases repeated in a fixed order. In 1937 William Astbury produced the first X-ray diffraction patterns that showed that DNA had a regular structure.

In 1943, Oswald Theodore Avery discovered that traits of the "smooth" form of the *Pneumococcus* could be transferred to the "rough" form of the same bacteria by mixing killed "smooth" bacteria with the live "rough" form. Avery identified DNA as this transforming principle. DNA's role in heredity was confirmed in 1953, when Alfred Hershey and Martha Chase in the Hershey-Chase experiment, showed that DNA is the genetic material of the T2 phage.

James Watson worked in the Cavendish Laboratory at the University of Cambridge. Using X-ray diffraction data from Rosalind Franklin and the information that the bases were paired, James D. Watson and Francis Crick produced the first accurate model of DNA structure in 1953 in their article “The Molecular structure of Nucleic Acids”. Watson and Crick proposed the central dogma of molecular biology in 1957, describing how proteins are produced from nucleic DNA. In 1962 Watson, Crick, and Maurice Wilkins jointly received the Nobel Prize.

In an influential presentation in 1957, Crick laid out the "Central Dogma", which foretold the relationship between DNA, RNA, and proteins, and articulated the "adaptor hypothesis". Final confirmation of the replication mechanism that was implied by the double-helical structure followed in 1958 through the Meselson-Stahl experiment. Further work by Crick and coworkers showed that the genetic code was based on non-overlapping triplets of bases, called codons, allowing Har Gobind Khorana, Robert W. Holley and Marshall Warren Nirenberg to decipher the genetic code. These findings represent the birth of molecular biology.

Exercise 14.*Name the most famous scientists related to genetic engineering and great dates of genetics mentioned in the text above.*

Exercise 15.*Put as many as you can questions to the text beginning them with WHAT, WHEN, WHERE, WHY, HOW.*

UNIT 2.12
DNA - RECIPE FOR LIFE

Exercise 1. *Before reading the text memorize words and word combinations.*

achievement	досягнення

to recognize	визнавати, визначати
to store	постачати, запасати, зберігати
providing	за умови
to result in	призводити до
to fascinate	зачаровувати
to speculate	припускати
to coil	згортатися у спіраль
to appreciate	цінити, усвідомлювати
to specify	точно визначати, називати
complementary	додатковий, доповняльний
reversible	зворотний
to allow	дозволяти, допускати
apparently	очевидно, безсумнівно
strand	нитка (ДНК)

Exercise *2. Give the definitions of the following terms.*
Chromatid, dipeptide, fermentation, hypothesis, peptide bond, protein, temperate phage, virus.

Exercise 3. *Look through the text and try to get the gist. Read and translate the text.*

A Molecule of DNA - the Recipe of Life

A molecule of DNA is the recipe of life. That's why the discovery of its structure is recognized as one of the most important achievements of science this century.

Like a recipe in a cookery book, the information for making an organism is stored in a form, which has to be translated into actions. We have no difficulty translating the alphabetical code in the cookery book (providing it is used to write in English) and the simple phrase ''take three eggs" can be quickly translated into a complex sequence of actions. We have more difficulty in understanding how a code based on molecules can be translated into actions. With the right DNA these actions result in the growth of a new human, and it is fascinating to speculate about the differences between the recipes for ourselves and our friends or between humans and other species. No wonder there is such interest in the chemistry of the molecules, which contain this information.

The recipe is written in a code based on four molecules called nucleotides which are joined together by polymerization to give a linear message. The DNA molecule itself is made up not of one but two of these long polymers, and they are coiled round each other to form a double helix. The two strands of the double helix are held together by hydrogen bonds. Each nucleotide has three components: a modified sugar (deoxyribose), a phosphate group, and a base. The only difference between the four nucleotides is in the structure of the base.

The principles of chemical bonding can explain why the DNA double helix is stable. But it must not be so stable that the two strands can never separate. Separation is needed because it is the sequence of bases which both codes the recipe and provides the printing press for making new copies of the recipe book. In order to read or to copy this sequence, the bases must be fully exposed.

The principle of printing a new set of instructions is clear when you appreciate that each single strand automatically contains all the information needed to specify the complementary strand. The principle of reading and translating the code similarly depends on the formation of a complementary second strand (this time with ribonucleic acid). This need for reading and printing shows how important it

is that the formation of the double helix from two single strands should be a reversible process with an equilibrium constant favouring fonnation but allowing strand separation.

Apparently the bonding between the two strands of DNA is sufficiently strong to make a book which does not fall to pieces, but not so strong that it cannot be opened.

Exercise 4. Give *derivatives of the following verbs. Translate them.*

To recognize_____
To separate_____
To expose _____
To appreciate _____
To reverse _____
Favor _____
To appear _____

Exercise *5. Give Ukrainian equivalents to the following expressions. Find them in the text and compose your own sentences with these expressions.*

Complex sequence, double helix, set of instructions, complementary strand, to fall to pieces.

Exercise *6. Answer the following questions.*

1. What is one of the most important achievements of science this century? 2. How is the information for making an organism stored? 3. What do we have more difficulty in? 4. How are nucleotides joined together? 5. What is a double helix? 6. What can the principles of chemical bonding explain? 7. Why is the separation needed? 8. What does each single strand contain? 9. What is the bonding between two strands similar to?

Exercise *1.Discuss the text given above. Points for discussion:*

5. H-bonds in a molecule of DNA;
6. DNA components;
7. Hydration of DNA;
8. DNA - a helical molecule;
9. DNA - the recipe of life.

Exercise 8. *Read and translate the text.*

DNA and the Genetic Code

Genes are the instructions, which direct the growth and development of organisms. The popular name for these instructions is the genetic code. In 1944 it was shown that genes are made of a chemical called deoxyribonucleic acid or DNA. In the early 1950s the structure of DNA was discovered and this led to an understanding of the genetic code. Structure of DNA. DNA is a long, thread-like molecule similar in shape to a rope ladder twisted into a spiral.

The genetic code. The genetic code is formed by the sequence in which these four chemical bases are arranged along the length of a DNA molecule. Put another way, if the genetic code were a set of written rather than chemical instructions, the letters A, G, C, and T would be the alphabet in which the "words" of the code were written. In fact, the code is written in words of only three letters each; that is, it consists of groups of three adjacent bases. For example, the base sequence AAT along one strand is one word, CAA is another, and so forth. The number of different three-letter words which can be composed

out of the four letters A, G, C, and T is 64. It is now known that these three-letter words (groups of three bases) are the instructions to a cell telling it how to make protein molecules out of ammo acids. The sequence AAT (adenine, adenine, thymine) in the code tells a cell how to make the amino acid leucine, and CAA (cytosine, adenine, adenine) tells a cell how to make the amino acid valine.

A single gene consists of a thousand or more groups of three bases. Together these groups represent instructions to make one complete protein molecule of a specific type. A cell "obeys" these instructions by putting together the correct amino acids in the exact sequence directed by the gene.

DNA, therefore, controls the type of protein manufactured in cells. In this way DNA controls the structure of an organism because proteins are the building materials out of which cells, tissues, and organs are made. But equally important is the fact that DNA directs the chemical activities which take place in an organism, because some proteins are enzymes and enzymes control the speed and type of chemical reactions in cells.

Duplication of DNA during cell division. Cell division by mitosis produces daughter ceils with exact copies of the chromosomes present in the original cell. Before mitosis can occur in a cell the DNA molecules in its chromosomes must be duplicated exactly. Eventually these duplicates form a second set of chromosomes.

Exercise 9. *Read through the passage quickly. Try to get a general idea of what it is about. Now choose a new title for the passage from the following suggestion:*

a) The language of chemistry
b) Instructions for growth
c) A chemical language
d) How cells obey orders
e) Learning a new alphabet

Exercise 10. *Read through the text quickly, but this time look for details and answer the following questions:*

a) When was the structure of DNA discovered?
b) To which chemical bases do the letters G and T refer?
c) What are the sides of the DNA "ladder" made of?
d) What instructions are given to a cell by "three-letter words"?
e) What controls the speed and type of chemical reactions in cells?
f) What process produces daughter cells with exact copies of the chromosomes present in the original cell?

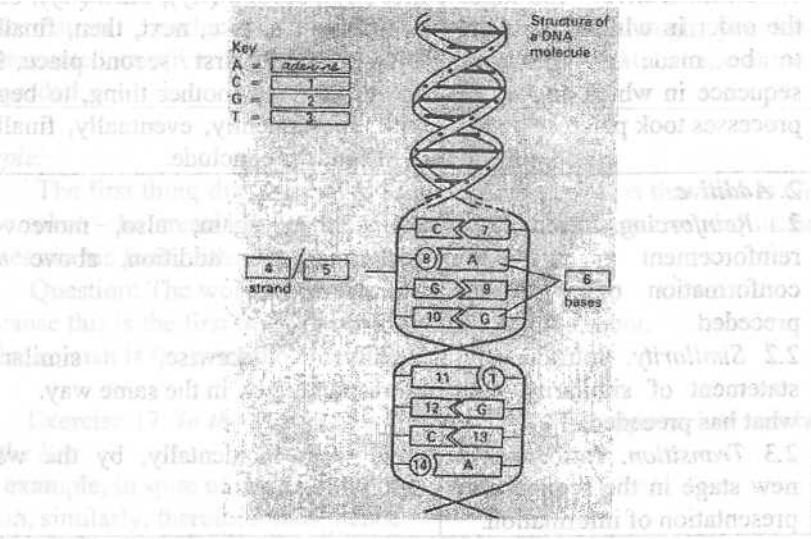
Exercise 11. *Decide which of these statements are correct and which are not correct according to the information contained in the passage.*

15. Genes control the size of organisms,
16. The genetic code was first understood in 1944.
17. The rungs of a ladder join its two sides together.
18. The letters of the genetic code can form 64 four-letter words.
19. The instruction to form amino acid leucine is AAT.
20. Proteins are the materials from which organisms are made.

Exercise 12. *This type of exercise helps you to understand how sentences are constructed and to appreciate which class of word is required in each case.*

Before describing DNA duplication _____ is necessary to look _____ closely at its structure. _____ rungs of the ladder-like _____ molecule are made up _____ chemical bases represented by A, G, C _____ T. Each rung consists of _____bases joined at the _____of the ladder. There _____ millions of rungs in DNA molecule, but in _____one, base A is ALWAYS _____base T and base C _____ ALWAYS opposite base G. This _____known as the pairing _____.

Exercise 13. *Complete the labels on this diagram. Replace the numbers with the correct word or letter.*



Exercise 14. *Here are the elements of 5 sentences. Put them in the right order to form these sentences then re-arrange the sentences to construct a short paragraph.*

a) on a DNA molecule/for making/each gene/a particular type of protein/carries instructions
b) this substance/two types/of/there are
c) by/this task/ribonucleic acid/is carried out
d) messenger RNA/transfer RNA/they are called/and
e) from the nucleus/the coded instructions/to the cytoplasm/for protein manufacture/pass

Exercise 15.*Explain the term inheritance from a chemical point of view.*

Exercise 16. *Learn about discourse and its markers:*

Types of Discourse Markers

These discourse markers, usually adverbs or prepositional phases, can be grouped in notional or semantic categories in the following way:

Notional Category/ Meaning	*Marker*
1. ***Enumerative.*** Introduce the order in which points are to be made or the time sequence in which actions or processes took place.	first (-ly), second (-ly), third (-ly), one, two, three / a, b, c, next, then, finally, last (-ly), in the first / second place, for one thing / for another thing, to begin with, subsequently, eventually, finally, in the end, to conclude.

2. **Additive** 2.1. *Reinforcing.* Introduces a reinforcement or conformation of what has preceded. 2.2. *Similarity.* Introduces a statement of similarity with what has preceded. 2.3. *Transition.* Introduces a new stage in the sequence of presentation of information.	again, then again, also, moreover, furthermore, in addition, above all, what is more. equally, likewise, similarly, correspondingly, in the same way. now, well, incidentally, by the way, O.K., fine.
3. ***Logical sequence*** 3.1. *Summative*. Introduces a summary of what has preceded. 3.2. *Resultative*. Introduces an expression of the result or consequence of what preceded (and includes inductive and deductive acts).	so, so far, altogether, overall, then, thus, in short, therefore, to sum up, to conclude, to summarize. so, as a result, consequently, hence, now, therefore, thus, as a consequence, in consequence.
4. ***Explicative.*** Introduces an explanation or reformulation of what preceded	namely, in other words, that is to say, better, rather, by (this) we mean.
5. ***Illustrative.*** Introduces an illustration or example of what preceded.	for example, for instance
6. **Contrastive.** 6.1.*Replacive.* Introduces an alternative to what preceded. 6.2. *Antithetic.* Introduces information in opposition to what preceded. 6.3. *Concessive.* Introduces information which is unexpected in view of what preceded	alternatively, (or) again, (or) rather, (but) then, on the other hand, conversely, instead, then, on the contrary, by contrast, on the other hand, anyway, anyhow, however, nevertheless, nonetheless, notwithstanding, still, though, yet, for all that, in spite of (that), at the same time, all the same.

Example:

The first thing that one has to realize about a robot is that man is God for the robot - he creates the robot. *Therefore,* its good qualities and its bad qualities are his fault, either way.

Question: The word *Therefore here,* means:

a) Because this is the first thing one must realize about a robot.
b) Because man is the one who creates the robot.

Exercise 17. *In the blanks below, supply the most appropriate marker from the list:*

a) for example, in spite of that, alternately
b) again, similarly, therefore, thus, hence
c) likewise, finally, however
d) nevertheless, moreover, on the other hand

The digestibility and therefore the feeding value of grass falls rapidly after emergence. _____(1) silage made from overmature grass will reflect this reduced feeding value. _____ (2) cuts for silage, particularly first cuts, have to be made over a short period if uniformly good silage with a high feeding value is to result._____(3) efficient organization of labour and machinery is one of the most important aspects of good silage making._____(4) it will help

to minimize the effect of unsettled weather if this occurs at the critical time.

Exercise 18.*Read and translate the text.*

Overview of Biological Functions

DNA contains the genetic information that allows living things to function, grow and reproduce. This information is held in the *sequence* of pieces of DNA called genes. Genetic information in genes is transmitted through complementary base pairing. For example, when a cell uses the information in a gene, the DNA sequence is copied into a complementary RNA sequence in a process called transcription. Usually, this RNA copy is then used to make a matching protein sequence in a process called translation. Alternatively, a cell may simply copy its genetic information in a process called DNA replication.

Transcription (genetics) and translation - Genetic code

A gene is a sequence of DNA that contains genetic information and can influence the phenotype of an organism. Within a gene, the sequence of bases along a DNA strand defines a messenger RNA sequence which then defines a protein sequence. The relationship between the nucleotide sequences of genes and the amino-acid sequences of proteins is determined by the rules of translation, known collectively as the genetic code. The genetic code consists of three-letter 'words' called *codons* formed from a sequence of three nucleotides (e.g. ACT, CAG, TTT). In transcription, the codons of a gene are copied into messenger RNA by RNA polymerase. This RNA copy is then decoded by a ribosome that reads the RNA sequence by base-pairing the messenger RNA to transfer RNA, which carries amino acids. Since there are 4 bases in 3-letter combinations, there are 64 possible codons (combinations). These encode the twenty standard amino acids. Most amino acids, therefore, have more than one possible codon. There are also three 'stop' or 'nonsense codons signifying the end of the coding region these are the TAA, TGA and TAG codons.

DNA replication. Cell division is essential for an organism to grow, but when a cell divides it must replicate the DNA in its genome so that the two daughter cells have the same genetic information as their parent. The double-stranded structure of DNA provides a simple mechanism for DNA replication. Here, the two strands are separated and then each strand's complementary DNA sequence is recreated by an enzyme called DNA polymerase. This enzyme makes the complementary strand by finding the correct base through complementary base pairing, and bonding it onto the original strand. As DNA polymerases can only extend a DNA strand in a 5' to 3' direction, different mechanisms are used to copy the anti-parallel strands of the double helix. In this way, the base on the old strand dictates which base appears on the new strand, and the cell ends up with a perfect copy of its DNA.

Exercise 19. *Write out from the text above all Past Participles and determine their functions (attributive or part of the predicate).*

Exercise 20. *Write out from the text above discourse markers and determine their notional or semantic categories.*

Exercise 21. *Underline the subject and the predicate of the sentences and put possible questions to all members of the sentences.*

1. This enzyme makes the complementary strand by finding the correct base.

2. Each strand's complementary DNA sequence is recreated by an enzyme called DNA polymerase.
3. The double-stranded structure of DNA provides a simple mechanism for DNA replication.
4. A cell may simply copy its genetic information in a process called DNA replication.
5. Genetic information in genes is transmitted through complementary base pairing.

Exercise *22. Give the annotation of the article above.*

Exercise 23 .*Read and translate the text in a written form.*

Genes and Genomes

DNA is located in the cell nucleus of eukaryotes, as well as small amounts in mitochondria and chloroplasts. In prokaryotes, the DNA is held within an irregularly shaped body in the cytoplasm called the nucleoid. The DNA is usually in linear chromosomes in eukaryotes, and circular chromosomes in prokaryotes. In the human genome, there are approximately 3 billion base pairs of DNA arranged into 46 chromosomes. The genetic information in a genome is held within genes. A gene is a unit of heredity and is a region of DNA that influences a particular characteristic in an organism. Genes contain an open reading frame that can be transcribed, as well as regulatory sequences such as promoters and enhancers, which control the expression of the open reading frame. In many species, only a small fraction of the total sequence of the genome encodes protein. Some non-coding DNA sequences play structural roles in chromosomes. All the functions of DNA depend on interactions with proteins. These protein interactions can either be non-specific, or the protein can only bind to a particular DNA sequence. Enzymes can also bind to DNA and of these, the polymerases that copy the DNA base sequence in transcription and DNA replication are particularly important.

Exercise 24.*This text is grammatically incorrect. Find the mistakes and make corrections.*

Genetic Recombination

Recombination involveing the breakage and rejoining of two chromosomes (M and F) to produced two re-arranged chromosomes (Cl and C2). A DNA helix do not usually interacting with other segments of DNA and in human cells the different chromosomes even occupies separate areas in the nucleus called "chromosome territories". This physical separation of different chromosomes are important for the ability of DNA to function as a stable repository for information, as one of the few times chromosomes interact is when they recombine. Recombination are when two DNA helices breaks, swap a section and then rejoin. In eukaryotes this process usually occur during meiosis, when the two sister chromatids is paired together in the center of the cell. Recombination allowing chromosomes to exchange genetic information and produces new combinations of genes, which increase the efficiency of selection and can be important in the rapid evolution of new proteins. Genetic recombination can also is involved in DNA repair, particularly in the cell's response to double-strand breaks. The most common form of recombination is homologous recombination, where the two chromosomes involved shares very similar sequences. Non-homologous recombination can to be damaging to cells, as it can to produce chromosomal translocations and genetic abnormalities.

Exercise 25. *Make up the annotation to the text above in English.*

Exercise 26. *Read and translate the text.*

Genetic Manipulation

Ever since man the hunter and gatherer gave up his nomadic way of life and began to tend stock and grow crops, he has been involved with genetic manipulation. Firstly, in ignorance simply by choosing to rear particular animals or plants, which were in some way advantageous to his developing lifestyle, and then much later as the science of Genetics began to develop, man has been engaged in breeding programs designed to produce varieties of plants and animals exhibiting the specific characteristics which fit them to his various needs.

As man's exploitation of natural resources has continued and industries have developed based on the synthetic ability of microorganisms, particularly the bacteria and fungi, his need for knowledge of the fundamental principles of the genetics of these organisms has increased and the new science of Molecular Genetics has emerged. The discipline seeks to understand the molecular base of inheritance and the way in which the information encoded by deoxyribonucleic acid (DNA) is utilized by the living cell.

Advances in the field of recombinant DNA research over the past decade have given the geneticist the techniques required to mobilize individual genes, that is specific sequences of DNA which code the amino acid structure of single proteins and transfer them from a donor to a recipient organism, thus conferring on the recipient the ability to synthesize the gene product. This is the practice of genetic manipulation as we understand the term today and which has become a cornerstone of the new Biotechnology. Now in addition to searching in nature for wild microorganisms capable of producing specific products, a process which is often long and tedious and sometimes unrewarding, microbial hosts can be tailored for specific purposes by introducing foreign genes into them. The source of this foreign DNA can be microbial, animal, or plant and thus microbial hosts can be converted into biosynthetic factories capable of making a wide diversity of materials needed in every aspect of our lives from food and fuel to agriculture and medicine. As well as its potential in aspects of applied biology, recombinant DNA research is an extremely powerful tool for the elucidation of gene structure and function.

Most recombinant DNA experiments arc designed to transfer specific genetic information from a donor organism to a recipient cell in such a way that the newly acquired gene will be expressed and result in the production of a "foreign" protein. In order to do this the DNA to be transferred must first be isolated from the donor organism and inserted into a DNA carrier or vector molecule, which will be used to transfer it into its new host.

The ease with which fragments of DNA can be cut out of large DNA molecules, present in the chromosomes of plants and animals, and inserted into vectors has been assisted greatly by the discovery within the last 20 years of a group of enzymes known as restricted endonucleases. These enzymes recognize specific base sequences on DNA molecules and cut them precisely within or near that sequence. There are currently some three hundred of these enzymes known and some forty or so are commercially available in a highly purified form.

The enormous growth of interest and input of capital into researching the applications of recombinant DNA research over the past decade is evidence of the potential benefit to man which these techniques can provide. Independent of its use for fundamental research in molecular genetics, a field which has provided and will continue to provide invaluable information to both academic and applied geneticists, recombinant DNA technology has already made important contributions in several areas of applied science.

Exercise 27. *Read through the text and quote the exact words used by the author to define, explain or amplify the following:*

3. molecular genetics
4. the practice of genetic manipulation
5. individual genes
6. a DNA carrier
7. bacteria and fungi
8. searching in nature for wild micro-organisms

Exercise 28. *The words in column A all appear in the text. For each one, find a word in column which is opposite in meaning.*

A	B
a) nomadic	1. useless
b) ignorance	2. entirety
c) particular	3. knowledge
d) individual	4. fixed
e) recipient	5. general
f) donor	6. group
g) ease	7. profitable
h) fragment	8. giver
i) invaluable	9. difficulty
j) unrewarding	10. receiver

Exercise 29. *Find a word in the text to replace the words underlined in these sentences:*

a) This English course has been specially designed for students of biology.
b) We must bring into use all our resources.
c) The study of genetics is a most important part of modem biology.
d) Technology has changed our manner of living.
e) The increase in size of the new industry has been very rapid.
f) Interesting work is being done in the general area of synthetic production.

Exercise 30. *Decide which of the statements are true, and which* are *not.*

a) The practice of genetic manipulation has a long history.
b) The science of molecular genetics is relatively modem.
c) Only wild micro-organisms can act as hosts to foreign DNA.
d) Microbial hosts will not accept plant DNA.
e) Research in recombinant DNA is valuable only to industry.
f) In recombinant DNA experiments, DNA is transferred direct to the host from the donor.
g) Enzymes are used to identify and isolate DNA transfer.
h) There are 40 enzymes in the group known as restricted nucleases.
i) A lot of time and money is being spent on research into recombinant DNA.
j) Not much can be expected of genetic manipulation in the future.

Exercise 31. *Fill in the blanks.*

Seven mice of no _____ to their pure-bred parents_____ been born as a _____ of a new technique _____ manipulating eggs. The technique _____ replacing the genetic material __a newly fertile egg _____ genetic material from another _____. Scientists used suction to _____the original genetic material _____ a vims to ease _____ passage of the new _____ into the egg.

Exercise 32. *Re-arrange the order of these sentences to make a very brief summary of the original passage.*

a) The future benefits from research into recombinant DNA wiii be very great.
b) The aim is to produce "foreign" protein.
c) The new science of molecular genetics has emerged.
d) Fragments of DNA are cut out with the aid of certain enzymes.
e) Man has been involved with genetic manipulation for thousands of years.
f) The hosts are converted into biosynthetic factories.
g) It is now possible to mobilize individual genes and transfer them to a host organism.

UNIT 2.13
GENETIC ENGINEERING IN INDUSTRY AND AGRICULTURE

Exercise 1. *Read through the text quickly. The aim is to get a general idea of what it is about. Choose from the list below what, in your opinion, the topic is:*

a) The manufacture of proteins
b) Microbiology in the chemical industries
c) The main uses of microbiology in industry
d) The nature of enzymes
e) Biological conversions
f) Research in micro-organisms

Exercise 2. *Read the text quickly, looking for specific details. Quote the exact words used in the text to define or explain the following:*

a) biological conversions
b) an isomer
c) acetic acid
d) enzymes

Industrial Microbiology
And the Advent of Genetic Engineering

Microbial cells have two main commercial applications. The first is as a source of protein, primarily for animal feed. In its commonest form this product is referred to as single-cell protein, although in fact it usually includes the entire microbial cell, the major component of which is protein.

Microbial cells are also used to carry out biological conversions, processes in which a compound is changed into a structurally related compound by means of one or more enzymes supplied by the cells.

Biological conversions, also known as microbial transformations, can be accomplished with growing cells, non-growing cells, spores or even dried cells. Microorganisms, which can carry out almost every kind of chemical reaction, have many advantages over chemical reagents. For example, many non-biological chemical reactions call for a considerable input of energy to heat or cool the reaction vessel; in addition they are generally conducted in solvents and require inorganic catalysts, both of which may be pollutants. Finally, many non-biological chemical reactions yield unwanted by-products that must be removed in a separate purification step.

Unlike most non-biological chemical reactions, biological conversions proceed at biological temperatures with water as the solvent. The cells can often be immobilized on a supporting structure for continuous processing. Another valuable asset of biological conversions is their specificity: one enzyme usually catalyses only one kind of reaction at a specific site on the substrate molecule. The enzyme can also be made to select one isomer, or molecular form of a compound, in a mixture of forms to produce a single isomer of the product. These characteristics account for the high yields typical of biological conversions, which can reach 100 per cent.

The biological conversion of ethanol into a dilute solution of acetic acid (vinegar) was done in Babylon by 5000 B.C. Other important biological conversions transform isopropanol into acetone, glucose into gluconic acid and sorbitol into sorbose. (The last reaction is the only biological step in the otherwise non-biological manufacture of ascorbic acid, vitamin C). Among the notable conversions in the pharmaceutical industry are those involved in the production of steroids. Wore recently, in the production of semi-synthetic penicillins it became possible to replace a chemical reaction that creates pollutants with a nonpolluting biological conversion.

The most versatile large molecules manufactured by microorganisms are enzymes. These biological catalysts are important in the food and chemical industries because of their specificity, efficiency and potency under conditions of moderate temperature and acidity. Although enzymes have traditionally been extracted from plants and animals, their production by microorganisms is increasing rapidly owing to the increasing availability of such organisms and the ease with which the yield can be improved by manipulating either the genes or the environment of the organisms. Moreover, in the microbial production of enzymes the fermentation times are short, the growth mediums are inexpensive and the screening procedures are simple.

Exercise 3. *Find some more detailed information.*

a) What are the three industries mentioned in the text in which microbiology is said to have an important role?

b) What are the disadvantages of non-biological reactions when used in industrial processes?

Exercise 4. *Fill in the blanks. This type of exercise helps you to appreciate sentence structure.*

Recent _____ of microbially produced_____ include the use of amylases in brewing, baking_____ the of textiles; _____proteases in brewing, meat tenderizing and the manufacture _____detergents and leather, and_____ rennin_____ cheesemaking. A_____ recent development has been _____combination of three microbially _____enzymes - alpha-amylose, glucamylose _____glucose isomerase - to obtain _____high-fructose sweetening agent _____cornstarch.

Exercise 5. *Time Sequence: when one event is related to another in terms of the passage of time. See "Discourse markers " in Unit 2 page 19.*

Pointer	Contrast	Reinforcemen t	Time sequence	Illustration
Although				
In fact				
For example				
In addition				
Finally				
Although				
Moreover				

Exercise 6. *Match an element in column A with an element in column B, to form sentences. Then arrange the sentences to make a short paragraph.*

A	B
the production of an enzyme can be enhanced	are replaced with starch or soybean meal
nutrients such as these	by replacing rapidly used sources of carbon and nitrogen
in the biosynthesis of enzymes it is often necessary	or a compound similar to the substrate
the manufacture of an enzyme is sometimes repressed	to exploit or bypass certain regulatory mechanisms
the inducer may be the substrate	are consumed more slowly
catabolite repression is avoided	by a natural feedback mechanism
for example, sources such as glucose and ammonia	by adding a special inducer substance

Exercise 7. *Read and translate the article. Put the words from the box into the gaps.*

Aquatic, technology, genotype, reversal, hybridization, domesticate, species, chromosome, molecular, fertilization, induce, to spawn, supply, crossing, vaccines, diversity, gene flow, genetic, environmentally.

Genetic Biotechnology in Agriculture

Biotechnology in fisheries and aquaculture represents a range of technologies that present opportunities to increase growth rate in farmed _____to improve nutrition of aqua feeds, to improve fish health, to help restore and protect environments, to extend the range of_____ species and to improve management and conservation of wild stocks. Some biotechnologies are simple with a long history of application, e.g. _____ of ponds to increase feed availability, while others are more advanced and take advantage of increased knowledge of _____ biology and genetics, e.g. genetic engineering and DNA disease diagnosis.

Genetic biotechnologies in aquaculture focus primarily on increasing growth rate, but also address increased disease resistance and increased environmental tolerance and include simple techniques, e.g. _____ , to the transfer of specific genes between species. The improvement in knowledge of breeding requirements and the ability to artificially _____breeding through the administering of natural or synthetic hormones and/or environmental manipulations (for example, changing photoperiod or water temperature can induce some fish _____) has been a key factor that has facilitated the application of more advanced biotechnologies: selective breeding, and the maintenance of other stocks genetically improved by _____manipulation, line_____, or sex _____all depend on controlled breeding of the farmed species.

These improvements in reproductive technologies have also assisted aqua culturists greatly in their efforts to_____ aquatic species. In addition, by making it possible to remove the natural constraints and timing of breeding, farmers are able to mate many more species at the times that are most beneficial, and thus help to ensure a steady and consistent _____of fish to the market. Molecular genetic techniques are also being used in fish health management to create_____ and to provide extremely sensitive DNA probes for disease diagnosis.

In fishery management, gene and_____frequency data can provide information on, inter alia, species identification, population stock structure, hybridization and_____. These genetic data can provide information on key aspects of fishery management such as, 1) an identification of the resource, 2) the breeding or stock structure of the resource, 3) an estimate of the size of the resource, and 4) the identification of key habitat that the resource requires.

_____biotechnologies can be used in conservation programmes, a) to reduce the impacts of farmed fish on wild populations, e.g. by making farmed fish sterile, b) to identify and manage endangered species, and c) to manage genetic resources of captive populations in aquaria or in species recovery programmes, e.g. to avoid inbreeding and loss of genetic_____.

A key consideration in transferring genetic technologies to the aquaculture sector is that they should be applied in an _____sound manner with due protection of native aquatic diversity. In addition, the social impact of genetic_____ transfer should be considered in how it affects the autonomy and economy of rural populations.

Exercise 8. *Divide the text above into sense parts. Write its plan. Write a synopsis of the text using the content words you have just written out.*

Exercise 9. *Put 10-12 special questions to the article to cover the general meaning if it.*

Exercise 10. *Read and translate the text.*

Biotechnology in Livestock Production and Health

Population growth, income growth and urbanization are fuelling a massive increase in demand for food of animal origin in developing countries - the 'livestock revolution'. In the past, developing countries have coped with the increases in demand mainly by expanding livestock populations. However, declining land areas per agricultural population are now forcing developing countries to intensify livestock production and monogastric animals, i.e. pigs and particularly poultry, are the most important sources of livestock sector growth.

Over the past centuries, biological, chemical and mechanical innovations have provided the basis for livestock sector development by containing the impact of livestock diseases, increasing yields and reducing labour requirements. Today, agricultural biotechnology is a new source of innovations that can potentially reshape agriculture as profoundly as any of the previous fields of technological innovation.

Intensification of livestock production is feared to reduce genetic diversity indirectly by displacing landraces and their inherent diversity as farmers adopt genetically uniform varieties of livestock. Biotechnologies such as cryopreservation of semen and embryos, coupled with artificial insemination and embryo transfer as well as somatic cloning are important actual and potential tools for the preservation of animal biodiversity.

Genetically modified livestock are not likely to play a major role in developing countries in the near future. The larger, short term potential for the application of biotechnologies in the livestock sector of developing countries resides in the use of bio-engineered inputs covering the entire food production chain from animal feed to product processing. In the short to medium term (5 to 10 years), the largest impacts of biotechnology on livestock production in developing countries are likely to stem from increasing the quality of livestock feeds through improving nutrient content of forages as Well as the digestibility of low quality feeds and through enhanced disease control.

The role of animal diseases as a major constraint to enhanced livestock productivity will substantially increase as animal production intensifies and as livestock densities increase in warmer and more humid ecological zones. Use of DNA biotechnology in animal health through more effective, cheap and robust vaccines combined with enhanced diagnostic tools could contribute significantly to improved animal disease control, thereby stimulating both domestic food production and participation in livestock trade.

Biotechnology also offers considerable potential for improvements in agro-industrial processing, particularly through more environmentally friendly or energy-efficient processes. While most of these technologies are not likely to be accessible to traditional animal agriculture, they will be accessible to a considerable degree to the emerging commercial and industrial sector in many developing countries.

Most of the biotechnology research and development activities (about 80%) are conducted by large private companies for commercial exploitation and are designed to meet the requirements of developed markets. They are thus unlikely to be very suitable for the conditions of small-scale farmers in tropical regions of the world and this may lead to increasing inequality of income and wealth within countries (large vs. small farmers) and between countries (developed vs. developing). Given that commercial considerations may not necessarily reflect social concerns and needs, there remains a pivotal role for public-sector research and the involvement of international organizations.

Exercise 11. Match the words in A with their definitions in B

A	B
Livestock	- An organism that has a simple single-chambered stomach
Diversity	- A limitation or restriction
Accessible	- A process where cells or whole tissues are preserved by cooling to low sub-zero temperatures
Monogastric	- Animals such as cattle and sheep which are kept on a farm
Forage	- Food for horses or cattle, esp. hay or straw
Robust	- An unborn animal or human being in the very early stages of development.
Cryopreservation	- Very strong, reliable or healthy
Embryo	- Able to be reached or entered
Constraint	- Very important for the development or success of something else
Pivotal	- The fact that something contains many very different elements.

Exercise 12. *The main parts of any scientific article are the title, introduction, main part, results and conclusion. Mark such parts in the article given above.*

Exercise 13. *Read and translate the article in a written form.*

The Rat Gene and Cancer

During the 1960s and 1970s, a great deal of research was done on a class of viruses that affects rodents and birds and causes tumours in those species. The motivation for a lot of this research was the idea that similar viruses might cause tumours in humans, but in fact it's turned out that there are very few viruses that cause tumours in humans. Nevertheless, the study of these rodent viruses has been enormously fruitful in helping us to understand human cancer, and that's the basis of this story.

One of the viruses that were studied in those years had two peculiarities. One was that it had lost most of the genes that it needed to reproduce itself. It could only reproduce if a helper virus was present in the same cell to supply the missing functions.

The second peculiarity was that in place of the genes that were required for reproduction of the virus was another gene that had actually been picked up at some point in the history of this virus when it went through rats, and it picked up a rat gene and incorporated it into its own genome.

At the same time that a lot of work was going on these viruses, other scientists were studying other aspects of tumour formation, in particular, the action of carcinogenic agents, chemicals and X-rays and ultraviolet light.

As you all know, human cells can turn into tumour cells under the influence of such agents. The tumour-like properties of those cells are inherited by all the daughter cells through many generations and, moreover, almost all chemicals that turn out to be carcinogens are also able to cause mutations.

Another observation was that in tumour cells, many of the chromosomes seemed to have altered structures. So, all of these observations and others certainly suggested that changes in DNA might be

involved in the development of tumour cells. By about 1980, it became possible to test that hypothesis directly.

Exercise 14. *Work in pairs. You have some more information, but you don't have the same information as your partner. Ask and answer Wh- questions to complete the information.*

Student A

1. During the 1960s and 1970s, a great deal of research was done on a class of viruses... (What class of viruses was...?)
2. The motivation for a lot of this research was the idea that similar viruses might cause tumours in humans, but in fact it's turned out that there are very few viruses that cause tumours in humans.
3. One of the studied viruses had... (What ?)
4. One peculiarity was that it had lost most of the genes that it needed to reproduce itself.
5. The second peculiarity was... (What ?)
6. At the same time other scientists were studying other aspects of tumour formation, in particular, the action of carcinogenic agents, chemicals and X- rays and ultraviolet light.
7. The tumour-like properties of human cells are inherited by..(What... by?)
8. Changes in DNA might be involved in the development of tumour cells.

Student B

1. During the 1960s and 1970s, a great deal of research was done on a class of viruses that affects rodents and birds and causes tumours in those species.
2. The motivation for a lot of this research was the idea... (What was...?)
3. One of the viruses that were studied in those years had two peculiarities.
4. One peculiarity was... (What... ?)
5. The second peculiarity was that in place of the genes that were required for reproduction of the virus was another gene that had actually been picked up at some point in the history of this virus when it went through rats, and it picked up a rat gene and incorporated it into its own genome.
6. At the same time other scientists were studying... (What...?)
7. The tumour-like properties of human cells are inherited by all the daughter cells through many generations and, moreover, almost all chemicals that turn out to be carcinogens are also able to cause mutations.
8. ... might be involved in the development of tumour cells. (What... ?)

Exercise 15. *Put the verbs in brackets into the correct grammar active or passive form.*

Facing biotech foods without the fear factor

Almost everywhere food (to be) sold these days, you (to be) likely to find products claiming to contain no genetically modified substances. But unless you (to buy) wild mushrooms, game, berries or fish, that statement is untrue.

Nearly every food we eat *{to have*) been genetically modified, through centuries of crosses, both within and between species, and for most of the last century through mutations induced by bombarding seeds with chemicals or radiation. In each of these techniques, dozens, hundreds, even thousands of genes of unknown function *{to transfer*) or modified to produce new food varieties.

Most so-called organic foods *{to be)* no exception. The claims of no genetic modification really *{to refer to)* foods that contain no ingredients that *{to produce)* through the highly refined technique of

gene splicing, in which one or a few genes *{to transfer)* to an organism. But alannist warnings about the possible hazards of gene splicing have made the public extremely wary of this selective form of genetic modification.

Such warnings (to be) groundless so far. "Americans *{to consume)* already more than a trillion servings of foods that *{to contain)* gene-spliced ingredients," said Dr. Henry Miller the author of "The Frankenfood Myth," a new book that questions the wisdom of current gene-splicing regulations. "There hasn't been a single untoward event documented, not a single ecosystem disrupted or person made ill from these foods," he said in an interview. "That is not something that can be *{to say)* about conventional foods, where imprecise methods of genetic modification actually have caused illnesses and deaths."

Exercise 16. *Read and translate the article.*

Uses in Technology

1. Forensic scientists can use DNA in blood, semen, skin, saliva or hair at a crime scene to identify a perpetrator. This process is called genetic fingerprinting or more accurately, DNA profiling. In DNA profiling, the lengths of variable sections of repetitive DNA, such as short tandem repeats and minisatellites, are compared between people. This method is usually an extremely reliable technique for identifying a criminal. However, identification can be complicated if the scene is contaminated with DNA from several people. DNA profiling was developed in 1984 by British geneticist Sir Alec Jeffreys, and first used in forensic science to convict Colin Pitchfork in the 1988 Enderby murders case. People convicted of certain types of crimes may be required to provide a sample of DNA for a database. This has helped investigators solve old cases where only a DNA sample was obtained from the scene. DNA profiling can also be used to identify victims of mass casualty incidents.

2. Bioinformatics involves the manipulation, searching, and data mining DNA sequence data. The development of techniques to store and search DNA sequences have led to widely-applied advances in computer science, especially string searching algorithms, machine learning and database theory. String searching or matching algorithms, which find an occurrence of a sequence of letters inside a larger sequence of letters, was developed to search for specific sequences of nucleotides. In other applications such as text editors, even simple algorithms for this problem usually suffice, but DNA sequences cause these algorithms to exhibit near-worst-case behavior due to their small number of distinct characters. The related problem of sequence alignment aims to identify homologous sequences and locate the specific mutations that make them distinct. These techniques, especially multiple sequence alignment, are used in studying phylogenetic relationships and protein function. Data sets representing entire genomes' worth of DNA sequences, such as those produced by the Human Genome Project, are difficult to use without annotations, which label the locations of genes and regulatory elements on each chromosome. Regions of DNA sequence that have the characteristic patterns associated with protein- or RNA-coding genes can be identified by gene finding algorithms, which allow researchers to predict the presence of particular gene products in an organism even before they have been isolated experimentally.

3. DNA was first used in computing to solve a small version of the directed Hamiltonian path problem, an NP-complete problem. DNA computing is advantageous over electronic computers in power use, space use, and efficiency, due to its ability to compute in a highly parallel fashion. A number of other problems, including simulation of various abstract machines, the boolean satisfiability problem, and the bounded version of the traveling salesman problem, have since been analyzed using DNA computing. Due to its compactness, DNA also has a theoretical role in cryptography, where in particular it allows unbreakable one-time pads to be efficiently constructed and used.

4. Because DNA collects mutations over time, which are then inherited, it contains historical information and by comparing DNA sequences, geneticists can infer the evolutionary history of organisms, their phytogeny. This field of phylogenetics is a powerful tool in evolutionary biology. If DNA sequences within a species are compared, population geneticists can learn the history of particular populations. This can be used in studies ranging from ecological genetics to anthropology, for example, DNA evidence is being used to try to identify the Ten Lost Tribes of Israel. DNA has also been used to look at modem family relationships, such as establishing family relationships between the descendants of Sally Hemings and Thomas Jefferson. This usage is closely related to the use of DNA in criminal investigations detailed above. Indeed, some criminal investigations have been solved when DNA from crime scenes has matched relatives of the guilty individual.

Exercise 17. *The article above consists of 4 parts. Give the following names to each of them in the correct order: History and anthropology, Bioinformatics, Genetic fingerprinting, DNA and computation.*

Exercise 18. *Put 10-12 special questions to the article to cover the general meaning if it.*

Exercise 19. *Write the summary of the article.*

Exercise 20. *Read and translate the following article.*

Ignorance vs. Progress

It is no secret that the public's understanding of science and genetics, in particular, is low. For example, in a telephone survey of 1,200 Americans released last October by the Food Policy Institute at Rutgers University, 43 percent thought, incorrectly, that ordinary tomatoes did not contain genes, while genetically modified tomatoes did. One-third thought, again incorrectly, that eating genetically modified fruit would change their own genes.

In another telephone survey, in which 1,000 American consumers were questioned last year in research for the Pew Initiative on Food and Biotechnology, 54 percent said they knew little or nothing about genetically modified foods. Still, 89 percent said that no such food should be allowed on the market until the Food and Dmg Administration determined that it was safe.

What most respondents did not seem to know is that almost none of the foods people eat every day, which contain many introduced genes whose functions are unknown, have ever been subjected to pre-marketing approval or post-marketing surveillance.

Why should people object to the presence of a single new gene whose function is known when for centuries they have accepted foods containing hundreds of new genes of unknown function?

A junior high school student in Idaho, Nathan Zohner, demonstrated in a 1999 science fair project how easy it was to hoodwink a scientifically uninformed public. As described in "The Frankenfood Myth," 86 percent of the 50 students he surveyed thought dihydrogen monoxide should be banned after they were told that prolonged exposure to its solid form caused severe tissue damage, that exposure to its gaseous form caused severe bums and that it had been found in tumours from terminal cancer patients. Only one student recognized the substance as water, H20.

Without better public understanding and changes in the many arcane rules we will miss out on major improvements that can result in more healthful foods, a cleaner environment and a worldwide ability to produce more food on less land - using less water, fewer chemicals and less money.

The European Union has, in effect, banned imports of all foods produced through gene splicing, and it has kept many African nations, including those afflicted with widespread malnutrition, from

accepting even dona ted gene-spliced foods and crops by threatening to cut off products they export because they might become contaminated with introduced genes. Even more puzzling, Uganda has prohibited the testing of a fungus-resistant banana created through gene splicing, even though the fungus is devastating that nation's most important crop.

Exercise 21. .*Put 10-12 special questions to the article above to cover the general meaning if it.*

Exercise 22. .*Read and translate the following article.*

A **Continuum of Techniques**

In a new report, "Safety of Genetically Engineered Foods," published by the National Academy of Sciences, an expert committee notes that any time genes are mutated or combined, as occurs in almost all breeding methods, there is a possibility of producing a new, potentially hazardous substance. Citing a conventionally bred potato that turned out to contain an unintended toxin, the report says the hazard lies with the toxin's presence, not the breeding method. Among the foods developed through induced mutations are lettuce, beans, grapefruit, rice, oats and wheat. None had to undergo stringent testing and federal approval before reaching the market.

Only those foods produced by the specific introduction of one or more genes into the organism's DNA are subject to strict and prolonged premarketing regulations. But as the academy's report points out, gene splicing is only a process, not a product, a process on a continuum of genetic modification of foods that began more than 10,000 years ago when people first crossed two varieties of a crop to improve its characteristics.

In fact, gene splicing is the most refined, precise and predictable method of genetic modification because the function of the transferred gene or genes is known. It is also important to realize that genes are rarely unique to a given organism.

All new crop varieties, whether produced through gene splicing or conventional techniques like cross-breeding or induced mutations, go through a series of tests before commercial introduction. After greenhouse testing for the look and perhaps taste of the crop, it is grown in a small, sequestered field trial and, if it passes that test, in a larger trial to check its commercial viability.

The potential risks associated with genetically modified foods result not so much from the method used to produce them but from the traits being introduced. With gene splicing, only one or two traits at a time are introduced, making it possible to assess beforehand how much testing is needed to assure safety. While such safety tests are important, it is possible to become fixated on hypothetical risks that can never be absolutely discounted.

Indeed, Dr. Miller, once director of the Office of Biotechnology for the Food and Drug Administration, argues that overly stringent regulations can needlessly raise public fears. "People naturally assume that something that is more highly regulated is more dangerous," he said, adding, "Government officials should have done less regulating and more educating."

A risk-based protocol for safety evaluation would greatly reduce the time and costs involved in developing most new gene-spliced crops, many of which could raise the standard of living worldwide and better protect the planet from chemical contamination.

Exercise 23.*Discuss informative and evaluative aspects of the article given above.*

III NANOTECHNOLOGIES

UNIT 3.1 THE BIG FUTURE OF NANOTECHNOLOGY

Active Vocabulary:

to deal	мати справу	argue	стверджувати
invisible	Невидимий	novel	новина, новітній
by most accounts	у всіх відношеннях	delivery	постачання
level	Рівень	to punch	протикати
STAIN-PROOF	такий, що не линяє	to disrupt	розривати,
scratch-resistant	стійкий до подряпин	benefit	користь
fuel cells	паливні елементи	determine	визначати

Nanotechnology deals in the realm of the nearly invisible. The word comes from the Greek nanos, meaning «dwarf». But by most accounts, the technology's potential is anything but small.

Scientists and engineers can now physically work with materials at the atomic level to create stain-proof fabrics, scratch-resistant paints and longer- lasting tennis balls. And researchers say new medical diagnostic tools and smaller, more efficient fuel cells and batteries based on nanoscience are on the way.

From computer chips invisible to the naked eye to microscopic machines that seek out and destroy cancers inside the human body, many scientists argue that the potential of nanotechnology could be endless, but not without controversy.

"If we can get a nanoparticle into a cell, that might prove to be a novel and useful drug delivery device," says Ms. Kulinowski, Executive Director of the Center for Biological and Environmental Nanotechnology at Rice University. "On the other hand, it might prove to be a toxin to the cell either by punching a hole in the cell membrane or otherwise disrupting the cell's function."

Still there's nearly universal agreement among scientists and policy makers that much more research is needed on the health and environmental effects o f this new technology.

Whether the benefits of nanotechnology outweigh the risks will determine the future of what many researchers and investors hope will be the world's next industrial revolution.

Exercise 1. Give negative of the following words:

efficient, useful, hopeful, possible, order, necessary, connect, definite, polite, correct, comfortable, organic.

Exercise 2. Answer the questions:

1. Where does the word "nano" come from and what does it mean? 2. What can scientists and engineers create using nanotechnology? 3. What are the possible medical applications of the nanotechnology? 4. Why can nanoparticles be harmful to human health? 5. What aspects of nanotechnology should be studied?

Exercise 3. Try to find the origins of the following words and explain them using the pattern: The word _____comes from_____:

bicycle, television, portfolio, microscope.

UNIT 3.2
HOW CAN NANOTECHNOLOGY IMPROVE FUEL CELLS?

Active Vocabulary:

nanoparticles	*наночастинки*	*digital*	*цифровий*
to reduce	*зменшувати*	*conventional*	*традиційний*
TO REPLACE	*Замінювати*	TO PLUG	*підключати*
entirely	*Повністю*	*electric outlet*	*електрична розетка*
device	*Приклад*	*tank*	*бак, цистерна*

Catalysts are used with fuels such as hydrogen or methanol to produce hydrogen ions. Platinum, which is very expensive, is the catalyst typically used in this process. Companies are using nanoparticles of platinum to reduce the amount of platinum needed, or using nanoparticles of other materials to replace platinum entirely and thereby lower costs.

Fuel cells contain membranes that allow hydrogen ions to pass through the cell but do not allow other atoms or ions, such as oxygen, to pass through. Companies are using nanotechnology to create more efficient membranes; this will allow them to build lighter weight and longer lasting fuel cells.

Small fuel cells are being developed that can be used to replac e batteries in handheld devices such as PDAs (Personal Digital Assistant) or laptop computers. Most companies working on this type of fuel cell are using methanol as a fuel and are calling them DMFC's, which stands for direct methanol fuel cell. DMFC's are designed to last longer than conventional batteries. In addition, rather than plugging your device into an electrical outlet and waiting for the battery to recharge, with a DMFC you simply insert a new cartridge of methanol into the device and you're ready to go.

Fuel cells that can replace batteries in electric cars are also under development. Hydrogen is the fuel most researchers propose for use in fuel cell powered cars. In addition to the improvements to catalysts and membranes discussed above, it is necessary to develop a lightweight and safe hydrogen fuel tank to hold the fuel and build a network of refueling stations. To build these tanks, researchers are trying to develop lightweight nanomaterials that will absorb the hydrogen and only release it when needed. The Department of Energy is estimating that widespread usage of hydrogen powered cars will not occur until approximately 2020.

Exercise 1. Decipher the abbreviations using the phrases stands for, means, is deciphered us:
PC, NATO, UNESCO, AIDS, GPS, AMD, MIT, CERN)

Exercise 2. Say whether these statements are TRUE or FALSE:
1. Platinum is used as a catalyst in chemical reactions with some fuels such as petrol and gas. 2. Companies are trying to increase the consumption of platinum. 3. Nanotechnology is used to create membranes which can trap the ions of hydrogen. 4. Laptop computers can operate only connected to the electric grid. 5. Small fuel cells are being designed to replace rechargeable batteries for notebooks and laptops. 6. Most researchers propose to use spirit in fuel cell powered cars. 7. Lightweight nanomaterials are being developed to make the body of cars. 8. Hydrogen powered cars will be widely used only in the next century.

Exercise 3. *Compose 3 sentences using the pattern* Rather than V-ing ... *which means Замість того, щоб…* e.g.: You may use a calculator rather than making calculations yourself.

UNIT 3.3
NANO-SCALE FUEL CELLS MAY BE CLOSER THAN WE THINK, THANKS TO AN INEXPENSIVE NEW MANUFACTURING METHOD ACTIVE VOCABULARY:

cell	клітина, комірка, чарунка	*capacity*	місткість, ємність
essential	Важливий	*to strip*	знімати, позбавляти
to expand	Розширювати	*to harvest*	збирати врожай
response	Відповідати	FUZZY	неясний, нечіткий
entertainment	Розваги	*frontier*	кордон
unavoidable	Невідворотний	*to etch*	гравірувати, травити
to provide	забезпечувати, постачати	*to borrow*	позичати

We live in a world of hand-held devices: iPods, cell phones, PDAs, pagers... the list of essential personal technology keeps expanding, and the natural response is consolidation. It's rare these days to see a new cell phone that isn't also a digital camera, and MP3 players can be integrated into just about anything. We're just a short step away from universal, hand-held devices that combine communication, media, and entertainment into one slim package. What's stopping us? In a word, power.

Cell phones last a few days on a single battery; laptop computers, two to three hours. If you could have a pocket-sized personal computer with a cellphone sized battery, how long do you think it would last? Just long enough to check your e-mail, or play a game of solitaire? It's a sad but unavoidable fact that the more complicated an electronic device gets, the less efficient it is.

Enter fuel cells, with an energy capacity at least ten times greater than that of conventional batteries. Where a lithium-ion battery can provide 300 Watt-hours per liter, the methanol in a fuel cell has a theoretical capacity of up to 4800 Watt- hours per liter! Imagine your laptop running for a full day without needing to recharge, and you can see why industiy leaders such as Toshiba, IBM, and NEC have been pouring funds into fuel cell research.

A polymer-electrolyte membrane (PEM) fuel cell generates current by stripping hydrogen atoms from a chemical source, breaking them apart on a catalyst (such as platinum), and harvesting the electrons. The hydrogen ions (protons) left over from this process are separated from the fuel by an electrolyte, and when brought into contact with the atmosphere they bind to oxygen molecules and produce water. The more fuel you can bring into contact with the catalyst, the more current can be drawn from the cell. A high catalytic surface area is the key to efficiency.

To compress more power into smaller volumes, researchers have begun to build fuel cells on the fuzzy frontier of nanotechnology. Silicon etching, evaporation, and other processes borrowed from chip manufacturers have been used to create tightly packed channel arrays to guide the flow of fuel through the cell. The point is to pack a large catalytic surface area into a wafer-thin volume. This approach is not only expensive, but inherently limited by its two-dimensional nature.

Exercise 1. *Compose 2 sentences using the pattern:* The more ..., the more.
E.g.: The higher the temperature, the higher the pressure.

Exercise 2. Answer the questions:

1. What is one of the main problems of modem hand-held devices? 2. How long may a pocket-sized computer on a usual battery last? 3. How can new fuel cells improve the situation? 4. What is the key to the efficiency of the fuel cells? 5. What technological processes are used to produce miniature fuel cells?

Exercise 3. Read the text below. How is it connected to the text above? How can you explain the title of the text?

Fiat Lux!

Researchers Kenneth Lux and Karien Rodriguez, at the University of Wisconsin, came up with an exciting new approach to the problem. Their method not only 'improves the performance of nano-scale fuel cells, hut completely sidesteps the need for industrial-strength technology. "Even the best electrocatalysts, on a flat surface, give only hundreds of microamps per square centimeter. What you really want is ... to increase the surface area by orders of magnitude." Lux explains to PhysOrg.com, "To do this you need a three- dimensional structure."

Lux and Rodriguez found their fuel channels ready-made in a commonly available, porous alumina filter costing only about $1. The filter is riddled with neat, cylindrical holes only 200 nanometers in diameter, and was already being used at their lab as a template for the growth of nanowires. Lux hit on the i dea of creating nanowires in a platinum-copper alloy, then dissolving the copper by soaking the filter in nitric acid. In place of a solid nanowire, each hole was left with a porous platinum electrode. The partially dissolved wires are structurally compl ex, as befits their random nature, and have an enormous surface area for thei r s ize.

To build a fuel cell, they fill the pores with acid. A sheet of electrolyte- loaded filter paper (or polymer-electrolyte) is placed between two of the nanoelectrode arrays to carry off the hydrogen ions. Electrodes can then be placed anywhere on the outer surface of the sandwich, allowing the electrical connections to be easily configured. Stacks of these fuel cell a'rays can be connected in series or parallel, to provide higher voltage or current respectively.

Of course, the result is hardly perfect. Lux estimates that only a third of the electrodes are active, and admits that there is a lot of room for improvement. Even this proof-of-concept prototype, however, has an energy capacity an order of magnitude higher- than its two-dimensional lithographic counterparts! The price can't be beat, either, with a total materials cost of only $200. "It's a really simple method." says Lux, "My power source for making the nanowires was an AA battery." If fuel-cell technology can be perfected, we might be looking at a future of cheap, disposable battery packs for our favorite electronic gadgets. When your universal media manager runs out of energy, you'll just run to the store and buy it a methanol sandwich!

UNIT 3.4
TARGETED DRUG DELIVERY THAT HITS THE MARK

Active Vocabulary:

To hit the mark	досягти успіху	to involve	включати
challenge	виклик, проблема	rod	прут, стрижень, вудка
treatment	лікування, обробка	vessel	посуд, посудина, судина
debilitating	послаблюючий	tumor	пухлина
to delliver	доставляти	to bind	зв'язувати
target	ціль	to attach	прикріпляти, приєднувати
approach	Підхід	TO INSERT	вставляти, вміщати

One of the challenges with current cancer treatments is how to deliver drugs to tumors without causing debilitating side effects. By delivering dmgs in a more targeted way, some of those side effects can be reduced. There are several companies and universities developing targeted drug delivery using nanoparticles. One method being developed by researchers at MIT and University of California at San Diego and Santa Barbara looks interesting. They have divided the task between two nanoparticles in order to increase the targeting effectiveness.

The approach involves several steps. First, they inject gold nanorods into the blood stream. The gold nanorods stay in the healthy blood vessels but exit the leaky blood vessels found at the site of tumors. The gold nanorocls then accumulate in the tmnor and an infrared laser is used to heat the gold naaorods, thereby heating the tumor.

The heating of a tumor increases the level of a stress related protein (called p32) on the surface of the tumor. Because an amino acid (called LyP-1) binds to the p32 protein, they developed a process to attach LyP-1 to spherical nanoparticles called liposomes. They then insert molecules of a chemotherapy drug inside the liposome.

When the drug packed liposome is injected into the bloodstream, the amino acids on the nanoparticles attach to the proteins, the heat has pushed to the surface of the tumor and more of the drug is delivered to the tumor.

Why Nanorods Work Better Than Nanospheres

Several methods in use today use spherical gold nanoparticles for drug delivery, so why did this group choose nanorods instead? It turns out that nanorods of different lengths absorb different frequencies of infrared radiation. The company making the nanorods, NanopartzTM, has shown that gold nanorods absorb infrared much more efficiently than spherical gold nanoparticles. Therefore gold nanorods do a better job of absorbing infrared light an'd heating up the tumor than spherical nanoparticles do.

It’s interesting to see this concept of using a combination of different nanoparticles doing different parts of the task to develop a system to deliver chemotherapy drugs to cancer tumors. It will be very interesting to see which of the several methods of targeted drug delivery under development is put into widespread use.

Exercise 1. Say whether these statements are TRUE or FALSE:

1. Scientists try to eliminate unwanted side effects of delivering drugs to tumors by using nanotechnology. 2. The new drug delivery method may be done by one step. 3. The nanorods injected into the: blood stream are made of silver. 4. The researchers use laser to heat the tumor. 5. The heat provides better absorption of the drag. 6. In the current methods of drug delivery they use spherical, cubical and ellipsoid nanoparticles. 7. Researchers use nanorods instead of nanoshpheres because nanorods absorb drugs much better.

Exercise 2. Say about the destination of the below-given objects and processes using the phrases: is used to; is designed for; is aimed at; the purpose of... is:

injection, blood vessels, drug, laser, nanoparticles; computer, cell-phone, MP3- player, umbrella.

Exercise 3. Give synonyms to the following words:

a chall enge, to deliver; a target, to reduce, to involve, to accumulate, a job.

UNIT 3.5
SMALL WINDMILLS IMPROVED WITH NANOTUBES

Active Vocabulary:

SUPPLEMENT	додатковий	ROUTE	шлях
WINDMILL	вітряк	TO RELY ON	покладатись
TO ASSUME	вважати	TO REVERT	вертатись
TO WITHSTAND	витримувати	TO GRIND	молоти
EPOXY	епоксидна смола	BLADE	лезо, лопать
TO IMPROVE	покращувати	CONVENTIONAL	традиційний

Solar panels are a widely accepted way to generate electricity if your house is off the grid or if you want to supplement power from the grid, however in some regions windmills may be much more effective.

Considering that adding nanotubes to composites produces stronger, lighter components I had assumed that nanotubes would be used to produce larger windmills that can withstand higher winds. I was therefore interested to find Eagle Windpower taking a different approach in one of their product lines by using an epoxy containing carbon nanotubes to improve small windmills, small enough to be used to power a single house.

Why go the windmill route for power generation on your house? Remember that not every place in the world gets enough hours of sunlight to make solar
power practical. For example in December Fairbanks, Alaska, gets about 4 hours of sunlight a day. If you lived in Miami, Florida, which gets over 10 hours of daylight in December, solar is great, but your average Fairbanks resident would be left out in the cold with only solar to rely on. Also, for people who actually live off the grid windmills are a logical choice, reverting back to the days when windmills were used to pump water and grind grain.

To service this windmill market, Eagle Windpower uses the nanotube based epoxy, and techniques taken from ski manufacturing to automate their blade manufacturing process, to produce lightweight, cost competitive, windmill blades. Eagle Windpower says the lightweight blades result in small windmills that produce 30 percent more electric power than windmills with conventional blades.

Exercise 1. *Answer the questions:*

1. What power sources could be used if your house is off the grid? 2 . What approach to power supply does Eagle Windpower suggest? 3. Why in your opinion the company Eagle Windpower has such a name? 4. Why solar panels are not effective in Fairbanks? 5. How did our predecessors use windmills? 6. What parts of windmills are produced using nanotechnology?

Exercise 2. *Compose the story beginning: If I were rich... using the pattern: if <subject> <Past Indefinite> ..., <subject> would <Infinitive>...*

Exercise 3. *Put as many questions as you can to the following sentences:*

1. Eagle Windpower produces windmills with unconventional blades.'2. Alaska towns get about 4 hours of sunlight in December. 3. Eagle Windpower uses epoxy containing carbon nanotubes to improve small windmills.

UNIT 3.6
DRESSING UP: THERMOELECTRIC NANOWIRES VS. NANO SOLAR CELLS

Active Vocabulary:

advantage	перевага	to dope	вводити добавку
waste	залишковий	TO SCORCH	обпалювати
embedded	вбудований	awning	навіс, тент
to reduce	зменшувати	handy	зручний
to maintain	підтримувати	*lead time*	час на підготовку проекту
requirement	вимога	*in the meantime*	тим часом
roughness	грубість, нерівність	*silicon*	кремній

Thermoelectric devices can convert heat into electricity. Many temperature sensing devices take advantage of this effect by using electricity' to measure temperature in devices called thermocouples. Various researchers are working to produce inexpensive and efficient thermoelectric materials that can change waste heat into electricity.

Recently there was an announcement that researchers at Berkeley had made silicon nanowires that convert heat into electricity using a thermoelectric effect. One possible use of these is to charge portable devices. The wires could be embedded in fabric, so that your jacket could become a charging station, using your body heat to generate the electricity.

Other researchers have made thermoelectric nanowires. The difference with Berkeley's work is that they have reduced the diameter of the wires and modified the surface texture to reduce the thermal conductivity while maintaining the electrical conductivity, a key requirement of thermoelectric materials. It is, in fact, the combination of the wire diameter, the roughness of the surface texture, and doping the silicon with boron that reduce the thermal conductivity without having serious impact on the electrical conductivity.

This concept can be applied in other ways as well. One possibility for this research is that cars could be set up to use their own waste heat to run the radio and other electrical devices in the car. Siphoning off and making use of heat from power- plants would be another logical use. All that heat your laptop computer generates that now scorches your thighs could be used to power the laptop up.

This got me thinking about the folks who are working on a parallel track to embed solar cells in fabric. Konarka Technologies, for example, is currently selling solar cell material to Sky Shades, a maker of awnings. By embedding nanoparticles in plastic film they produce a lightweight, flexible photovoltaic material called Power Plastic®. The process involves printing; or coating nanoparticles (such as quantum dots or nanocrystals) onto other material using a process similar to printing ink on newspaper.

That's when I started wondering, why would you need both of these technologies? Then a light went off in my brain—solar doesn't work in the dark, or in region;; of the country where it's cloudy many days of the year. That's why the combination of these two solutions could work to ensure that you're inexpensively charged up, 24/7.

The jacket of the future might have thermo electric nanowires in strategic places (under your arms is a logical hot spot) with solar cells embedded on the shoulders. Imagine how handy a military jacket with both thermo-electric nanowires and solar cells would be. Lighter weight batteries that can be constantly recharged could be carried onto the battlefield to power communications or other equipment.

When will you find such a juiced up jacket in your local department store? You're probably looking about ten years lead time till you make that shopping trip. In the meantime keep that cell phone charger handy and check my Nanotechnology and Energy Web page for updates.

Exercise 1. Give synonyms to the following words from the text:

to convert, to use, device, inexpensive, waste, heat, fabric, to reduce, to modify, requirement, in fact, impact, to apply, possibility, power, folks, for example, currently, produce, similar to, regions, handy, constantly, equipment, probably.

Exercise 2. Say whether these statements are TRUE or FALSE:

1. Thermoelectric devices can covert water into vapour. 2. Researches from Berkley made their nanowires from gold. 3. Thermoelectric jacket may use the energy of sun to power your hand-held devices. 4. One of the possible applications of the thermoelectric effect in the car is to use the waste heat to power radio and other electrical devices. 5. Konarka Technologies is now producing photovoltaic materials using nanotechnology. 6. Thermoelectric technology and solar cells may be also used in military uniform. 7. We can buy thermoelectric jackets in any shop today.

Exercise 3. Find in the text the English words which have similar equivalents in your native language. Note that sometimes they have different meanings, e.g. silicon means кремній but not силікон. Consult the dictionary to find the difference or similarity.

UNIT 3.7
SANTA GOES NANO

Active Vocabulary:

ANNUEL	щорічний	*to make up for*	компенсувати
to retire	виходити на пенсію	*one-too-many*	зайвий
capacitor	конденсатор	*invasive surgery*	агресивна хірургія
GIVEN	за умови, що	*to perfect*	вдосконалювати
heft	вага	*spill*	пролиття
INSULATOR	ізолятор	*to punch*	проколювати

With the holidays coming up I got to wondering how nanotechnology might help Jolly Old St. Nick with his annual gift-giving. I came up with several ideas to make Santa's life easier.

Rudolph the Red Nosed Reindeer has to retire sometime, so Santa will need some kind of light to guide him on his rounds. To keep a sleigh headlight going he can use an ultra-capacitor, a battery replacement being developed by MIT. Using carbon nanotubes, the capacitor can store ten times as much energy as current hybrid car batteries - perhaps enough to light Santa's way around the world. Such an ultra-capacitor would also be light weight, so it won't overtax his reindeer (who, let's face it, given Santa's heft are carrying a pretty big load to begin with).

The last thing Santa needs is to get sick in December, so it's important that he keep Warm on those sub-zero North Pole nights. Aspen Aerogels makes nanoporous materials (Pyrogel) that are excellent insulators. Fabric made of these materials contains billions of nano-sized air pockets that stop heat from escaping. With boots made of Pyrogel, Santa could avoid getting cold feet just as Christmas approaches.

And let's face it, hundreds of years of sliding down chimneys m ust also have taken its toll on Santa's knees. To make up for one-too-many hard landings, Santa's doctor might try using nano-robots to regenerate the meniscus (the pads between bones in his knees). These nano-robots would be so tiny that they could make repairs without invasive surgery. It may take a few decades to perfect this technique, but Santa's lasted this long, and since he's not

about to retire, he'll just have to wait a little longer.

It's no secret that on his rounds Santa finds lots of milk and cookies waiting for him, and naturally spills do occur. What Santa needs is something like Nano-
Tex's nano-whiskers. These can be used in fabrics to cause liquids to bead up. These tiny pointed carbon whiskers can be used to make milk roll off the old fellow's suit . Tiny tots trying to catch a glimpse of him will find his suit neat and clean, thanks to nanotechnology.

But what about Santa's elves who have to slave away making toys till year long? For them a Star Trek-like replicator based on molecular manufacturing techniques would be a great gift. All they have to do is throw some raw materials into the replicator, punch a button and voila: a toy! Building a toy atom by atom, a replicator may actually make toys strong enough to last beyond Christmas morning.

Exercise 1. *Say whether these statements are TRUE or FALSE:*

1. Instead of the reindeer Santa may use a nano-motor. 2. A special battery replacement is being developed in MIT. 3. The new capacitor will use nanowires. 4. The boots which are made using nano-technology can prevent Santa from getting cold. 5. Nano-technology may also be used to cure Santa's stomach. 6. Thanks to nano-technology Santa's clothes will always be clean. 7. Molecular manufacturing technique can be applied to produce sweets for children.

Exercise 2. *Give plural of the following words. Remember that the words having Roman or Greek origin often have a special form of Plural:*

meniscus, nucleus, radius, focus, cactus, curriculum, millennium, forum, spectrum, memorandum, momentum, optimum, formula, alumna, antenna, crisis, analysis, axis.

Exercise 3. *Pay attention to the italicized pattern in the fragment "the capacitor can store ten times as much energy as current hybrid car batteries" which means ten times more energy than.... Say the same using the pattern as ... as:*

1. His watch is twice more expensive than mine. 2. There are tree times more pages in this textbook on physics than in that one. 3. With this TV antenna we can watch ten times more programs than earlier. 4. Next time I will put twice more sugar in the cake than this time. 5. The new computer makes such calculations ten times quicker than the old one. 6. Your suitcase is twice heavier than mine.

UNIT 3.8
BRIGHT IDEAS: NANOTECHNOLOGY AND ELECTRONICS

Active Vocabulary:

to emit	випромінювати	*high definition*	висока чіткість
to enable	давати змогу	*reliable*	надійний
to detach	відокремлювати	*solid state*	твердий стан
to attach	прикріпляти	*available*	наявний
shape:	форма	*feature*	риса, властивість
sturdy	міцний, твердий	*fine*	дрібний, тонкий
to tally up	підраховувати	*probe*	зонд

flexible	гнучкий	*scale*	масштаб
resolution	рішення,	*to enhance*	вдосконалювати

I recently read about researchers at the University of Michigan who have demonstrated that nanowires can be used as electrodes in organic light emitting diode (OLED) displays, thereby enabling manufacture of larger flexible OLED displays. This started me thinking about how nanotechnology might affect the appearance and function of electronic devices.

For example, could a laptop computer display unroll like a portable movie screen or could you detach it from the laptop and attach it to the back of an airline seat with Velcro®? Or might the laptop of tomorrow be roughly the same shape as the ones we use today, but be thinner, lighter, sturdier, and able to perform moire functions? I began to tally up the ways that nanotechnology might change laptops.

One option to the nanowire-enabled flexible OLED displays cculd be a very thin, low-power, high resolution screen that uses nanotubes. Motorcla is working on such a display which it calls a nano-emissive display because the nanotubes emit electrons at each spot on the display that has to be illuminated to form a picture. This display actually works much like an old fashioned TV, but can provide laptops with very lightweight screens and fine enough resolution for high definition TV.

Motorized hard drives may also become a thing of the past, replaced by lighter, faster, and more reliable solid state hard drives. One such drive is the 64 Gb solid state hard drive that Samsung is making available later this year. These drives are created using a process that prints nano-scale features called transistor gates on the memory chip. The width of these gates can vary. The Samsung module uses flash memory chips with 60 nanometer-wide transistors gates. It will be interesting to see how quickly manufacturers convert from conventional hard drives to flash based-hard drives as they become available with 64 Gb and greater capacity.

Less conventional technologies are also being explored, such as the atomic force microscopy-based memory being developed in IBM's Millipede project. This type of memory uses many fine silicon probes with tips 1 nanometer in diameter. Researchers are projecting that this chip should be able to store 1 terabyte (abbreviated Tb, and equaling 1,000 gigabytes) on a 1 square inch silicon chip.

Microprocessor manufacturers are also making processors with nanoscale transistors that use less power and fit more transistors on each silicon chip, therefore providing higher performance. The current generation of microprocessors is being built with 65 nanometer gate width transistors and processors that use 45 nanometer gate width transistors should be available: in the next few months as the race to increase th e computing capabilities of your laptop continues.

Nanotechnology is also providing options for powering your laptop. Lithium ion batteries are commonly used in laptops and many lithium ion battery manufacturers use nano-enhanced electrodes to improve battery performance and safety. A company called ZPower is developing batteries composed of silver and zinc that use nanoparticle-enhanced electrodes. The claim is that these batteries will have twice the energy density of lithium ion batteries and allow your laptop to operate longer on a single charge.

Several companies are working on fuel cells powered by methanol. These cells use a nano-enhanced catalyst and could run your laptop for as long as a full day. When the fuel cell runs out you just replace the methanol cartridge, rather than having to plug your laptop into a wall outlet.

Nanotechnology will certainly transform laptops and other electronic devices over the next few years, and with the many types of changes who knows what the laptop of tomorrow will be. It could weigh just ounces and ran for weeks on a single charge. We can only hope that while reinventing the laptop some manufacturers take the opportunity to also design a chassis that offers a break from today's standard flat, black or grey box. Imagine

impressing your friends with a laptop with a display that unfurls like a sail and a case that comes in every color of the rainbow.

Exercise 1. *Say whether these statements are TRUE or FALSE:*

1. Researchers at Michigan University has developed a technique for producing flexible computer monitors. 2. Motorola is working on the creation of a display containing nano-shperes. 3. Nano-emissive display works much like an old TV- set. 4. Samsung is already selling its solid state hard drives. 5. New nanotechnology hard drives are placed on the flash-memory chip. 6. IBM is developing a 1 square inch memory chip which can store 5,000 Tb. 7. Microprocessors using 45 nanometer gate width transistors are already available. 8. Nano-scale transistors used for production of processors can increase power consumption. 9. Manufacturers of lithium ion batteries use nano-technology to produce batte ry cases. 10. ZPower is developing batteries composed of silver and copper. 11. New batteries can 10 times increase the energy density. 12. When your laptop is powered by methanol fuel cell you have to recharge it plugging it into a wall outlet.

Exercise 2. *Replace the underlined words with one of the options:*

My grandfather says that weather changes affect his health, a) improves b) troubles c) influences
This flower has an unusual shape, a) colour b) form c) smell
Actually, my brother knows English much better than me. a) unfortunately b) evidently c) in fact
We need to replace this light bulb, a) change b) throw away c) break
Now it is possible to convert solar energy into electricity, a) transfer b) itransform c) translate
This exercises will help you improve your English, a) forget b) stabilize c) make better

Exercise 3. *Find in the text the words that mean:*

1. an institution of higher education having authority to award bachelors' and higher degrees, usually having research facilities; 2. a device capable of
representing information visually; 3. an informal word for film; 4. a stable elementary particle present in all atoms, orbiting the nucleus in numbers equal to the atomic number of the element in the neutral atom; 5. a tiny wafer of semiconductor material, such as silicon, processed to form a type of integrated circuit or component such as a transistor; 6. a very brief space of time; 7. a bowshaped display in the sky of the colours of the spectrum, caused by the refraction and reflection of the sun's rays through rain or mist.

UNIT 3.9
NANOTECHNOLOGY ON THE ROAD

Active Vocabulary:

to inspire	надихати	to gain a foothold	закріпитися
performance	продуктивність	ramp rip	збільшення
appealing	привабливий	Obstacle	перепона, завада
density	щільність, питома вага	Powder	порошок
issue	питання	Sufficiently	достатньо
proprietary	патентований	Fleet	парк (напр. машин)
to incorporate	об'єднувати, включати	Plentiful	багатий на щось

surface	поверхня	to intend	збиратися
vehicle	транспорний засіб	Utility	коменальне підприємство
to meet the requirement	задовольнити потребу	psi = pound per square inch	фунт на квадратний дюйм
to evaluate	оцінювати	Hurdle	перешкода

The astronomical price of gas this summer inspired me to look at how nanotechnology might help reduce the cost of driving. I identified two rays of hope: better batteries for cars powered by electricity and hydrogen fuel cells.

Electric or Hybrid Cars

Electric and hybrid cars are becoming more popular given the cost of a tank of gas. Work by nanotech companies such as Altair Nanotechnologies and A123Systems to improve the performance of lithium ion batteries may make electric cars even more appealing. Lithium ion batteries have a higher power density than the nickel metal hydride batteries currently used in electric and hybrid cars. Using lithium ion batteries you can store the same amount of power in a lighter weight, smaller package. Also lithium ion manufacturers project that their batteries will last about ten years, about four years longer than nickel metal hydride batteries.

However previous generations of lithium ion batteries were slower to charge and had safety issues much publicized when batteries in laptop computers caught fire. Nanotechnology companies have changed the material used in the lithium ion battery electrodes. Each has used its own proprietary material composition both to reduce the risk of the battery catching fire and to incorporate the ability of a nanostructured surface to provide faster charge transfer between the chemicals in the battery and the electrodes[1]..

It appears that the efforts of these companies will result in improved hybrid and electric cars, with some becoming available in 2008. Batteries from Altair are being used in electric vehicles made by Phoenix Motorcars. Currently these are only being sold for use in corporate fleets but should be available to consumers in 2008. Batteries from A123Systems, as well as other lithium ion battery manufacturers, are being evaluated by GM for use in Saturn hybrids.

Once these nano-enhanced lithium ion batteries pass evaluations by GM and other car manufacturers, electric or hybrid cars can be produced that will have higher performance than cars using nickel metal hydride batteries or the same performance while using smaller/lighter batteries.

Of course for hybrid or electric cars that use nano-enhanced lithium ion batteries to gain a foothold the batteries will also have to come down in price and ' be manufactured in large numbers. It will be interesting to see how battery manufacturers manage the manufacturing ramp up if the demand for these batteries increases both for electronic devices, such as laptop computers, and cars.

Those Elusive Hydrogen Fuel Cells

You may have heard talk about hydrogen fuel cells powered cars replacing gasoline powered cars, but don’t hold your breath. The major obstacles to widespread use of hydrogen fuel cell powered cars in the next few years are the lack of a network of hydrogen fuel stations and the need for lightweight, safe hydrogen fuel tanks.

Researchers are developing hydrogen fuel tanks based upon absorption of hydrogen in solid materials (such as the metal hydride powder that a company named EDC Ovonics is using), carbon or other materials, that are sufficiently safe, lightweight, fast to refuel, and inexpensive to meet the requirements of mass market cars.

Widespread usage of cars powered by hydrogen fuel cells won’t happen until refueling stations become as plentiful as your neighborhood gas station. Currently there are only a few hundred hydrogen fueling stations around

the world, many intended to be used by a few demonstration vehicles within eco- minded transit bus systems or part of a commercial or utility fleet. Even California only has 24 hydrogen refueling stations at this time.

One of the basic challenges in establishing these stations is deciding how to refill the hydrogen tank in a car. A 6000 psi hydrogen supply is used to fill the high pressure gas cylinders used on many demonstration vehicles. On the other hand, a 1500 psi hydrogen supply is used to till the cylinders made by EDC Ovonics; that store hydrogen in a solid.

The California Fuel Cell Partnership, a coalition between industry and government is planning to establish a standard fuel delivery method over the next 5 years before they can begin to build a network of hydrogen fuel stations.

These hurdles mean that hydrogen fuel cell powered cars won't be your way soon leaving high gas prices next summer. In fact, the Department of Energy's Hydrogen Program is estimating the start of mass market usage of hydrogen fuel cell cars around 2020.

Exercise 1. *Give synonyms to the following words from the text:*

price, to reduce, to improve, to store, manufacturer, issue, to change, ability, to enhance, demand, increase, fast, plentiful, around the world, method, in fact.

Exercise 2. *Say whether these statements are TRUE or FALSE using the words: sure, of course, certainly, quite right, absolutely true if y ou agree; and certainly not, nothing of the kind, by no means, not exactly if you don't. Example: a) Electrons are negatively charged. - Quite right, b) The Earth has a form of a cube. - Nothing of the kind. It has a form of a sphere.*

1. Lithium ion batteries are used in hydrogen powered cars. 2. Lithium ion batteries can last more than 5 years. 3. Lithium ion batteries caused fire in laptop computers. 4, Nanotechnology companies have changed the material of which the case of the lithium ion battery was made. 5. General Motors approved the use of the lithium ion batteries in their cars. 6. Nickel metal hydride batteries are more effective than lithium ion batteries. 7. Hydrogen fuel cells powered cars are not used widely today mainly because they are very expensive. 8. To produce hydrogen fuel tanks researchers use solid materials and carbon. 9. Today there are more than 5 thousand hydrogen fueling stations around the world.

Exercise 3. *Try to explain in English the meaning of the following words:*

electricity, a tank, a computer, a consumer, to talk, hydrogen, fuel, a market, a year, a price.

UNIT 3.10
NANOTECHNOLOGY IN SPACE

Nanotechnology may hold the key to making spaceflight more practical. Advancements in materials to make lightweight solar sails and the cable for the space elevator could significantly cut the cost of reaching orbit and traveling in space, as well as dramatically reducing the amount of rocket fuel used. Also new materials, along with nanosensors and nanorobots could improve the perform ance of spaceships, spacesuits and equipment used to explore planels and moons, making a big difference on the 'final frontier.[5]

Nanotechnology Fueling Rockets

The space elevator is a device that will dramatically reduce the cost of sending cargo into orbit. Like any elevator the space elevator will have a cable, however it will need to be stronger than any existing cable. Roughly 90,000 kilometers long, the space elevator cable will probably be made from carbon nanotubes. It will be anchored at the top to an asteroid (called the counterweight) in orbit around the earth, and at the bottom by an anchor station,

perhaps floating in the ocean similar to a drilling rig.

This device would eliminate the need to use rocket fuel, and dramatically reduce the cost of sending cargo into orbit (about 95% of the weight of the space shuttle at blast off is rocket fuel). Instead, solar cells on space elevator cars would convert light from a laser beam mounted on the anchor station into electricity to drive the car up or down the cable like a vertical monorail.

While there are some engineering challenges, to me the most intriguing of which is actually stringing this 90,000 kilometer cable between the anchor station in the ocean and the counterweight ftsteroid in orbit, steps are underway to address these challenges. A report by NASA's Institute for Advanced Concepts gives a very good introduction to the techniques necessary to construct the space elevator. Yearly competitions conducted by the Elevator 2010 group are providing a focus for energetic minds to demonstrate prototypes with some substantial cash prizes, totaling one million dollars in 2007.

Setting Sail in Space

Once you have people and cargo in orbit nanotechnology can be used to reduce the rocket fuel needed to travel to the moon or planets. Just as sailboats are propelled by wind while cm the seas, spaceships can be propelled by light from the sun reflected off of solar sails while travelling through space. That means that the only fuel required would be during liftoff, docking, or landing.

However solar sails will have to be very large, spreading for kilometers, and very thin to keep their weight low. That's where nanotechnology enters the picture. Researchers at the University of Texas have used carbon nanotubes to make thin, lightweight sheets that may replace the polymer sheets that have been experimented with to date. While there are details still to be worked out (such as how to unfurl a thin, fragile sail in orbit, along with the continual struggle to reduce weight) this method has great potential for reducing the amount of fuel needed to travel between planets.

Building Better Engines

For those times when spacecraft need engines there's a type of engine called ion thrusters that uses less fuel than chemical rockets. Unlike chemical rockets, which push a spaceship by burning fuel and expelling the resulting hot gasses ion thrusters use electricity gathered from solar cells to generate electric fields that push ions away from the spaceship.

Researchers at the University of Michigan have developed ion thrusters that use MEMS devices to accelerate charged nanoparticles. This Nanoparticle Field Extraction Thruster or NanoFET is designed to allow it to last longer than other types of ion tlirusters and allow multiple NanoFETs to be clustered together. This could simplify the job of spacecraft engineers by allowing the same thruster design to be used on spacecraft over many different missions just by changing the number of NanoFETs mounted on the spacecraft.

How Nanotechnology Cam Improve Spaceships

Regardless of how fuel efficient propulsion systems are, it's still important to make spacecraft lightweight. Researchers are investigating nanotube composites from which they can manufacture strong and lightweight skin and structural members for spacecraft. However this is just the start of how nanotechnology could change the way that spaceships are made. NASA has included a concept called self healing spaceships in their 2030 nanotechnology roadmap. Just as your skin heals a small puncture wound NASA is looking to nanotechnology to provide a way for the skin and structural components of a spaceship to seal up damage from meteors that strike the spaceship.

NASA is also planning to use nanosensors to improve the monitoring of spaceship systems such as life support. The ability of nanosensors to quickly report changed levels of trace chemicals in air could be very useful to keeping life support systems working correctly in a spaceship's closed system. A longer term proposal is to place nanosensors throughout the skin of a spacecraft to act like nerve endings in your skin. When a particular region of the spacecraft skin becomes stressed or damaged, the mam computer is alerted to take action and alter the spaceship's

course, just as you would jerk your hand away from a hot stove.

What the Well Dressed Astronaut Will Wear

Occasionally astronauts have to leave their spaceships, so researchers at Northeastern University and Rutgers University propose that we protect the astronauts by including layers of bio-nano robots in their spacesuits. The outer layer of bio-nano robots would respond to damages to the spacesuit, for example to seal up punctures. An inner layer of bio-nano robots could respond if the astronaut was in trouble, for example by providing drugs in a medical emergency.

The term "bio-nano robots" comes from the use of biological; molecules to provide portions of the robots mechanism. For example, proteins have mechanisms to travel within a body that enable it them to work as a motor for a nano robot. These proteins could be connected to carbon nanotubes that link parts of the nano robot together. When you think about it, this idea is just like harnessing a horse to a cart as the nano robots hitch a ride on the proteins. There's a lot of development work to be done, but it will be interesting to see how these self-healing suits turn out.

UNIT 3.11
NANOTECHNOLOJRY IN THE FOOD INDUSTRY

Nanotechnology is having an impact on several aspects of the food industry, from how food is grown to how it is packaged. Companies are developing nanomaterials that will make a difference not only in the taste of food, but also in food safety, and the health benefits food delivers.

Nanomaterials in Food Packaging

Use of nanomaterials in food packaging is already a reality. One example is bottles made with nanocomposites that minimize the leakage of carbon dioxide out of the bottle; this increases the shelf life of carbonated beverages without

having to use heavier glass bottles or more expensive cans. Another example is food storage bins with silver nanoparticles embedded in the plastic. The silver nanoparticles kill bacteria from any food previously stored in the bins, minimizing harmful bacteria.

There are other food packaging products currently under development. For example nanosensors in plastic packaging can detect gases given off by food when it spoils and the packaging itself changes color to alert you to food gone bad. Plastic films are being developed that will allow the food to stay fresher longer. These films are packed with silicate nanoparticles to reduce the flow of oxygen into the package and the leaking of moisture out of the package,

Nanoserisors are being developed that can detect bacteria and other contaminates such as salmonella on the surface of food at a packaging plant. This will allow for frequent testing at a much lower cost than is incurred by sending samples to a lab for analysis. This point-of-packaging testing, if conducted pro perly, has; the potential to dramatically reduce the chance of contaminated food reaching grocery store shelves.

There are also nanosensors being developed to detect pesticides on fruit and vegetables. While this would be useful at a packing plant I'm anxiously waiting for the handheld version so I can check out the apples and grapes in my local grocery store!

Nanomaterials Changing Food Characteristics

Nanopaiticles are being used to deliver vitamins or other nutrients in food and beverages without affecting the taste or appearance. These nanoparticles actually encapsulate the nutrients and carry them through the stomach into the bloodstream. For many vitamins this delivery method also allows a higher percentage of the nutrients to be used by the body because, when not encapsulated by the nanoparticles, some nutrients would be lost in the stomach.

Research is also being conducted to develop nanocapsules containing nutrients that would be released when

nanosensors detect a deficiency in your body. Basically this research could result in a super vitamin storage system in your body that gives you just what you need, when you need it.

Nanomaterials are being developed to improve the taste, color, and texture of foods. For example "interactive" foods are being developed that would allow you to choose which flavor and color a piece of food has. The idea is that nanocapsules that contain flavor or color enhancers sit in the food waiting until a
hungry consumer triggers them. The method hasn't been published, so it will be interesting to see how this particular trick is accomplished.

Finally, nanoparticle emulsions are being used in ice cream and various spreads to improve the texture and uniformity.

Nanotechnology in Agriculture

Researchers are working on pesticides encapsulated in nanoparticles; these only release pesticide in an insect's stomach, which minimizes the contamination of plants themselves.

Another development being looked at is a network of nanosensors and dispensers throughout a food crop. The sensors, recognize when a plant needs nutrients or water, before you could see any sign that the plant is deficient. The dispensers then release fertilizer, nutrients, or water as needed, optimizing the growth of each plant in the field one by one.

Regulation of Nanotechnology in the Food Industry

While there are lots of opportunities for using nanotechnology to improve food production, packaging, and quality, there is also some concern about how this will play out. For example the organizers of the Joint Symposium on Food Safety and Nutrition, organized by the Central Science Laboratory in the UK and the Joint Institute for Food Safety and Applied Nutrition at the University of Maryland, have chosen to focus their 2007 symposium on Nanotechnology in Foods and Cosmetics. They feel that nanotech materials both have "the potential for use in a vast variety of products and may pose new and unique safety issues."

In its February, 2007 meeting the European Food Safety Authority Regulatory agency announced that it was forming a scientific panel to conduct a risk assessment of nanoparticles in food and food packaging. This panel should be able to draw input and expertise from across Europe. For example, Denmark's National Food Institute is working on a project to gather toxicology information on nanoparticles and the UK Food Safety Authority has put together a report that provides "an outline of potential areas for future regulation relating to the use of nanotechnology and nanomaterials in foods".

In August 2006, the U.S. Food and Drug Administration (FDA) formed a Nanotechnology Task Force with goals that include:

Evaluate the effectiveness of the agency's regulatory approaches and authorities to meet any unique challenge that may be presented by the use of nanotechnology materials in FDA-regulated products.

Explore opportunities to foster innovation using nanotechnology materials to develop safe and effective drugs, biologies, and devices, and to develop safe foods, feeds, and cosmetics.

While the regulatory agencies may be making these efforts a little late, because some products are already available and development has been started on many more, we can hope that current discussions will help consumers to benefit from improved and safe food products with a minimum of controversy.

UNIT 3.12
CHEMOTHERAPY: NANO MEDICAL CURES COMING CLOSER?

In updating my Nanotechnology in Medicine page recently, I noticed that several efforts to use nanotechnology in medicine have moved from the realm of research papers to the pre-clinical or clinical testing stage.

For example, Cytlmmune has published the preliminary results of a phase 1 clinical trial of a targeted chemotherapy treatment method. They use gold nanoparticles attached to a molecule of a tumor-killing agent called tumor necrosis factor alpha (TNF) as well as a molecule of Thiol-derivatized polyethylene glycol (PEG-THIOL), which hides the TNF bearing nanoparticle from the immune system. The PEG- THIOL allows the nanoparticle to flow through the blood stream without being attacked. The combination of a gold nanoparticle, TNF and PEG-THIOL is named Aurmine.

The nanoparticle carrying the TNF tends to accumulate in cancer tumors but does not appear to accumulate in other regions of the body, which limits the toxic effects of TI'IF on healthy cells. Cytlmmune uses a combination of two techniques to target the TNF-carrying nanoparticle to cancer tumors. First,' the nanoparticle is designed to be too big to exit most healthy blood vessels, however some blood vessels located at the site of tumors are leaky, allowing the nanoparticle to exit the blood vessel at the tumor site. The second technique involves the TNF molecules binding to the tumor.

The fact that they had to get all these details right, determine the right size, a way to hide the nanoparticle from the immune system as well as choosing a targeting molecule to bind to the: cancer turmor, gives you some idea as to why it has taken a while to go from research concept to clinical testing.

TNF has been shown to be most effective when administered with other chemotherapy drugs.Therefore, now that the phase 1 trial involving 16 patients is over, Cytlmmune is planning a phase 2 trial with Aurmine combined with other chemotherapy drugs. They are also pierforming pre-clinical testing of another combination in which TNF, PEG-THIOL and a chemotherapy drug called paclitaxel is bound to the surface of the nanoparticle. Three other treatments are under development using nanoparticles combined with TNF and other chemotherapy drugs. It will take a while to bring these treatments through all the phases required for qualification with the FDA, however it is exciting that they have progressed from the realm of research papers to trials that will lead to targeted treatment for patients.

UNIT 3.13
NANOTECHNOLOGY AIDS DELIVERY OF DRUGS IN PATIENTS

If your drug use consists of an occasional aspirin, you may not see the need for serious work on drug delivery. But if you were diabetic, having to inject insulin several times a day, or a cancer patient experiencing debilitating side effects from your treatment, the benefits of improved drug delivery could change your life.

Perhaps the most publicized use of nanotechnology in drug delivery under development is the use of nanoparticles to deliver drugs to cancer cells. However, that’s just the tip of the drug delivery i ceberg: there are a number of other ways that nanotechnology can make the delivery of drugs more efficient and potentially less unpleasant for the patient.

Destroying Cancer without Side Effects

Several companies and universities are working on developing nanoparticles that seek out cancer cells and des'trcy them while causing minimal harm to healthy cells. NanoBioDrug from Nanobiotix are nanoparticles with molecules on the surface that are attracted to certain types of diseased cells. Researchers at Harvard Medical School have shown that nanoparticles with a particular RNA strand on their surface are attracted by prostate cancer cells, for example. Once the nanoparticles are concentrated in the diseased cells, the material in the core of the nanoparticle is activated by a signal which could be delivered by an MRI, ultrasound, or laser light.

The mechanism of killing the diseased cell varies. For example, if the magnetic signal from an MRI is used with a nanoparticle whose core is iron oxide, the magnetic signal moves each nanopaiticle and physically stirs up the insides of the cell, thereby destroying it. If an ultrasound signal is used, the core of the nanoparticle could contain chemicals that are released by the signal. At this point in time, studies of the effectiveness of NanoBioDrugs on cancer in large animals are currently underway.

Getting Rid of Those Needles

Many drugs are injected, rather than being taken in pill form, because they can be destroyed by acids in the stomach. BioDelivery Sciences International has developed a method whereby drug molecules are contained in particles called nanocochleate. These particles protect the drug from stomach acid. When the nanocochleate particles reach the blood stream, they fuse with cells, releasing the drug into one cell and then head ing off to do the same with other cells.

BioDelivery is conducting pre-clinical studies of the first drug to use this method, a fungal infection-fighting drug that is currently delivered by injection. In similar work a university in Taiwan, the National Tsing Hua University, has been successful in delivering insulin in studies with laboratory rats. The insulin molecule is encapsulated in nanospheres made from a polymer called chitosan, and delivered orally. If all goes well, this pill form of insulin will be a godsend to millions of diabetics worldwide.

Stopping the Common Cold in its Tracks

But what about the holy grail of medical breakthroughs, preventing the common cold? NanoBio Corporation may just have found a way to use nanosized antimicrobial droplets, called nano emulsions, to head your next cold off at the pass. The key to helping you avoid catching a cold or the flu is the longevity of die nanoemulsions; they can stay in your respirator)' tract for several hours and continue to kill viruses while having no discemable side-effects. If you, like me, dislike hanging out in groups during cold or flu season, keep a watch on this research and hope it gets into clinical trials and through the approval process soon.

NanoBio and the University of Michigan are also developing a variety of vaccines that use nanoemulsions. These vaccines would be applied with a nasal swab rather than by injection, and would not require refrigeration.

Going Skin Deep

Novavax, Inc. encapsulates drugs in emulsion nanoparticles (called micellar nano particles) that transport a drug through the skin. You spread the emulsion on your skin like a lotion. This method avoids passing the drug through your stomach with associated side effects. The emulsion provides a reservoir of the drug just under the surface of your skin from which the drug can continue to spread into your bloodstream, maintaining stable levels of the drug over time.

An estrogen replacement therapy lotion using micellar nano particles is already on the market and a testosterone therapy lotion is under development. Novavax now seems to be focused on vaccines and is licensing the micellar nano particles technology. The technique may eventually be used across a range of products such as hormones, pain killers, and allergy relief.

Making the Daily Dose Obsolete

pSivida Limited has a drug delivery product called BioSilicon. This is a silicon particle riddled with nano-sized pores. Tire drug to be delivered is loaded into the pores and as the silicon particle dissolves, the drug is released. pSivida can customize the size and porosity of silicon particles to control the time it takes them to dissolve. BioSilicon may be used in implants under the skin that could release a drug over days, weeks or months.

UNIT 3.14
TUNNELLING TO THE BEGINNING OF TIME

The Large Hadron Collider

The LHC (Large Hadron Collider) is an international project, in which the UK has a leading role. The LHC is asking some Big Questions about the universe we live in.

How did our universe come to be the way it is?

The Universe started with a Big Bang - but we don't fully understand how or why it developed the way it did. The LHC will let us see how matter behaved a tiny fraction of a second after the Big Bang. Researchers have some ideas of what to expect - but also expect the unexpected!

What kind of Universe do we live: in?

Many physicists think the Universe has more dimensions than the four (space and time) we are aware of. Will the LHC bring us evidence of new dimensions?

Gravity does not fit comfortably into the current descriptions of forces used by physicists. It is also very much weaker than the other forces. One explanation for this may be that our Universe is part of a larger multi dimensional reality and that gravity can leak into other dimensions, making it appear weaker. The LHC may allow us to see evidence of these extra dimensions - for example, the production of mini-black holes which blink into and out of existence in a tiny fraction of a second.

What happened in the Big Bang?

What was the Universe ma de of before the matter we see around us formed? The LHC will recreate, on a microscale, conditions that existed during the first billionth of a second of the Big Bang.

At the earliest moments of the Big Bang, the Universe consisted of a searingly hot soup of fundamental particles - quarks, leptons and the force carriers. As the Universe cooled to 1000 billion degrees, the quarks and gluons (carriers of the strong force) combined into composite particles like protons and neutrons. The: LHC will collide lead nuclei so that they release their constituent quarks in a fleeting 'Little Bang'. This will take us back to the time before these particles formed, re-creating the conditions early in the evolution of the universe, when quarks and gluons were free to mix without combining. The debris detected will provide important information about this very early state of matter.

Where is the antimatter? The Big Bang created equal amounts of matter and antimatter, but we only see matter now. What happened to the antimatter?'

Every fundamental matter particle has an antimatter partner with equal but opposite properties such as electric charge (for example, the negative electron has a positive antimatter partner called the positron). Equal amounts of matter and antimatter were created in the Big Bang, but antimatter then disappeared. So what happened to it? Experiments have already shown that some matter particles decay at different rates from their anti-particles, which could explain this. One of the LHC experiments will study these subtle differences between matter and antimatter particles.

Why do particles have mass?

Why do some particles have mass while others don't? What makes this difference? If the LHC reveal particles predicted by theory it will help us understand this.

Particles of light (known as photons) have no mass. Matter particles (such as electrons and quarks)

do - and we're not sure why. British physicist, Peter Higgs, proposed the existence of a field (the Higg's Field), which pervades the entire Universe and interacts with some particles and this gives them mass. If the theory is right then the field should reveal itself as a particle (the Higg's particle). The Higg's particle is too heavy to be made in existing accelerators, but the high energies of the LHC should enable us to produce and detect it.

What is our Universe made of?

Ninety-six percent of our Universe is missing! Much of the missing matter is stuff researchers have called 'dark matter'. Can the LHC find out what it is made of?

The theory of'supersymmetry' suggests that all known particles have, as yet undetected, 'superpartners'. If they exist, the LHC should find them. These 'supersymmetric' particles may help explain one mystery of the Universe - missing matter. Astronomers detect the gravitational effects of large amounts of matter that can't be seen and so Is called 'Dark Matter'. One possible explanation of dark matter is that it consists of supersymmetric particles.

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