MINISTRY OF EDUCATION OF THE REPUBLIC OF BELARUS
Belarusian National Technical University

English language Department № 1

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# PROFESSIONAL COMMUNICATION. PRACTICAL COURSE

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as manual for students of specialty
6-05-0716-06 “Biomedical engineering”

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The aim of the teaching aid is to develop students' skills and abilities to understand and correctly translate scientific and technical English language texts in their speciality.

The teaching aid includes 8 lessons containing authentic texts and exercises, as well as additional material for students' independent classroom and extracurricular work.

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## Предисловие

Данное пособие предназначено для обучения чтению и переводу научно-технической литературы с английского языка на русский. Оно адресовано студентам приборостроительного факультета, которые владеют базовой грамматикой и лексикой английского языка. Пособие рассчитано на 50 часов аудиторных занятий.

Цель пособия – сформировать у студентов навыки и развить умения анализировать различные элементы текста, понимать и правильно переводить научно-технические англоязычные тексты по специальности.

Пособие состоит из 8 уроков (Units), подборки дополнительных текстов для чтения и приложения. Каждый урок содержит учебный текст с комплексом упражнений по анализу содержания и переводу. Дополнительные тексты могут использоваться в качестве практикума в самостоятельной работе студентов.

Текстовый материал представлен аутентичными текстами, содержащими информацию о различном медицинском оборудовании, таком как магнитно-резонансный томограф, медицинские лазеры, кардиостимуляторы и др., а также о современных методах диагностики и лечения различных заболеваний.

Упражнения, включенные в уроки, отражают лексические и грамматические особенности перевода. В систему лексических упражнений входят задания на перевод интернациональных и псевдоинтернациональных слов, терминологических словосочетаний разной структуры, многофункциональных слов. Упражнения на словообразование ставят целью научить студента переводить слова, в состав которых входят префиксы и суффиксы, часто встречающиеся в научно-технической литературе.

В систему грамматических упражнений входят упражнения на перевод инфинитива и инфинитивных конструкций, причастия и причастных оборотов, герундия и др.

## Unit 1

## DIAGNOSTIC MEDICAL EQUIPMENT

**Exercise 1. Learn the following words and word combinations and their meanings.**

1. Affected organ – пораженный (болезнью) орган.
2. Computed tomography – компьютерная томография.
3. Diagnostic medical equipment – диагностическое медицинское оборудование.
4. Disease (n) – болезнь.
5. Emergency room – отделение неотложной помощи.
6. Equipment (n) – оборудование.
7. Hospital setting – больничные условия.
8. Inpatient hospital room – стационарная больничная палата.
9. Magnetic resonance – магнитный резонанс.
10. Medical imaging machines – медицинские машины для визуализации.
11. Medical intervention – медицинское вмешательство.
12. Patient (n) – пациент.
13. Pediatrics (n) – педиатрия.
14. Radiography (n) – рентгенография.
15. Resolution (n) – разрешение.
16. Sole purpose – единственная цель.
17. Tissue (n) – ткань.
18. Treatment (n) – лечение.
19. Tool (n) – инструмент.
20. Tomosynthesis (n) – томосинтез.

**Exercise 2. Read the text attentively and translate it into Russian.**

### Diagnostic medical equipment

Diagnostic medical equipment is found in outpatient care centers for adult and **pediatrics**, in **emergency rooms**, as well as **inpatient hospital rooms** and intensive care units.

**Diagnostic medical equipment** is any type of **equipment** or **tools** used in a **hospital setting** for the **sole purpose** of diagnosing a patient's condition. Based on the symptoms described by the patient, a diagnostic test is performed using the appropriate equipment to evaluate the **patient** internally. The doctor or technician is looking for any abnormalities in the **affected organs** or parts of the body that are causing the symptoms to be exhibited.

Below are some of the most common types of diagnostic equipment used in laboratories and medical clinics:

1. **Medical imaging machines** – medical imaging is a type of technology that is used to create visual representations of the human body's interior. The visual image produced by the equipment is used for clinical analysis and medical intervention. There is many medical imaging equipment, such as **radiography** (X-ray machine), **computed tomography** (CT scan), magnetic resonance imaging (MRI scan), ultrasound, and echocardiography. Now the most popular technology is a 3D imaging technology. This technology allows healthcare professionals to obtain images at different angles and study **tissues** at different depths, as well as with increased **resolution** and more complex details, which allows a better understanding of the human body. Unlike previously used imaging technologies that could provide erroneous results, 3D imaging technology offers accurate information when diagnosing any disease. This method has proven to be revolutionary in the diagnosis of various diseases, including breast **tomosynthesis**, which is crucial in the treatment of breast cancer.

2. Aside from medical imaging machines, there are other medical devices used for diagnosing patients. Some examples include patient scales, stethoscopes, dopplers, and pulse oximetry.

**Exercise 3. Complete the table 1.1 with the international words from the text according to their stress pattern and translate them into Russian.**

Diagnostic, organs, medical, hospital, tomography, center, symptom, test, doctor, radiography, machine, Doppler, pediatrics, clinical, analysis, pulse, echocardiography, professional, tomosynthesis.

Table 1.1

| 1 ●○ | 2 ○● | 3 ○●○ | 4○●○○ | 5 ○○●○ | 6 ○○●○○ | 7 ○●○○○ |
|---|---|---|---|---|---|---|
| | | | | | | |

**Exercise 4. Using the definitions given below guess the crossword (fig. 1.1).**

**Across:**

1. A medical specialty that uses operative manual and instrumental techniques on a person to investigate or treat a pathological condition such as a disease or injury, to help improve bodily function, appearance, or to repair unwanted rupture.

4. The process or capability of making distinguishable the individual parts of an object, closely adjacent optical images, or sources of light.

7. This is the sum of techniques, skills, methods, and processes used in the production of goods or services or in the accomplishment of objectives, such as scientific investigation.

9. It regulates the metabolism of carbohydrates, fats and protein by promoting the absorption of glucose from the blood into liver, fat and skeletal muscle cells.

10. This is medical attention given to a sick or injured person or animal.

12. This is imaging by sections or sectioning that uses any kind of penetrating wave. The method is used in radiology, archaeology, biology, atmospheric science, etc.

13. This is an acoustic medical device for auscultation, or listening to internal sounds of an animal or human body.

**Down:**

2. It is produced primarily by the contraction of the heart muscle.

3. It is a facility that provides controlled conditions in which scientific or technological research, experiments, and measurement may be performed.

5. This is a collection of tissues joined in a structural unit to serve a common function.

6. Identifying a particular illness using a combination of signs.

8. The set of necessary tools for a particular purpose.

11. A group of connected cells in an animal or plant that are similar to each other.

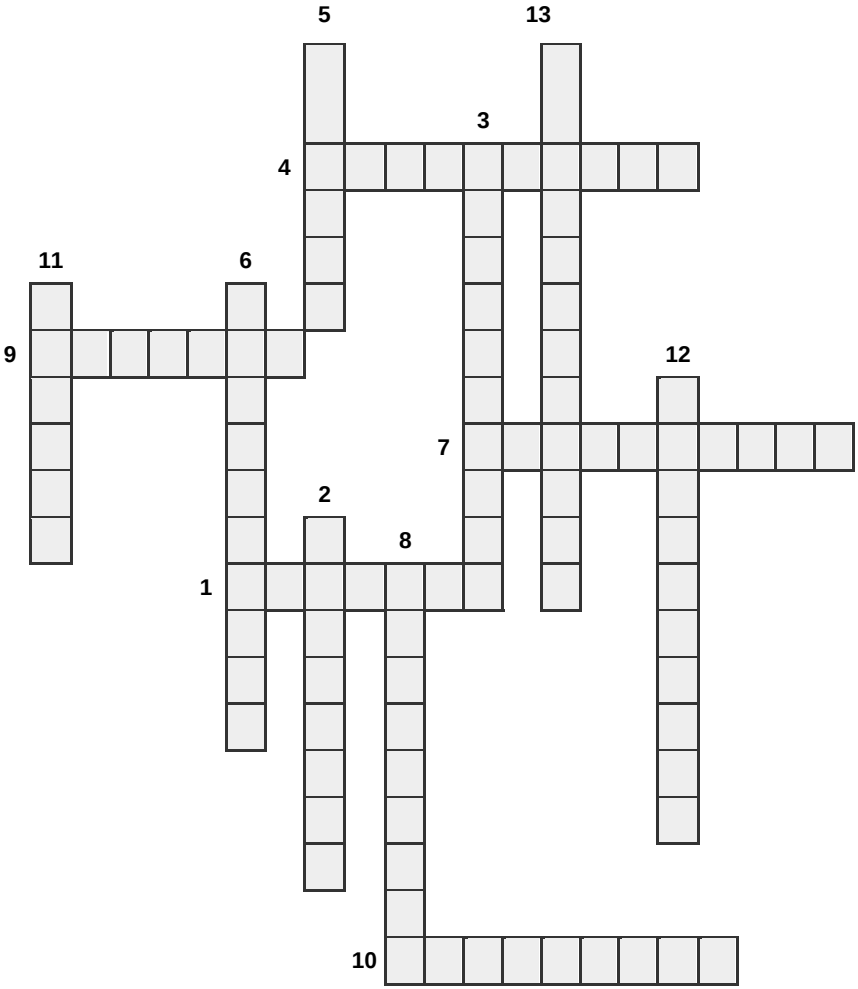


Fig. 1.1. Crossword

**Exercise 5. Match the words with the opposite meaning.**

| | |
|---|---|
| 1. adult | a) unknown |
| 2. to create | b) similar |
| 3. many | c) simple |
| 4. popular | d) currently |
| 5. different | e) young |
| 6. depths | f) few |
| 7. complex | g) to destroy |
| 8. erroneous | h) height |
| 9. accurate | i) correct |
| 10. previously | j) incorrect |

**Exercise 6. Make up the word combinations from columns A and B and find their equivalents in C (table 1.2).**

Table 1.2

| A | B | C |
|---|---|---|
| affected | pressure | кровяное давление |
| emergency | setting | больничные условия |
| intensive | flow | диагностический инструмент |
| blood | rooms | медицинское оборудование |
| hospital | tomography | пораженные органы |
| diagnostic | intervention | отделение неотложной помощи |
| blood | organs | компьютерная томография |
| medical | care | медицинское вмешательство |
| computed | tool | кровоток |
| medical | equipment | интенсивная терапия |

**Exercise 7. Match the following English words and word combinations with their Russian equivalents.**

| | |
|---|---|
| 1. patient lift | a) напорный матрас |
| 2. hospital bed | b) инсулиновая помпа |
| 3. pressure mattresse | c) кислородные концентраторы вентиляторы |
| 4. insulin pump | d) тяговое оборудование |

| | |
|---|---|
| 5. breast pump | e) диагностические области применения |
| 6. oxygen concentrators ventilators | f) молокоотсос |
| 7. diagnostic scopes | g) медицинский лазер |
| 8. infusion pump | h) больничная койка |
| 9. traction equipmet | i) подъемник |
| 10. medical laser | j) хирургический колпачок |
| 11. surgical cap | k) инфузионный насос |

**Exercise 8. Mark the following phrases S (if they both mean the same) and D (if they are different).**

| | |
|---|---|
| 1. every day / daily | S / D |
| 2. other day / later | S / D |
| 3. two ninth / twenty ninth | S / D |
| 4. recently / just now | S / D |
| 5. fifteen / quarter | S / D |
| 6. day after day / once a day | S / D |
| 7. forty / four | S / D |

**Exercise 9. Answer the following questions.**

1. Where can you find diagnostic medical equipment?
2. Has 3D imaging technology proven to be revolutionary in the diagnosis of various diseases?
3. What technology allows healthcare professionals to obtain images at different angles?
4. Who is looking for any abnormalities in the affected organs or parts of the body that are causing the symptoms to be exhibited?
5. What medical devices can you list?
6. A diagnostic test is performed using the appropriate equipment to evaluate the patient internally, isn't it?
7. Where can the most common types of diagnostic equipment be used?
8. What is medical imaging technology?

**Exercise 10. Make up the summary of the text in Exercise 2.**

The text under consideration is devoted to …
It appears from the text …
The author points out that …
It is reported that …
The essential interest of the article…
Further the author says that …
In conclusion …

**Exercise 11. Complete the sentences with the necessary preposition from the box.**

| **at, from, to, into, of, through, in, for** |
|---|

1. Our Diagnostic Equipment comply … the internationally quality standards.
2. Stethoscopes are used **…** listen **…** heart sounds, the lungs, and even blood flow in the arteries and veins.
3. Digital units measure mean arterial pressure, which basically translates **…** an average **…** the systolic and diastolic pressure.
4. Otoscopes are handheld devices that allow physicians to look **…** the ear canal and view the tympanic membrane **…** the magnification lens.
5. The term 'durable' is derived **…** the fact that these types of equipment have been tested for quality.
6. It is very important **…** any laboratory or a hospital to go **…** the right diagnostic equipment.
7. Infusion Pumps are used **…** a hospital setting.
8. Medtronic has received reports of hypoglycemia requiring medical intervention potentially related **…** this issue.
9. The scope of diagnostic and treatment activities **…** a particular patient is determined **…** attending physician **…** accordance **…** the standards of medical care.
10. Maxwell Photonics is a Russian innovation company, dealing **…** the development and planning **…** production and introduction of brand new medical laser systems **…** hard and soft tissues surgery **…** the domestic market.

11. Portable pulse oximetry **…** the early stages **…** the disease revealed changes **…** nocturnal respiratory parameters that indicated a predisposition to the development **…** hypoventilation syndrome.

**Exercise 12. Divide the words into five columns (table 1.3) according to their part of speech.**

Table 1.3

| Noun | Adjective | Pronoun | Adverb | Conjunction |
|---|---|---|---|---|
| | | | | |

Recently, or, technology, early, very, diagnostic, once, equipment, soon, little, medical, this, disease, his, pump, before, quietly, different, blood, unknown, daily, as, organ, human, image, easily, which, crucial, internally.

**Exercise 13. Read the sentences and translate them into Russian. Define the Objective Infinitive Construction.**

1. This method permits good results to be obtained.
2. There is some information I want you to obtain.
3. These instruments allow the pressure to be controlled continuously.
4. The hospital emergency rooms use special means to neutralize drugs and poisons.
5. The doctor ordered the ward to be aired.
6. 3D imaging technology allows plastic surgeons and patients to predict outcome of a procedure well before surgery.
7. These conditions enable new methods to be applied in this work.
8. This technology allows healthcare professionals to obtain images at different angles.
9. The availability of modern diagnostic equipment in clinics enables you to quickly and easily determine the glycemic profile of the patient's sensitivity to glucose-lowering drugs.
10. The specialist persuaded them to install new medical imaging machines.

11. Miniature size Micro Mote allow it to enter into the human body, where it can carry out an electrocardiographic study to measure blood pressure and body temperature.

12. An ultrasound doctor evaluates the results of an ultrasound examination to diagnose any health problems for the patient.

**Exercise 14. Translate the following text into Russian in writing form.**

## Life Support Equipment

As the name implies, life support equipment are those medical devices intended to maintain the bodily function of a patient. Without life support, it will be difficult for the patient's organ systems to function on their own. There are a variety of life support machines in the medical field today, such as the following:

1. Heart-lung Machines – also known as cardiopulmonary bypass (CB) devices, this type of equipment temporarily functions as the heart or lungs of a patient during surgery. It facilitates in the circulation of blood and oxygen throughout the patient's body. It is known as a form of extracorporeal circulation.

2. Medical Ventilators – this type of device is designed to move breathable air in and out of the lungs. It is used on patients who have difficulty breathing, or who are incapable of delivering an adequate supply of oxygen throughout the body. There are two types of medical ventilators. One is hand-operated using a bag valve mask. The other is run and operated by a computer. You will find this machine used in intensive care unit patients or home care patients.

3. Dialysis Machine – dialysis is the method of removing excess solutes or toxins from the blood. It is used on people whose kidneys have been damaged and are incapable of performing these functions. It is a type of renal replacement therapy. Dialysis machines are essential for those who have kidney damage or lost kidney function.

4. Incubators – an incubator is a medical apparatus used for neonatal intensive care. It is designed to mimic the environmental conditions suitable for newborn babies. It is often used in conjunction with a few other medical equipment such as an oxygen hood and ventilator.

## Treatment Equipment

Treatment equipment is any type of medical device or tool that is designed to treat a specific condition. It utilizes modern technology in order to address any abnormalities to restore function in the affected organs or tissues within the body. This can also include the surgical supplies designed to provide treatment for certain conditions that require surgical intervention.

Below are common examples of medical treatment equipment that you will find in hospitals and clinics:

1. Infusion Pumps – this type of treatment equipment is used in a hospital setting. It is designed to infuse medication, fluids, and other forms of treatment to the patient's circulatory system. This machine is used intravenously but you can also find epidural or arterial infusions. This machine is reliable because it injects controlled amounts of fluids into the patient's system over a given period of time.

2. LASIK Surgical Machines – the use of LASIK technology is used primarily for the treatment of eye conditions. It is designed for use on patients suffering from myopia, hyperopia, or astigmatism.

3. Medical Lasers – the laser is a revolutionary technology introduced in the medical field for the treatment of various medical conditions. It is a device that emits a wavelength of electromagnetic radiation for clinical applications. These wavelengths vary when it comes to energy level and pulse duration. These settings are to be determined by the attending physician during treatment.

## Unit 2

## X-RAY IMAGING

**Exercise 1. Learn the following words and word combinations and their meanings.**

1. Adjacent (adj) – соседний.
2. Angiography (n) – ангиография.
3. Biliary channel – желчный проток.
4. Cavity (n) – полость.
5. Contrast medium – контрастное вещество.
6. Dense (adj) – плотный.
7. Differentiated (adj) – дифференцированный.
8. Disturbance (n) – нарушение.
9. Enema (n) – клизма.
10. Exposed film – экспонированная пленка.
11. Gallbladder (n) – желчный пузырь.
12. Imaging technique – метод визуализации.
13. Interior of the body – внутренняя часть тела.
14. Opaque (adj) – рентгеноконтрастный.
15. Passage of blood – прохождение крови.
16. Roughly (adv) – примерно.
17. Specific plane – определенная плоскость.
18. Spinal cord – спинной мозг.
19. Strike (v) – ударять *зд.*попадать, проникать.
20. Swallow (v) – глотать.
21. Tissue (n) – ткань (тела).
22. Virtually (adv) – практически.
23. X-ray imaging – рентгеновское изображение.
24. X-ray motion-picture film – рентгеновская кинопленка.

**Exercise 2. Read the text attentively and translate it into Russian.**

### X-Ray Imaging

X-rays, used since 1895, were the first type of radiation to provide images of the interior of the body. X-rays pass through bodily **tissues**

and also have the property of darkening photographic film when they **strike** it. As they penetrate tissues, the X-rays are absorbed differentially, with **denser** objects such as bones absorbing more of the rays and thus preventing them from reaching the film. Soft tissues, on the other hand, absorb fewer rays; the result is that in an X-ray photograph of the **interior of the body**, bones show up as lighter areas and soft tissues show up as darker ones on the **exposed film**.

A limiting factor in X-rays when used alone is the inability to distinguish between **adjacent**, **differentiated** soft tissues of **roughly** the same density (i.e. it is not possible to produce contrasting tones between such objects on the exposed film). To obtain this contrast, a contrast medium—a liquid or gaseous substance that is comparatively **opaque** to X-rays or comparatively transparent to them—is injected into the body. **Contrast-medium** fluids can be injected into naturally occurring body **cavities**, injected into the bloodstream and lymphatic vessels, **swallowed** or introduced by **enema** for study of the digestive tract, or injected around organs to show their external contour. Different contrast media thus allow the **X-ray imaging** of particular types of soft internal structures, such as the arteries and veins in angiography, the **passage of blood** through the heart in angiocardiography, the gallbladder and **biliary channels** in cholecystography, the spinal cord in myelography, and the urinary tract in urography. **Virtually** any part of the body can be examined for physiological **disturbances** of the normal structures by X-ray analysis. **X-ray motion-picture** films can record the body processes as the contrast media enter and leave parts of the body.

Other **imaging techniques** have been developed using X-rays. In tomography, X-ray images of deep internal structures can be obtained by focusing the rays on a **specific plane** within the body. A more complex variation of this technique is computed tomography, known as a CT scan.

**Exercise 3. Complete the table 2.1 with the international words from the text according to their stress pattern and translate them into Russian.**

Radiation, photographic, differential, comparatively, object, result, technique, limit, factor, angiography, contrasting, lymphatic, organ, contour, structure, physiology, analysis, process, specific, variation, tomography.

Table 2.1

| 1 ●○ | 2 ○● | 3 ○●○ | 4 ○●○○ | 5 ○○●○ | 6 ○○●○○ | 7 ○●○○○ |
|---|---|---|---|---|---|---|
| | | | | | | |

**Exercise 4. Using the definitions given below guess the words and cross them out in the word square.**

| D | O | F | I | L | M | R | Y |
|---|---|---|---|---|---|---|---|
| I | R | A | N | C | E | A | D |
| S | G | T | I | S | H | D | O |
| T | A | S | U | G | N | I | B |
| U | N | B | S | T | I | A | Y |
| R | S | U | I | D | N | T | H |
| B | A | N | C | E | O | I | P |
| A | N | G | I | O | G | R | A |

1. An x-ray or computer image of the blood vessels and blood flow in the body.
2. A departure or divergence from that which is considered normal.
3. A collection of tissues that structurally form a functional unit specialized to perform a particular function.
4. The emission of energy as electromagnetic waves or as moving subatomic particles, especially high-energy particles which cause ionization.
5. The physical structure, including the bones, flesh, and organs, of a person or an animal.
6. A thin flexible strip of plastic or other material coated with high-sensitive emulsion for exposure in a camera, used to produce photographs or motion pictures.
7. A particular kind of matter with uniform properties.
8. Recognize or treat (someone or something) as different.

**Exercise 5. Match the words with the opposite meaning.**

| | |
|---|---|
| 1. dense | a) hard |
| 2. specific | b) artificial |
| 3. leave | c) abnormal |

| | |
|---|---|
| 4. different | d) exterior |
| 5. natural | e) thin |
| 6. light | f) simple |
| 7. interior | g) arrive |
| 8. complex | h) same |
| 9. soft | i) common |
| 10. normal | j) dark |

**Exercise 6. Make up the word combinations from columns A and B and find their equivalents in C (table 2.2).**

Table 2.2

| A | B | C |
|---|---|---|
| lymphatic | film | мягкая ткань |
| limiting | contour | лимфатический сосуд |
| digestive | transparent | засвеченная область |
| soft | area | фотографическая пленка |
| external | channel | техника изображения |
| biliary | tissue | пищеварительный тракт |
| comparatively | technique | ограничивающий фактор |
| photographic | vessel | относительно прозрачный |
| imaging | factor | внешний контур |
| light | tract | желчный проток |

**Exercise 7. Match the following English words and word combinations with their Russian equivalents.**

| | |
|---|---|
| 1. contrast medium | a) полость тела |
| 2. inability to distinguish | b) рентгеновский снимок |
| 3. property of darkening | c) экспонированная плёнка |
| 4. particular type | d) жидкое вещество |
| 5. exposed film | e) прохождение крови |
| 6. computed tomography | f) проникать в ткани |
| 7. X-ray image | g) внешний контур |
| 8. liquid substance | h) компьютерная томография |
| 9. passage of blood | i) свойство затемнения |
| 10. interior of the body | j) контрастное вещество |

| | |
|---|---|
| 11. to penetrate tissues | k) определенный вид |
| 12. external contour | l) неспособность различать |

**Exercise 8. Mark the following phrases S (if they both mean the same) and D (if they are different).**

| | |
|---|---|
| 1. over seventeen degrees / less than seventeen degrees | S / D |
| 2. an average of twenty meters / exactly twenty meters | S / D |
| 3. two thirds / sixty-six percent | S / D |
| 4. at least twice a day / two times a day or more | S / D |
| 5. a forth / twenty-five percent | S / D |
| 6. more than half / forty-five percent | S / D |
| 7. the vast majority / ninety percent | S / D |

**Exercise 9. Answer the following questions.**

1. When were X-rays first used?
2. What are the main properties of X-rays?
3. What is the difference between bones and tissues showing up on the exposed film?
4. Why did it become possible to study the deep internal structures of the body?
5. How can any part of the body be examined for physiological disturbances of the normal structures?
6. What is a contrast medium used for?
7. What are the methods of injecting a contrast medium into the body?
8. Do you agree that X-rays are the greatest discovery in medicine?

**Exercise 10. Make up the summary of the text in Exercise 2.**

The title of the text is …
The text deals with …
It is reported that …
According to the text …
It should be stressed that …
The author comes to the conclusion that …
I found the text rather / very …

**Exercise 11. Complete the sentences with the necessary preposition from the box.**

| at, from, to, under, into, of, through, in, for, between |
|---|

1. This allows the X-ray machine's computer to analyze the absorption rates … the individual X-ray waves and compare them.
2. You might recognize X-rays as a staple tool for doctors' offices – especially if you ever been treated … a broken bone.
3. This is why when you look … an X-ray "picture", you see the bones of the body as white areas.
4. They are able to pass … objects that block electromagnetic waves in the visible light spectrum.
5. An X-ray inspection machine passes a product or package … one or more X-ray generators.
6. If the image deviates … the acceptance standard, the product is rejected.
7. The detector then records the changes … how much of the X-ray beam is reaching it.
8. X-rays are roughly classified … soft X-rays and hard X-rays.
9. X-rays are a form of electromagnetic radiation that are invisible … the naked eye.
10. As the product or package passes … the generator and the detector, some of the X-rays get absorbed.

**Exercise 12. Divide the words into five columns (table 2.3) according to their part of speech.**

Table 2.3

| Noun | Adjective | Pronoun | Adverb | Conjunction |
|---|---|---|---|---|
| | | | | |

Beneath, itself, and, advance, powerful, a few, these, structural, therefore, or, cell, moreover, ray, relatively, wave, that, human, their, roughly, atomic, which, unstable, because, bone, well, region, whereas, nuclear.

**Exercise 13. Read the sentences and translate them into Russian. Define the Infinitive functions.**

1. To know the X-ray radiation basics is important for engineers of all specializations.
2. It is possible to change an insulating area to a conducting area in a fraction of a second.
3. Newer systems use two X-ray generators to emit X-rays on two different wavelengths.
4. X-rays are well-known for their ability to see through a person's skin and reveal images of the bones beneath it.
5. The development of X-rays helped to provide images of the human bones and soft tissues.
6. The task of designers using wood materials is to build modern hospital furniture, including medicine cabinets, treatment tables, and many other items.
7. The atom becomes unstable; an electron drops in to fill the gap.
8. Radiation therapy can kill cancer cells by damaging their DNA.
9. It's not a very easy way to make a high-energy, bright source of X-rays.
10. They want to carry out this experiment next month.
11. There are a lot of problems to be discussed as soon as possible.

**Exercise 14. Translate the following text into Russian in writing.**

**Key Components of an X-Ray Inspection Machine**

*An X-Ray Generator.*

Most modern X-ray machines use a vacuum tube with an electrode pair—one anode and one cathode—with an extreme voltage difference between the two. The positively-charged anode (usually made of tungsten) draws electrons from the cathode. When the electrons collide with the tungsten atoms, photons are generated with high energy levels—enough to be in the X-ray wavelength spectrum:

1. A camera designed to record X-ray spectrum wavelengths sits opposite the generator. Once captured, the recorded image is transmitted to a computer for analysis. The images captured are procedurally generated line by line as the product passes through the narrow beam.

2. For safety reasons, food X-ray systems have a protective, high-density casing designed to keep any excess X-rays from escaping. The average X-ray machine exposes nearby workers to less than 1 microsievert (1 μSv) of radiation per hour, whereas normal daily living exposes people to 2,400 μSv throughout the year, or 6.57 μSv of radiation a day.

3. Most X-ray inspection machines have a built-in computer that is used to govern system actions and to automatically analyze X-ray images. It is this computer that compares the grayscale image to the acceptance standard and rejects products with contaminants.

There are many more components, such as conveyor belts, that may be part of a given X-ray machine, but the above systems are the most vital for an X-ray machine's operations.

*What Can X-Rays Machines Detect?*

X-ray inspection machines excel at detecting high-density foreign objects in most products. Things such as stone, dense animal bones, most metals, and glass are often easily detected by X-ray machines.

Lower-density contaminants, such as light metals (like aluminum), wood, low-density plastics, and human hair are usually very difficult to detect. Detectability of some contaminants may depend on their size and the sensitivity of the specific X-ray machine you use. For example, MDX systems have an easier time detecting small pieces of glass and aluminum than older single-emitter systems.

X-ray systems may also be able to check for other quality issues beyond contaminants depending on their configuration. Common alternative quality checks an x-ray system might perform include:

– seal integrity;
– package weight;
– fill level;
– component inclusion/absence.

These extra quality inspection capabilities allow X-ray machines to fulfill a broad range of quality assurance requirements using a single device.

**Exercise 15. Video activity (https://www.youtube.com/watch?v=gsV7SJDDCY4&t=44s).**

**Before you watch**

What do you know about X-rays?

***Match the English words with their Russian equivalents (table 2.4).***

Table 2.4

| | |
|---|---|
| 1. a cathode tube | a. щитовидная железа |
| 2. fluorescent window | b. светиться |
| 3. cardboard | c. тромб |
| 4. tube | d. перемещение |
| 5. fluorescent light | e. опухоль |
| 6. glow | f. атомный номер |
| 7. invisible ray | g. спиральная траектория |
| 8. angle | h. передник |
| 9. atomic number | i. сталкиваться |
| 10. reshuffling | j. флуоресцентное окно |
| 11. tissue | k. болезнь |
| 12. thyroid | l. электроннолучевая трубка |
| 13. semi-transparent | m. флуоресцентный свет |
| 14. apron | n. картон |
| 15. collide | o. трубка |
| 16. tumor | p. полупрозрачный |
| 17. spiral trajectory | r. ткань |
| 18. blood clot | s. невидимый луч |
| 19. disease | t. угол |

***While you watch***

***Watch the video and answer the questions:***

1. Who invented X-rays?
2. How were X-rays invented?
3. What prize did the inventor get for his discovery?
4. What are X-rays?

5. Are X-rays powerful enough to fly through many kinds of matter?
6. How does a CT scanner work?
7. What do spiral CT scans produce?
8. What can CT scans detect?

***Watch the video again and complete the gaps in the sentences.***

**tissues, cardboard, atoms, matter, rays, scans, medical, mummies, scans, beam, angles, tube, energy, film, body**

1. Wilhelm Roentgen had wrapped … around the tube to keep the fluorescent light from escaping.
2. Invisible … had passed through the cardboard.
3. When high energy electrons in the cathode … hit a metal component, they either got slowed down and released extra … , or kicked off electrons from the atoms they hit, which triggered a reshuffling that again released energy.
4. X-rays are powerful enough to fly through many kinds of … .
5. X-rays are particularly useful for … applications.
6. X-rays penetrate … like lungs and muscles, darkening the … .
7. When X-rays travel through the … , they can interact with many … along the path.
8. If you take X-rays from multiple … , you should be able to find the tumor's position and shape.
9. The X-ray … is rotated around the patient, and often also moved down the patient's body.
10. Spiral CT … produce date.
11. CT scans can even detect heart disease and cavities in … buried thousands years ago.
12. Hospitals and clinics now conduct over 100 millions … each year worldwide.

**After you watch**

Discuss where we can use X-rays and the possibility of new usages in groups.

## Unit 3

## DOPPLER FETAL MONITOR

**Exercise 1. Learn the following words and word combinations and their meanings.**

1. Acoustic streaming – акустический / звуковой ветер.
2. Angulation (n) – ангуляция, угловое смещение.
3. Audio output – звуковой вывод.
4. Auscultation (n) – аускультация, выслушивание (больного).
5. Beats per minute (BPM) – удары в минуту.
6. Build-in LCD (liquid crystal display) – встроенный жидкокристаллический индикатор.
7. Cavitation – образование полости.
8. Concern (n) – причина для озабоченности.
9. Doppler fetal monitor – фетальный допплер (акуш.).
10. Fetal heart tones (FHT) – звуки сердцебиения плода.
11. Fetal stethoscope – стетоскоп для беременных.
12. Fetus (n) – плод (зародыш с 9-й недели развития до момента рождения).
13. Gestation (n) – беременность.
14. Health care professional – медицинский работник.
15. Heart beat – частота ударов сердца.
16. In response to – как реакция на, в ответ на.
17. Obese – с избыточной массой тела.
18. Practitioner (n) – врач-практик.
19. Prenatal care – наблюдение беременности.
20. Probe type – тип датчика.
21. Probe frequency – частота зондирования.
22. Retroverted (adj) – отклонённый кзади (гинек.).
23. Time (v) – рассчитывать по времени, синхронизировать.
24. Uterus (n) – матка.

**Exercise 2. Read the text attentively and translate it into Russian.**

## Doppler Fetal Monitor

A ***Doppler fetal monitor*** is a hand-held ultrasound transducer used to detect the fetal heartbeat for **prenatal care**. It uses the Doppler effect to provide an audible simulation of the **heart beat**. Some models also display the heart rate in **beats per minute** (BPM). Use of this monitor is sometimes known as *Doppler* ***auscultation***. The Doppler fetal monitor may be classified as a form of Doppler ultrasonography (although usually not technically-graphy but rather sound-generating).

Doppler fetal monitors provide information about the **fetus** similar to that provided by a **fetal stethoscope**. One advantage of the Doppler fetal monitor over a (purely acoustic) fetal stethoscope is the electronic **audio output**, which allows people other than the user to hear the heartbeat. One disadvantage is the greater complexity and cost and the lower reliability of an electronic device.

The device was invented in 1958 by Dr. Edward H. Hon. Originally intended for use by **health care professionals**, this device is becoming popular for personal use.

Dopplers for home or hospital use differ in the following ways:

1. Manufacturer: popular manufacturers are Baby Doppler, Sonoline, Ultrasound Technologies, Newman Medical, Nicolet (purchased by Natus), Arjo-Huntleigh, and Summit Doppler (now Cooper Surgical).

2. **Probe type**: waterproof or not. Waterproof probes are used for water births.

3. **Probe frequency**: 2-MHz or 3-MHz probes. Most **practitioners** can find the heart rate with either probe. A 3-MHz probe is recommended to detect a heart rate in early pregnancy (8–10 weeks **gestation**).

A 2-MHz probe is recommended for pregnant women who are overweight. The newer EchoHeart 5-MHz transvaginal probes aids in the detection of **fetal heart tones** (FHT) early in pregnancy (6–8 weeks) and for patients who have a **retroverted uterus** or throughout pregnancy for FHT detection for women who are **obese**.

4. Heart rate display: some Dopplers automatically display the heart rate on **a built-in LCD**; for others the fetal heart rate must be counted and **timed** by the practitioner.

A major advantage of being able to record and share the recording is that it can be emailed to a health care professional to be checked if there are any **concerns** about whether or not it is the fetus's heart rate and whether or not is normal. Typically, they work from about 12 weeks.

**In response to** increasing home usage of clinical fetal doppler systems, the FDA issued a formal statement recommending against at-home use. Fetal dopplers using 2-3MHz ultrasound are prescription devices designed and developed for use by licensed and trained health care professionals. System misuse (duration, **angulation**) and systems operating outside of intended range can produce thermal and non-thermal effects on fetal tissue, including the possibility for over-heating fetal tissue and introducing mechanical stress on the fetus due to **cavitation**, radiation force, and **acoustic streaming**.

**Exercise 3. Match the adverbs in A with their synonyms in B and the right Russian equivalents in C (table 3.1).**

Table 3.1

| A | B | C |
|---|---|---|
| therefore | incidentally | более того, кроме того |
| because of | in fact | следовательно, таким образом |
| nevertheless<br>in addition | moreover<br>thus | между прочим, кстати<br>благодаря, вследствие |
| actually | however | фактически, по сути |
| by the way | due to | тем не менее, однако |

**Exercise 4. Match the human organ in A with its definition in B and the right translation in C (table 3.2).**

Table 3.2

| A | B | C |
|---|---|---|
| heart | an organ of soft nervous tissue contained in the skull of vertebrates, functioning as the coordinating center of sensation and intellectual and nervous activity | мозг |

| | | |
|---|---|---|
| lymph gland | the hollow pear-shaped organ in a woman's pelvis, the place where a fetus (unborn baby) develops and grows | легкие |
| placenta | a hollow muscular organ that pumps the blood through the circulatory system by rhythmic contraction and dilation | матка |
| lungs | a small bean-shaped structure that is part of the body's immune system; it contains lymphocytes (white blood cells) that help the body fight infection and disease | лимфатический узел |
| brain | A flattened circular organ in the uterus of pregnant mammals, nourishing and maintaining the fetus through the umbilical cord | сердце |
| uterus | a pair of breathing organs located with the chest which remove carbon dioxide from and bring oxygen to the blood | плацента |

**Exercise 5. Match the words with the similar meaning.**

| | |
|---|---|
| 1. acoustic | a) pulsation |
| 2. provide | b) find |
| 3. complexity | c) pretending |
| 4. hand-held | d) voltaic |
| 5. heartbeat | e) audible |
| 6. simulation | f) difficulty |
| 7. detect | j) portable |
| 8. electronic | h) supply |

**Exercise 6. Find the English equivalents in B to the Russian words in A.**

| A | B | | |
|---|---|---|---|
| 1. чистый | a) light | b) pure | c) dirty |
| 2. встроенный | a) define | b) board | c) built-in |
| 3. соотношение | a) ratio | b) extent | c) requirement |
| 4. взаимодействие | a) influence | b) attitude | c) interaction |
| 5. удар (сердца) | a) blow | b) knock | c) beat |

| A | B | | |
|---|---|---|---|
| 6. частота | a) frequency | b) quickly | c) fast |
| 7. наблюдение (медицинское) | a) help | b) assistance | c) care |
| 8. датчик (медицинский) | a) device | b) probe | c) receiver |
| 9. клетка (живого организма) | a) square | b) cage | c) cell |
| 10. реакция | a) response | b) tone | c) concern |

**Exercise 7. Translate the following terminological word combinations containing nouns only.**

1. Heart beat rate.
2. Home usage doppler.
3. Fetal heart tones.
4. Device complexity.
5. Health care professional.
6. Radiation force perception.
7. Hospital use.
8. Light energy source.
9. Audio output.
10. Sound frequency generator.

**Exercise 8. Translate the following sentences into Russian paying attention to the words in bold type.**

1. I'm going to a medical conference to St. Petersburg next month **while** my colleague is going to a medical conference to Moscow.
2. **Since** this Doppler fetal monitor has inaccuracies in the heart rate detection, we can't rely on it only.
3. **Despite** having all the necessary qualifications, they didn't offer him the job **as** a deputy head physician.
4. My aunt is a doctor of ultrasound diagnostics and our parents were doctors of ultrasound diagnostics **as well**.
5. She always has to carry an inhaler with her **due to** a congenital disease of bronchial asthma.
6. Doppler fetal monitor is not recommended for home use **because of** the possibility for over-heating fetal tissue.

7. Dopplers can be classified **according to** the probe type and probe frequency they detect.

8. The newer EchoHeart 5-MHz transvaginal probes aids in the detection of fetal heart tones (FHT) early in pregnancy (6–8 weeks) or **throughout** pregnancy for FHT detection for woman who are obese.

**Exercise 9. Put the words in the questions in the correct order and answer them.**

1. know / a / what / do / is / Doppler fetal monitor / you?
2. is / the / used / Doppler fetal monitor / when?
3. Doppler fetal monitor / are / types / materials / what / the / of?
4. what / depend / output / does / audio / the / electronic / on?
5. term / what / ultrasonography / does / the / mean?
6. as / classified / sound-generation / Doppler fetal monitor / or / as / many / technically-graphy?
7. probe / is / between / and / type / difference / the / probe / what / frequency?
8. the / Doppler fetal monitor / what / disadvantage / only / of / is?
9. this / whom / device / when / invented / by / was / and?
10. popular / can / what / Doppler / name / manufacturers / you?

**Exercise 10. Make up the summary of the text in Exercise 2.**

The title of the text is …
The text is about …
The main idea of the text is …
The author starts by telling the readers about …
Much attention is given to …
According to the text …
The author goes on to say that …
I found the text interesting / important …

**Exercise 11. Complete the sentences with the necessary preposition from the box.**

| **from, to, into, with, out of, in, of, for, among, off** |
|---|

1. Emergency ultrasound is used … quickly diagnose a limited set of injuries or pathalogic conditions.

2. Ultrasound of the lungs may demonstrate resolution of pulmonary edema … congestive heart failure.

3. It is now used for a variety … exams in various clinical settings at the person's bedside.

4. Emergency ultrasound has increased … use in the last decade as ultrasound machines have become more compact and portable.

5. People presenting … hypotension of unknown cause, ultrasound has been utilized to determine the cause of shock.

6. Unfortunately, at present the emergency ultrasound machine is … … order.

7. Blood clots that form in deep veins of the body can break … and block blood vessels in the lungs.

8. Did you put the tubes with blood plasma samples ... the fridge?

9. Emergency ultrasound can also evaluate the lungs … hemothorax (bleeding in the chest).

10. Use of bedside ultrasound can decrease waiting times and improve satisfaction … injured.

**Exercise 12. Fill in the table 3.3 with the derivatives from the words given below and translate them.**

Table 3.3

| VERB | NOUN | ADJECTIVE |
|---|---|---|
| … | … | careful |
| … | injection | … |
| to measure | … | … |
| … | … | diagnostic |
| to visualize | … | … |
| … | … | productive |
| … | purity | … |
| … | … | comprehensive |
| to install | … | … |
| … | monitor | … |
| … | … | suspectable |

**Exercise 13. Read the sentences and translate them into Russian. Define the Participle functions.**

1. The substance obtained was pure.
2. When using the emergency ultrasound it is possible to diagnose and monitor a person's response to therapeutic interventions.
3. If tested the device may be used.
4. Here's a point of care ultrasound built for people with traumatic injury.
5. Having been cleaned, the filter increased the airflow.
6. Be careful while transporting critically ill person.
7. Being influenced by temperature and pressure, the volume of any substance is not constant.
8. The work performed by this scientist showed good results.

**Exercise 14. Translate the following text into Russian in writing.**

## Doppler ultrasonography

Doppler ultrasonography is medical ultrasonograhy that employs the Doppler effect to generate imaging of the movement of tissues and body fluids (usually blood), and their relative velocity to the probe. By calculating the frequency shift of a particular sample volume, for example flow in an artery or a jet of blood flow over a heart valve, its speed and direction can be determined and visualized. Color Doppler is the presentation of the velocity by color scale. Color Doppler images are generally combined with grayscale (B-mode) images to display duplex ultrasonography images, allowing for simultaneous visualization of the anatomy of the area.

This is particularly useful in cardiovascular studies (sonography of the vascular system and heart) and essential in many areas such as determining reverse blood flow in the liver vasculature in portal hypertension.

The Doppler data is displayed graphically using spectral Doppler, or as an image using color Doppler (directional Doppler) or power Doppler (non-directional Doppler). This Doppler shift falls in the audible range and is often presented audibly using stereo speakers: this produces a very distinctive, although synthetic, pulsating sound.

All modern ultrasound scanners use pulsed Doppler to measure velocity. Pulsed wave instruments transmit and receive series of pulses. The frequency shift of each pulse is ignored, however the relative phase changes of the pulses are used to obtain the frequency shift (since frequency is the rate of change of phase).

There are no standards for the displaying color Doppler. Some laboratories show arteries as red and veins as blue, as medical illustrators usually show them, even though some vessels may have portions flowing toward and portions flowing away from the transducer. This results in the illogical appearance of a vessel being partly a vein and partly an artery. Other laboratories use red to indicate flow toward the transducer and blue away from the transducer. Still other laboratories display the Doppler color map in accord with published data, with red shift representing longer wavelengths (scattered) from blood flowing away from the transducer, and with blue representing the shorter wavelengths from blood flowing toward the transducer. Because of this confusion and lack of standards, the sonographer must understand the underlying physics of color Doppler and the physiology of normal and abnormal blood flow in the human body.

## Unit 4

## BIOTECHNOLOGY

**Exercise 1. Learn the following words and word combinations and their meanings.**

1. Artificial environment – искусственная среда.
2. Augment (v) – приумножить.
3. Biotechnology (n) – биотехнология.
4. Blossoming (n) – расцвет.
5. Debilitating (adj) – изнурительный.
7. DNA – ДНК (дезоксирибонуклеиновая кислота).
8. Elucidation (n) – объяснение.
9. Facet (n) – аспект, сфера.
10. Human genetics – генетика человека.
11. Implant (n) – имплантант.
12. Inexorably (adv) – необратимо, неизбежно.
13. Leap (n) – прорыв.
14. Peer (n) – коллега.
15. Sketch (adj) – обрисовывать.
16. Stake out (v) – застолбить.
17. Stave off (v) – предотвратить.
18. Unleash (v) – раскрыть.
19. Wearables – носимые устройства.

**Exercise 2. Read the text attentively and translate it into Russian.**

### Biotechnology

In the next decade or two, several of the most important but disparate scientific and engineering achievements of the twenty first century – the **blossoming** of electronics, the discovery of **DNA** and the **elucidation** of **human genetics** – will be the basis for **leaps** in technology that will extend, enhance or **augment** human capabilities far more directly, personally and powerfully than ever before. The heady assortment of **biotechnologies**, **implants**, **wearables**, **artificial environments**, synthetic sensations, and even demographic and societal shifts defies any attempt at

concise categorisation. As scientists and engineers **unleash** fully the power of the gene and of the electron, they will transform bits and pieces of the most fundamental **facets** of our lives, including eating and reproducing, staying healthy, being entertained and recovering from serious illness. Big changes could even be in store for what we wear, how we attract mates and how we **stave off** the **debilitating** effects of getting older. Within a decade, we will see a cloned human being, replacement hearts and livers, custom-grown from the recipient's own versatile stem cells.

Virtual reality becomes far more vivid and compelling by adding the senses of smell and touch to those of sight and sound. Essentially all the predicted developments will follow directly from technologies or advances that have already been achieved in the laboratory. Take that genetic muscle vaccine: a University of Pennsylvania researcher is exercising laboratory mice whose unnaturally muscular hind legs were created by injection. He has little doubt about the suitability of the treatment for humans. However, neurosurgeon Robert J. White, geneticist Dean Hamer and engineer-entrepreneur Ray Kurzweil **stake out** positions that are controversial among their **peers**. R. J. White raises the possibility of making the Frankenstein myth a reality as he declares that medical science is now capable of transplanting a human head onto a different body. Hamer uses today's scientific fact and his best guesses about tomorrow's technology to **sketch** a fictional account of a couple in the year 2250 customising the genes that will underlie their baby's behaviour and personality. Kutzweil argues not only that machines will eventually have human thoughts, emotions and consciousness but that their ability to share knowledge instantaneously will **inexorably** push them far past us in every category of endeavour, mental and otherwise.

**Exercise 3. Complete the table 4.1 with the international words from the text according to their stress pattern and translate them into Russian.**

Biology, antibiotics, decade, bacteria, demographic, biotechnology, electron, gene, technologies, laboratory, vaccine, geneticist, embryo, problem, gene, process, product.

Table 4.1

| 1 ●○ | 2 ○● | 3 ○●○ | 4○●○○ | 5 ○○●○ | 6 ○○●○○ | 7 ○●○○○ |
|---|---|---|---|---|---|---|
| | | | | | | |

**Exercise 4. Using the definitions given below guess the crossword.**

**Across:**

1. The art or practice of diagnosis.
5. The production and behavior of materials at very low temperatures.
7. Something (such as a garment or a device) that can be worn.
8. To put an organ, group of cells, or device into the body in a medical operation.
10. Organisms that are microscopic, unicellular, independently reproducing, and mostly free-living.
12. A plant or animal that has the same genes as the original from which it was produced.
15. The sum of techniques, skills, methods, and processes used in the production of goods or services or in the accomplishment of objectives, such as scientific investigation.

**Down:**

2. A basic unit of heredity and a sequence of nucleotides in DNA.
3. A biological preparation that provides active acquired immunity to a particular infectious disease.
4. The set of articles or physical resources serving to equip a person or thing.
6. A person who studies genetics.
9. Belonging or relating to genes (= parts of the DNA in cells) received by each animal or plant.
11. The integration of natural sciences and engineering sciences in order to achieve the application of organisms, cells, parts thereof and molecular analogues for products and services.
13. The smallest basic unit of a plant or animal.
14. The red liquid that is sent around the body by the heart, and carries oxygen.

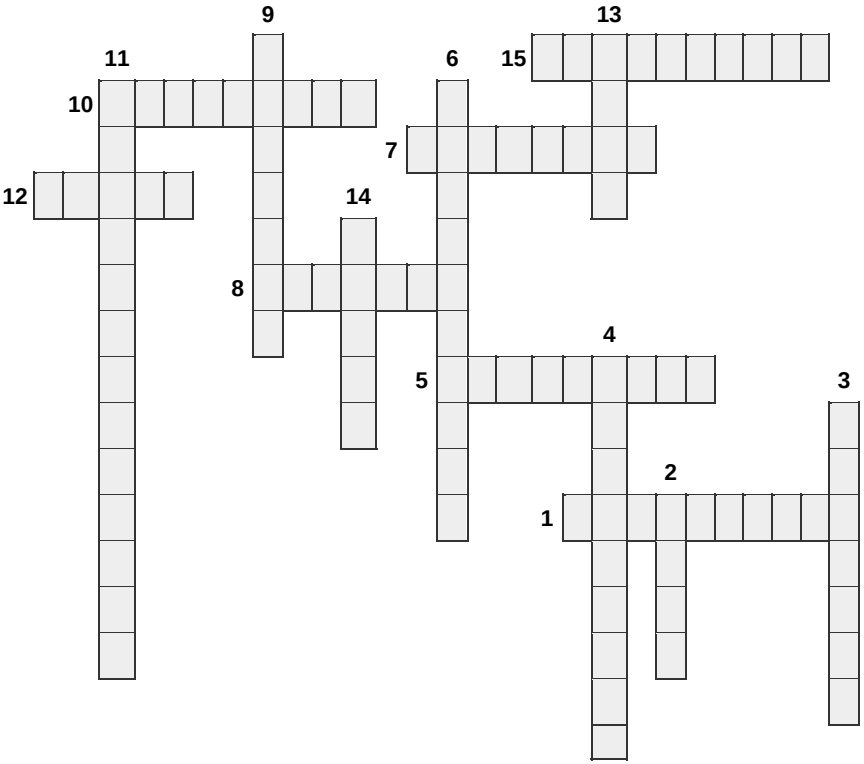


Fig. 4.1. Crossword

**Exercise 5. Match the words with the opposite meaning.**

| | |
|---|---|
| 1. much | a) solution |
| 2. decade | b) slow |
| 3. discovery | c) fiction |
| 4. transform | d) little |
| 5. vivid | e) high |
| 6. fact | f) loss |
| 7. fast | g) unreality |
| 8. reality | h) year |
| 9. low | i) unclear |
| 10. problem | j) preserve |

**Exercise 6. Make up the word combinations from columns A and B and find their equivalents in C (table 4.2).**

Table 4.2

| A | B | C |
|---|---|---|
| blood | conversion | необратимая рекомбинация генов |
| gene | consultation | клетка крови |
| cryogenic | line | колонии клеток |
| recessive | genes | криогенная электроника |
| human | mapping | медико-генетическая консультация |
| cell | environment | генное картографирование |
| genetic | gene | искусственная среда |
| artificial | cell | человеческие гены |
| blood | electronics | рецессивный ген |
| gene | flow | кровоток |

**Exercise 7. Match the following English words and word combinations with their Russian equivalents.**

1. leap in technology
2. disparate scientific achievement
3. fundamental facet of life
4. recovering from serious illness
5. elucidation of human genetics
6. fictional account
7. custom-grown replacement organ
8. heady assortment
9. versatile stem cell

a) расшифровка человеческих генов
b) универсальная стволовая клетка
c) воображаемый отчет
d) головокружительное сочетание
e) несоизмеримое научное достижение
f) важная сторона жизни
g) прорыв в технологии
h) излечение от тяжелой болезни
i) искусственно выращенный орган для трансплантации

**Exercise 8. Open the brackets inserting the corresponding forms of degrees of comparison. Translate the following sentences orally.**

1. We, as human beings, are (гораздо больше) than merely biological computers, but this "computational self-image" actually limits our understanding of the world, each other, and (в наибольшей степени разрушительно), our own selves.

2. Computers are becoming (более человекообразными) as we impart our intelligence to them; and on the other, we are becoming (менее) than fully human as we consider ourselves (все более и более) as just biological computers.

3. The scientists are sure that the perspectives of cloning should be treated (менее эмоционально).

4. I don't think that computers are evolving into something that is actually different to previous human creations by being actually comparable to us, regardless of the sheer number of networked computers on the Inter net, or the sheer processing power of (самого последнего) supercomputer.

5. In 1972, Cray founded a company to design and build (самое высокое в мире) performance general-purpose supercomputers.

6. The IBM machine was especially designed to do (самое лучшее) that we thought could be done with the computer.

7. A genetic vaccine that endows the user with (более большими и более выносливыми) muscles, without any need to break a sweat at the gym.

8. Today virtual reality is becoming (гораздо более живой и неотразимой).

9. The first attempt to clone a human being will not come in a very distant future, and independently on the success of this experiment, this will not be (последняя) attempt.

10. The protesters are confident that cloning is (самое худшее) of all possible evils that can await mankind in the new century.

11. Religious groups opposed to cloning are sure that even their (самый неубедительный) argument is compelling enough to bar cloning forever; they insist that (будущие) generations are not to be experimented with.

**Exercise 9. Answer the following questions.**

1. What is biotechnology?
2. What does biotechnology deal with?
3. What biotechnologists do you know?
4. What important scientific and engineering achievements of the twentieth century can you name?
5. Do scientists and engineers unleash fully the power of the gene?
6. Dean Hamer and engineer-entrepreneur Ray Kurzweil stake out positions that are controversial among their peers, do not they?
7. Who raises the possibility of making the Frankenstein myth a reality?
8. In what spheres of medicine is biotechnology used?
9. Does virtual reality become far more vivid?

**Exercise 10. Make up the summary of the text in Exercise 2.**

The paper puts forward the idea …
The paper discusses some problems relating to …
The first paragraph deals with …
Then follows a discussion on …
It must be emphasized that …
The final paragraph states …
In my opinion …

**Exercise 11. Complete the sentences with the necessary preposition from the box.**

| **on, from, to, with , of, by , in, for** |
|---|

1. Biotechnology is technology based … biology, especially when used … agriculture, food science, and medicine.
2. We attended a conference … biotechnology.
3. Pharmaceutical Biotechnology deals … the utilization … living organisms … the production … useful products.
4. The medicines made … biotechnology companies are derived … living organisms.

5. For centuries, the principles … biotechnology were restricted … agriculture, such as harvesting better crops and improving yields … using the best seeds and breeding livestock.

6. Currently, about 30 recombinant therapeutics have been approved … human use worldwide.

7. Insulin consists … two short, polypeptide chains.

8. There are numerous methods applied … biotechnology such as gene treatment, recombinant DNA technology.

9. Advancements in medical biotechnology have impacted millions … lives … the past few decades.

10. Biotech professionals typically perform research … advanced therapies; for example, stem cells, gene therapy, or as swoon ass.

11. Biotechnology relies heavily … statistics skills combined … the use … software such as Excel, Minitab, JMP, and Design Expert.

**Exercise 12. Divide the words into five columns according to their part of speech (table 4.3).**

Table 4.3

| Noun | Adjective | Pronoun | Adverb | Conjunction |
|---|---|---|---|---|
| | | | | |

Fully, biotechnology, although, our, typically, pharmaceutical, after, medicine, cloning, especially, scientist, as soon as, heavily, gene, we, elucidation, when, artificial, science, short, cryogenic, insulin, unless, its, smart, creator, achievement, electronics, inexorably.

**Exercise 13. Read the sentences and translate them into Russian. Define the Subjective Infinitive Construction.**

1. New biocumputers are likely to become smarter than their creators.

2. Today's biotechnologies are sure to vary in application and complexity.

3. American scientists are said to clone the Tasmanian tiger which died more than 60 years ago.

4. Biotechnology is considered to have numerous applications, particularly in medicine and agriculture.

5. Human Papilloma Virus (HPV) is believed to be one of the causative agents of cervical cancer.

6. Biotechnology is known to have a variety of applications that focus on human welfare.

7. Biotechnology is known to be widely used in different fields such as medicine, agriculture, food processing, etc. to produce useful products for human benefits.

8. Gene Therapy is believed to hold the most promising answer to the problem of genetic diseases.

9. Pharmacogenomics is reported to have led to the production of drugs that are best suited to an individual's genetic makeup.

10. Genetic engineering is proved to have helped in the production of therapeutic proteins as well as biological organisms.

11. Biotechnology is declared to have made major advances in molecular biology and industrial biotechnology.

**Exercise 14. Translate the following text into Russian in writing form.**

## History of biotechnology

People have been harnessing biological processes to improve their quality of life for some 10,000 years, beginning with the first agricultural communities. Approximately 6,000 years ago, humans began to tap the biological processes of microorganisms in order to make bread, alcoholic beverages, and cheese and to preserve dairy products. But such processes are not what is meant today by *biotechnology*, a term first widely applied to the molecular and cellular technologies that began to emerge in the 1960s and '70s. A fledgling "biotech" industry began to coalesce in the mid- to late 1970s, led by Genentech, a pharmaceutical company established in 1976 by Robert A. Swanson and Herbert W. Boyer to commercialize the recombinant DNA technology pioneered by Boyer, Paul Berg, and Stanley N. Cohen. Early companies such as Genentech, Amgen, Biogen, Cetus, and Genex began by manufacturing genetically engineered substances primarily for medical and environmental uses.

For more than a decade, the biotechnology industry was dominated by recombinant DNA technology, or genetic engineering. This technique consists of splicing the gene for a useful protein (often a human protein)

into production cells—such as yeast, bacteria, or mammalian cells in culture—which then begin to produce the protein in volume. In the process of splicing a gene into a production cell, a new organism is created. At first, biotechnology investors and researchers were uncertain about whether the courts would permit them to acquire patents on organisms; after all, patents were not allowed on new organisms that happened to be discovered and identified in nature. But, in 1980, the U.S. Supreme Court resolved the matter by ruling that "a live human-made microorganism is patentable subject matter." This decision spawned a wave of new biotechnology firms and the infant industry's first investment boom. In 1982 recombinant insulin became the first product made through genetic engineering to secure approval from the U.S. Food and Drug Administration (FDA). Since then, dozens of genetically engineered protein medications have been commercialized around the world, including recombinant versions of growth hormone, clotting factors, proteins for stimulating the production of red and white blood cells, interferons, and clot-dissolving agents.

**Exercise 15. Video activity (https://www.youtube.com/watch?v=SqQqYy6UAOo).**

**Before you watch**

What is biotechnology?
Where is biotechnology used?

***Match the English words with their Russian equivalents (table 4.4).***

Table 4.4

| | |
|---|---|
| living cell | соленья |
| food additives | технология моноклонального антитела |
| bioprocessing technology | клетка |
| pickles | живая клетка |
| Monoclonal antibody technology | рак |
| cell | пищевая добавка |
| pollutant | технология рекомбинантной ДНК |

End of the table 4.4

| | |
|---|---|
| cell culture | вирусное заболевание |
| immune system | технология биопереработки |
| cancer | загрязняющее вещество |
| recombinant DNA technology | млекопитающий |
| protein engineering | микрочип |
| microarray | иммунная система |
| mammalian | клеточная культура |
| viral disease | белковая инженерия |

**While you watch**

***Watch the video and answer the questions:***

1. Is biotechnology a new advancement in the area of science?
2. What definition can you give to the biotechnology?
3. What products does biotechnology include?
4. Are there eight major areas of biotechnology? What are they?
5. What does bioprocessing technology refer to?
6. When were microorganisms first discovered?
7. What does monoclonal antibody technology use?
8. When did people come to realize that their biochemical machinery was the substance for useful products?
9. What is extremely useful to locate any pollutants found in the environment?
10. What does cell culture mean?
11. What does cloning technology actually allow?
12. What is protein engineering?
13. What is biosensor?
14. What is microarray?

***Watch the video again and complete the gaps in the sentences.***

**Cloning, culture, living, microorganisms, antibody, bioprocessing, microarray, sciences, environment, structures, engineering, DNA, pieces**

1. Biotechnology means utilizing living organism or their products to revise or change human health or the … or to run a process.

2. Biotechnology itself is the combination of biology and other … to create new, innovative products.

3. … technology refers to use of living cells to produce preferred products.

4. … were first discovered in the mid-1800s.

5. Monoclonal … technology uses the cells from the immune system to make antibodies.

6. Cell … simply means growing cells outside of a … organism.

7. Recombinant DNA technology means recombining two … of DNA from two different species.

8. … became well known after the cloning of Dolly the sheep years back.

9. Protein … is a ... recombinant technique that is meant to improve existing proteins to create new proteins that do not exist in nature.

10. Nano- biotechnology refers to the study, manipulation and manufacture of ultra-small … and machines that can consist of only a single molecule.

11. … is the study of gene structure and functions which enable us to analyze tens of thousands of samples simultaneously.

**After you watch**

Discuss in groups. Is it worth using biotechnology? What is Biotechnology?

## Unit 5

## A MAGNETIC RESONANCE IMAGING (MRI) SCAN

**Exercise 1. Learn the following words and word combinations and their meanings.**

1. Blur (n) – пятно; размытость, нечеткость.
2. Buckle (n) – пряжка (в одежде).
3. Denture – стоматологический протез.
4. Earplug (n) – беру́ши (противошумовое средство).
5. Fastener (n) – застежка (в одежде).
6. Gown (n) – медицинский халат.
7. Hearing aid – слуховой аппарат.
8. Intercom – внутренняя телефонная связь.
9. Interpret (v) – толковать, объяснять.
10. Magnetic resonance imaging scan – магнитно-резонансный томограф.
11. Motorized bed – моторизированная кровать.
12. Necklace (n) – колье; цепочка.
13. Nipple ring (n) – кольцо для соска.
14. Radiographer (n) – рентгенолаборант; рентгенотехник.
15. Radiologist (n) – врач-рентгенолог; специалист в области лучевой диагностики.
16. Scan – томографическое изображение; томография.
17. Still (adj) – неподвижный, смирный.
18. Tapping noise – шум, имеющий характер стука.
19. Underwire (n) – бюстгальтер «на косточках».
20. Urgently (adv) – срочно, экстренно.
21. Wig (n) – парик.
22. Zip (n) – застежка-молния (в одежде).

**Exercise 2. Read the text attentively and translate it into Russian.**

### A magnetic resonance imaging (MRI) scan

A **magnetic resonance imaging** (MRI) **scan** is a painless procedure that lasts 15 to 90 minutes, depending on the size of the area being scanned and the number of images being taken.

*Before the **scan**.* On the day of your MRI scan, you should be able to eat, drink and take any medication as usual, unless you're advised otherwise.

As the MRI scanner produces strong magnetic fields, it's important to remove any metal objects from your body. These include: watches; jewellery, such as earrings and **necklaces**; piercings, such as ear, **nipple** and nose **rings**; **dentures** (false teeth); ***hearing aids***; **wigs** (some wigs contain traces of metal).

Depending on which part of your body is being scanned, you may need to wear a hospital **gown** during the procedure. If you don't need to wear a gown, you should wear clothes without metal **zips**, **fasteners**, buttons, **underwire** (bras), belts or **buckles**.

An MRI scan is a painless procedure, so *anaesthesia (painkilling)* isn't usually needed.

*During the scan.* An MRI scanner is a short cylinder that's open at both ends. You'll lie on a **motorized bed** that's moved inside the scanner. You'll enter the scanner either head first or feet first, depending on the part of your body being scanned. In some cases, a frame may be placed over the body part being scanned, such as the head or chest. This frame contains receivers that pick up the signals sent out by your body during the scan and it can help to create a better-quality image. A computer is used to operate the MRI scanner, which is located in a different room to keep it away from the magnetic field generated by the scanner. The **radiographer** operates the computer, so they'll also be in a separate room to you. But you'll be able to talk to them, usually through an **intercom**, and they'll be able to see you at all times on a television monitor.

To avoid the images being **blurred**, it's very important to keep the part of your body being scanned **still** throughout the whole of the scan until the radiographer tells you to relax. A single scan may take from a few seconds to 3 or 4 minutes. You may be asked to hold your breath during short scans.

The MRI scanner will make loud **tapping noises** at certain times during the procedure. This is the electric current in the scanner coils being turned on and off. You'll be given **earplugs** or headphones to wear. You're usually able to listen to music through headphones during the scan if you want to, and in some cases you can bring your own CD. You'll be moved out of the scanner when your scan is over.

*After the scan.* Your MRI scan needs to be studied by a **radiologist** (a doctor trained in **interpreting** scans and X-rays) and possibly discussed with other specialists. This means it's unlikely you'll get the results of your scan immediately. The radiologist will send a report to the doctor who arranged the scan, who will discuss the results with you. It usually takes a week or two for the results of an MRI scan to come through, unless they're needed **urgently**.

**Exercise 3. Complete the table 5.1 with the international words from the text according to their stress pattern and translate them into Russian.**

Magnetic, procedure, minute, resonance, scanner, medication, anaesthesia, cylinder, receiver, computer, locate, radiographer, generate, intercom, television, second, interpret, monitor, radiologist, discuss, specialist, result, process.

Table 5.1

| 1 ●○ | 2 ○● | 3 ●○○ | 4 ○●○ | 5 ○○●○ | 6 ○○●○○ |
|---|---|---|---|---|---|
| | | | | | |

**Exercise 4. Complete the sentences with the correct words and cross them out in the word square. (The words go across or down and can break at right angles).**

1. The MRI scanner produces s_____ m_____ fields.
2. An MRI scan is a painless p_____, so p_____ isn't usually needed.
3. The electric c_____ in the scanner c_____ being turned on and off.
4. The MRI scanner will make loud t_____ noises at c_____ times during the procedure.
5. Your MRI scan needs to be studied by a radiologist, this means it's u_____ you'll get the results of your scan i_____.
6. You'll be given e_____ or h_____ to wear.

| M | A | G | A | C | U | R | R | E | N | T |
|---|---|---|---|---|---|---|---|---|---|---|
| P | I | N | P | Q | C | K | W | X | N | F |
| A | T | E | R | J | E | D | C | O | I | L |
| I | M | T | O | U | R | P | Y | R | G | I |
| N | E | I | C | S | T | R | O | N | G | M |
| K | T | C | E | C | A | H | E | A | D | M |
| I | A | G | D | V | I | Y | L | E | P | E |
| L | P | N | U | U | N | L | I | K | H | D |
| L | P | I | R | O | Z | H | E | N | O | I |
| I | N | G | E | L | B | Y | L | E | T | A |

**Exercise 5. Unjumble the letters to make the words from the text.**

1. leyeljwre — j _____
2. retuedn — d _____
3. tunotb — b _____
4. lryicdne — c _____
5. nsecran — s _____
6. disrtoagloi — r _____
7. tebhar — b _____
8. rtepirnet — i _____
9. senitolive — t _____
10. csaitpilie — s _____
11. sisudes — d _____
12. gynutrle — u _____

**Exercise 6. Match the following English word combinations with their Russian equivalents.**

1. hospital gown
2. traces of metal
3. pick up a signal
4. separate room
5. hold one's breath
6. scan results
7. take medication
8. depending on the size

a) ловить сигнал
b) результаты томографии
c) принимать лекарства
d) в зависимости от размера
e) безболезненная процедура
f) слуховой аппарат
g) постукивающий шум
h) следы металла

| | |
|---|---|
| 9. tapping noise | i) задерживать дыхание |
| 10. painless procedure | j) больничный медицинский халат |
| 11. hearing aid | k) отдельная комната |

**Exercise 7. Match the abbreviations in A with their definitions in B and the right Russian equivalents in C (table 5.2).**

Table 5.2

| A | B | C |
|---|---|---|
| rf. | et cetera | против, в сравнении с |
| e.g. | cubic centimetre | наружный диаметр |
| a.m. | id est | до полудня |
| etc. | exempli gratia | постоянный ток |
| o.d. | versus | например |
| d.c. | ante meridiem | футов в минуту |
| c.c. | feet per minute | кубический сантиметр |
| i.e. | outer diametre | и так далее |
| f.p.m. | reference | сноска, ссылка |
| vs | direct current | то есть |

**Exercise 8. Answer the following questions.**

1. What does the abbreviation ‘MRI’ mean?
2. What is the MRI scanner?
3. When is an MRI procedure necessary?
4. How does the MRI scanner function?
5. Why is it important to remove any metal objects from your body before the scan?
6. How much time does the MRI procedure last?
7. What type of bed is needed to lie inside the MRI scanner?
8. Do you happen to know what branch of medicine is concerned with MRI scanners?

**Exercise 9. Make up the summary of the text in Exercise 2.**

The text is under the headline …
The main idea of the text is …

According to the text …
The author points out …
It should be stressed that …
In conclusion the author says that …
I found the text useful …

**Exercise 10. Translate the following terminological word combinations containing nouns only.**

1. Voltage drop.
2. Taking medications.
3. Signal receiver.
4. Scan image interpretation.
5. Check valve.
6. Television monitor.
7. Scanner coils.
8. Time consumption.
9. Tube diode.
10. Water amount.
11. Power supply device.

**Exercise 11. Cross out the odd word. All the words in the line should belong to one part of speech.**

1. Health, staff, procedure, medical, number.
2. They, you, second, we, she.
3. Exceedingly, essentially, typically, tightly, efficiency.
4. Usual, remove, operate, generate, depend.
5. Magnetic, discuss, possible, safe, short.
6. Scanner, image, body, separate, object.
7. Under, it, below, above, near.
8. Painless, large, important, motorized, radiologist.
9. Unlikely, otherwise, urgently, medication, beforehand.
10. Thickness, structure, visible, length, width.

**Exercise 12. Complete the sentences with the necessary preposition from the box.**

| on, as, to, for, in, before, with, after |
|---|

1. You may be asked not to eat or drink anything for up to 4 hours … the scan.
2. He has to fill … a questionnaire about his health and medical history.
3. An MRI scan is usually carried out … an outpatient procedure.
4. … the scan, you can resume normal activities immediately.
5. This helps the medical staff … ensure you have the scan safely.
6. When a diode is not connected … any source of power, the p-n junction serves as an insulator.
7. Carriers flow … the p-n junction and all across the combined segment.
8. This method is useful because it lets you determine the maximum rate … which a sensor can acquire data.

**Exercise 13. Translate the following sentences into Russian paying attention to the use of the Complex Subject.**

1. The development of a new vaccine is sure to be not easy.
2. Titanium alloys are considered to be the strongest, able to withstand heavy loads, for example, when replacing a hip joint.
3. The fabrication of modern materials for dental implants is known to be based on zirconium, titan and titan alloys.
4. The results of his research turned out to be even more interesting than we had expected.
5. This invention is certain to save much money.
6. A magnetic resonance imaging scan is expected to have a bright future in medicine.
7. The practical importance of this invention proved to be great.
8. A computer is believed to be used to operate the MRI scanner.
9. Most mechanical blood pressure monitors are known to be used with difficulty without assistance.
10. These laboratory experiments are considered to be of great importance.

**Exercise 14. Translate the following text into Russian in writing.**

**What is computed tomography?**

Computed tomography (CT) is an imaging procedure that uses special X-ray equipment to create detailed pictures, or scans, of areas inside the body. It is also called computerized tomography and computerized axial tomography (CAT).

The term *tomography* comes from the Greek words *tomos* (a cut, a slice, or a section) and *graphein* (to write or record). Each picture created during a CT procedure shows the organs, bones, and other tissues in a thin "slice" of the body. The entire series of pictures produced in CT is like a loaf of sliced bread—you can look at each slice individually (2-dimensional pictures), or you can look at the whole loaf (a 3-dimensional picture). Computer programs are used to create both types of pictures.

Most modern CT machines take continuous pictures in a helical (or spiral) fashion rather than taking a series of pictures of individual slices of the body, as the original CT machines did. Helical CT has several advantages over older CT techniques: it is faster, produces better 3-D pictures of areas inside the body, and may detect small abnormalities better. The newest CT scanners, called multislice CT or multidetector CT scanners, allow more slices to be imaged in a shorter period of time.

In addition to its use in cancer, CT is widely used to help diagnose circulatory (blood) system diseases and conditions, such as coronary artery disease (atherosclerosis), blood vessel aneurysms, and blood clots; spinal conditions; kidney and bladder stones; abscesses; inflammatory diseases, such as ulcerative colitis and sinusitis; and injuries to the head, skeletal system, and internal organs. CT can be a life-saving tool for diagnosing illness and injury in both children and adults.

*What can a person expect during a CT procedure?*

During a CT procedure, the person lies very still on a table, and the table passes slowly through the center of a large x-ray machine. With some types of CT scanners, the table stays still and the machine moves around the person. The person might hear whirring sounds during the procedure. At times during a CT procedure, the person may be asked to hold their breath to prevent blurring of the images.

Sometimes, CT involves the use of a contrast (imaging) agent, or "dye." The dye may be given by mouth, injected into a vein, given

by enema, or given in all three ways before the procedure. The contrast dye highlights specific areas inside the body, resulting in clearer pictures. Iodine and barium are two dyes commonly used in CT.

CT does not cause any pain. However, lying in one position during the procedure may be slightly uncomfortable. The length of a CT procedure depends on the size of the area being scanned, but it usually lasts only a few minutes to half an hour. For most people, the CT is performed on an outpatient basis at a hospital or a radiology center, without an overnight hospital stay.

Some people are concerned about experiencing claustrophobia during a CT procedure. However, most CT scanners surround only portions of the body, not the whole body. Therefore, people are not enclosed in a machine and are unlikely to feel claustrophobic.

Women should let their health care provider and the technologist know if there is any possibility that they are pregnant, because radiation from CT can harm a growing fetus.

## Unit 6

## MEDICAL LASERS

**Exercise 1. Learn the following words and word combinations and their meanings.**

1. Beam (n) – луч.
2. Bulb (n) – лампочка.
3. Cataract removal – удаление катаракты.
4. Cornea (n) – роговица.
5. Endodontic(adj) – эндодонтический.
6. LASIK – операция Фемто-Ласик.
7. Ionizing radiation – ионизирующее излучение.
8. Periodontic (n) – парадантоз.
9. PRK (phase-reversal keying) – двукратная относительная фазовая манипуляция.
10. Refractive eye surgery – рефракционная хирургия глаза.
11. Reshape(v) – менять.
12. Scalpel(n) – скальпель.
13. Scar(n) – шрам, рубец.
14. Spider veins – сосудистые сеточки.
15. Stretch marks – растяжки.
16. Surgical(adj) – хирургический.
17. Tissue(n) – ткань.
18. Tumor(n) – новообразование.
19. Vision(n) – зрение.
20. Wavelength – длина волны.

**Exercise 2. Read the text attentively and translate it into Russian.**

### Medical lasers

Medical lasers are medical devices that use precisely focused light sources to treat or remove **tissues**.

The term “laser” stands for Light Amplification by Stimulated Emission of Radiation. Ordinary light, such as that from a light **bulb**, has many **wavelengths** and spreads in all directions. Laser light, on the other

hand, has a specific wavelength. It is focused in a narrow **beam** and creates a very high-intensity light. Because lasers can focus very accurately on tiny areas, they can be used for very precise **surgical** work or for cutting through tissue (in place of a **scalpel**).

Lasers are used in many types of surgical procedures. Some examples include:

– cosmetic surgery (to remove tattoos, **scars**, **stretch marks**, sunspots, wrinkles, birthmarks, **spider veins** or hair);

**Refractive eye surgery** (to **reshape** the **cornea** in order to correct or improve **vision** as in **LASIK** or **PRK**);

Dental procedures (such as **endodontic / periodontic** procedures, tooth whitening, and oral surgery);

General surgery (such as **tumor** removal, **cataract removal**, breast surgery, plastic surgery and most other surgical procedures).

With proper use, lasers allow the surgeon to accomplish more complex tasks, reduce blood loss, decrease postoperative discomfort, reduce the chance of wound infection, and achieve better wound healing.

As with any type of surgery, laser surgery has potential risks. Risks of laser surgery include incomplete treatment of the problem, pain, infection, bleeding, scarring, and skin color changes.

Laser surgery uses non-ionizing radiation, so it does not have the same long-term risks as X-rays or other types of **ionizing radiation**.

In addition, surgical lasers must comply with radiation safety performance standards. Because they are medical devices, surgical laser products must also comply with the medical device regulations.

**Exercise 3. Complete the table 6.1 with the international words from the text according to their stress pattern and translate them into Russian.**

Scalpel, anesthetic, tattoo, laser, problem, infection, risk, medical, product, factor, moment, plan, factor, colleague, pharmaceutical, resonance, bionics, cosmetic.

Table 6.1

| 1 ●○ | 2 ○● | 3 ○●○ | 4○●○○ | 5 ○○●○ | 6 ○○●○○ | 7 ○●○○○ |
|---|---|---|---|---|---|---|
| | | | | | | |

**Exercise 4. Using the definitions given below guess the crossword (fig. 6.1).**

**Across:**

1. An instrument involved in performing medical operations.
3. It is the emission or transmission of energy in the form of waves or particles through space or through a material medium.
7. A permanent image, pattern, or word on the skin that is created by using needles to put colours.
8. It is mixtures of chemical compounds derived from either natural sources, or synthetically created ones.
9. It is a distressing feeling often caused by intense or damaging stimuli.
11. A line of light that shines from a bright object.
14. This is the spatial period of a periodic wave—the distance over which the wave's shape repeats.
15. Lancet is a small and extremely sharp bladed instrument used for surgery.

**Down:**

2. An object or machine that has been invented for a particular purpose.
4. A powerful, narrow beam of light that can be used as a tool to cut.
5. A condition in which bacteria or viruses that cause disease have entered the body.
6. It is substance or mixture of substances.
10. Related to the treatment of illness and injuries.
12. The form of energy that makes it possible to see things the brightness produced by the sun, by fire, by a lamp, etc. sometimes used figuratively.
13. This is the term for an abnormal growth of cells (neoplasm) that has formed a lump.

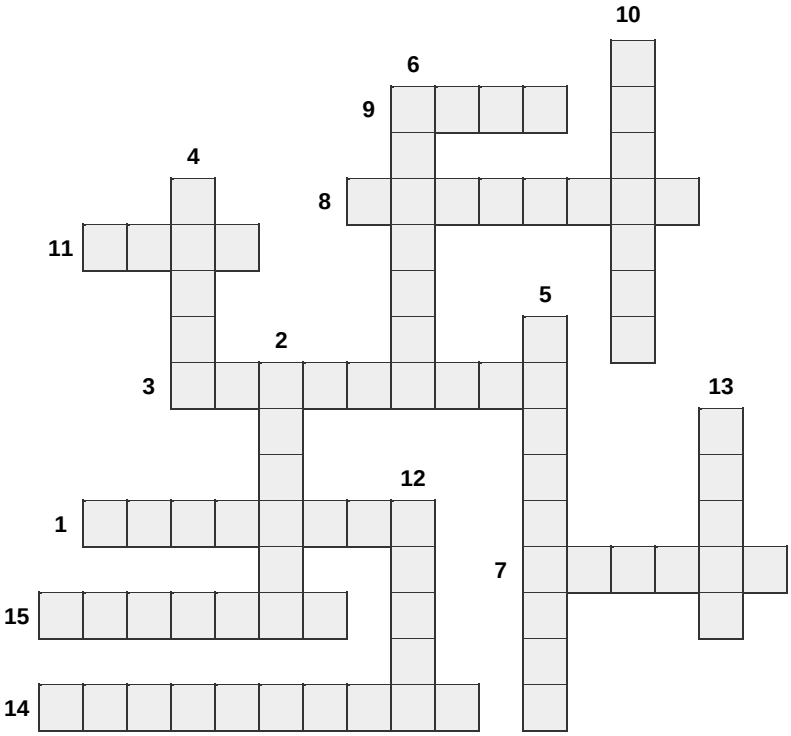


Fig. 6.1. Crossword

**Exercise 5. Match the words with the opposite meaning.**

| | |
|---|---|
| 1. to focus | a) kind |
| 2. work | b) to decrease |
| 3. to cut | c) to mean |
| 4. type | d) issue |
| 5. procedure | e) to concentrate |
| 6. general | f) process |
| 7. proper | g) job |
| 8. to reduce | h) appropriate |
| 9. radiation | i) slice |
| 10. problem | j) common |

**Exercise 6. Make up the word combinations from columns A and B and find their equivalents in C (table 6.2).**

Table 6.2

| A | B | C |
|---|---|---|
| coherence | marks | биологическая ткань |
| host | driver | ионизирующее излучение |
| light | identification | длина когерентности |
| laser | length | основной материал |
| biological | radiation | лазерное излучение |
| chemical | amplification | растяжки |
| light | material | лазерный драйвер |
| laser | tissue | световая волна |
| ionizing | wave | усиление света |
| stretch | emission | химическая идентификация |

**Exercise 7. Match the following English words and word combinations with their Russian equivalents.**

| | |
|---|---|
| 1. laser light | a) полупроводниковый лазер |
| 2. periodic wave | b) природный источник |
| 3. abnormal growth of cell | c) передача энергии |
| 4. chemical compounds | d) аномальный рост клеток |
| 5. natural source | e) периодическая волна |
| 6. narrow beam | f) химические соединения |
| 7. transmission of energy | g) узкий луч |
| 8. medical operation | h) медицинская операция |
| 9. semiconductor laser | i) лазерный луч |

**Exercise 8. Put the words in the correct order.**

1. laser / are / by / characterized / the / lasers / duration / of / emission.
2. people / medical / do / manufacturing / how / and / sensors / in / help / process / treatment?
3. beam / a / very / laser / has / tight / a / light.
4. role / medical / does / operations / laser / pivotal / technology / play / a / in?

5. to / propotion / lasers / conventional / procedures / greater / safe / alternative / of / a / become / effective / have / the / and / surgical.

6. emission / laser / acronym / radiation / amplification / of / an / stimulated / is / for / by / light.

7. light / the / one / wavelength / light / specific / of / contains.

8. teeth / lasers / many / an / treating / may / healthy / tool / problems / the / be / of / ideal / for / of.

9. areas / treated / beams / can / dental / on / lasers / infected /carries / shedding / be / by.

10. laser / powerful / are / a / force / beams?

**Exercise 9. Answer the following questions.**

1. What do medical lasers use?
2. What does the term “laser” stand for?
3. What does laser light have?
4. Is laser beam focused in a narrow beam and creates a very high-intensity light?
5. Can lasers focus very accurately on tiny areas?
6. What are medical lasers used for?
7. Do lasers allow the surgeon to accomplish more complex tasks?
8. What potential risks of laser surgery can you name?
9. Laser surgery uses non-ionizing radiation, does not it?
10. What should comply with radiation safety performance standards?

**Exercise 10. Make up the summary of the text in Exercise 2.**

The article is devoted to…
The paper deals firstly with the problem of…
Next the author tries to…
It must be emphasized that…
The author concludes that…
To my mind…
The paper is interesting (not interesting) …

**Exercise 11. Complete the sentences with the necessary preposition from the box.**

| on, from, to, with , of, by , in, for |
|---|

1. All the energy is concentrated **…** a narrow region.
2. The laser medium or gain medium is made **… …** the mixture of gases.
3. Semiconductor lasers do not belong **…** this category because these lasers are usually electrically pumped and involve different physical processes.
4. The glass tube filled **…** the mixture of gases acts as an active medium or laser medium.
5. A gas laser works **…** the principle of converting electrical energy **…** light energy.
6. The high-intensity high-power laser beam is suitable **…** tissue cutting.
7. Surgical removal **…** tissue … a laser is a physical process similar **…** industrial laser drilling.
8. A ruby laser consists **…** a ruby rod and two mirrors (one half-silvered).
9. The modern electronics industry relies heavily **…** the technological maturity, performance, and cost efficiency of semiconductor wafer processing methods, most notably silicon and gallium arsenide.
10. I am rather interested **…** making experiments **…** laser beams.
11. Lasers work is based **…** the principle of amplifying the light **…** a certain wavelength **…** the resonator cavity.

**Exercise 12. Divide the words into five columns according to their part of speech (table 6.3).**

Table 6.3

| Noun | Adjective | Pronoun | Adverb | Conjunction |
|---|---|---|---|---|
| | | | | |

Laser, and, emission, but, technology, precisely, so, narrow, bulb, before wavelength, conventional, if, device, just as, light, in fact, surgery

radiation, highly, or, beam, ideal, this, tissue, biological, accurately, chemical, bulb, our.

**Exercise 13. Read the sentences and translate them into Russian. Define the Gerundial Constructions.**

1. We know of laser being used in surgery.
2. Will they object my using the laser without asking for their permission?
3. The student does not mind my being helped.
4. We insist on their buying the solid-state laser.
5. Professor is interested in our completing the research.
6. Safety rules insist on acetylene being stored in the liquid state under pressure.
7. The professor objects to our carrying out the experiment.
8. They are interested in materials being produced without losses of energy.
9. We hear of new type of laser having been invented.
10. Nobody is surprised at his receiving the Nobel prize for his discoveries in medical lasers.
11. The inventor made a report on the laser being used in dental procedures.

**Exercise 14. Translate the following text into Russian in writing form.**

**Types of lasers**

A laser is a device which produces highly directional light. It emits light through a process called stimulated emission of radiation which increases the intensity of light.

A laser is different from conventional light sources in four ways: coherence, directionality, monochromacity, and high intensity.

The light waves of ordinary light sources have many wavelengths. Hence, the photons emitted by ordinary light sources are out of phase. Thus, ordinary light is incoherent.

On the other hand, the light waves of laser light have only one wavelength. Hence, all the photons emitted by laser light are in phase. Thus, laser light is coherent.

The light waves from laser contain only one wavelength or color so it is known as monochromatic light.

The laser beam is very narrow and can be concentrated on a very small area. This makes laser light highly directional.

The laser light spreads in a small region of space. Hence, all the energy is concentrated on a narrow region. Therefore, laser light has greater intensity than the ordinary light.

Lasers are classified into 4 types based on the type of laser medium used: solid-state laser, gas laser, liquid laser, semiconductor laser.

*Solid-state laser.* A solid-state laser is a laser that uses solid as a laser medium. In these lasers, glass or crystalline materials are used.

The first solid-state laser was a ruby laser. It is still used in some applications. In this laser, a ruby crystal is used as a laser medium.

In solid-state lasers, light energy is used as pumping source. Light sources such as flashtube, flash lamps, arc lamps, or laser diodes are used to achieve pumping.

Semiconductor lasers do not belong to this category because these lasers are usually electrically pumped and involve different physical processes.

*Gas laser.* A gas laser is a laser in which an electric current is discharged through a gas inside the laser medium to produce laser light. In gas lasers, the laser medium is in the gaseous state.

Gas lasers are used in applications that require laser light with very high beam quality and long coherence lengths.

In gas laser, the laser medium or gain medium is made up of the mixture of gases. This mixture is packed up into a glass tube. The glass tube filled with the mixture of gases acts as an active medium or laser medium.

A gas laser is the first laser that works on the principle of converting electrical energy into light energy. It produces a laser light beam in the infrared region of the spectrum at 1.15 μm.

Gas lasers are of different types: they are, Helium (He) – Neon (Ne) lasers, argon ion lasers, carbon dioxide lasers ($CO_2$ lasers), carbon monoxide lasers (CO lasers), hydrogen lasers, etc. The type of gas used to construct the laser medium can determine the lasers wavelength or efficiency.

*Liquid laser.* A liquid laser is a laser that uses the liquid as laser medium. In liquid lasers, light supplies energy to the laser medium.

A dye laser is an example of the liquid laser. A dye laser is a laser that uses an organic dye (liquid solution) as the laser medium.

A dye laser is made up of an organic dye mixed with a solvent. These lasers generate laser light from the excited energy states of organic dyes dissolved in liquid solvents. It produces laser light beam in the near ultraviolet (UV) to the near infrared (IR) region of the spectrum.

*Semiconductor laser*. Semiconductor lasers play an important role in our everyday life. These lasers are very cheap, compact size and consume low power. Semiconductor lasers are also known as laser diodes.

Semiconductor lasers are different from solid-state lasers. In solid-state lasers, light energy is used as the pump source whereas, in semiconductor lasers, electrical energy is used as the pump source.

In semiconductor lasers, a p-n junction of a semiconductor diode forms the active medium or laser medium. The optical gain is produced within the semiconductor material.

**Exercise 15. Video activity (https://www.youtube.com/watch?v=kn7JXDGpEfI).**

**Before you watch**

What is High Intensity Laser?
What do you know about High Intensity Laser?

***Match the English words with their Russian equivalents (table 6.4).***

Table 6.4

| | |
|---|---|
| coherent light | не инвазивно |
| wavelength | сухожилие |
| tissue | поглощение |
| healing | отражение |
| non-invasively | уменьшение отека |
| subcutaneous | исцеление |
| tendon | клеточный уровень |
| treated area | расширение сосудов |
| reflection | ткань |
| scattering | дыхательные ферменты |

End of the table 6.4

| | |
|---|---|
| absorption | фото акустический эффект |
| scatter coefficient | АТФ-синтеза |
| photoacoustic effect | когерентный свет |
| cellular level | перфузия крови |
| respiratory enzymes | РНК |
| ATP synthase | обработанная область |
| RNA | рассасывающийся |
| edema reduction | длина волны |
| vasodilation | коэффициент рассеяния |
| blood perfusion | рассеяние |
| resorbed | подкожный |

**While you watch**

***Watch the video and answer the questions.***

1. What does High Intensity Laser produce?
2. What can laser beam be used for?
3. How does High Intensity Laser penetrate the skin and spread?
4. What is photobiostimulation?
5. Can you list 3 key effects of therapeutic High Intensity Laser?
6. What makes it ideal for deep tissue penetration?
7. When are photoacoustic waves created?
8. What is biostimulation?
9. When is the thermic effect of High Intensity Laser therapy caused?

***Watch the video again and complete the gaps in the sentences.***

**nerve, human tissue, mitochondria, photoacoustic waves, key, application, photobiostimulation, oxygen, scatter coefficient, laser irradiation, waves**

1. Upon … of laser light on human tissue there are 4 different effects that occur.

2. The process through which laser heals the damaged tissue is called … .

3. … … is composed of various components of which the most important for laser irradiation are water, hemoglobin and melanin.

4. Their absorption as well as … … are different for different wavelength.

5. One of the … effects induced by the 1064nm High Intensity Laser beam is the photoacoustic effect.

6. … … are created when the area is irradiated by using very short pulses with high repetition rate.

7. Such mechanical … stimulate free … endings in the tissue and cause nearly instantaneous pain relief in the area.

8. … is processed in cells by mitochondria.

9. … are further stimulated to synthesize ATP faster by … … at 1064 mm.

**After you watch**

Discuss advantages and disadvantages of High Intensity Laser in groups.

## Unit 7

## PACEMAKERS

**Exercise 1. Learn the following words and word combinations and their meanings.**

1. Abdomen – брюшная полость.
2. Biventricular (adj) – бивентрикулярный (относящийся к обоим желудочкам).
3. Cardiac resynchronization therapy (CRT) – сердечная ресинхронизирующая терапия.
4. Chamber (n) – полость (сердца).
5. Chest (v) – грудная клетка.
6. Collarbone (n) – ключица.
7. Contraction – сокращение сердечной мышцы.
8. Electrophysiologist (n) – электрофизиолог.
9. Fainting – испытывать головокружения.
10. Fatigue – чрезмерная усталость, упадок сил.
11. Follow-up visit – контрольный визит.
12. Incision (n) – надрез, рассечение.
13. In-person – сам (лично), в личном порядке.
14. Lead (n) – электрод (в кардиостимуляции).
15. Moderate (adj) – умеренный (о физической нагрузке).
16. Nutrition (n) – питание, пища.
17. Pacemaker (n) – кардиостимулятор.
18. Prompt (v) – побуждать.
19. Rate (n) – ритм (сердца).
20. Relieve (v) – смягчать, ослаблять.
21. Resume (v) – возобновлять, продолжать.
22. Ventricle – желудочек сердца, головного мозга.

**Exercise 2. Read the text attentively and translate it into Russian. Check the abbreviations in Exercise 4.**

## Pacemakers

A pacemaker is a small device that's placed in the **chest** or **abdomen** to help control abnormal heart rhythms. This device uses electrical pulses to **prompt** the heart to beat at a normal **rate**.

**Pacemakers** are used to treat arrhythmias. A pacemaker can **relieve** some arrhythmia symptoms, such as **fatigue** and **fainting**. A pacemaker also can help a person who has abnormal heart rhythms **resume** a more active lifestyle.

Faulty electrical signaling in the heart causes arrhythmias. Pacemakers use low-energy electrical pulses to overcome this faulty electrical signaling.

*Types of Pacemakers.* Pacemakers have one, two or three wires. These can be placed in dif-ferent **chambers** of the heart, depending upon the patient's heart con-dition:

1. Single-chamber pacemakers have one **lead**. It will carry impulses from the pulse generator to an upper or lower chamber of the heart.
2. Dual-chamber pacemakers have two leads. They'll carry impulses to an upper chamber and a lower chamber, coordinating the timing of **contractions** made by these two chambers.
3. **Biventricular** pacemakers — also called **cardiac resynchronization therapy** (**CRT**) devices — have three leads. These leads will carry impulses to an upper chamber and both lower chambers (**ventricles**), ensuring that the ventricles contract at the same time.

*Pacemaker Implant Surgery.* Pacemakers most frequently are inserted through small **incisions** in the skin, near the **collarbone**. You receive a mild sedative, but you're kept awake; a local anesthetic is used. An **electrophysiologist** — a physician who specializes in heart rhythm problems — will perform the procedure.

After the incision is made, the pacemaker's leads are guided along a vein until they reach the heart. A large X-ray machine will help the doctor position the leads in place. Next, the tip of each lead is attached to the heart muscle. The doctor connects the leads to the pacemaker's pulse generator, which is placed in a pocket created beneath the skin in the upper chest.

With the pacemaker in place, the doctor will perform tests to ensure that the device is working properly. An artificially fast heart rhythm might be programmed to ensure that the leads are properly monitoring the heart and the pulse generator is correctly sending signals to stop the abnormal heart beat. Once testing is complete, the device is programmed to meet your needs.

*After Pacemaker Implant Surgery.* After surgery, you need to return to doctor for routine **follow-up visits**. The first appointment will be scheduled within six weeks of the device implant procedure.

During the first visit, the pacemaker will be checked by a programmer device that will indicate how the pacemaker is working. The pacemaker should be checked every three months from home, using a telephone transmitter. An annual **in-person** device check, along with an echocardiogram, may also be scheduled.

A pacemaker's battery typically lasts up to eight years. When the battery's voltage runs low, a new pacemaker will be implanted. However, in most cases, the device's leads will not require replacement.

Pacemaker therapy is part of a larger treatment program, which may include medications, proper **nutrition**, **moderate** physical activity and healthy lifestyle choices.

**Exercise 3. Find the English equivalents in B to the Russian words in A.**

| A | B | | |
|---|---|---|---|
| 1. ритм (сердца) | a) rhythm | b) depend | c) determine |
| 2. ослаблять (боль) | a) recover | b) visible | c) comparable |
| 3. приблизительно | a) typically | b) usually | c) roughly |
| 4. неисправный | a) faulty | b) junction | c) performance |
| 5. побуждать | a) depend | b) improve | c) realize |
| 6. хотя | a) hence | b) essentially | c) although |
| 7. часто | a) frequently | b) seldom | c) periodically |
| 8. умеренный (о физич. нагрузке) | a) moderate | b) suitable | c) comparable |
| 9. камера (сердца) | a) junction | b) chamber | c) compartment |
| 10. возобновлять | a) resume | b) remain | c) report |

**Exercise 4. Match the nouns in A with their definitions in B and the right Russian equivalents in C (table 7.1).**

Table 7.1

| A | B | C |
|---|---|---|
| collarbone | the area of the body located between the neck and the abdomen, containing the heart, the lungs and part of the aorta | брюшная полость |
| ventricle | the belly, that part of the body that contains all the structures between the chest and the pelvis | сокращение (мышечное) |
| incision | a horizontal bone above the first rib that makes up the front part of the shoulder | желудочек сердца |
| abdomen | the fact of heart muscle becoming smaller or shorter | ключица |
| contraction | a wound or scar made by a surgical cut | грудная клетка |
| chest | each of the two main spaces in the heart, left and right | надрез |

**Exercise 5. Divide the words into five columns according to their part of speech (table 7.2).**

Table 7.2

| Noun | Adjective | Pronoun | Adverb | Conjunction |
|---|---|---|---|---|
| | | | | |

Symptom, and, permanent, early, usually, or, surgery, that, twice, blood, double, but, unless, this, temporary, already, fast, wire, quickly, yet, rhythm, they, right, chamber, also, dual, it.

**Exercise 6. Using the definitions given below guess the words and cross them out in the word square.**

| D | I | A | C | I | P | E | J |
|---|---|---|---|---|---|---|---|
| A | P | T | I | E | F | R | U |
| R | H | I | F | N | O | R | N |
| N | O | O | F | C | A | M | C |
| O | T | N | E | Y | N | T | T |
| S | N | E | L | E | C | N | I |
| C | O | N | S | T | I | E | O |
| D | I | O | D | E | T | U | N |

1. A small, local, involuntary, muscular contraction, due to spontaneous activation of single muscle cells or muscle fibers.

2. A small device that's placed in the chest or abdomen to help control abnormal heart rhythms.

3. Any feeling of illness or physical or mental change that is caused by a particular disease.

4. The regular movement or sound that the heart makes as it sends blood around your body.

5. A pathological condition in which the heart rate, rhythm and sequence of heartbeats are disturbed.

6. A medicine, or a sort of medicines or drugs, used to improve a particular condition or illness.

7. A chemical element that is a gas with no smell or colour.

**Exercise 7. Say if the following sentences are true or false. Correct the false ones.**

1. Pacemakers use electrical pulses to prompt the heart to beat at a normal rate.

2. Pacemakers are used to treat cephalalgia.

3. Faulty electrical signaling in the heart causes arrhythmias.

4. New pacemakers can monitor your blood temperature, breathing, and other factors.

5. The pacemaker's computer doesn't record your heart's electrical activity and heart rhythm.

6. A pacemaker can be placed only in one chamber of the heart.

7. A defibrillator is programmed by an electrophysiologist, a cardiac physician specializing in heart rhythms.

8. Single-chamber pacemakers have two leads.

9. Pacemakers are frequently inserted through small incisions in the skin, near the collarbone.

**Exercise 8. Make up the summary of the text in Exercise 2.**

The text is under the headline …
The text deals with …
It is pointed out that …
Much attention is given to …
Further the author says that …
I think this text is …

**Exercise 9. Form adjectives from the following nouns.**

| **Noun** | **Adjective** |
|---|---|
| 1. detection | a) … |
| 2. change | b) … |
| 3. frequency | c) … |
| 4. difference | d) … |
| 5. electricity | e) … |
| 6. activity | f) … |
| 7. connection | g) … |
| 8. structure | h) … |
| 9. dependence | i) … |
| 10. health | j) … |
| 11. base | k) … |
| 12. physics | l) … |

**Exercise 10. Unjumble the letters to make the words from the text.**

| | |
|---|---|
| 1. tntaremte | t _____ |
| 2. gurysre | s _____ |
| 3. rehta | h _____ |
| 4. pluiems | i _____ |
| 5. hrytmh | r _____ |
| 6. ibntgreha | b _____ |
| 7. oisincin | i _____ |

8. rtemueratpe t _____
9. acrcaid c_____
10. trocncat c_____
11. ulcmse m_____
12. mcreabh c_____

**Exercise 11. Restore the original sentences and translate them.**

1. Permanent / can / or / pacemakers / temporary / be.
2. The / connect / the / generator / wires / to / heart / the.
3. Temperature / other / pacemakers / monitor / breathing / can / factors / your / and / blood.
4. Have / two / three / a / leads / may / pacemaker / one / or.
5. Level / adjust / activity / signals / your / electrical / to.
6. Is / the / each / tip / heart / to / attached / muscle / the / of / lead.
7. Lasts / battery / years / up / pacemaker's / eight / to / typically / a.

**Exercise 12. Think of the questions using the following sentences.**

1. A pacemaker can be programmed to regulate the heart's upper chambers (atria), lower chambers (ventricles) or both.
What _____?
What purpose _____?
2. Electrical signals are transmitted to the heart only when it beats too slowly or skips a beat.
When _____?
What _____?
3. Pacemakers' wires can be placed in different chambers of the heart, depending upon the patient's heart condition.
Where_____?
What _____?
4. Rate-responsive pacing is more popular simply because the target heart rate can change from moment to moment, based on your body movements and breathing.
Why _____?
What's the name_____?
5. A pacemaker's battery typically lasts up to eight years.
Does _____?
How long _____?

**Exercise 13. Read the sentences and translate them into Russian. Define the Gerund functions.**

1. This medical device is capable of exchanging oxygen and carbon dioxide in the blood.
2. The machine replaces both the heart's pumping action and the lungs' gas exchange function.
3. Although the effects of heparin are reversible by administering protamine, there are a number of side effects associated with this.
4. The target of rate-responsive pacing is normal breathing and proper body movements.
5. This defibrillator needs repairing.
6. He insisted on taking these medications in the medical therapy.
7. Lifting this heavy weight is impossible without necessary appliances.
8. One of the effects of heat is changing a solid into liquid.
9. The faulty electrical device needs replacing.
10. An electrophysiologist can adjust your pacemaker by using these records, so it works better for you.
11. The pulses help coordinate the timing of the two chambers' contractions.

**Exercise 14. Translate the following text into Russian in writing.**

**Oxygenator**

An *oxygenator* is a medical device that is capable of exchanging oxygen and carbon dioxide in the blood of human patient during surgical procedures that may necessitate the interruption or cessation of blood flow in the body, a critical organ or great blood vessel. These organs can be the heart, lungs or liver, while the great vessels can be the aorta, pulmonary artery, pulmonary veins or vena cava. An oxygenator is typically utilized by a perfusionist in cardiac surgery in conjunction with the heart-lung machine. However, oxygenators can also be utilized in extracorporeal membrane oxygenation in neonatal intensive care units by nurses.

For most cardiac operations such as coronary artery bypass grafting, the cardiopulmonary bypass is performed using a heart-lung machine (or cardiopulmonary bypass machine). The heart-lung machine serves to

replace the work of the heart during the open bypass surgery. The machine replaces both the heart's pumping action and the lungs' gas exchange function. Since the heart is stopped during the operation, this permits the surgeon to operate on a bloodless, stationary heart.

One component of the heart-lung machine is the oxygenator. The oxygenator component serves as the lung, and is designed to expose the blood to oxygen and remove carbon dioxide. It is disposable and contains about 2–4 m² of a membrane permeable to gas but impermeable to blood, in the form of hollow fibers. Blood flows on the outside of the hollow fibers, while oxygen flows in the opposite direction on the inside of the fibers. As the blood passes through the oxygenator, the blood comes into intimate contact with the fine surfaces of the device itself. Gas containing oxygen and medical air is delivered to the interface between the blood and the device, permitting the blood cells to absorb oxygen molecules directly.

## Unit 8

## ECHOCARDIOGRAM

**Exercise 1. Learn the following words and word combinations and their meanings.**

1. Allergies (n) – аллергия.
2. Aortic aneurysm – аневризм аорты.
3. Bounce off (v) – отражаться от.
4. Cardiologist (n) – кардиолог.
5. Chest (n) – грудь.
6. Conductive gel – проводящий гель.
7. Congenital heart disease – врожденный порок сердца.
8. Coronary artery – коронарная артерия.
9. Echocardiogram (n) – эхокардиограмма.
10. Echo machine (n) – эхо-машина.
11. Eject (v) – выбрасывать.
12. Ejection fraction – фракция выброса.
13. Emanating (adj) – исходящий.
14. Housed (adj) – размещенный.
15. Iodine (n) – йод.
16. Mitral valve prolapse – пролапс митрального клапана.
17. Myocarditis (n) – миокардит.
18. Neat trick – ловкий трюк.
19. Plain speak – прямолинейно говорите.
20. Prolapse (n) – пролапс.
21. Related structures – связанные структуры.
22. Sonar (n) – гидролокатор.
23. Sonogram (n) – сонограмма.
24. Transducer (n) – датчик.
25. Tumor (n) – опухоль.
26. Valve abnormalities – аномалии клапанов.
27. Wave (n) – волна.

**Exercise 2. Read the text attentively and translate it into Russian.**

## Echocardiogram

An **echocardiogram** or echo for short, is a powerful tool used primarily by **cardiologists** to evaluate the heart's structure and function. An echocardiogram is a type of **sonogram** which means that it uses sound **waves** to take pictures of your heart and **related structures**. The system is very similar to **sonar** on a submarine. The echo machine sends out sound waves in short bursts through a special wand called a transducer. The **transducer** transmits the sound waves through a **conductive gel** placed on your chest. The **echo machine** waits for the sound waves **bounce off** structures and return to the transducer. The timing and pattern of the returning sound waves is converted to electricity and transmitted to the computer **housed** within the echo machine. Through a combination of equal parts science and magic the information is converted into a 2-dimensional moving picture. There are several things that your doctor will be looking for when they review your echocardiogram. The first thing will be the **ejection fraction**. The ejection fraction (EF) represents the percentage of blood that the heart **ejects** with each heartbeat. Although this method does not actually measure the strength of the heart muscle, it does an amazing job at giving us an estimate of how effective the heart is supplying blood to the remainder of the body. As a general rule, the higher the ejection fraction the more effectively your heart is working. As with everything in life there are exceptions. Another **neat trick** is the identification of portions of the heart muscle that are not as active as they should be. This can be suggestive of other problems like **coronary artery** disease or **myocarditis**, a type of infection. We can also look for **aortic aneurysms**, **mitral valve prolapses**, **congenital heart disease**, **tumors**, etc.

The echocardiogram is also equipped with a Doppler function. The Doppler effect is the change in the frequency of a periodic event by an observer moving relative to its source. What does this mean in **plain speak**? If there is a sound **emanating** from a source, an ambulance for instance, the frequency (pitch) of the siren will change depending upon whether the ambulance is driving towards you or away from you. We have all experienced this phenomenon. The echocardiogram uses this physical principle to its advantage. We can tell which direction blood is traveling throughout the heart and how fast that blood is traveling. This

helps us determine whether you are having specific **valve abnormalities**. For more complicated cases 3-dimensinoal imaging may be helpful. The same echocardiographic principles can be used to construct a 3D image to allow your physician to more completely evaluate your heart structures. Three dimensional imaging is not always necessary but sometimes it can be invaluable. The decision may be made to give you contrast. Echo contrast is like turning on the lights in a dark room. This contrast does not have **iodine** so you do not have to worry about **allergies**.

**Exercise 3. Complete the table 8.1 with the international words from the text according to their stress pattern and translate them into Russian.**

Cardiologist, echocardiogram, sonogram, prolapse, submarine, system, gel, machine, electricity, effect, structure, combination, energy, computer, information, phenomenon.

Table 8.1

| 1 ●○ | 2 ○● | 3 ○●○ | 4○●○○ | 5 ○○●○ | 6 ○○●○○ | 7 ○●○○○ |
|---|---|---|---|---|---|---|
| | | | | | | |

**Exercise 4. Using the definitions given below guess the crossword (fig. 8.1).**

**Across:**

1. It has been defined phenomenologically as a soft, solid or solid-like material consisting of two or more components, one of which is a liquid, present in substantial quantity.
3. It is also used for the equipment used to generate and receive the sound.
5. It is an abnormal condition of an organism that impairs the organism's function in whole or in part and is identified by characteristic signs or symptoms.
8. It is the front part of the torso.
9. A person who is skilled in the science of medicine a person who is trained and licensed to treat sick and injured people.
10. He is a physician who specializes in finding, treating, and preventing diseases that affect the heart, the arteries, and the veins.

12. There is a transfer of energy from one point to another without the transfer of any material between the two points.

**Down:**

2. It is defined as a device that senses non-electrical variation signals and shows it in an electrical form.

4. It is a specialized watercraft that can operate underwater at very high pressures beyond the range of unaided human survivability.

6. It is a machine for manipulating data according to a list of instructions.

7. It is continually refining and expanding our knowledge of the universe, and as it does, it leads to new questions for future investigation.

11. It is a type of medical imaging of the heart, using standard ultrasound or Doppler ultrasound.

13. It is composed of smooth muscle. It has four chambers which contract in a specific order.

14. It is the image generated during ultrasonography, which is a diagnostic imaging technique that uses ultrasound to visualize anything inside the body.

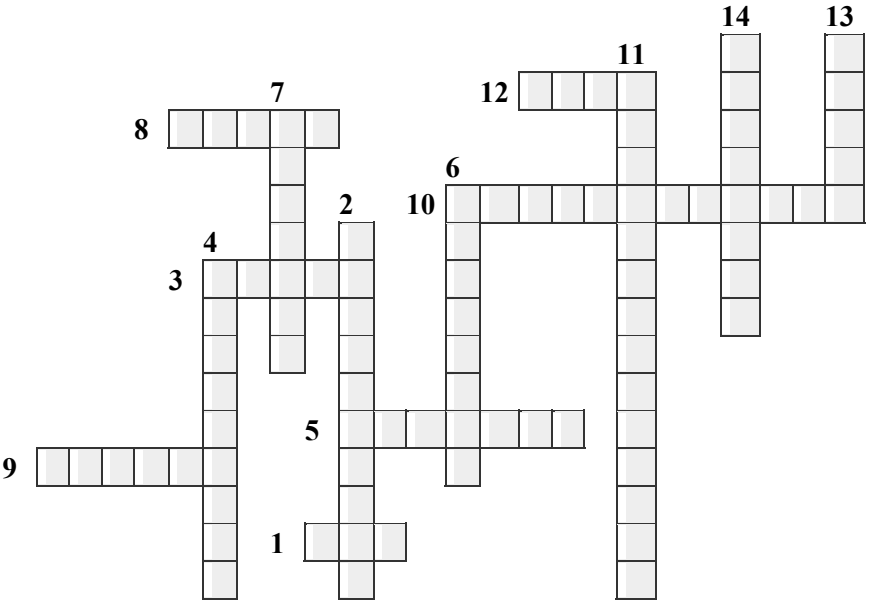


Fig. 8.1. Crossword

**Exercise 5. Match the words with the opposite meaning.**

| | |
|---|---|
| 1. short | a) calmness |
| 2. powerful | b) power |
| 3. primarily | c) slow |
| 4. similar | d) usual |
| 5. transmit | e) long |
| 6. strength | f) powerless |
| 7. amazing | g) derange |
| 8. active | h) carry |
| 9. equip | i) different |
| 10. worry | j) secondarily |

**Exercise 6. Make up the word combinations from columns A and B and find their equivalents in C (table 8.2).**

Table 8.2

| A | B | C |
|---|---|---|
| mitral valve | imaging | врожденный порок сердца |
| sophisticated and advanced | vessels | пролапс митрального клапана |
| single-dimension | images | одномерные изображения |
| ultrasound | gel | современные и передовые изображения |
| blood | condition | двумерное (2-D) эхо |
| echocardiography | test | кровеносные сосуды |
| sticky patches | beams | эхокардиографический тест |
| colorless | or electrodes | липкие пластыри или электроды |
| two-dimensional (2-D) | Echo | бесцветный гель |
| congenital heart | prolapse | ультразвуковые лучи |

**Exercise 7. Match the following English words and word combinations with their Russian equivalents.**

| | |
|---|---|
| 1. heart attack | a) боль в груди |
| 2. myocardial infarction | b) аппарат для эхокардиографии |

| | |
|---|---|
| 3. mitral valve prolapse | c) сердечная мышца |
| 4. chest pain | d) диагностическое эхо |
| 5. arterial disease | e) пролапс митрального клапана |
| 6. echocardiography machine | f) инфаркт миокарда |
| 7. conductive gel | g) врожденный порок сердца |
| 8. heart muscle | h) ишемическая болезнь сердца |
| 9. coronary artery disease | i) проводящий гель |
| 10. diagnostic echo | j) сердечный приступ |
| 11. congenital heart disease | k) артериальное заболевание |

**Exercise 8. Mark the following phrases S (if they both mean the same) and D (if they are different).**

| | |
|---|---|
| 1. first / one | S / D |
| 2. usual / common | S / D |
| 3. majority/ most | S / D |
| 4. fourthly / fourfold | S / D |
| 5. hardly / ever | S / D |
| 6. triply / three times | S / D |
| 7. nine / ninety | S / D |

**Exercise 9. Answer the following questions.**

1. What is an echocardiogram?
2. What waves does an echocardiogram use to take pictures of your heart and related structures?
3. The system is very similar to sonar on a submarine, is not it?
4. What does the echo machine use to send out sound waves?
5. Does the transducer transmit the sound waves through a conductive gel placed on your chest?
6. Is the timing and pattern of the returning sound waves converted to electricity and transmitted to the computer housed within the echo machine?
7. How is the information converted into a 2-dimensional moving picture?
8. What is your doctor looking for when he reviews your echocardiogram?
9. When does your heart work more effectively?

10. What is the echocardiogram also equipped with?
11. What is the Doppler effect?
12. Is three dimensional imaging always necessary?

**Exercise 10. Make up the summary of the text in Exercise 2.**

The discussed article is …
The article contains … parts.
The theme of the article is …
The author considers the problem of …
It is notable that …
The purpose of the article is to provide …
In conclusion the author …

**Exercise 11. Complete the sentences with the necessary preposition from the box.**

| **on, from, to, of, in, for, through, up of, at** |
|---|

1. Depending **…** what information your doctor needs, you may have one **…** several types of echocardiograms.
2. Many patients find it useful to understand the images and what the doctor is looking **….**
3. This can occur due **…** tissue damage from a prior heart attack or coronary artery disease.
4. There are several types **…** echocardiograms and the doctor will choose which one to do based **…** what information they want to have.
5. The transducer projects ultrasound … your body.
6. This lets the doctor get pictures … a different angle than the transthoracic echocardiogram.
7. Sound is made … … several different frequency waves
8. In many cases, the diagnosis can be made … the basis of history, physical examination and blood tests.
9. Transthoracic echocardiogram is a noninvasive way to look … blood flow through the heart and heart valves.

**Exercise 12. Divide the words into five columns (table 8.2) according to their part of speech.**

| Noun | Adjective | Pronoun | Adverb | Conjunction |
|---|---|---|---|---|
| | | | | |

He, gel, in addition, powerful, then, echocardiogram, amazing, fast, it, neither … nor, tissue, image, soon, us, beautiful, sonar, in order to, them, yet, effective, valve, our, extremely, transducer, for, general, infection, me, so, obviously, test, power, all, his, disease, in fact effect, well, conductive.

**Exercise 13. Read the sentences and translate them into Russian. Define the Participial Construction.**

1. The students observed the doctor making an echocardiogram.
2. An experiment was carried out yesterday, new equipment being used.
3. This group of researchers is believed experimenting with a new type of an echo machine.
4. The analysis of the new data having been carried out, the researchers made an interesting report.
5. The scientist is considered applying advanced methods of research.
6. I would like to have ultrasound machine fixed.
7. The device is assumed having many faults.
8. The experiments having been carried out, the students started a new series of tests.
9. I would like to have an echo machine prepared.
10. We consider the echocardiogram being equipped with a Doppler function.
11. An echocardiogram is a test, ultrasound being used to examine the heart.

**Exercise 14. Translate the following text into Russian in writing form.**

What is an Echocardiogram? An echocardiogram is a test in which ultrasound is used to examine the heart. The equipment is far superior to that used by fishermen. In addition to providing single-dimension

images, known as M-mode echo that allows accurate measurement of the heart chambers, the echocardiogram also offers far more sophisticated and advanced imaging. This is known as two- dimensional (2-D) Echo and is capable of displaying a cross-sectional "slice" of the beating heart, including the chambers, valves and the major blood vessels that exit from the left and right ventricle.

An echocardiogram can be obtained in a physician's office or in the hospital. For a resting echocardiogram no special preparation is necessary. Clothing from the upper body is removed and covered by a gown or sheet to keep you comfortable and maintain the privacy of females. The patient then lies on an examination table or a hospital bed.

Sticky patches or electrodes are attached to the chest and shoulders and connected to electrodes or wires. These help to record the electrocardiogram (EKG or ECG) during the echocardiography test. The EKG helps in the timing of various cardiac events (filling and emptying of chambers). A colorless gel is then applied to the chest and the echo transducer is placed on top of it. The echo technologist then makes recordings from different parts of the chest to obtain several views of the heart. You may be asked to move form your back and to the side. Instructions may also be given for you to breathe slowly or to hold your breath. This helps in obtaining higher quality pictures. The images are constantly viewed on the monitor. It is also recorded on photographic paper and on videotape. The tape offers a permanent record of the examination and is reviewed by the physician prior to completion of the final report.

## SUPPLEMENTARY TEXTS FOR READING AND TRANSLATING

### Doppler and Echocardiography Examination

What is a Doppler Examination? Doppler is a special part of the ultrasound examination that assess blood flow (direction and velocity). In contrast, the M-mode and 2-D Echo evaluates the size, thickness and movement of heart structures (chambers, valves, etc.). During the Doppler examination, the ultrasound beams will evaluate the flow of blood as it makes it way though and out of the heart. This information is presented visually on the monitor (as color images or grayscale tracings and also as a series of audible signals with a swishing or pulsating sound).

What information does Echocardiography and Doppler provide? Echocardiography is an invaluable tool in providing the doctor with important information about the following:

Size of the chambers of the heart, including the dimension or volume of the cavity and the thickness of the walls. The appearance of the walls may also help identify certain types of heart disease that predominantly involve the heart muscle. In patients with long standing hypertension or high blood pressure, the test can determine the thickness and "stiffness" of the LV walls. When the LV pump function is reduced in patients with heart failure, the LV and RV tends to dilate or enlarge. Echocardiography can measure the severity of this enlargement. Serial studies performed on an annual basis can gauge the response of treatment.

Pumping function of the heart can be assessed by echocardiography. One can tell if the pumping power of the heart is normal or reduced to a mild or severe degree. This measure is known as an ejection fraction or EF. A normal EF is around 55 to 65 %. Numbers below 45 % usually represent some decrease in the pumping strength of the heart, while numbers below 30 to 35 % are representative of an important decrease.

Echocardiography can also identify if the heart is pumping poorly due to a condition known as cardiomyopathy (pronounced cardio-myo-puth-e), or if one or more isolated areas have depressed movement (due to prior heart attacks). Thus, echocardiography can assess the pumping ability of each chamber of the heart and also the movement of each visualized wall. The decreased movement, in turn, can be graded from mild to severe. In extreme cases, an area affected by a heart attack may have no move-

ment (akinesia, pronounced a-kine-neez-ya), or may even bulge in the opposite direction (dyskinesia, pronounced dis-kine-neez-ya). The latter is seen in patients with aneurysm (pronounced an-new-riz-um) of the left ventricle or LV. It must be remembered that LV aneurysm due to an old heart attack does not usually rupture or "burst".

The top diagram on the monitor shows an ultrasound beam (gray triangular area) traveling through the right (RV) and left (LV) ventricle. You can also see the aorta (Ao), left atrium (LA), aortic valve (AV) and mitral valve (MV). Please note that you can review cardiac anatomy and physiology by clicking here. The two pictures on the bottom of the monitor were taken from actual patients. The arrows point to the septum or partition between the RV and LV. The lower left picture demonstrates normal movement of the septum as it moves towards the opposite wall of the LV when the heart contracts. In contrast, the patient on the bottom right has had a heart attack involving the septum. Note that the septum moves sluggishly. Also, it is thinner and "shriveled" as a result of the heart attack.

## Approaches and tools of biotechnology

In the early years, the main achievement of biotechnology was the ability to produce naturally occurring therapeutic molecules in larger quantities than could be derived from conventional sources such as plasma, animal organs, and human cadavers. Recombinant proteins are also less likely to be contaminated with pathogens or to provoke allergic reactions. Today, biotechnology researchers seek to discover the root molecular causes of disease and to intervene precisely at that level. Sometimes this means producing therapeutic proteins that augment the body’s own supplies or that make up for genetic deficiencies, as in the first generation of biotech medications.

The biotechnology industry has also expanded its research into the development of traditional pharmaceuticals and monoclonal antibodies that stop the progress of a disease. Successful production of monoclonal antibodies was one of the most important techniques of biotechnology to emerge during the last quarter of the 20th century. The specificity of monoclonal antibodies and their availability in quantity have made it possible to devise sensitive assays for an enormous range of biologically important substances and to distinguish cells from one another by identifying previously unknown marker molecules on their surfaces.

Such advances were made possible through the study of genes, the proteins that they encode (proteomics), and the larger biological pathways in which they act.

## Applications of biotechnology

Biotechnology has numerous applications, particularly in medicine and agriculture. Examples include the use of biotechnology in merging biological information with computer technology (bioinformatics), exploring the use of microscopic equipment that can enter the human body (nanotechnology), and possibly applying techniques of stem cell research and cloning to replace dead or defective cells and tissues (regenerative medicine). Companies and academic laboratories integrate these disparate technologies in an effort to analyze downward into molecules and also to synthesize upward from molecular biology toward chemical pathways, tissues, and organs.

In addition to being used in health care, biotechnology has proved helpful in refining industrial processes through the discovery and production of biological enzymes that spark chemical reactions (catalysts); for environmental cleanup, with enzymes that digest contaminants into harmless chemicals and then die after consuming the available "food supply"; and in agricultural production through genetic engineering.

Agricultural applications of biotechnology have proved the most controversial. Some activists and consumer groups have called for bans on genetically modified organisms (GMOs) or for labeling laws to inform consumers of the growing presence of GMOs in the food supply. In the United States, the introduction of GMOs into agriculture began in 1993, when the FDA approved bovine somatotropin (BST), a growth hormone that boosts milk production in dairy cows. The next year, the FDA approved the first genetically modified whole food, a tomato engineered for a longer shelf life. Since then, regulatory approval in the United States, Europe, and elsewhere has been won by dozens of agricultural GMOs, including crops that produce their own pesticides and crops that survive the application of specific herbicides used to kill weeds.

Studies by the U.S. National Academy of Sciences, the European Union, the American Medical Association, U.S. regulatory agencies, and other organizations have found GMO foods to be safe, but skeptics contend that it is still too early to judge the long-term health

and ecological effects of such crops. In the late 20th and early 21st centuries, the land area planted in genetically modified crops increased dramatically, from 1.7 million hectares (4.2 million acres) in 1996 to 180 million hectares (445 million acres) by 2014. By 2014–2015 about 90 percent of the corn, cotton, and soybeans planted in the United States were genetically modified. The majority of genetically modified crops were grown in the Americas.

Overall, the revenues of U.S. and European biotechnology industries roughly doubled over the five-year period from 1996 through 2000. Rapid growth continued into the 21st century, fueled by the introduction of new products, particularly in health care. By 2020 the biotechnology market size was estimated at $752.88 billion globally, with new opportunities for growth emerging in particular from government- and industry-driven efforts to accelerate drug development and product-approval processes.

## Genetically Engineered Insulin

Have you ever come across a diabetic who needs regular insulin injections? Where do you think this artificial insulin comes from? It is a product of biotechnology applications in the field of medicine. Let's learn about these biotechnology applications in detail.

Earlier, diabetes was treated using insulin from the pancreas of slaughtered pigs and cattle. Do you think this insulin causes any side-effects in humans? Yes! Insulin from animal sources induces allergies and other unwanted immune reactions in humans. This is why there was a need to isolate human insulin. Is there a way to do this? What if we can use bacteria to produce human insulin? Not only can we grow bacteria in large amounts, but we can also mass-produce human insulin!

Insulin consists of two short, polypeptide chains – chain A and B, linked via disulfide bridges. Insulin is produced as a 'prohormone' in mammals (including humans). This prohormone has an extra peptide, the C peptide, which needs to be removed to give rise to mature insulin.

The major challenge while generating human insulin is to assemble insulin into its mature form. An American company called 'Eli Lilly' overcame this hurdle in 1983. They prepared two DNA sequences that correspond to the A and B chains of human insulin. They then incorporated these sequences into plasmids of *E.* Coli to generate insulin chains. Further, they produced the chains separately, extracted and combined them by creating disulfide bonds to give rise to human insulin.

## Optical medical devices

Optical medical devices use light to detect, diagnose, or treat disease or injury. Often, these devices also involve coordinated motion – focusing or scanning the light, for example, while squeezing or stretching tissue. The safety, efficacy, and reliability of these devices requires specialized and careful design, construction, and alignment. Ergonomic and clinical considerations that constrain the size and shape of the device can further complicate the design and manufacturing process.

There are many hurdles on the way from concept to commercially successful medical device. They can be either milestone achievements that add value to the device and the enterprise (often in the form of investment that allows continued development) or stumbling blocks. The same experience and expertise with medical optical systems that is vital to the safety and efficacy of the device is also vital to the success of the product development effort as a whole:

Early on, speed of development is critical as the basic science and technology are proven out and refined. But even then, fragile or unstable test devices can delay progress and confuse results.

As more prototypes are developed and tested, stability and consistency from unit-to-unit becomes more important. Also, design decisions made at this time are increasingly difficult to change later and have a more significant impact on the viability of the eventual device.

Most of these innovative and sensitive devices will require clinical trials for validation, which will hinge on the stability and reliability of the optics and mechanisms when exposed to shipping and handling; a less controlled environment; and extended use for the first time.

In production, an optical medical device that was not designed with alignment, fixturing, and tooling in mind will be difficult for non-specialists to build, align, and test. The device will have already been through verification and validation, so only marginal improvements can be made using external tooling and fixtures without invalidating the design. Yield may suffer and it will be difficult to scale production.

## What of the Future and Concerns Surrounding Nanomaterials?

Recent years have seen an explosion in the number of studies showing the variety of medical applications of nanotechnology and nano-

materials. In this article we have glimpsed just a small cross-section of this vast field. However, across the range, there exist considerable challenges, the greatest of which appear to be how to scale up production of materials and tools, and how to bring down costs and timescales. But another challenge is how to quickly secure public confidence that this rapidly expanding technology is safe. And so far, it is not clear whether that is being done.

There are those who suggest concerns about nanotechnology may be over-exaggerated. They point to the fact that just because a material is nanosized, it does not mean it is dangerous, indeed nanoparticles have been around since the Earth was born, occurring naturally in volcanic ash and sea-spray, for example. As byproducts of human activity, they have been present since the Stone Age, in smoke and soot.

Of attempts to investigate the safety of nanomaterials, the National Cancer Institute in the US says there are so many nanoparticles naturally present in the environment that they are "often at order-of-magnitude higher levels than the engineered particles being evaluated". In many respects, they point out, "most engineered nanoparticles are far less toxic than household cleaning products, insecticides used on family pets, and over-the-counter **dandruff** remedies," and that for instance, in their use as carriers of chemotherapeutics in cancer treatment, they are much less toxic than the drugs they carry.

It is perhaps more in the food sector that we have seen some of the greatest expansion of nanomaterials on a commercial level. Although the number of foods that contain nanomaterials is still small, it appears set to change over the next few years as the technology develops. Nanomaterials are already used to lower levels of fat and sugar without altering taste, or to improve packaging to keep food fresher for longer, or to tell consumers if the food is spoiled. They are also being used to increase the bioavailablity of nutrients (for instance in food supplements). But, there are also concerned parties, who highlight that while the pace of research quickens, and the market for nanomaterials expands, it appears not enough is being done to discover their toxicological consequences.

This was the view of a science and technology committee of the House of Lords of the British Parliament, who in a recent report on nanotechnology and food, raise several concerns about nanomaterials and human health, particularly the risk posed by ingested nanomaterials. For instance, one area that concerns the committee is the size and excep-

tional mobility of nanoparticles: they are small enough, if ingested, to penetrate cell membranes of the lining of the gut, with the potential to access the brain and other parts of the body, and even inside the nuclei of cells.

Another is the solubility and persistence of nanomaterials. What happens, for instance, to insoluble nanoparticles? If they can't be broken down and digested or degraded, is there a danger they will accumulate and damage organs? Nanomaterials comprising inorganic metal oxides and metals are thought to be the ones most likely to pose a risk in this area.

Also, because of their high surface area to mass ratio, nanoparticles are highly reactive, and may for instance, trigger as yet unknown chemical reactions, or by bonding with toxins, allow them to enter cells that they would otherwise have no access to. For instance, with their large surface area, reactivity and electrical charge, nanomaterials create the conditions for what is described as "particle aggregation" due to physical forces and "particle agglomoration" due to chemical forces, so that individual nanoparticles come together to form larger ones. This may lead not only to dramatically larger particles, for instance in the gut and inside cells, but could also result in disaggregation of clumps of nanoparticles, which could radically alter their physicochemical properties and chemical reactivity. "Such reversible phenomena add to the difficulty in understanding the behaviour and toxicology of nanomaterials," says the committee, whose overall conclusion is that neither Government nor the Research Councils are giving enough priority to researching the safety of nanotechnology, especially "considering the timescale within which products containing nanomaterials may be developed".

They recommend much more research is needed to "ensure that regulatory agencies can effectively assess the safety of products before they are allowed onto the market". It would appear, therefore, whether actual or perceived, the potential risk that nanotechnology poses to human health must be investigated, and be seen to be investigated. Most nanomaterials, as the NCI suggests, will likely prove to be harmless. But when a technology advances rapidly, knowledge and communication about its safety needs to keep pace in order for it to benefit, especially if it is also to secure public confidence. We only have to look at what happened, and to some extent is still happening, with genetically modified food to see how that can go badly wrong.

## TRANSCRIPTS

### Unit 2, exercise 15

In 1895 a physicist named Wilhelm Roentgen was doing experiments with a cathode tube, a glass container in which a beam of electrons lights up a fluorescent window. He had wrapped cardboard around the tube to keep the fluorescent light from escaping, when something peculiar happened. Another screen outside the tube was glowing. In other words, invisible rays had passed through the cardboard. Wilhelm no idea what rays were, so he called them X-rays and his discovery eventually won him a Nobel Prize. Here is what we now know was happening. When high energy electrons in the cathode tube hit a metal component, they either got slowed down and released extra energy, or kicked off electrons from the atoms they hit, which triggered a reshuffling that again released energy. In both cases, the energy was emitted in the form of X-rays, which is a type of electromagnetic radiation with higher energy than visible light, and lower energy, than Gamma rays. X-rays are powerful enough to fly through many kinds of matter as if they are semi-transparent and they are particularly useful for medical applications because they can make images of organs, like bones, without harming them, although they do have a small chance of causing mutations in reproductive organs, and tissues like the thyroid, which is why lead aprons are often used to block them. When X-rays interact with matter, they collide with electrons. Sometimes, the X-rays transfers all of its energy to the matter and gets absorbed. Other times, it only transfers some of its energy, and the rest is scattered. The frequency of these outcomes depends on how many electrons the X-rays are likely to hit. Collisions are more likely if a material is dense, or if it is made of elements with higher atomic numbers, which means more electrons. Bones are dense and full of calcium, which has a relatively high atomic number, so they absorb X-rays pretty well. Soft tissue, on the other hand, is not as dense, and contains mostly lower atomic number elements, like carbon, hydrogen, and oxygen. So more of the X-rays penetrate tissues like lungs and muscles, darkening the film. These 2-D pictures are only useful up to a point, though. When X-rays travel through the body, they can interact with many atoms along the path. What is recorded on the film reflects the sum of all those interactions. It is like trying to print 100 pages of a novel on

a single sheet of a paper. To see what is really going on you would have to take X-rays views from many angles around the body and use them to construct an internal image. And that is something doctors do all the time in a procedure called a CT, Computed Tomography scan, another Nobel Prize winning invention. Think of CT like this with just one X-ray, you might be able to see the density change due to a solid tumor in a patient, but you would not know how deep it is beneath surface. However, if you take X-rays from multiple angles, you should be able to find the tumor's position and shape. A CT scanner works by sending a fan or cone of X-rays through a patient to an array of detectors. The X-ray beam is rotated around the patient, and often also moved down the patient's body, with the X-ray source tracing a spiral trajectory. Spiral CT scans produce date that can be processed into cross sections detailed enough to spot anatomical features, tumors, blood clots, and infections. CT scans can even detect heart disease and cavities in mummies buried thousands years ago. So what began as Roentgens happy accident has become medical marvel. Hospitals and clinics now conduct over 100 millions scans each year worldwide to treat diseases and save lives.

**Unit 4, exercise 15**

Biotechnology is not a new advancement in the area of science. It actually has been utilized for years, but was not significantly described as biotechnology. In its simple form, biotechnology means utilizing living organism or their products to revise or change human health or the environment or to run a process. Biotechnology itself is the combination of biology and other sciences to create new, innovative products in the agricultural sector, industrial sector and environmental industries. The products include medicines, vaccines, grown hormones for plants and food additives. There are nine major areas of this technology and its applications in the field of biotechnology. These nine major areas are bioprocessing technology, monoclonal antibodies, cell culture, recombinant DNA technology, cloning, protein engineering, biosensors, nanobiotechnology and microarrays. Bioprocessing technology refers to use of living cells to produce preferred products. This method has been utilized for thousands of years without knowing the actual scientific implications of it, such as in beer brewing, winemaking, and even for making bread and pickles! Microorganisms were first discovered in the mid-1800s, and

people came to realize that their biochemical machinery was the substance for these useful products. In depth research and further experiments have led us today to the production of amino acids, birth control pills, pesticides, antibiotics and also vitamins, just to name a few. Monoclonal antibody technology uses the cells from the immune system to make antibodies. Monoclonal antibodies are extremely useful to locate any pollutants found in the environment, detect microorganisms that may be harmful in food, differentiate between normal cells and cancer cells, and also diagnose in a more precise manner any infectious diseases that may be present in humans, animals or plants. Cell culture simply means growing cells outside of a living organism. There are three areas in this study, which include plant cell culture, insect cell culture and mammalian cell culture. Recombinant DNA technology, in the plain sense of the word means recombining two pieces of DNA from two different species. This is used to produce new medicines and vaccines, slow down the process of food spoilage, control viral diseases and hamper inflammation, just to name a few. Cloning became well known after the cloning of Dolly the sheep years back. Cloning technology actually allows for the generation of genetically identical molecules, plants, cells or animals. Protein engineering is a DNA recombinant technique that is meant to improve existing proteins to create new proteins that do not exist in nature. These proteins may then be used in food processing, drug development and industrial manufacturing. Biosensors are a combination of biology and the advances in microelectronics. Biosensors are detecting devices that rely on the specificity of cells and molecules to identify and measure substances at extremely low concentrations, which is why they are highly used to measure the nutritional value, safety and freshness of food, detect explosives, toxins and bio-warfare agents, locate and measure pollutants, and also to provide emergency room physicians with bedside measurements of vital blood components. Nano- biotechnology refers to the study, manipulation and manufacture of ultra-small structures and machines that can consist of only a single molecule. This field of study enables us to improve the specificity and timing of drug delivery, increase the speed and power of diagnosing diseases, and also encourage the development of green manufacturing practices. Microarray is the study of gene structure and functions which enable us to analyze tens of thousands of samples simultaneously. This field allows us to monitor

gene activity, identify genes that are important to crop productivity, and also to detect mutations in disease-related genes.

## Unit 6, exercise 15

High Intensity Laser is a device which produces coherent light of one (or more) specific wavelength. A laser beam carries energy which spreads through the tissue and can be used to treat inflame, torn or otherwise damaged or infected tissue in which it speeds up healing, recovery and reduces pain. High Intensity Laser penetrates the skin non-invasively and spreads further into the subcutaneous, fat, muscle, tendon, and bone tissue depending on the location of the treated area. The process through which laser heals the damaged tissue is called photobiostimulation. Upon application of laser light on human tissue there are 4 different effects that occur: reflection (the light does not penetrate the tissue), scattering (the light is distributed randomly in the tissue), absorption (the light is absorbed by the molecules of the tissue) and transmission (the light is transferred deeper into tissue structures, being absorbed eventually). There are 3 key effects of therapeutic High Intensity Laser: photoacoustic, biostimulation and thermic. Human tissue is composed of various components of which the most important for laser irradiation are water, hemoglobin and melanin. Their absorption as well as scatter coefficient are different for different wavelength. The optimum scatter to absorption ratio of 1064 nm wavelength makes it ideal for deep tissue penetration. 1064 nm High Intensity Laser beam can reach up to 10cm deep into the tissue. One of the key effects induced by the 1064nm High Intensity Laser beam is the photoacoustic effect. Photoacoustic waves are created when the area is irradiated by using very short pulses with high repetition rate. Such mechanical waves stimulate free nerve endings in the tissue and cause nearly instantaneous pain relief in the area. Biostimulation – in other words, stimulating the organism on the cellular level to enhance healing and recovery with 1064nm laser beam is another key effect of High Intensity Laser. Oxygen is processed in cells by mitochondria. Here oxygen is processed by a cascade of respiratory enzymes and delivered to ATP synthase which synthesizes the organism`s source of energy- ATP. Faster exchange of oxygen and metabolites due to laser irradiation causes more oxygen atoms to reach mitochondria. Mitochondria are further stimulated to synthesize ATP faster by laser irradiation at

1064 mm. ATP allows for faster synthesis of RNA and DNA and leads to faster recovery, healing and edema reduction in the treated area. The thermic effect of High Intensity Laser therapy is caused by absorption of the 1064 nm laser beam in the superficial structures which consequently causes temperature increase in the tissue. Thermic effect also causes vasodilation. As a consequence, blood perfusion increases larger amounts of oxygen are delivered to the tissue and more metabolites resorbed.

## Literature

1. Common Types of Diagnostic Medical Equipment [Электронный ресурс]. – Режим доступа : https://www.medium.com/@barzahmariyam/medical-equipments-use-for-treatment-and-diagnosis-of-diseases-in. – Дата доступа : 19.01.2023 г.

2. Medical Encyclopedia: MedlinePlus [Электронный ресурс]. – Режим доступа : https://www.medlineplus.gov/encyclopedia.html. – Дата доступа : 15.02.2023 г.

3. What is Biotechnology [Электронный ресурс]. – Режим доступа : https://www.studyfile.net/preview/7078415/page:31/. – Дата доступа : 28.02.2023 г.

4. High Intensity Laser [Электронный ресурс]. – Режим доступа : https://www.fda.gov/radiation-emitting-products/surgical-and-therapeutic-products/medical-lasers. – Дата доступа : 10.01.2023 г.

5. Echocadiogram [Электронный ресурс]. – Режим доступа : https://www/myheartnet.wordpress.com/2013/08/12/echocardiography-part-1-what-is-an-echocardiogram/. – Дата доступа: 22.03.2023г.

6. Pacemakers [Электронный ресурс]. – Режим доступа : https://www.nhlbi.nih.gov/health/pacemakers/how-it-works. – Дата доступа : 05.04.2023 г.

7. MRT procedure [Электронный ресурс]. – Режим доступа : https://www.mrtdon.ru/mrt/info/chto-pokazyvaet-mrt/. – Дата доступа : 01.03.2023 г.

8. Кипнис, И. Ю. Грамматические особенности перевода английского научно-технического текста. Грамматический справочник / И. Ю. Кипнис, С. А. Хоменко. – Минск : БНТУ, 2010. – 121 с.

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